# UM0427
# User manual

## ARM®-based 32-bit MCU STM32F101xx and STM32F103xx firmware library

## Introduction

This document describes the ARM®-based 32-bit MCU STM32F101xx and STM32F103xx firmware library.

This library is a firmware package which contains a collection of routines, data structures and macros covering the features of all peripherals. It includes a description of the device drivers plus a set of examples for each peripheral. The firmware library allows any device to be used in the user application without the need for in-depth study of each peripheral specifications. As a result, using the firmware library saves significant time that would otherwise be spent in coding, while reducing the application development and integration cost.

Each device driver consists of a set of functions covering all peripheral functionalities. The development of each driver is driven by a common API (application programming interface) which standardizes the driver structure, the functions and the names of parameters.

The driver source code is developed in 'Strict ANSI-C' (relaxed ANSI-C for projects and examples files). It is fully documented and is MISRA-C 2004 compliant (the compliancy matrix is available upon request). Writing the whole library in 'Strict ANSI-C' makes it independent from the software toolchain. Only the start-up files depend on the toolchain.

The firmware library implements run-time failure detection by checking the input values for all library functions. This dynamic checking contributes to enhance the robustness of the software. Run-time detection is suitable for user application development and debugging. It adds an overhead and can be removed from the final application code to minimize code size and execution speed. For more details refer to *Section 2.5: Run-time checking on page 46*.

Since the firmware library is generic and covers all peripherals functionalities, the size and/or execution speed of the application code may not be optimized. For many applications, the library may be used as is. However, for applications having tough constraints in terms of code size and/or execution speed, the library drivers should be used as a reference on how to configure the peripheral and tailor them to specific application requirements.

The firmware library user manual is structured as follows:

- Definitions, document conventions and firmware library rules
- Overview of the firmware library (package content, library structure), installation guidelines, and example on how to use the library.
- Detailed description the firmware library: configuration structure and software functions for each peripheral.

STM32F101xx and STM32F103xx will be referred to as STM32F101x throughout the document.

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# 1 Document and library rules

The user manual and the firmware library use the conventions described in the sections below.

## 1.1 Acronyms

*Table 1* describes the acronyms used in this document.

**Table 1. List of abbreviations**

| Acronym | Peripheral / Unit |
|---|---|
| ADC | Analog/digital converter |
| BKP | Backup registers |
| CAN | Controller area network |
| DMA | DMA controller |
| EXTI | External interrupt/event controller |
| FLASH | Flash memory |
| GPIO | General purpose I/O |
| I2C | Inter-integrated circuit |
| IWDG | Independent watchdog |
| NVIC | Nested vectored interrupt controller |
| PWR | Power control |
| RCC | Reset and clock controller |
| RTC | Real-time clock |
| SPI | Serial peripheral interface |
| SysTick | System tick timer |
| TIM | General purpose timer |
| TIM1 | Advanced control timer |
| USART | Universal synchronous asynchronous receiver transmitter |
| WWDG | Window watchdog |

## 1.2 Naming conventions

The firmware library uses the following naming conventions:

- **PPP** refers to any peripheral acronym, for example **ADC**. See *Section 1.1: Acronyms* for more information.
- System and source/header file names are preceded by ‘stm32f10x_’, for example *stm32f10x_conf.h.*
- Constants used in one file are defined within this file. A constant used in more than one file is defined in a header file. All constants are written in upper case.
- Registers are considered as constants. Their names are in upper case. In most cases, the same acronyms as in the STM32F10x reference manual document are used.
- Names of peripheral functions are preceded by the corresponding peripheral acronym in upper case followed by an underscore. The first letter in each word is in upper case, for example ***SPI_SendData***. Only one underscore is allowed in a function name to separate the peripheral acronym from the rest of the function name.
- Functions used to initialize the PPP peripheral according to parameters specified in ***PPP_InitTypeDef*** are named ***PPP_Init***, for example ***TIM_Init***.
- Functions used to reset the PPP peripheral registers to their default values are named ***PPP_DeInit***, for example ***TIM_DeInit***.
- Functions used to fill the ***PPP_InitTypeDef*** structure with the reset values of each member are named ***PPP_StructInit***, for example ***USART_StructInit***.
- Functions used to enable or disable the specified PPP peripheral are named ***PPP_Cmd***, for example ***SPI_Cmd***.
- Functions used to enable or disable an interrupt source of the specified PPP peripheral are named ***PPP_ITConfig***, for example ***RCC_ITConfig***.
- Functions used to enable or disable the DMA interface of the specified PPP peripheral are named ***PPP_DMAConfig***, for example ***TIM1_DMAConfig***.
- Functions used to configure a peripheral function always end with the string ‘Config’, for example ***GPIO_PinRemapConfig***.
- Functions used to check whether the specified PPP flag is set or reset are named ***PPP_GetFlagStatus***, for example ***I2C_GetFlagStatus***.
- Functions used to clear a PPP flag are named ***PPP_ClearFlag***, for example ***I2C_ClearFlag***.
- Functions used to check whether the specified PPP interrupt has occurred or not are named ***PPP_GetITStatus***, for example ***I2C_GetITStatus***.
- Functions used to clear a PPP interrupt pending bit are named ***PPP_ClearITPendingBit***, for example ***I2C_ClearITPendingBit***.

## 1.3 Coding rules

This section describes the coding rules used in the firmware Library.

### 1.3.1 Variables

24 specific variable types are defined. Their type and size are fixed. These types are defined in the file *stm32f10x_type.h*:

```
typedef signed long  s32;
typedef signed short s16;
typedef signed char  s8;

typedef signed long  const sc32;  /* Read Only */
typedef signed short const sc16;  /* Read Only */
typedef signed char  const sc8;   /* Read Only */

typedef volatile signed long  vs32;
typedef volatile signed short vs16;
typedef volatile signed char  vs8;

typedef volatile signed long  const vsc32;  /* Read Only */
typedef volatile signed short const vsc16;  /* Read Only */
typedef volatile signed char  const vsc8;   /* Read Only */

typedef unsigned long  u32;
typedef unsigned short u16;
typedef unsigned char  u8;

typedef unsigned long  const uc32;  /* Read Only */
typedef unsigned short const uc16;  /* Read Only */
typedef unsigned char  const uc8;   /* Read Only */

typedef volatile unsigned long  vu32;
typedef volatile unsigned short vu16;
typedef volatile unsigned char  vu8;

typedef volatile unsigned long  const vuc32;  /* Read Only */
typedef volatile unsigned short const vuc16;  /* Read Only */
typedef volatile unsigned char  const vuc8;   /* Read Only */
```

### 1.3.2 Boolean type

*bool* type is defined in the *stm32f10x_type.h* file as:

```
typedef enum
{
  FALSE = 0,
  TRUE  = !FALSE
} bool;
```

### 1.3.3 FlagStatus type

*FlagStatus* type is defined in the file *stm32f10x_type.h*. Two values can be assigned to this variable: *SET* or *RESET.*

```
typedef enum
{
  RESET = 0,
  SET   = !RESET
} FlagStatus;
```

### 1.3.4 FunctionalState type

*FunctionalState* type is defined in the *stm32f10x_type.h* file*.* Two values can be assigned to this variable: *ENABLE* or *DISABLE*.

```
typedef enum
{
  DISABLE = 0,
  ENABLE  = !DISABLE
} FunctionalState;
```

### 1.3.5 ErrorStatus type

*ErrorStatus* type is defined in the *stm32f10x_type.h* file*.* Two values can be assigned to this variable: *SUCCESS* or *ERROR*.

```
typedef enum
{
  ERROR   = 0,
  SUCCESS = !ERROR
} ErrorStatus;
```

### 1.3.6 Peripherals

Pointers to peripherals are used to access the peripheral control registers. They point to data structures that represent the mapping of the peripheral control registers.

#### Peripheral control register structures

*stm32f10x_map.h* contains the definition of all peripheral structures. The example below illustrates the *SPI* register structure declaration:

```
/*------------------ Serial Peripheral Interface ----------------*/
typedef struct
{
  vu16 CR1;
  u16 RESERVED0;
  vu16 CR2;
  u16 RESERVED1;
  vu16 SR;
  u16  RESERVED2;
  vu16 DR;
  u16  RESERVED3;
  vu16 CRCPR;
```

```
  u16 RESERVED4;
  vu16 RXCRCR;
  u16  RESERVED5;
  vu16 TXCRCR;
  u16  RESERVED6;
} SPI_TypeDef;
```

Register names are the register acronyms written in upper case for each peripheral. RESERVEDi (i being an integer that indexes the reserved field) indicates a reserved field.

### Peripheral declaration

All peripherals are declared in *stm32f10x_map.h*. The following example shows the declaration of the *SPI* peripheral:

```
#ifndef EXT
#Define EXT extern
#endif
...
#define PERIPH_BASE            ((u32)0x40000000)
#define APB1PERIPH_BASE        PERIPH_BASE
#define APB2PERIPH_BASE        (PERIPH_BASE + 0x10000)
...
/* SPI2 Base Address definition*/
#define SPI2_BASE              (APB1PERIPH_BASE + 0x3800)
...
/* SPI2 peripheral declaration*/
#ifndef DEBUG
...
#ifdef _SPI2
  #define SPI2                 ((SPI_TypeDef *) SPI2_BASE)
#endif /*_SPI2 */
...
#else   /* DEBUG */
...
#ifdef _SPI2
  EXT SPI_TypeDef              *SPI2;
#endif /*_SPI2 */
...
#endif  /* DEBUG */
```

Define the label *_SPI, to* include the *SPI* peripheral library in your application*.*

Define the label *_SPIn*, to access the *SPIn* peripheral registers*.* For example, the *_SPI2* label must be defined in *stm32f10x_conf.h* to be able to access the registers of *SPI2* peripheral. *_SPI* and *_SPIn* labels are defined in the *stm32f10x_conf.h* file as follows:

```
#define _SPI
#define _SPI1
#define _SPI2
```

Each peripheral has several dedicated registers which contain different flags. Registers are defined within a dedicated structure for each peripheral. Flags are defined as acronyms written in upper case and preceded by ‘***PPP_FLAG_***’.Flag definition is adapted to each peripheral case and defined in *stm32f10x_ppp.h*.

To enter DEBUG mode you have to define the label *DEBUG* in the file *stm32f10x_conf.h*. This creates a pointer to the peripheral structure in SRAM. Debugging consequently becomes easier and all register settings can be obtain by dumping a peripheral variable. In both cases *SPI2* is a pointer to the first address of the *SPI2* peripheral.

The *DEBUG* variable is defined in the *stm32f10x_conf.h* file as follows:

```
#define DEBUG    1
```

The DEBUG mode is initialized as follows in the *stm32f10x_lib.c* file:

```
#ifdef DEBUG
void debug(void)
{
  ...
#ifdef _SPI2
  SPI2 = (SPI_TypeDef *)  SPI2_BASE;
#endif /*_SPI2 */
  ...
}
#endif /* DEBUG*/
```

*Note:* 1 *When the* DEBUG *mode is selected, the* ***assert_param*** *macro is expanded and run time checking is enabled in the firmware library code.*

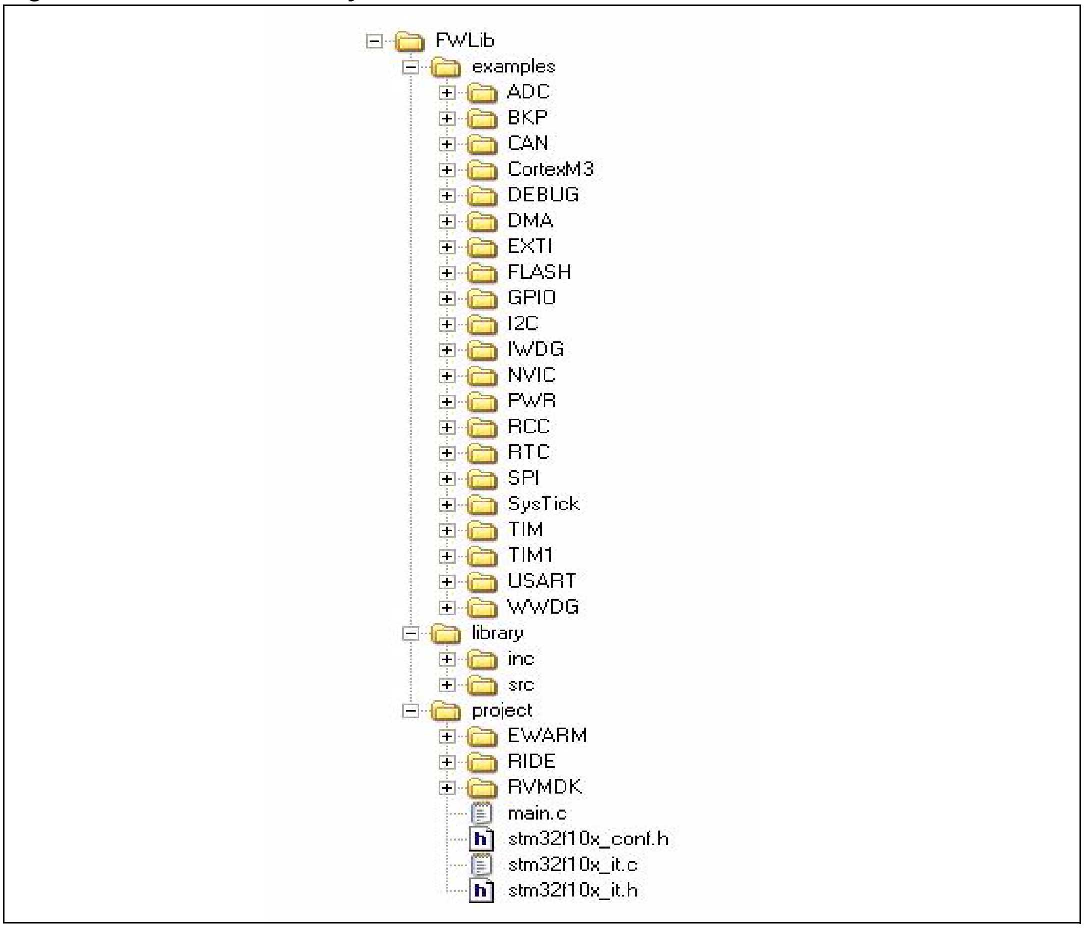
2 *The* DEBUG *mode increases the code size and reduces the code performance. For this reason, it is recommended to used it only when debugging the application and to remove it from the final application code.*

# 2 Firmware library

## 2.1 Package description

The firmware library is supplied in one single zip file. The extraction of the zip file generates one folder, ***STM32F10xFWLib\FWLib***, which contains the following sub-folders:

**Figure 1. Firmware library folder structure**




### 2.1.1 Examples folder

This **Examples** folder contains, for each peripheral sub-folder, the minimum set of files needed to run a typical example on how to use a peripheral:

- ***readme.txt***: **-** brief text file describing the example and how to make it work,
- ***stm32f10x_conf.h*** **-** header file allowing to configure the peripherals that are used, and containing miscellaneous DEFINE statements,
- ***stm32f10x_it.c*** - source file containing the interrupt handlers (the function bodies may be emptied if not used),
- ***stm32f10x_it.h*** **-** header file including all interrupt handler prototypes,
- ***main.c*** - example of code

*Note: All the examples are independent from the software toolchain.*

### 2.1.2 Library folder

The **Library** folder contains all the subdirectories and files that make up the core of the library:

- ***inc*** sub-folder contains the firmware library header files. They do not need to be modified by the user:
  - ***stm32f10x_type.h***: common data types and enumeration used in all other files,
  - ***stm32f10x_map.h***: peripherals memory mappings and registers data structures,
  - ***stm32f10x_lib.h***: main header file including all other headers,
  - ***stm32f10x_ppp.h*** (one header file per peripheral): function prototypes, data structures and enumeration.
  - ***cortexm3_macro.h***: header file for cortexm3_macro.s.
- ***src*** sub-folder contains the firmware library source files. They do not need to be modified by the user:
  - ***stm32f10x_ppp.c*** (one source file per peripheral): function bodies of each peripheral.
  - ***stm32f10x_lib.c***: all peripherals pointers initialization.

*Note: All library files are coded in Strict ANSI-C and are independent from the software toolchain.*

### 2.1.3 Project folder

The **Project** folder contains a standard template project program that compiles all library files plus all the user-modifiable files that are necessary to create a new project:

- ***stm32f10x_conf.h***: configuration header file with all peripherals defined by default.
- ***stm32f10x_it.c***: source file containing the interrupt handlers (the function bodies are empty in this template).
- ***stm32f10x_it.h***: header file including all interrupt handlers prototypes.
- ***main.c***: main program body.

- ***EWARM***, ***RVMDK, RIDE:*** it is used by the toolchain, and refers to the **readme.txt** file located in the same folder.

## 2.2 Description of firmware library files

*Table 2* lists and describes the different files used by the firmware library.

The firmware library architecture and file inclusion relationship are shown in *Figure 2*. Each peripheral has a source code file, *stm32f10x_ppp.c*, and a header file, *stm32f10x_ppp.h*. The *stm32f10x_ppp.c* file contains all the firmware functions required to use the PPP peripheral. A single memory mapping file, *stm32f10x_map.h,* is supplied for all peripherals. It contains all the register declarations used both in Debug and release modes.

The header file *stm32f10x_lib.h* includes all the peripheral header files. This is the only file that needs to be included in the user application to interface with the library.

*stm32f10x_conf.h* is the only file which must be modified by the user. It is used to specify the set of parameters to interface with the library before running any application.

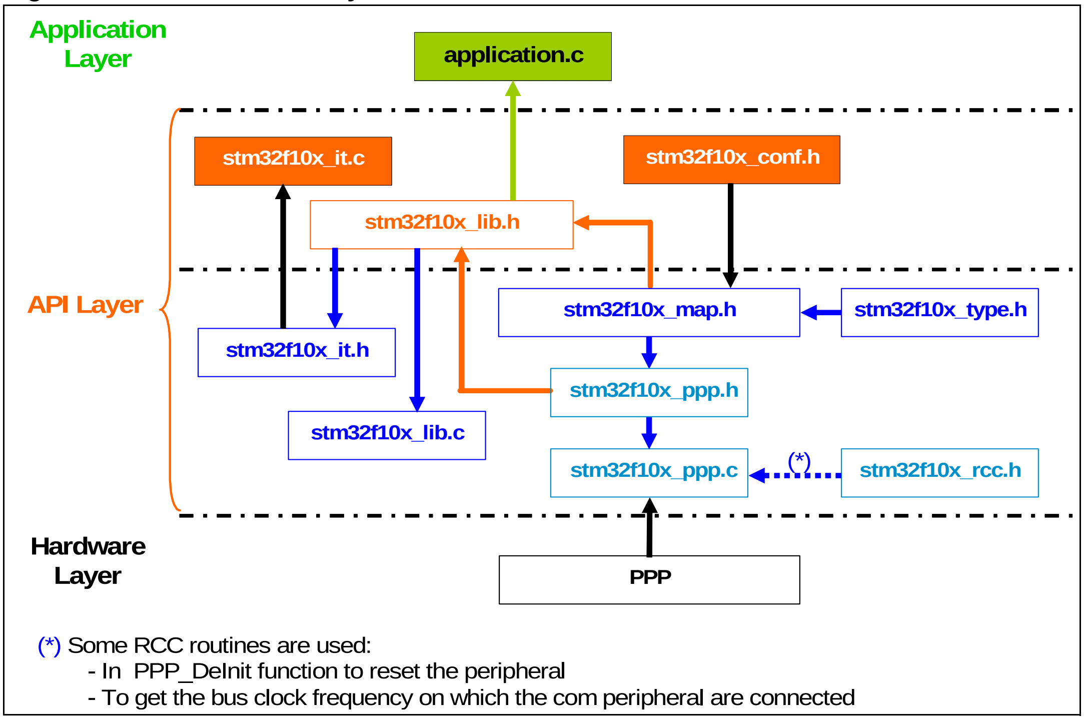
**Table 2. Firmware library files**

| File name | Description |
|---|---|
| stm32f10x_conf.h | Parameter configuration file.<br>It must be modified by the user to define the parameters used to interface with the library before running any application.<br>The user can enable or disable peripherals by using the template and can also change the value of the external Quartz oscillator.<br>This file can also be used to enable the Debug or Release mode before compiling the firmware library. |
| main.c | Main example program body. |
| stm32f10x_it.h | Header file including all interrupt handlers prototypes. |
| stm32f10x_it.c | Peripheral interrupt functions file.<br>The user can modify it by including the code of interrupt functions used in his application. In case of multiple interrupt requests mapped to the same interrupt vector, the function polls the interrupt flags of the peripheral to identify the exact source of the interrupt. The names of these functions are already provided in the firmware library. |
| stm32f10x_lib.h | Header file including all peripheral header files.<br>It is the only file that has to be included in the user application to interface with the firmware library. |
| stm32f10x_lib.c | Debug mode initialization file.<br>It includes the definition of variable pointers. Each one points to the first address of a specific peripheral and to the definition of the function which is called when the Debug mode is enabled.<br>This function initializes the defined pointers. |
| stm32f10x_map.h | This file implements memory mapping and physical registers address definition for both debug and release modes. It is supplied with all peripherals. |
| stm32f10x_type.h | Common declarations file.<br>It includes common types and constants used by all peripheral drivers. |
| stm32f10x_ppp.c | Driver source code file of PPP peripheral written in C language. |
| stm32f10x_ppp.h | Header file of PPP peripheral. It includes the definition of PPP peripheral functions and variables used within these functions. |

**Table 2. Firmware library files (continued)**

| File name | Description |
|---|---|
| cortexm3_macro.h | Header file for cortexm3_macro.s. |
| cortexm3_macro.s | Instruction wrappers for special Cortex-M3 instructions. |

**Figure 2. Firmware library file architecture**



## 2.3 Peripheral initialization and configuration

This section describes step-by-step how to initialize and configure a peripheral. The peripheral will be referred to as PPP.

1. In the main application file, declare a ***PPP_InitTypeDef*** structure, for example:

   ```
   PPP_InitTypeDef  PPP_InitStructure;
   ```

   The `PPP_InitStructure` is a working variable located in data memory area. It allows to initialize one or more PPP instances.
2. Fill the `PPP_InitStructure` variable with the allowed values of the structure member. There are two ways of doing this:
   a) Configuring the whole structure by following the procedure described below:

   ```
   PPP_InitStructure.member1 = val1;
   PPP_InitStructure.member2 = val2;
   PPP_InitStructure.memberN = valN;
   /* where N is the number of the structure members */
   ```

   The previous initialization step can be merged in one single line to optimize the code size:

   ```
   PPP_InitTypeDef  PPP_InitStructure = { val1, val2,.., valN}
   ```

   b) Configuring only a few members of the structure: in this case the user should modify the `PPP_InitStructure` variable that has been already filled by a call to the ***PPP_StructInit(..)*** function. This ensures that the other members of the `PPP_InitStructure` variable are initialized to the appropriate values (in most cases their default values).

   ```
   PPP_StructInit(&PPP_InitStructure);
   PP_InitStructure.memberX = valX;
   PPP_InitStructure.memberY = valY;
   /*where X and Y are the members the user wants to configure*/
   ```
3. Initialize the PPP peripheral by calling the ***PPP_Init(..)*** function.

   ```
   PPP_Init(PPP, &PPP_InitStructure);
   ```
4. At this stage the PPP peripheral is initialized and can be enabled by making a call to ***PPP_Cmd(..)*** function.

   ```
   PPP_Cmd(PPP, ENABLE);
   ```

   The PPP peripheral can then be used through a set of dedicated functions. These functions are specific to the peripheral. For more details refer to *Section 3: Peripheral firmware overview*.

*Note: 1 Before configuring a peripheral, its clock must be enabled by calling one of the following functions:*

```
RCC_AHBPeriphClockCmd(RCC_AHBPeriph_PPPx, ENABLE);
RCC_APB2PeriphClockCmd(RCC_APB2Periph_PPPx, ENABLE);
RCC_APB1PeriphClockCmd(RCC_APB1Periph_PPPx, ENABLE);
```

*2 **PPP_DeInit(..)** function can be used to set all PPP peripheral registers to their default values:*

```
PPP_DeInit(PPP)
```

3 *To modify the peripheral settings after configuring the peripheral, the user can proceed as follows:*

```
PPP_InitStucture.memberX = valX;
PPP_InitStructure.memberY = valY; /* where X and Y are the only 
members that user wants to modify*/
PPP_Init(PPP, &PPP_InitStructure);
```

## 2.4 Bit-Banding

The Cortex-M3 memory map includes two bit-band memory regions. These regions map each word in an alias region of memory to a bit in a bit-band region of memory. Writing to a word in the alias region has the same effect as a read-modify-write operation on the targeted bit in the bit-band region.

All the STM32F10x peripheral registers are mapped in a bit-band region. This feature is consequently intensively used in functions which perform single bit set/reset in order to reduce and optimize code size.

*Section 2.4.1* and *Section 2.4.2* give a description of how the bit-band access is used in the peripheral firmware library.

### 2.4.1 Mapping formula

The mapping formula shows how to link each word in the alias region to a corresponding target bit in the bit-band region. The mapping formula is given below:

bit_word_offset = (byte_offset x 32) + (bit_number × 4)

bit_word_addr = bit_band_base + bit_word_offset

where:

- bit_word_offset is the position of the target bit in the bit-band memory region
- bit_word_addr is the address of the word in the alias memory region that maps to the targeted bit.
- bit_band_base is the starting address of the alias region
- byte_offset is the number of the byte in the bit-band region that contains the targeted bit
- bit_number is the bit position (0-31) of the targeted bit.

### 2.4.2 Example of implementation

The following example shows how to map the PLLON[24] bit of RCC_CR register in the alias region:

```
/* Peripheral base address in the bit-band region */
#define PERIPH_BASE       ((u32)0x40000000)

/* Peripheral address in the alias region */
#define PERIPH_BB_BASE    ((u32)0x42000000)

/* ----- RCC registers bit address in the alias region ------ */
#define RCC_OFFSET         (RCC_BASE - PERIPH_BASE)

/* --- CR Register ---*/
/* Alias word address of PLLON bit */
```

```
#define CR_OFFSET            (RCC_OFFSET + 0x00)
#define PLLON_BitNumber      0x18
#define CR_PLLON_BB          (PERIPH_BB_BASE + (CR_OFFSET * 32
(PLLON_BitNumber * 4))
```

To code a function which enables/disables the PLL, proceed as follows:

```
...
#define CR_PLLON_Set        ((u32)0x01000000)
#define CR_PLLON_Reset      ((u32)0xFEFFFFFF)
...
void RCC_PLLCmd(FunctionalState NewState)
{
  if (NewState != DISABLE)
  { /* Enable PLL */
    RCC->CR |= CR_PLLON_Set;
  }
  else
  { /* Disable PLL */
    RCC->CR &= CR_PLLON_Reset;
  }
}
```

Using bit-band access this function will be coded as follows:

```
void RCC_PLLCmd(FunctionalState NewState)
{
  *(vu32 *) CR_PLLON_BB = (u32)NewState;
}
```

## 2.5 Run-time checking

The firmware library implements run-time failure detection by checking the input values of all library functions. The run-time checking is achieved by using an ***assert_param*** macro. This macro is used in all the library functions which have an input parameter. It allows to check that the input value lies within the parameter allowed values.

### Example: *PWR_ClearFlag* function

*stm32f10x_pwr.c*:

```
void PWR_ClearFlag(u32 PWR_FLAG)
{
  /* Check the parameters */
  assert_param(IS_PWR_CLEAR_FLAG(PWR_FLAG));
   PWR->CR |=  PWR_FLAG << 2;
}
```

*stm32f10x_pwr.h*:

```
/* PWR Flag */
#define PWR_FLAG_WU              ((u32)0x00000001)
#define PWR_FLAG_SB              ((u32)0x00000002)
#define PWR_FLAG_PVDO            ((u32)0x00000004)
```

```
#define IS_PWR_CLEAR_FLAG(FLAG) ((FLAG == PWR_FLAG_WU) || (FLAG ==
PWR_FLAG_SB))
```

If the expression passed to the ***assert_param*** macro is false, the ***assert_failed*** function is called and returns the name of the source file and the source line number of the call that failed. If the expression is true, no value is returned.

The ***assert_param*** macro is implemented in ***stm32f10x_conf.h***:

```
/* Exported macro ------------------------------------------------------------*/
#ifdef  DEBUG
/*******************************************************************************
* Macro Name     : assert_param
* Description    : The assert_param macro is used for function's parameters check.
*                  It is used only if the library is compiled in DEBUG mode.
* Input          : - expr: If expr is false, it calls assert_failed function
*                    which reports the name of the source file and the source
*                    line number of the call that failed.
*                    If expr is true, it returns no value.
* Return         : None
*******************************************************************************/
  #define assert_param(expr) ((expr) ? (void)0 : assert_failed((u8 *)__FILE__,
__LINE__))
/* Exported functions ------------------------------------------------------- */
  void assert_failed(u8* file, u32 line);
#else
  #define assert_param(expr) ((void)0)
#endif /* DEBUG */
```

The ***assert_failed*** function is implemented in the *main.c* file or in any other user C file:

```
#ifdef  DEBUG
/*******************************************************************
* Function name  : assert_failed
* Description    : Reports the name of the source file and the source line number
*                  where the assert_param error has occurred.
* Input          : - file: pointer to the source file name
*                  - line: assert_param error line source number
* Output         : None
* Return         : None
*******************************************************************/
void assert_failed(u8* file, u32 line)
{
  /* User can add his own implementation to report the file name and line number,
```

```
    ex: printf("Wrong parameters value: file %s on line %d\r\n", file, line) */

  /* Infinite loop */
  while (1)
  {
  }
}
#endif
```

*Note:* ***The run-time checking, that is the assert_param macro, should only be used when the library is compiled in DEBUG mode.***

*It is recommended to use run-time checking during application code development and debugging, and to remove it from the final application to improve code size and speed (because of the overhead it introduces).*

*However if the user wants to keep this functionality in his final application, he can re-use the* ***assert_param*** *macro defined within the library to test the parameter values before calling the library functions.*

# 3 Peripheral firmware overview

This section describes in detail each peripheral firmware library. The related functions are fully described, an example of how to use them is provided.

The functions are described in the following format:

**Table 3. Function description format**

| | |
|---|---|
| Function name | The name of the peripheral function |
| Function prototype | Prototype declaration |
| Behavior description | Brief explanation of how the function is executed |
| Input parameter {x} | Description of the input parameters |
| Output parameter {x} | Description of the output parameters |
| Return Value | Value returned by the function |
| Required preconditions | Requirements before calling the function |
| Called functions | Other library functions called |

# 4 Analog/digital converter (ADC)

The analog/digital converter (ADC) consists of an input multiplexing channel selector feeding an approximation converter. The conversion resolution is of 12 bits.

The data structures used in the ADC firmware library are described in *Section 4.1*, while *Section 4.2* presents the firmware library functions.

## 4.1 ADC register structure

The ADC register structure, *ADC_TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 SR;
vu32 CR1;
vu32 CR2;
vu32 SMPR1;
vu32 SMPR2;
vu32 JOFR1;
vu32 JOFR2;
vu32 JOFR3;
vu32 JOFR4;
vu32 HTR;
vu32 LTR;
vu32 SQR1;
vu32 SQR2;
vu32 SQR3;
vu32 JSQR;
vu32 JDR1;
vu32 JDR2;
vu32 JDR3;
vu32 JDR4;
vu32 DR;
} ADC_TypeDef;
```

*Table 4* gives the lists of ADC registers:

**Table 4. ADC registers**

| Register | Description |
|---|---|
| SR | ADC Status Register |
| CR1 | ADC Configuration Register1 |
| CR2 | ADC Configuration Register2 |
| SMPR1 | ADC Sample Time Register1 |
| SMPR2 | ADC Sample Time Register2 |
| JOFR1 | ADC Offset Register1 |
| JOFR2 | ADC Offset Register2 |

**Table 4. ADC registers (continued)**

| Register | Description |
|---|---|
| JOFR3 | ADC Offset Register3 |
| JOFR4 | ADC Offset Register4 |
| HTR | ADC High Voltage Threshold Register |
| LTR | ADC Low Voltage Threshold Register |
| SQR1 | ADC Sequence Selector for Regular group Register1 |
| SQR2 | ADC Sequence Selector for Regular group Register2 |
| SQR3 | ADC Sequence Selector for Regular group Register3 |
| JSQR | ADC Sequence Selector for Injected group Register |
| JDR1 | ADC Data converted Injected group Register1 |
| JDR2 | ADC Data converted Injected group Register2 |
| JDR3 | ADC Data converted Injected group Register3 |
| JDR4 | ADC Data converted Injected group Register4 |
| DR | ADC Regular group data Register |

The two ADC peripherals are declared in *stm32f10x_map*:

```
...
#define PERIPH_BASE             ((u32)0x40000000)
#define APB1PERIPH_BASE         PERIPH_BASE
#define APB2PERIPH_BASE         (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE          (PERIPH_BASE + 0x20000)
....
#define ADC1_BASE               (APB2PERIPH_BASE + 0x2400)
#define ADC2_BASE               (APB2PERIPH_BASE + 0x2800)
....
#ifndef DEBUG
...
#ifdef _ADC1
  #define ADC1                  ((ADC_TypeDef *) ADC1_BASE)
#endif /*_ADC1 */

#ifdef _ADC2
  #define ADC2                  ((ADC_TypeDef *) ADC2_BASE)
#endif /*_ADC2 */
...
#else   /* DEBUG */
...
#ifdef _ADC1
  EXT ADC_TypeDef               *ADC1;
#endif /*_ADC1 */

#ifdef _ADC2
  EXT ADC_TypeDef               *ADC2;
#endif /*_ADC2 */
...
#endif
```

When using the Debug mode, _ADC1 and _ADC2 pointers are initialized in *stm32f10x_lib.c* file:

```
...
#ifdef _ADC1
  ADC1 = (ADC_TypeDef *)  ADC1_BASE;
#endif /*_ADC1 */

#ifdef _ADC2
  ADC2 = (ADC_TypeDef *)  ADC2_BASE;
#endif /*_ADC2 */
...
```

To access the ADC registers, _ADC, _ADC1 and _ADC2 must be defined in *stm32f10x_conf.h*, as follows:

```
...
#define _ADC
#define _ADC1
#define _ADC2
...
```

## 4.2 ADC library functions

*Table 5* lists the ADC firmware library functions.

**Table 5. ADC firmware library functions**

| Function name | Description |
|---|---|
| ADC_DeInit | Resets the ADCx peripheral registers to their default reset values. |
| ADC_Init | Initializes the ADCx peripheral according to the parameters specified in the ADC_InitStruct. |
| ADC_StructInit | Fills each ADC_InitStruct member with its default value. |
| ADC_Cmd | Enables or disables the specified ADC peripheral. |
| ADC_DMACmd | Enables or disables the specified ADC DMA request |
| ADC_ITConfig | Enables or disables the specified ADC interrupts. |
| ADC_ResetCalibration | Resets the selected ADC calibration registers |
| ADC_GetResetCalibrationStatus | Gets the selected ADC reset calibration registers status. |
| ADC_StartCalibration | Starts the selected ADC calibration process. |
| ADC_GetCalibrationStatus | Gets the selected ADC calibration status. |
| ADC_SoftwareStartConvCmd | Enables or disables the selected ADC software start conversion. |
| ADC_GetSoftwareStartConvStatus | Gets the selected ADC Software start conversion Status. |

Table 5. ADC firmware library functions (continued)

| Function name | Description |
|---|---|
| ADC_DiscModeChannelCountConfig | Configures the discontinuous mode for the selected ADC regular group channel. |
| ADC_DiscModeCmd | Enables or disables the discontinuous mode on regular group channel for the specified ADC. |
| ADC_RegularChannelConfig | Configures for the selected ADC regular channel the corresponding rank in the sequencer and the sample time. |
| ADC_ExternalTrigConvCmd | Enables or disables the ADCx conversion through external trigger |
| ADC_GetConversionValue | Returns the last ADCx conversion result data for regular channel |
| ADC_GetDualModeConversionValue | Returns the last ADCs conversion result data in dual mode |
| ADC_AutoInjectedConvCmd | Enables or disables the selected ADC automatic injected group conversion after regular one |
| ADC_InjectedDiscModeCmd | Enables or disables the discontinuous mode for injected group channel for the specified ADC |
| ADC_ExternalTrigInjectedConvConfig | Configures the ADCx external trigger for injected channels conversion |
| ADC_ExternalTrigInjectedConvCmd | Enables or disables the ADCx injected channels conversion through external trigger |
| ADC_SoftwareStartInjectedConvCmd | Enables or disables the selected ADC start of the injected channels conversion |
| ADC_GetSoftwareStartInjectedConvStatus | Gets the selected ADC Software start injected conversion Status. |
| ADC_InjectedChannelConfig | Configures for the selected ADC injected channel its corresponding rank in the sequencer and its sample time. |
| ADC_InjectedSequencerLengthConfig | Configures the sequencer length for injected channels |
| ADC_SetInjectedOffset | Sets the injected channels conversion value offset |
| ADC_GetInjectedConversionValue | Returns the ADC conversion result data for the selected injected channel |
| ADC_AnalogWatchdogCmd | Enables or disables the analog watchdog on single/all regular or injected channels |
| ADC_AnalogWatchdogThresholdsConfig | Configures the high and low thresholds of the analog watchdog |
| ADC_AnalogWatchdogSingleChannelConfig | Configures the analog watchdog guarded single channel |
| ADC_TempSensorVrefintCmd | Enables or disables the temperature sensor and Vrefint channel. |

Table 5. ADC firmware library functions (continued)

| Function name | Description |
|---|---|
| ADC_GetFlagStatus | Checks whether the specified ADC flag is set or not. |
| ADC_ClearFlag | Clears the ADCx pending flags. |
| ADC_GetITStatus | Checks whether the specified ADC interrupt has occurred or not. |
| ADC_ClearITPendingBit | Clears the ADCx interrupt pending bits. |

### 4.2.1 ADC_DeInit function

Table 6 describes the ADC_DeInit function.

Table 6. ADC_DeInit function

| | |
|---|---|
| Function name | ADC_DeInit |
| Function prototype | void ADC_DeInit(ADC_TypeDef* ADCx) |
| Behavior description | Resets the ADCx peripheral registers to their default reset values. |
| Input parameter | ADCx: where x can be either 1 or 2 to select ADC peripheral ADC1 or ADC2. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphClockCmd(). |

**Example:**

```
/* Resets ADC2 */
ADC_DeInit(ADC2);
```

### 4.2.2 ADC_Init function

Table 7 describes the ADC_Init function.

Table 7. ADC_Init function

| | |
|---|---|
| Function name | ADC_Init |
| Function prototype | void ADC_Init(ADC_TypeDef* ADCx, ADC_InitTypeDef* ADC_InitStruct) |
| Behavior description | Initializes the ADCx peripheral according to the parameters specified in the ADC_InitStruct. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_InitStruct: pointer to an ADC_InitTypeDef structure that contains the configuration information for the specified ADC peripheral. Refer to the Section 4.2.3: ADC_StructInit function for a full description of the ADC_InitStruct values. |
| Output parameter | None |

Table 7. ADC_Init function (continued)

| | |
|---|---|
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## ADC_InitTypeDef structure

The **ADC_InitTypeDef** structure is defined in the *stm32f10x_adc.h* file:

```
typedef struct
{
  u32 ADC_Mode;
  FunctionalState ADC_ScanConvMode;
  FunctionalState ADC_ContinuousConvMode;
  u32 ADC_ExternalTrigConv;
  u32 ADC_DataAlign;
  u8 ADC_NbrOfChannel;
} ADC_InitTypeDef
```

### ADC_Mode

ADC_Mode configures the ADC to operate in independent or dual mode. See *Table 8* for the values taken by this member.

Table 8. ADC_Mode definition

| ADC_Mode | Description |
|---|---|
| ADC_Mode_Independent | ADC1 and ADC2 operate in independent mode |
| ADC_Mode_RegInjecSimult | ADC1 and ADC2 operate in simultaneous sample/hold 1 and 2 mode |
| ADC_Mode_RegSimult_AlterTrig | ADC1 and ADC2 operate in simultaneous sample/hold 2 and Alternate trigger mode |
| ADC_Mode_InjecSimult_FastInterl | ADC1 and ADC2 operate in simultaneous sample/hold 1 and Interleaved 1 mode |
| ADC_Mode_InjecSimult_SlowInterl | ADC1 and ADC2 operate in simultaneous sample/hold 1 and Interleaved 2 mode |
| ADC_Mode_InjecSimult | ADC1 and ADC2 operate in simultaneous sample/hold 1 mode |
| ADC_Mode_RegSimult | ADC1 and ADC2 operate in simultaneous sample/hold 2 mode |
| ADC_Mode_FastInterl | ADC1 and ADC2 operate in interleaved 1 mode |
| ADC_Mode_SlowInterl | ADC1 and ADC2 operate in interleaved 2 mode |
| ADC_Mode_AlterTrig | ADC1 and ADC2 operate in alternate trigger mode |

### ADC_ScanConvMode

ADC_ScanConvMode specifies whether the conversion is performed in Scan (multi-channels) or Single (one channel) mode. This member can be set to ENABLE or DISABLE.

### ADC_ContinuousConvMode

ADC_ContinuousConvMode specifies whether the conversion is performed in Continuous or Single mode. This member can be set to ENABLE or DISABLE.

### ADC_ExternalTrigConv

ADC_ExternalTrigConv defines the external trigger used to start the analog to digital conversion of regular channels. The values taken by this member are given in *Table 9*.

**Table 9. ADC_ExternalTrigConv definition**

| ADC_ExternalTrigConv | Description |
| --- | --- |
| ADC_ExternalTrigConv_T1_CC1 | Timer1 Capture Compare1 selected as external trigger conversion |
| ADC_ExternalTrigConv_T1_CC2 | Timer1 Capture Compare2 selected as external trigger conversion |
| ADC_ExternalTrigConv_T1_CC3 | Timer1 Capture Compare3 selected as external trigger conversion |
| ADC_ExternalTrigConv_T2_CC2 | Timer2 Capture Compare2 selected as external trigger conversion |
| ADC_ExternalTrigConv_T3_TRGO | Timer3 TRGO selected as external trigger conversion |
| ADC_ExternalTrigConv_T4_CC4 | Timer4 Capture Compare4 selected as external trigger conversion |
| ADC_ExternalTrigConv_Ext_IT11 | External interrupt 11 event selected as external trigger conversion |
| ADC_ExternalTrigConv_None | Conversion started by software and not by external trigger |

### ADC_DataAlign

ADC_DataAlign specifies whether the ADC data alignment is left or right. The values taken by this member are given in *Table 10*.

**Table 10. ADC_DataAlign definition**

| ADC_DataAlign | Description |
| --- | --- |
| ADC_DataAlign_Right | ADC data right aligned |
| ADC_DataAlign_Left | ADC data left aligned |

### ADC_NbrOfChannel

ADC_NbreOfChannel specifies the number of ADC channels that will be converted using the sequencer for regular channel group. This number must range from 1 to 16.

**Example**:

```
/* Initialize the ADC1 according to the ADC_InitStructure members */
ADC_InitTypeDef  ADC_InitStructure;
ADC_InitStructure.ADC_Mode = ADC_Mode_Independent;
ADC_InitStructure.ADC_ScanConvMode = ENABLE;
ADC_InitStructure.ADC_ContinuousConvMode = DISABLE;
ADC_InitStructure.ADC_ExternalTrigConv =
ADC_ExternalTrigConv_Ext_IT11;
```

```
ADC_InitStructure.ADC_DataAlign = ADC_DataAlign_Right;
ADC_InitStructure.ADC_NbrOfChannel = 16;
ADC_Init(ADC1, &ADC_InitStructure);
```

*Note: To correctly configure the ADC channels conversion, the user must call the ADC_ChannelConfig() function after ADC_Init() to configure the sequencer rank and sample time for each used channel.*

### 4.2.3 ADC_StructInit function

*Table 11* describes the ADC_StructInit function.

**Table 11. ADC_StructInit function**

| | |
|---|---|
| Function name | ADC_StructInit |
| Function prototype | void ADC_StructInit(ADC_InitTypeDef* ADC_InitStruct) |
| Behavior description | Fills each ADC_InitStruct member with its default value. |
| Input parameter | ADC_InitStruct: pointer to the ADC_InitTypeDef structure to initialize. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The ADC_InitStruct members have the following default values:

**Table 12. ADC_IniyStruct default values**

| Member | Default value |
|---|---|
| ADC_Mode | ADC_Mode_Independent |
| ADC_ScanConvMode | DISABLE |
| ADC_ContinuousConvMode | DISABLE |
| ADC_ExternalTrigConv | ADC_ExternalTrigConv_T1_CC1 |
| ADC_DataAlign | ADC_DataAlign_Right |
| ADC_NbrOfChannel | 1 |

**Example:**

```
/* Initialize a ADC_InitTypeDef structure. */
ADC_InitTypeDef  ADC_InitStructure;
ADC_StructInit(&ADC_InitStructure);
```

### 4.2.4 ADC_Cmd function

*Table 13* describes the ADC_Cmd function.

Table 13. ADC_Cmd function

| Function name | Description |
|---|---|
| Function name | ADC_Cmd |
| Function prototype | void ADC_Cmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified ADC peripheral. |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the ADCx peripheral.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable ADC1 */
ADC_Cmd(ADC1, ENABLE);
```

*Note: The ADC_Cmd function must be called after all other ADC configuration functions.*

### 4.2.5 ADC_DMACmd function

*Table 14* describes the ADC_DMACmd function.

Table 14. ADC_DMACmd function

| | |
|---|---|
| Function name | ADC_DMACmd |
| Function prototype | ADC_DMACmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified ADC DMA request. |
| Input parameter1 | ADC*x*: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the ADC DMA transfer.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable ADC2 DMA transfer */
ADC_DMACmd(ADC2, ENABLE);
```

### 4.2.6 ADC_ITConfig function

*Table 15* describes the ADC_ITConfig function.

**Table 15. ADC_ITConfig function**

| | |
|---|---|
| Function name | ADC_ITConfig |
| Function prototype | void ADC_ITConfig(ADC_TypeDef* ADCx, u16 ADC_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified ADC interrupts. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_IT: specifies the ADC interrupt sources to be enabled or disabled.<br>Refer to *Section : ADC_IT* for details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified ADC interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### ADC_IT

ADC_IT is used to enable or disable ADC interrupts. One or a combination of the following values can be used:

**Table 16. ADC_IT definition**

| ADC_IT | Description |
|---|---|
| ADC_IT_EOC | EOC interrupt mask |
| ADC_IT_AWD | AWDOG interrupt mask |
| ADC_IT_JEOC | JEOC interrupt mask |

**Example:**

```
/* Enable ADC2 EOC and AWDOG interrupts */
ADC_ITConfig(ADC2, ADC_IT_EOC | ADC_IT_AWD, ENABLE);
```

### 4.2.7 ADC_ResetCalibration function

*Table 17* describes the ADC_ResetCalibration function.

**Table 17. ADC_ResetCalibration function**

| | |
|---|---|
| Function name | ADC_ResetCalibration |
| Function prototype | void ADC_ResetCalibration(ADC_TypeDef* ADCx) |
| Behavior description | Resets the selected ADC calibration registers. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Reset the ADC1 Calibration registers */
ADC_ResetCalibration(ADC1);
```

### 4.2.8 ADC_GetResetCalibrationStatus function

*Table 18* describes the ADC_GetResetCalibration function.

**Table 18. ADC_GetResetCalibration function**

| | |
|---|---|
| Function name | ADC_GetResetCalibrationStatus |
| Function prototype | FlagStatus ADC_GetResetCalibrationStatus(ADC_TypeDef* ADCx) |
| Behavior description | Gets the selected ADC reset calibration registers status. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | The new state of ADC Reset Calibration registers (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the ADC2 reset calibration registers status */
FlagStatus Status;
Status = ADC_GetResetCalibrationStatus(ADC2);
```

### 4.2.9 ADC_StartCalibration function

*Table 19* describes the ADC_StartCalibration function.

**Table 19. ADC_StartCalibration function**

| | |
|---|---|
| Function name | ADC_StartCalibration |
| Function prototype | void ADC_StartCalibration(ADC_TypeDef* ADCx) |
| Behavior description | Starts the selected ADC calibration process. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Start the ADC2 Calibration */
ADC_StartCalibration(ADC2);
```

### 4.2.10 ADC_GetCalibrationStatus function

*Table 20* describes the ADC_GetCalibrationStatus function.

**Table 20. ADC_GetCalibrationStatus function**

| | |
|---|---|
| Function name | ADC_GetCalibrationStatus |
| Function prototype | FlagStatus ADC_GetCalibrationStatus(ADC_TypeDef* ADCx) |
| Behavior description | Gets the selected ADC calibration status. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | The new state of ADC Calibration (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the ADC2 calibration status */
FlagStatus Status;
Status = ADC_GetCalibrationStatus(ADC2);
```

### 4.2.11 ADC_SoftwareStartConvCmd function

*Table 21* describes the ADC_SoftwareStartConvCmd function.

**Table 21. ADC_SoftwareStartConvCmd function**

| | |
|---|---|
| Function name | ADC_SoftwareStartConvCmd |
| Function prototype | void ADC_SoftwareStartConvCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the selected ADC software start conversion. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC software start conversion.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Start by software the ADC1 Conversion */
ADC_SoftwareStartConvCmd(ADC1, ENABLE);
```

### 4.2.12 ADC_GetSoftwareStartConvStatus function

*Table 22* describes the ADC_GetSoftwareStartConvStatus function.

**Table 22. ADC_GetSoftwareStartConvStatus function**

| | |
|---|---|
| Function name | ADC_GetSoftwareStartConvStatus |
| Function prototype | FlagStatus ADC_GetSoftwareStartConvStatus(ADC_TypeDef* ADCx) |
| Behavior description | Gets the selected ADC Software start conversion Status. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | The new state of ADC software start conversion (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the ADC1 conversion start bit */
FlagStatus Status;
Status = ADC_GetSoftwareStartConvStatus(ADC1);
```

### 4.2.13 ADC_DiscModeChannelCountConfig function

*Table 23* describes the ADC_DiscModeChannelCountConfig function.

**Table 23. ADC_DiscModeChannelCountConfig function**

| | |
|---|---|
| Function name | ADC_DiscModeChannelCountConfig |
| Function prototype | void ADC_DiscModeChannelCountConfig(ADC_TypeDef* ADCx, u8 Number) |
| Behavior description | Configures the discontinuous mode for the selected ADC regular group channel. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | Number: the discontinuous mode regular channel count value.<br>This number ranges from 1 to 8. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Set the discontinuous mode channel count to 2 for ADC1 */
ADC_DiscModeChannelCountConfig(ADC1, 2);
```

### 4.2.14 ADC_DiscModeCmd function

*Table 24* describes the ADC_DiscModeCmd function.

**Table 24. ADC_DiscModeCmd function**

| | |
|---|---|
| Function name | ADC_DiscModeCmd |
| Function prototype | void ADC_DiscModeCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the discontinuous mode on regular group channel for the specified ADC |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the ADC discontinuous mode on regular group channel.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Disable the discontinuous mode for ADC1 regular group channel */
ADC_DiscModeCmd(ADC1, ENABLE);
```

## 4.2.15 ADC_RegularChannelConfig function

*Table 25* describes the ADC_RegularChannelConfig function.

**Table 25. ADC_RegularChannelConfig function**

| | |
|---|---|
| Function name | ADC_RegularChannelConfig |
| Function prototype | void ADC_RegularChannelConfig(ADC_TypeDef* ADCx, u8 ADC_Channel, u8 Rank, u8 ADC_SampleTime) |
| Behavior description | Configures for the selected ADC regular channel its corresponding rank in the sequencer and its sample time. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_Channel: the ADC channel to be configured.<br>Refer to *Section : ADC_Channel* for details on the allowed values of this parameter. |
| Input parameter3 | Rank: The rank in the regular group sequencer.<br>This parameter ranges from 1 to 16. |
| Input parameter4 | ADC_SampleTime: The sample time value to be set for the selected channel.<br>Refer to section *Section : ADC_SampleTime* for details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### ADC_Channel

The ADC_Channel parameter specifies the ADC channel that will be configured by issuing a ADC_RegularChannelConfig function. *Table 26* shows the values taken by ADC_Channel:

**Table 26. ADC_Channel values**

| ADC_Channel | Description |
|---|---|
| ADC_Channel_0 | ADC Channel0 selected |
| ADC_Channel_1 | ADC Channel1 selected |
| ADC_Channel_2 | ADC Channel2 selected |
| ADC_Channel_3 | ADC Channel3 selected |
| ADC_Channel_4 | ADC Channel4 selected |
| ADC_Channel_5 | ADC Channel5 selected |
| ADC_Channel_6 | ADC Channel6 selected |
| ADC_Channel_7 | ADC Channel7 selected |
| ADC_Channel_8 | ADC Channel8 selected |
| ADC_Channel_9 | ADC Channel9 selected |
| ADC_Channel_10 | ADC Channel10 selected |

Table 26. ADC_Channel values (continued)

| ADC_Channel | Description |
|---|---|
| ADC_Channel_11 | ADC Channel11 selected |
| ADC_Channel_12 | ADC Channel12 selected |
| ADC_Channel_13 | ADC Channel13 selected |
| ADC_Channel_14 | ADC Channel14 selected |
| ADC_Channel_15 | ADC Channel15 selected |
| ADC_Channel_16 | ADC Channel16 selected |
| ADC_Channel_17 | ADC Channel17 selected |

### ADC_SampleTime

This parameter specifies the ADC samples time for the selected channel. *Table 27* gives the values taken by ADC_SampleTime.

Table 27. ADC_SampleTime values

| ADC_SampleTime | Description |
|---|---|
| ADC_SampleTime_1Cycles5 | Sample time equal to 1.5 cycles |
| ADC_SampleTime_7Cycles5 | Sample time equal to 7.5 cycles |
| ADC_SampleTime_13Cycles5 | Sample time equal to 13.5 cycles |
| ADC_SampleTime_28Cycles5 | Sample time equal to 28.5 cycles |
| ADC_SampleTime_41Cycles5 | Sample time equal to 41.5 cycles |
| ADC_SampleTime_55Cycles5 | Sample time equal to 55.5 cycles |
| ADC_SampleTime_71Cycles5 | Sample time equal to 71.5 cycles |
| ADC_SampleTime_239Cycles5 | Sample time equal to 239.5 cycles |

**Example**:

```
/* Configures ADC1 Channel2 as: first converted channel with an 7.5
cycles sample time */
ADC_RegularChannelConfig(ADC1, ADC_Channel_2, 1,
ADC_SampleTime_7Cycles5);
```

```
/* Configures ADC1 Channel8 as: second converted channel with an 1.5
cycles sample time */
ADC_RegularChannelConfig(ADC1, ADC_Channel_8, 2,
ADC_SampleTime_1Cycles5);
```

### 4.2.16 ADC_ExternalTrigConvCmd function

*Table 28* describes the ADC_ExternalTrigConvCmd function.

**Table 28. ADC_ExternalTrigConvCmd function**

| | |
|---|---|
| Function name | ADC_ExternalTrigConvCmd |
| Function prototype | void ADC_ExternalTrigConvCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the ADCx conversion through external Trigger. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or AD2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC external trigger starting the conversion.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/*Enable the start of conversion for ADC1 through exteral trigger */
ADC_ExternalTrigConvCmd(ADC1, ENABLE);
```

### 4.2.17 ADC_GetConversionValue function

*Table 29* describes the ADC_GetConversionValue function.

**Table 29. ADC_GetConversionValue function**

| | |
|---|---|
| Function name | ADC_GetConversionValue |
| Function prototype | u16 ADC_GetConversionValue(ADC_TypeDef* ADCx) |
| Behavior description | Returns the last ADCx conversion result data for regular channel. |
| Input parameter | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | The Data conversion value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/*Returns the ADC1 Master data value of the last converted channel*/
u16 DataValue;
DataValue = ADC_GetConversionValue(ADC1);
```

### 4.2.18 ADC_GetDualModeConversionValue function

*Table 30* describes the ADC_GetDualModeConversionValue function.

**Table 30. ADC_GetDualModeConversionValue function**

| | |
|---|---|
| Function name | ADC_GetDualModeConversionValue |
| Function prototype | u32 ADC_GetDualModeConversionValue() |
| Behavior description | Returns the last ADC converted data in dual mode |
| Output parameter | None |
| Return parameter | The Data conversion value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Returns the ADC1 and ADC2 last converted values*/
u32 DataValue;
DataValue = ADC_GetDualModeConversionValue();
```

### 4.2.19 ADC_AutoInjectedConvCmd function

*Table 31* describes the ADC_AutoInjectedConvCmd function.

**Table 31. ADC_AutoInjectedConvCmd function**

| | |
|---|---|
| Function name | ADC_AutoInjectedConvCmd |
| Function prototype | void ADC_AutoInjectedConvCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the selected ADC automatic injected group conversion after regular group. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC auto injected conversion.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the auto injected conversion for ADC2 */
ADC_AutoInjectedConvCmd(ADC2, ENABLE);
```

### 4.2.20 ADC_InjectedDiscModeCmd function

*Table 32* describes the ADC_InjectedDiscModeCmd function.

**Table 32. ADC_InjectedDiscModeCmd function**

| | |
|---|---|
| Function name | ADC_InjectedDiscModeCmd |
| Function prototype | void ADC_InjectedDiscModeCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the discontinuous mode for injected group channel for the specified ADC |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC discontinuous mode on injected group channel.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the injected discontinuous mode for ADC2 */
ADC_InjectedDiscModeCmd(ADC2, ENABLE);
```

### 4.2.21 ADC_ExternalTrigInjectedConvConfig function

*Table 33* describes the ADC_ExternalTrigInjectedConvConfig function.

**Table 33. ADC_ExternalTrigInjectedConvConfig function**

| | |
|---|---|
| Function name | ADC_ExternalTrigInjectedConvConfig |
| Function prototype | void ADC_ExternalTrigInjectedConvConfig(ADC_TypeDef* ADCx, u32 ADC_ExternalTrigConv) |
| Behavior description | Configures the ADCx external trigger for injected channels conversion. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ACD2 peripheral. |
| Input parameter2 | ADC_ExternalTrigInjecConv: the ADC trigger to start injected conversion.<br>Refer to *Section : ADC_ExternalTrigInjecConv* for details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### ADC_ExternalTrigInjecConv

This parameter specifies the ADC trigger that is used to start injected conversion. *Table 34* gives the values taken by ADC_ExternalTrigInjecConv.

**Table 34. ADC_ExternalTrigInjecConv values**

| ADC_ExternalTrigInjecConv | Description |
|---|---|
| ADC_ExternalTrigInjecConv_T1_TRGO | Timer1 TRGO event selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_T1_CC4 | Timer1 capture compare4 selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_T2_TRGO | Timer2 TRGO event selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_T2_CC1 | Timer2 capture compare1 selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_T3_CC4 | Timer3 capture compare4 selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_T4_TRGO | Timer4 TRGO event selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_Ext_IT15 | External interrupt 15 event selected as external trigger for injected conversion |
| ADC_ExternalTrigInjecConv_None | Injected conversion started by software and not by external trigger |

**Example**:

```
/* Set ADC1 injected external trigger conversion start to Timer1
capture compare4 */
ADC_ExternalTrigInjectedConvConfig(ADC1,
ADC_ExternalTrigConv_T1_CC4);
```

### 4.2.22 ADC_ExternalTrigInjectedConvCmd function

*Table 35* describes the ADC_ExternalTrigInjectedConvCmd function.

**Table 35. ADC_ExternalTrigInjectedConvCmd function**

| | |
|---|---|
| Function name | ADC_ExternalTrigInjectedConvCmd |
| Function prototype | void ADC_ExternalTrigInjectedConvCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the ADCx injected channels conversion through external trigger |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC external trigger used to start injected conversion.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the start of injected conversion for ADC1 through exteral
trigger */
ADC_ExternalTrigInjectedConvCmd(ADC1, ENABLE);
```

### 4.2.23 ADC_SoftwareStartInjectedConvCmd function

*Table 36* describes the ADC_SoftwareStartInjectedConvCmd function.

**Table 36. ADC_SoftwareStartInjectedConvCmd function**

| | |
|---|---|
| Function name | ADC_SoftwareStartInjectedConvCmd |
| Function prototype | void ADC_SoftwareStartInjectedConvCmd(ADC_TypeDef* ADCx, FunctionalState NewState) |
| Behavior description | Enables or disables the start of the injected channels conversion. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | NewState: new state of the selected ADC software used to start injected conversion.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Start by software the ADC2 Conversion */
ADC_SoftwareStartInjectedConvCmd(ADC2, ENABLE);
```

### 4.2.24 ADC_GetSoftwareStartInjectedConvStatus function

*Table 37* describes the ADC_GetSoftwareStartInjectedConvStatus function.

**Table 37. ADC_GetSoftwareStartInjectedConvStatus function**

| | |
|---|---|
| Function name | ADC_GetSoftwareStartInjectedConvStatus |
| Function prototype | FlagStatus ADC_GetSoftwareStartInjectedConvStatus(ADC_TypeDef* ADCx) |
| Behavior description | Gets the selected ADC Software start injected conversion Status. |
| Input parameter | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Output parameter | None |
| Return parameter | The new state of ADC software start injected conversion (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the ADC1 injected conversion start bit */
FlagStatus Status;
Status = ADC_GetSoftwareStartInjectedConvStatus(ADC1);
```

### 4.2.25 ADC_InjectedChannelConfig function

*Table 38* describes the ADC_InjectedChannelConfig function.

**Table 38. ADC_InjectedChannelConfig function**

| | |
|---|---|
| Function name | ADC_InjectedChannelConfig |
| Function prototype | void ADC_InjectedChannelConfig(ADC_TypeDef* ADCx, u8 ADC_Channel, u8 Rank, u8 ADC_SampleTime) |
| Behavior description | Configures for the selected ADC injected channel the corresponding rank in the sequencer and the sample time. |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_Channel: ADC channel to be configured.<br>Refer to *Section : ADC_Channel* for more details on the allowed values of this parameter. |
| Input parameter3 | Rank: The rank in the injected group sequencer.<br>This parameter ranges from 1 to 4. |
| Input parameter4 | ADC_SampleTime: sample time value to be set for the selected channel.<br>Refer to *Section : ADC_SampleTime* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | ADC_InjectedSequencerLengthConfig must be called before to specify the total injected channel number. This is necessary specially when this number is less than 4 to properly configure the rank of each injected channel |
| Called functions | None |

#### ADC_Channel

ADC_Channel specifies the ADC channel to be configured. Refer to *Table 26* for the values taken by this parameter.

#### ADC_SampleTime

ADC_SampleTime specifies the ADC Sample Time for the selected channel. Refer to *Table 27* for the values taken by this parameter.

**Example**:

```
/* Configures ADC1 Channel12 as: second converted channel with an
28.5 cycles sample time */
ADC_InjectedChannelConfig(ADC1, ADC_Channel_12, 2,
ADC_SampleTime_28Cycles5);

/* Configures ADC2 Channel4 as: eleven converted channel with an
71.5 cycles sample time */
ADC_InjectedChannelConfig(ADC2, ADC_Channel_4, 11,
ADC_SampleTime_71Cycles5);
```

### 4.2.26 ADC_InjectedSequencerLengthConfig function

*Table 39* describes the ADC_InjectedSequencerLengthConfig function.

**Table 39. ADC_InjectedSequencerLengthConfig function**

| | |
|---|---|
| Function name | ADC_InjectedSequencerLengthConfig |
| Function prototype | void ADC_InjectedSequencerLengthConfig(ADC_TypeDef* ADCx, u8 Length) |
| Behavior description | Configures the sequencer length for injected channels |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | Length: sequencer length.<br>This parameter ranges from 1 to 4. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set the ADC1 Sequencer length to 4 channels */
ADC_InjectedSequencerLengthConfig(ADC1, 4);
```

### 4.2.27 ADC_SetInjectedOffset function

*Table 40* describes the ADC_SetInjectedOffset function.

**Table 40. ADC_SetInjectedOffset function**

| | |
|---|---|
| Function name | ADC_SetInjectedOffset |
| Function prototype | void ADC_SetInjectedOffset(ADC_TypeDef* ADCx, u8 ADC_InjectedChannel, u16 Offset) |
| Behavior description | Set the injected channels conversion offset value |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_InjectedChannel: ADC injected channel for which the offset must be set<br>Refer to *Section : ADC_InjectedChannel* for more details on the allowed values of this parameter. |
| Input parameter3 | Offset: offset value for the selected ADC injected channel<br>This parameter is a 12-bit value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### ADC_InjectedChannel

ADC_InjectedChannel specifies the ADC injected channel for which the offset must be set. *Table 41* gives the values of this parameter.

**Table 41. ADC_InjectedChannel values**

| ADC_InjectedChannel | Description |
|---|---|
| ADC_InjectedChannel_1 | Injected Channel1 selected |
| ADC_InjectedChannel_2 | Injected Channel2 selected |
| ADC_InjectedChannel_3 | Injected Channel3 selected |
| ADC_InjectedChannel_4 | Injected Channel4 selected |

**Example**:

```
/* Set the offset 0x100 for the 3rd injected Channel of ADC1 */
ADC_SetInjectedOffset(ADC1, ADC_InjectedChannel_3, 0x100);
```

## 4.2.28 ADC_GetInjectedConversionValue function

*Table 42* describes the ADC_GetInjectedConversionValue function.

**Table 42. ADC_GetInjectedConversionValue function**

| | |
|---|---|
| Function name | ADC_GetInjectedConversionValue |
| Function prototype | u16 ADC_GetInjectedConversionValue(ADC_TypeDef* ADCx, u8 ADC_InjectedChannel) |
| Behavior description | Returns the selected ADC injected channel conversion result |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_InjectedChannel: converted ADC injected channel.<br>Refer to *Section : ADC_InjectedChannel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | Data conversion value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Return the ADC1 injected channel1 converted data value */
u16 InjectedDataValue;
InjectedDataValue = ADC_GetInjectedConversionValue(ADC1,
ADC_InjectedChannel_1);
```

### 4.2.29 ADC_AnalogWatchdogCmd function

*Table 43* describes the ADC_AnalogWatchdogCmd function.

**Table 43. ADC_AnalogWatchdogCmd function**

| | |
|---|---|
| Function name | ADC_AnalogWatchdogCmd |
| Function prototype | void ADC_AnalogWatchdogCmd(ADC_TypeDef* ADCx, u32 ADC_AnalogWatchdog) |
| Behavior description | Enables or disables the analog watchdog on one or all regular or injected channels |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ACD2 peripheral. |
| Input parameter2 | ADC_AnalogWatchdog: ADC analog watchdog configuration.<br>Refer to *Section : ADC_AnalogWatchdog* for more details on the values taken by this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### ADC_AnalogWatchdog

ADC_AnalogWatchdog specifies the ADC analog watchdog configuration. *Table 44* gives the value taken by this parameter.

**Table 44. ADC_AnalogWatchdog values**

| ADC_AnalogWatchdog | Description |
|---|---|
| ADC_AnalogWatchdog_SingleRegEnable | Analog watchdog on a single regular channel |
| ADC_AnalogWatchdog_SingleInjecEnable | Analog watchdog on a single injected channel |
| ADC_AnalogWatchdog_SingleRegorInjecEnable | Analog watchdog on a single regular or injected channel |
| ADC_AnalogWatchdog_AllRegEnable | Analog watchdog on all regular channels |
| ADC_AnalogWatchdog_AllInjecEnable | Analog watchdog on all injected channels |
| ADC_AnalogWatchdog_AllRegAllInjecEnable | Analog watchdog on all regular and injected channels |
| ADC_AnalogWatchdog_None | No channel guarded by the analog watchdog |

**Example**:

```
/* Configue the Analog watchdog on all regular and injected channels
of ADC2 */
ADC_AnalogWatchdogCmd(ADC2,
ADC_AnalogWatchdog_AllRegAllInjecEnable);
```

### 4.2.30 ADC_AnalogWatchdogThresholdsConfig function

*Table 45* describes the ADC_AnalogWatchdogThresholdsConfig function.

**Table 45. ADC_AnalogWatchdogThresholdsConfig function**

| | |
|---|---|
| Function name | ADC_AnalogWatchdogThresholdsConfig |
| Function prototype | void ADC_AnalogWatchdogThresholdsConfig(ADC_TypeDef* ADCx, u16 HighThreshold, u16 LowThreshold) |
| Behavior description | Configures the high and low thresholds of the analog watchdog |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | HighThreshold: ADC analog watchdog High threshold value.<br>This parameter must be a 12-bit value. |
| Input parameter3 | LowThreshold: ADC analog watchdog Low threshold value.<br>This parameter must be a 12-bit value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Configue the Analog watchdog High and Low thresholds for ADC1 */
ADC_AnalogWatchdogThresholdsConfig(ADC1, 0x400, 0x100);
```

### 4.2.31 ADC_AnalogWatchdogSingleChannelConfig function

*Table 46* describes the AnalogWatchdogSingleChannelConfig function.

**Table 46. AnalogWatchdogSingleChannelConfig function**

| | |
|---|---|
| Function name | ADC_AnalogWatchdogSingleChannelConfig |
| Function prototype | void ADC_AnalogWatchdogSingleChannelConfig(ADC_TypeDef* ADCx, u8 ADC_Channel) |
| Behavior description | Configures the analog watchdog guarded single channel |
| Input parameter1 | ADCx: where x can be 1 or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_Channel: ADC channel for which the analog watchdog will be configured.<br>Refer to *Section : ADC_Channel* or more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Configue the Analog watchdog on Channel1 of ADC1 */
ADC_AnalogWatchdogSingleChannelConfig(ADC1, ADC_Channel_1);
```

### 4.2.32 ADC_TempSensorVrefintCmd function

*Table 47* describes the ADC_TempSensorVrefintCmd function.

**Table 47. ADC_TempSensorVrefintCmd function**

| | |
|---|---|
| Function name | ADC_TempSensorVrefintCmd |
| Function prototype | void ADC_TempSensorVrefintCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the temperature sensor and Vrefint channel. |
| Input parameter | NewState: new state of the temperature sensor and Vrefint channel<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the temperature sensor and vref internal channel */
ADC_TempSensorVrefintCmd(ENABLE);
```

### 4.2.33 ADC_GetFlagStatus function

*Table 48* describes the ADC_GetFlagStatus function.

**Table 48. ADC_GetFlagStatus function**

| | |
|---|---|
| Function name | ADC_GetFlagStatus |
| Function prototype | FlagStatus ADC_GetFlagStatus(ADC_TypeDef* ADCx, u8 ADC_FLAG) |
| Behavior description | Checks whether the specified ADC flag is set or not. |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_FLAG: specifies the flag to check.<br>Refer to *Section : ADC_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | New state of ADC_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### ADC_FLAG

The values of the ADC_FLAG are given in *Table 49*.

**Table 49. ADC_FLAG values**

| ADC_FLAG | Description |
|---|---|
| ADC_FLAG_AWD | Analog watchdog flag |
| ADC_FLAG_EOC | End of conversion flag |
| ADC_FLAG_JEOC | End of injected group conversion flag |
| ADC_FLAG_JSTRT | Start of injected group conversion flag |
| ADC_FLAG_STRT | Start of regular group conversion flag |

**Example:**

```
/* Test if the ADC1 EOC flag is set or not */
FlagStatus Status;
Status = ADC_GetFlagStatus(ADC1, ADC_FLAG_EOC);
```

## 4.2.34 ADC_ClearFlag function

*Table 50* describes the ADC_ClearFlag function.

**Table 50. ADC_ClearFlag function**

| | |
|---|---|
| Function name | ADC_ClearFlag |
| Function prototype | void ADC_ClearFlag(ADC_TypeDef* ADCx, u8 ADC_FLAG) |
| Behavior description | Clears the ADCx's pending flags. |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_FLAG: flag to clear. More than one flag can be cleared using the "\|" operator.<br>Refer to *Section : ADC_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the ADC2 STRT pending flag */
ADC_ClearFlag(ADC2, ADC_FLAG_STRT);
```

### 4.2.35 ADC_GetITStatus function

*Table 51* describes the ADC_GetITStatus function.

**Table 51. ADC_GetITStatus function**

| | |
|---|---|
| Function name | ADC_GetITStatus |
| Function prototype | ITStatus ADC_GetITStatus(ADC_TypeDef* ADCx, u16 ADC_IT) |
| Behavior description | Checks whether the specified ADC interrupt has occurred or not. |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_IT: ADC interrupt source to check.<br>Refer to *Section : ADC_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of ADC_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Test if the ADC1 AWD interrupt has occurred or not */
ITStatus Status;
Status = ADC_GetITStatus(ADC1, ADC_IT_AWD);
```

### 4.2.36 ADC_ClearITPendingBit function

*Table 52* describes the ADC_ClearITPendingBit function.

**Table 52. ADC_ClearITPendingBit function**

| | |
|---|---|
| Function name | ADC_ClearITPending Bit |
| Function prototype | void ADC_ClearITPendingBit(ADC_TypeDef* ADCx, u16 ADC_IT) |
| Behavior description | Clears the ADCx’s interrupt pending bits. |
| Input parameter1 | ADCx: where x can be 1or 2 to select ADC1 or ADC2 peripheral. |
| Input parameter2 | ADC_IT: interrupt pending bit to clear.<br>Refer to *Section : ADC_IT*” for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the ADC2 JEOC interrupt pending bit */
ADC_ClearITPendingBit(ADC2, ADC_IT_JEOC);
```

# 5 Backup registers (BKP)

The backup registers are ten 16-bit registers which are used to store 20 bytes of user application data. They are implemented in the backup domain that remains powered on by $V_{BAT}$ when $V_{DD}$ is switched off.

The BKP registers are also used to manage Tamper detection feature and RTC calibration.

*Section 5.1: BKP register structure* describes the data structures used in the BKP firmware library. *Section 5.2: Firmware library functions* presents the firmware library functions.

## 5.1 BKP register structure

The BKP register structure, *BKP_TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  u32 RESERVED0;
  vu16 DR1;
  u16  RESERVED1;
  vu16 DR2;
  u16  RESERVED2;
  vu16 DR3;
  u16  RESERVED3;
  vu16 DR4;
  u16  RESERVED4;
  vu16 DR5;
  u16  RESERVED5;
  vu16 DR6;
  u16  RESERVED6;
  vu16 DR7;
  u16  RESERVED7;
  vu16 DR8;
  u16  RESERVED8;
  vu16 DR9;
  u16  RESERVED9;
  vu16 DR10;
  u16  RESERVED10;
  vu16 RTCCR;
  u16  RESERVED11;
  vu16 CR;
  u16  RESERVED12;
  vu16 CSR;
  u16  RESERVED13;
} BKP_TypeDef;
```

*Table 53* gives the list of the BKP registers:

**Table 53. BKP registers**

| Register | Description |
|---|---|
| DR 1-10 | Data Backup Register 1 to 10 |
| RTCCR | RTC Clock Calibration Register |
| CR | Backup Control Register |
| CSR | Backup Control Status Register |

The BKP peripheral is also declared in *stm32f10x_map.h*:

```
#define PERIPH_BASE             ((u32)0x40000000)
#define APB1PERIPH_BASE         PERIPH_BASE
#define APB2PERIPH_BASE         (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE          (PERIPH_BASE + 0x20000)
#define BKP_BASE                (APB1PERIPH_BASE + 0x6C00)
#ifndef DEBUG
...
#ifdef _BKP
  #define BKP                     ((BKP_TypeDef *) BKP_BASE)
#endif /*_BKP */
...
#else   /* DEBUG */
...
#ifdef _BKP
  EXT BKP_TypeDef               *BKP;
#endif /*_BKP */
...
#endif
```

When using the Debug mode, the BKP pointer is initialized in *stm32f10x_lib.c*:

```
#ifdef _BKP
  BKP = (BKP_TypeDef *)  BKP_BASE;
#endif /*_BKP */
```

To access the backup registers, _BKP must be defined in *stm32f10x_conf.h,* as follows:

```
#define _BKP
```

## 5.2 Firmware library functions

*Table 54* lists the BKP library functions.

**Table 54. BKP library functions**

| Function name | Description |
|---|---|
| BKP_DeInit | Resets the BKP peripheral registers to their default reset values. |
| BKP_TamperPinLevelConfig | Configures the Tamper Pin active level. |
| BKP_TamperPinCmd | Enables or disables the Tamper Pin activation. |
| BKP_ITConfig | Enables or disables the Tamper Pin Interrupt. |
| BKP_RTCOutputConfig | Selects the RTC output source to output on the Tamper pin. |
| BKP_SetRTCCalibrationValue | Sets RTC Clock Calibration value. |
| BKP_WriteBackupRegister | Writes user data to the specified Data Backup Register. |
| BKP_ReadBackupRegister | Reads data from the specified Data Backup Register. |
| BKP_GetFlagStatus | Checks whether the Tamper Pin Event flag is set or not. |
| BKP_ClearFlag | Clears Tamper Pin Event pending flag. |
| BKP_GetITStatus | Checks whether the Tamper Pin Interrupt has occurred or not. |
| BKP_ClearITPendingBit | Clears Tamper Pin Interrupt pending bit. |

### 5.2.1 BKP_DeInit function

*Table 55* describes the BKP_DeInit function.

**Table 55. BKP_DeInit function**

| | |
|---|---|
| Function name | BKP_DeInit |
| Function prototype | void BKP_DeInit(void) |
| Behavior description | Resets the BKP registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_BackupResetCmd |

**Example:**

```
/* Reset the BKP registers */
BKP_DeInit();
```

### 5.2.2 BKP_TamperPinLevelConfig function

*Table 56* describes the BKP_TamperPinLevelConfig function.

**Table 56. BKP_TamperPinLevelConfig function**

| | |
|---|---|
| Function name | BKP_TamperPinLevelConfig |
| Function prototype | void BKP_TamperPinLevelConfig(u16 BKP_TamperPinLevel) |
| Behavior description | Configures the Tamper Pin active level. |
| Input parameter | BKP_TamperPinLevel: Tamper Pin active level.<br>Refer to *Section : BKP_TamperPinLevel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### BKP_TamperPinLevel

The BKP_TamperPinLevel input parameter is used to select the Tamper Pin active level. It can take one of the following values:

**Table 57. BKP_TamperPinLevel values**

| BKP_TamperPinLevel | Description |
|---|---|
| BKP_TamperPinLevel_High | Tamper pin active on high level |
| BKP_TamperPinLevel_Low | Tamper pin active on low level |

**Example:**

```
/* Configure Tamper pin to be active on high level*/
BKP_TamperPinLevelConfig(BKP_TamperPinLevel_High);
```

### 5.2.3 BKP_TamperPinCmd function

*Table 58* describes the BKP_TamperPinCmd function.

**Table 58. BKP_TamperPinCmd function**

| | |
|---|---|
| Function name | BKP_TamperPinCmd |
| Function prototype | void BKP_TamperPinCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the Tamper Pin activation. |
| Input parameter | NewState: new state of the Tamper Pin activation.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable Tamper Pin functionality */
BKP_TamperPinCmd(ENABLE);
```

### 5.2.4 BKP_ITConfig function

*Table 59* describes the BKP_ITConfig function.

**Table 59. BKP_ITConfig function**

| | |
|---|---|
| Function name | BKP_ITConfig |
| Function prototype | void BKP_ITConfig(FunctionalState NewState) |
| Behavior description | Enables or disables the Tamper Pin Interrupt. |
| Input parameter | NewState: new state of the Tamper Pin Interrupt.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable Tamper Pin interrupt */
BKP_ITConfig(ENABLE);
```

### 5.2.5 BKP_RTCOutputConfig function

*Table 60* describes the BKP_RTCOutputConfig function.

**Table 60. BKP_RTCOutputConfig function**

| | |
|---|---|
| Function name | BKP_RTCOutputConfig |
| Function prototype | void BKP_RTCOutputConfig(u16 BKP_RTCOutputSource) |
| Behavior description | Selects the RTC output source to output on the Tamper pin. |
| Input parameter | BKP_RTCOutputSource: specifies the RTC output source.<br>Refer to *Section : BKP_RTCOutputSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | The Tamper Pin functionality must be disabled before using this function. |
| Called functions | None |

#### BKP_RTCOutputSource

The BKP_RTCOutputSource input parameter is used to select the RTC output source. It can take one of the following values:

**Table 61. BKP_RTCOutputSource values**

| BKP_RTCOutputSource | Description |
|---|---|
| BKP_RTCOutputSource_None | No RTC output on the Tamper pin. |
| BKP_RTCOutputSource_CalibClock | Output the RTC clock with frequency divided by 64 on the Tamper pin |
| BKP_RTCOutputSource_Alarm | Output the RTC Alarm pulse signal on the Tamper pin. |
| BKP_RTCOutputSource_Second | Output the RTC Second pulse signal on the Tamper pin. |

**Example:**

```
/* Output the RTC clock source with frequency divided by 64 on the
Tamper pad(if the Tamper Pin functionality is disabled) */
BKP_RTCOutputConfig(BKP_RTCOutputSource_CalibClock);
```

### 5.2.6 BKP_SetRTCCalibrationValue function

*Table 62* describes the BKP_SetRTCCalibrationValue function.

**Table 62. BKP_SetRTCCalibrationValue function**

| | |
|---|---|
| Function name | BKP_SetRTCCalibrationValue |
| Function prototype | void BKP_SetRTCCalibrationValue(u8 CalibrationValue) |
| Behavior description | Sets RTC Clock Calibration value. |

Table 62. BKP_SetRTCCalibrationValue function (continued)

| | |
|---|---|
| Input parameter | CalibrationValue: RTC Clock Calibration value.<br>This parameter ranges from 0 to 0x7F. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set RTC clock calibration value to 0x7F (maximum) */
BKP_SetRTCCalibrationValue(0x7F);
```

### 5.2.7 BKP_WriteBackupRegister function

*Table 63* describes the BKP_WriteBackupRegister function.

Table 63. BKP_WriteBackupRegister function

| | |
|---|---|
| Function name | BKP_WriteBackupRegister |
| Function prototype | void BKP_WriteBackupRegister(u16 BKP_DR, u16 Data) |
| Behavior description | Writes user data to the specified Data Backup Register. |
| Input parameter1 | BKP_DR: Data Backup Register.<br>Refer to *Section : BKP_DR* for more details on the allowed values of this parameter. |
| Input parameter2 | Data: data to write. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**BKP_DR**

BKP_CR is used to select the Data Backup Register. *Table 64* shows the values taken by this parameter.

Table 64. BKP_DR values

| BKP_DR | Description |
|---|---|
| BKP_DR1 | Data Backup Register1 is selected |
| BKP_DR2 | Data Backup Register2 is selected |
| BKP_DR3 | Data Backup Register3 is selected |
| BKP_DR4 | Data Backup Register4 is selected |
| BKP_DR5 | Data Backup Register5 is selected |
| BKP_DR6 | Data Backup Register6 is selected |
| BKP_DR7 | Data Backup Register7 is selected |

Table 64. BKP_DR values (continued)

| BKP_DR | Description |
|---|---|
| BKP_DR8 | Data Backup Register8 is selected |
| BKP_DR9 | Data Backup Register9 is selected |
| BKP_DR10 | Data Backup Register10 is selected |

**Example:**

```
/* Write 0xA587 to Data Backup Register1 */
BKP_WriteBackupRegister(BKP_DR1, 0xA587);
```

### 5.2.8 BKP_ReadBackupRegister function

*Table 65* describes the BKP_ReadBackupRegister function.

Table 65. BKP_ReadBackupRegister function

| | |
|---|---|
| Function name | BKP_ReadBackupRegister |
| Function prototype | u16 BKP_ReadBackupRegister(u16 BKP_DR) |
| Behavior description | Reads data from the specified Data Backup Register. |
| Input parameter | BKP_DR: Data Backup Register.<br>Refer to *Section : BKP_DR* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The content of the specified Data Backup Register. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Read Data Backup Register1 */
u16 Data;
Data = BKP_ReadBackupRegister(BKP_DR1);
```

### 5.2.9 BKP_GetFlagStatus function

*Table 66* describes the BKP_GetFlagStatus function.

**Table 66. BKP_GetFlagStatus function**

| | |
|---|---|
| Function name | BKP_GetFlagStatus |
| Function prototype | FlagStatus BKP_GetFlagStatus(void) |
| Behavior description | Checks whether the Tamper Pin Event flag is set or not. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The new state of the Tamper Pin Event flag (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Test if the Tamper Pin Event flag is set or not */
FlagStatus Status;
Status = BKP_GetFlagStatus();
if(Status == RESET)
{
...
}
else
{
...
}
```

### 5.2.10 BKP_ClearFlag function

*Table 67* describes the BKP_ClearFlag function.

**Table 67. BKP_ClearFlag function**

| | |
|---|---|
| Function name | BKP_ClearFlag |
| Function prototype | void BKP_ClearFlag(void) |
| Behavior description | Clears Tamper Pin Event pending flag. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear Tamper Pin Event pending flag */
BKP_ClearFlag();
```

### 5.2.11 BKP_GetITStatus function

*Table 68* describes the BKP_GetITStatus function.

**Table 68. BKP_GetITStatus function**

| | |
|---|---|
| Function name | BKP_GetITStatus |
| Function prototype | ITStatus BKP_GetITStatus(void) |
| Behavior description | Checks whether the Tamper Pin Interrupt has occurred or not. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The new state of the Tamper Pin Interrupt (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Test if the Tamper Pin interrupt has occurred or not */
ITStatus Status;
Status = BKP_GetITStatus();
if(Status == RESET)
{
...
}
else
{
...
}
```

### 5.2.12 BKP_ClearITPendingBit function

*Table 69* describes the BKP_ClearITPendingBit function.

**Table 69. BKP_ClearITPendingBit function**

| | |
|---|---|
| Function name | BKP_ClearITPendingBit |
| Function prototype | void BKP_ClearITPendingBit(void) |
| Behavior description | Clears Tamper Pin Interrupt pending bit. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear Tamper Pin interrupt pending bit */
BKP_ClearITPendingBit();
```

# 6 Controller area network (CAN)

This peripheral interfaces the CAN network. It supports the CAN protocols version 2.0A and B. It has been designed to manage efficiently a high number of incoming messages with a minimum CPU load. It also meets the priority requirements for transmit messages.

*Section 6.1* describes the data structures used in the CAN firmware library. *Section 6.2* presents the firmware library functions.

## 6.1 CAN register structure

The CAN register structure, CAN_*TypeDef,* is defined in *stm32f10x_map.h* as follows:

```
typedef struct
{
  vu32 MCR;
  vu32 MSR;
  vu32 TSR;
  vu32 RF0R;
  vu32 RF1R;
  vu32 IER;
  vu32 ESR;
  vu32 BTR;
  u32 RESERVED0[88];
  CAN_TxMailBox_TypeDef sTxMailBox[3];
  CAN_FIFOMailBox_TypeDef sFIFOMailBox[2];
  u32 RESERVED1[12];
  vu32 FMR;
  vu32 FM0R;
  u32 RESERVED2[1];
  vu32 FS0R;
  u32 RESERVED3[1];
  vu32 FFA0R;
  u32 RESERVED4[1];
  vu32 FA0R;
  u32 RESERVED5[8];
  CAN_FilterRegister_TypeDef sFilterRegister[14];
} CAN_TypeDef;

typedef struct
{
  vu32 TIR;
  vu32 TDTR;
  vu32 TDLR;
  vu32 TDHR;
} CAN_TxMailBox_TypeDef;

typedef struct
{
  vu32 RIR;
  vu32 RDTR;
```

```
  vu32 RDLR;
  vu32 RDHR;
} CAN_FIFOMailBox_TypeDef;
typedef struct
{
vu32 FR0;
vu32 FR1;
} CAN_FilterRegister_TypeDef;
```

Table 70 shows the list of all CAN registers.

**Table 70. CAN registers**

| Register | Description |
|---|---|
| CAN_MCR | CAN Master Control Register |
| CAN_MSR | CAN Master Status Register |
| CAN_TSR | CAN Transmit Status Register |
| CAN_RF0R | CAN Receive FIFO 0 Register |
| CAN_RF1R | CAN Receive FIFO 1 Register |
| CAN_IER | CAN Interrupt Enable Register |
| CAN_ESR | CAN Error Status Register |
| CAN_BTR | CAN Bit Timing Register |
| TIR | Tx Mailbox Identifier Register |
| TDTR | Mailbox Data Length Control and Time Stamp Register |
| TDLR | Mailbox Data Low Register |
| TDHR | Mailbox Data High Register |
| RIR | Rx FIFO Mailbox Identifier Register |
| RDTR | Receive FIFO Mailbox Data Length Control and Time Stamp Register |
| RDLR | Receive FIFO Mailbox Data Low Register |
| RDHR | Receive FIFO Mailbox Data High Register |
| CAN_FMR | CAN Filter Master Register |
| CAN_FM0R | CAN Filter Mode Register |
| CAN_FSC0R | CAN Filter Scale Register |
| CAN_FFA0R | CAN Filter FIFO Assignment Register |
| CAN_FA0R | CAN Filter Activation Register |
| CAN_FR0 | Filter x Register 0 |
| CAN_FR1 | Filter x Register 1 |

The CAN peripheral is also declared in *stm32f10x_map.h*:

```
#define PERIPH_BASE             ((u32)0x40000000)
#define APB1PERIPH_BASE         PERIPH_BASE
#define APB2PERIPH_BASE         (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE          (PERIPH_BASE + 0x20000)

#define CAN_BASE                (APB1PERIPH_BASE + 0x6400)

#ifndef DEBUG
...
#ifdef _CAN
  #define CAN                   ((CAN_TypeDef *) CAN_BASE)
#endif /*_CAN */
...
#else   /* DEBUG */
...
#ifdef _CAN
  EXT CAN_TypeDef               *CAN;
#endif /*_CAN */
...
#endif
```

When using the Debug mode, the CAN pointer is initialized in *stm32f10x_lib.c*:

```
#ifdef _CAN
  CAN = (CAN_TypeDef *)  CAN_BASE;
#endif /*_CAN */
```

To access the CAN registers, _CAN must be defined in stm32f10x_conf.h:

```
#define _CAN
```

## 6.2 Firmware library functions

*Table 71* gives the list of the CAN library functions.

**Table 71. CAN firmware library functions**

| Function name | Description |
|---|---|
| CAN_DeInit | Resets the CAN peripheral registers to their default reset values. |
| CAN_Init | Initializes the CAN peripheral according to the parameters specified in the CAN_InitStruct. |
| CAN_FilterInit | Initializes the CAN peripheral according to the parameters specified in the CAN_FilterInitStruct. |
| CAN_StructInit | Fills each CAN_InitStruct member with its default value. |
| CAN_ITConfig | Enables or disables the specified CAN interrupts. |
| CAN_Transmit | Initiates the transmission of a message |
| CAN_TransmitStatus | Checks the transmission of a message |
| CAN_CancelTransmit | Cancels a transmit request |
| CAN_FIFORelease | Releases a FIFO |
| CAN_MessagePending | Returns the number of pending messages |
| CAN_Receive | Receives a message |
| CAN_Sleep | Enters the low power mode |
| CAN_WakeUp | Wakes the CAN up |
| CAN_GetFlagStatus | Checks whether the specified CAN flag is set or not. |
| CAN_ClearFlag | Clears the CAN pending flags. |
| CAN_GetITStatus | Checks whether the specified CAN interrupt has occurred or not. |
| CAN_ClearITPendingBit | Clears the CAN interrupt pending bits. |

### 6.2.1 CAN_DeInit function

Table 72 describes the CAN_DeInit function.

**Table 72. CAN_DeInit function**

| | |
|---|---|
| Function name | CAN_DeInit |
| Function prototype | void CAN_DeInit(void) |
| Behavior description | Resets the CAN peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB1PeriphResetCmd() |

**Example:**

```
/* Deinitialize the CAN */
CAN_DeInit();
```

### 6.2.2 CAN_Init function

Table 73 describes the CAN_Init function.

**Table 73. CAN_Init function**

| | |
|---|---|
| Function name | CAN_Init |
| Function prototype | u8 CAN_Init(CAN_InitTypeDef* CAN_InitStruct) |
| Behavior description | Initializes the CAN peripheral according to the parameters specified in the CAN_InitStruct. |
| Input parameter | CAN_InitStruct: pointer to a CAN_InitTypeDef structure that contains the configuration information for the CAN peripheral.<br>Refer to *Section : CAN_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | Constant indicating that the CAN initialization has been successful.<br>CANINITFAILED = initialization failed<br>CANINITOK = initialization successful |
| Required preconditions | None |
| Called functions | None |

## CAN_InitTypeDef structure

The CAN_InitTypeDef structure is defined in the *stm32f10x_can.h* file:

```
typedef struct
{
  FunctionnalState CAN_TTCM;
  FunctionnalState CAN_ABOM;
  FunctionnalState CAN_AWUM;
  FunctionnalState CAN_NART;
  FunctionnalState CAN_RFLM;
  FunctionnalState CAN_TXFP;
  u8 CAN_Mode;
  u8 CAN_SJW;
  u8 CAN_BS1;
  u8 CAN_BS2;
  u16 CAN_Prescaler;
} CAN_InitTypeDef;
```

### CAN_TTCM

CAN_TTCM is used to enable or disable the time triggered communication mode. This member can be set either to ENABLE or DISABLE.

### CAN_ABOM

CAN_ABOM is used to enable or disable the automatic bus-off management. This member can be set either to ENABLE or DISABLE.

### CAN_AWUM

CAN_AWUM is used to enable or disable the automatic wake-up mode. This member can be set either to ENABLE or DISABLE.

### CAN_NART

CAN_NART is used to enable or disable the no-automatic retransmission mode. This member can be either set to ENABLE or DISABLE.

### CAN_RFLM

CAN_RFLM is used to enable or disable the Receive Fifo Locked mode. This member can be either set to ENABLE or DISABLE.

### CAN_TXFP

CAN_TXFP is used to enable or disable the transmit FIFO priority. This member can be set either to ENABLE or DISABLE.

### CAN_Mode

CAN_Mode configures the CAN operating mode. The values taken by this member are given in *Table 74*.

Table 74. CAN_Mode values

| CAN_Mode | Description |
|---|---|
| CAN_Mode_Normal | CAN hardware operates in normal mode |
| CAN_Mode_Silent | CAN hardware operates in silent mode |
| CAN_Mode_LoopBack | CAN hardware operates in loop back mode |
| CAN_Mode_Silent_LoopBack | CAN hardware operates in loop back combined with silent mode |

### CAN_SJW

CAN_SJW configures the maximum number of time quanta the CAN hardware is allowed to lengthen or shorten a bit to perform resynchronization. The values taken by this member are given in *Table 75*.

Table 75. CAN_SJW values

| CAN_SJW | Description |
|---|---|
| CAN_SJW_1tq | Resynchronization Jump Width=1 time quantum |
| CAN_SJW_2tq | Resynchronization Jump Width= 2 time quantum |
| CAN_SJW_3tq | Resynchronization Jump Width= 3 time quantum |
| CAN_SJW_4tq | Resynchronization Jump Width= 4 time quantum |

### CAN_BS1

CAN_BS1 configures the number of time quanta in Bit Segment 1. The values taken by this member are given in *Table 76*.

Table 76. CAN_BS1 values

| CAN_BS1 | Description |
|---|---|
| CAN_BS1_1tq | Bit Segment 1= 1 time quantum |
| ... | ... |
| CAN_BS1_16tq | Bit Segment 1= 16 time quantum |

### CAN_BS2

CAN_BS2 configures the number of time quanta in Bit Segment 2. The values taken by this member are given in *Table 77*.

Table 77. CAN_BS2 values

| CAN_BS2 | Description |
|---|---|
| CAN_BS2_1tq | Bit Segment 2= 1 time quantum |
| ... | ... |
| CAN_BS2_8tq | Bit Segment 2= 8 time quantum |

### CAN_Prescaler

CAN_Prescaler configures the length of a time quantum. It ranges from 1 to 1024.

**Example:**

```
/* Initialize the CAN as 1Mb/s in normal mode, receive FIFO locked:
*/
CAN_InitTypeDef CAN_InitStructure;

CAN_InitStructure.CAN_TTCM = DISABLE;
CAN_InitStructure.CAN_ABOM = DISABLE;
CAN_InitStructure.CAN_AWUM = DISABLE;
CAN_InitStructure.CAN_NART = DISABLE;
CAN_InitStructure.CAN_RFLM = ENABLE;
CAN_InitStructure.CAN_TXFP = DISABLE;
CAN_InitStructure.CAN_Mode = CAN_Mode_Normal;
CAN_InitStructure.CAN_BS1 = CAN_BS1_4tq;
CAN_InitStructure.CAN_BS2 = CAN_BS2_3tq;
CAN_InitStructure.CAN_Prescaler = 0;
CAN_Init(&CAN_InitStructure);
```

## 6.2.3 CAN_FilterInit function

*Table 78* describes the CAN_FilterInit function.

**Table 78. CAN_FilterInit function**

| | |
|---|---|
| Function name | CAN_FilterInit |
| Function prototype | void CAN_FilterInit(CAN_FilterInitTypeDef* CAN_FilterInitStruct) |
| Behavior description | Initializes the CAN peripheral according to the specified parameters in the CAN_FilterInitStruct. |
| Input parameter | CAN_FilterInitStruct: pointer to a CAN_FilterInitTypeDef structure containing the configuration information.<br>Refer to *Section : CAN_FilterInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## CAN_FilterInitTypeDef structure

The CAN_FilterInitTypeDef structure is defined in the *stm32f10x_can.h* file:

```
typedef struct
{
  u8 CAN_FilterNumber;
  u8 CAN_FilterMode;
  u8 CAN_FilterScale;
  u16 CAN_FilterIdHigh;
  u16 CAN_FilterIdLow;
  u16 CAN_FilterMaskIdHigh;
  u16 CAN_FilterMaskIdLow;
  u16 CAN_FilterFIFOAssignment;
  FunctionalState CAN_FilterActivation;
} CAN_FilterInitTypeDef;
```

### CAN_FilterNumber

CAN_FilterNumber selects the filter which will be initialized. It ranges from 0 to 13.

### CAN_FilterMode

CAN_FilterMode selects the mode to be initialized. The values taken by this member are given in *Table 79*.

**Table 79. CAN_FilterMode values**

| CAN_FilterMode | Description |
|---|---|
| CAN_FilterMode_IdMask | id/mask mode |
| CAN_FilterMode_IdList | identifier list mode |

### CAN_FilterScale

CAN_FilterScale configures the filter scale. The values taken by this member are given in *Table 80*.

**Table 80. CAN_FilterScale values**

| CAN_FilterScale | Description |
|---|---|
| CAN_FilterScale_Two16bit | Two 16-bit filters |
| CAN_FilterScale_One32bit | One 32-bit filter |

### CAN_FilterIdHigh

CAN_FilterIdHigh is used to select the filter identification number (MSBs for a 32-bit configuration, first one for a 16-bit configuration). It ranges from 0x0000 to 0xFFFF.

### CAN_FilterIdLow

CAN_FilterIdLow is used to select the filter identification number (LSBs for a 32-bit configuration, second one for a 16-bit configuration). It ranges from 0x0000 to 0xFFFF.

### CAN_FilterMaskIdHigh

CAN_FilterMaskIdHigh is used to select the filter mask number or identification number, according to the mode (MSBs for a 32-bit configuration, first one for a 16-bit configuration). It ranges from 0x0000 to 0xFFFF.

### CAN_FilterMaskIdLow

CAN_FilterMaskIdLow is used to select the filter mask number or identification number, according to the mode (LSBs for a 32-bit configuration, second one for a 16-bit configuration). It ranges from 0x0000 to 0xFFFF.

### CAN_FilterFIFO

CAN_FilterFIFO is used to select the FIFO (0 or 1) which will be assigned to the filter. The values taken by this member are given in *Table 81*.

**Table 81. CAN_FilterFIFO values**

| CAN_FilterFIFO | Description |
|---|---|
| CAN_FilterFIFO0 | Filter FIFO 0 assignment for filter x |
| CAN_FilterFIFO1 | Filter FIFO 1assignment for filter x |

### CAN_FilterActivation

CAN_FilterActivation enables or disables the filter. It can be set either to ENABLE or DISABLE.

**Example:**

```
/* Initialize the CAN filter 2 */
CAN_FilterInitTypeDef CAN_FilterInitStructure;

CAN_FilterInitStructure.CAN_FilterNumber = 2;
CAN_FilterInitStructure.CAN_FilterMode = CAN_FilterMode_IdMask;
CAN_FilterInitStructure.CAN_FilterScale = CAN_FilterScale_One32bit;
CAN_FilterInitStructure.CAN_FilterIdHigh = 0x0F0F;
CAN_FilterInitStructure.CAN_FilterIdLow = 0xF0F0;
CAN_FilterInitStructure.CAN_FilterMaskIdHigh = 0xFF00;
CAN_FilterInitStructure.CAN_FilterMaskIdLow = 0x00FF;
CAN_FilterInitStructure.CAN_FilterFIFO = CAN_FilterFIFO0;
CAN_FilterInitStructure.CAN_FilterActivation = ENABLE;
CAN_FilterInit(&CAN_InitStructure);
```

### 6.2.4 CAN_StructInit function

*Table 82* describes the CAN_StructInit function.

**Table 82. CAN_StructInit function**

| | |
|---|---|
| Function name | CAN_StructInit |
| Function prototype | void CAN_StructInit(CAN_InitTypeDef* CAN_InitStruct) |
| Behavior description | Fills each CAN_InitStruct member with its default value. |
| Input parameter | CAN_InitStruct: pointer to a CAN_InitTypeDef structure which will be initialized.<br>Refer to *Table 83* for the default values of the CAN_InitStruct members. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Table 83. CAN_InitStruct default values**

| Member | Default value |
|---|---|
| CAN_TTCM | DISABLE |
| CAN_ABOM | DISABLE |
| CAN_AWUM | DISABLE |
| CAN_NART | DISABLE |
| CAN_RFLM | DISABLE |
| CAN_TXFP | DISABLE |
| CAN_Mode | CAN_Mode_Normal |
| CAN_SJW | CAN_SJW_1tq |
| CAN_BS1 | CAN_BS1_4tq |
| CAN_BS2 | CAN_BS2_3tq |
| CAN_Prescaler | 1 |

**Example:**

```
/* Initialize a CAN_InitTypeDef structure. */
CAN_InitTypeDef  CAN_InitStructure;
CAN_StructInit(&CAN_InitStructure);
```

### 6.2.5 CAN_ITConfig function

*Table 84* describes the CAN_ITConfig function.

**Table 84. CAN_ITConfig function**

| | |
|---|---|
| Function name | CAN_ITConfig |
| Function prototype | void CAN_ITConfig(u32 CAN_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified CAN interrupts. |
| Input parameter1 | CAN_IT: CAN interrupt sources to be enabled or disabled.<br>Refer to *Section : CAN_IT* for details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the CAN interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### CAN_IT

The CAN_IT input parameter enables or disables CAN interrupts. One or a combination of the following values can be used:

**Table 85. CAN_IT values**

| CAN_IT | Description |
|---|---|
| CAN_IT_TME | Transmit Mailbox Empty Mask |
| CAN_IT_FMP0 | FIFO 0 Message Pending Mask |
| CAN_IT_FF0 | FIFO 0 Full Mask |
| CAN_IT_FOV0 | FIFO 0 Overrun Mask |
| CAN_IT_FMP1 | FIFO 1 Message Pending Mask |
| CAN_IT_FF1 | FIFO 1 Full Mask |
| CAN_IT_FOV1 | FIFO 1 Overrun Mask |
| CAN_IT_EWG | Error Warning Mask |
| CAN_IT_EPV | Error Passive Mask |
| CAN_IT_BOF | Bus-Off Mask |
| CAN_IT_LEC | Last Error Code Mask |
| CAN_IT_ERR | Error Mask |
| CAN_IT_WKU | Wake-Up Mask |
| CAN_IT_SLK | Sleep Flag Mask |

**Example:**

```
/* Enable CAN FIFO 0 overrun interrupt */
CAN_ITConfig(CAN_IT_FOV0, ENABLE);
```

### 6.2.6 CAN_Transmit function

*Table 86* describes the CAN_Transmit function.

**Table 86. CAN_Transmit function**

| | |
|---|---|
| Function name | CAN_Transmit |
| Function prototype | u8 CAN_Transmit(CanTxMsg* TxMessage) |
| Behavior description | Initiates the transmission of a message. |
| Input parameter | TxMessage: pointer to a structure which contains CAN Id, CAN DLC and CAN data. |
| Output parameter | None |
| Return parameter | Number of the mailbox that is used for transmission or CAN_NO_MB if there is no empty mailbox. |
| Required preconditions | None |
| Called functions | None |

## CanTxMsg

The CanTxMsg structure is defined in the *stm32f10x_can.h* file:

```
typedef struct
{
  u32 StdId;
  u32 ExtId;
  u8 IDE;
  u8 RTR;
  u8 DLC;
  u8 Data[8];
} CanTxMsg;
```

### StdId

StdId is used to configure the standard identifier. This member ranges from 0 to 0x7FF.

### ExtId

ExtId is used to configure the extended identifier. This member ranges from 0 to 0x3FFFF.

### IDE

IDE is used to configure the type of identifier for the message that will be transmitted. See *Table 87* for the values taken by this member.

**Table 87. IDE values**

| IDE | Description |
|---|---|
| CAN_ID_STD | standard ID used |
| CAN_ID_EXT | extended ID + standard ID used |

### RTR

RTR is used to select the type of frame for the message that will be transmitted. It can be set either to data frame or remote frame.

**Table 88. RTR values**

| RTR | Description |
|---|---|
| CAN_RTR_DATA | Data frame |
| CAN_RTR_REMOTE | Remote frame |

### DLC

DLC is used to configure the length of the frame that will be transmitted. It ranges from 0 to 0x8.

### Data[8]

Data[8] contain the data to be transmitted. It ranges from 0 to 0xFF.

**Example:**

```
/* Send a message with the CAN */
CanTxMsg TxMessage;

TxMessage.StdId = 0x1F;
TxMessage.ExtId = 0x00;
TxMessage.IDE = CAN_ID_STD;
TxMessage.RTR = CAN_RTR_DATA;
TxMessage.DLC = 2;
TxMessage.Data[0] = 0xAA;
TxMessage.Data[1] = 0x55;
CAN_Transmit(&TxMessage);
```

### 6.2.7 CAN_TransmitStatus function

*Table 89* describes the CAN_TransmitStatus function.

**Table 89. CAN_TransmitStatus function**

| | |
|---|---|
| Function name | CAN_Transmit |
| Function prototype | u8 CAN_TransmitStatus(u8 TransmitMailbox) |
| Behavior description | Checks message transmission status |
| Input parameter | TransmitMailbox: the number of the mailbox that is used for the transmission. |
| Output parameter | None |
| Return parameter | CANTXOK if the CAN driver is transmitting the message<br>CANTXPENDING if the message is pending<br>CANTXFAILED otherwise |
| Required preconditions | Transmission ongoing |
| Called functions | None |

**Example:**

```
/* Check the status of a transmission with the CAN */
CanTxMsg TxMessage;
...
switch(CAN_TransmitStatus(CAN_Transmit(&TxMessage))
{
case CANTXOK: ...;break;
...
}
```

### 6.2.8 CAN_CancelTransmit function

*Table 90* describes the CAN_CancelTransmit function.

**Table 90. CAN_CancelTransmit function**

| | |
|---|---|
| Function name | CAN_CancelTransmit |
| Function prototype | void CAN_CancelTransmit(u8 Mailbox) |
| Behavior description | Cancels a transmission request |
| Input parameter | Mailbox number |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Transmission pending in a mailbox |
| Called functions | None |

**Example:**

```
/* Cancel a CAN transmit initiates by CANTransmit */
u8 MBNumber;
CanTxMsg TxMessage;
MBNumber = CAN_Transmit(&TxMessage);
if (CAN_TransmitStatus(MBNumber) == CANTXPENDING)
{
  CAN_CancelTransmit(MBNumber);
}
```

### 6.2.9 CAN_FIFORelease function

*Table 91* describes the CAN_FIFORelease function.

**Table 91. CAN_FIFORelease function**

| | |
|---|---|
| Function name | CAN_FIFORelease |
| Function prototype | void CAN_FIFORelease(u8 FIFONumber) |
| Behavior description | Releases a FIFO |
| Input parameter | FIFO number: FIFO to release, CANFIFO0 or CANFIFO1. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | none |
| Called functions | None |

**Example:**

```
/* Release FIFO 0*/
CAN_FIFORelease(CANFIFO0);
```

### 6.2.10 CAN_MessagePending function

*Table 92* describes the CAN_MessagePending function.

**Table 92. CAN_MessagePending function**

| | |
|---|---|
| Function name | CAN_MessagePending |
| Function prototype | u8 CAN_MessagePending(u8 FIFONumber) |
| Behavior description | Return the number of pending messages. |
| Input parameter | FIFONumber: receive FIFO number, CANFIFO0 or CANFIFO1. |
| Output parameter | None |
| Return parameter | NbMessage which is the number of pending messages |
| Required preconditions | none |
| Called functions | None |

**Example:**

```
/* Check the number of pending messages for FIFO 0*/
u8 MessagePending = 0;
MessagePending = CAN_MessagePending(CANFIFO0);
```

### 6.2.11 CAN_Receive function

*Table 93* describes the CAN_Receive function.

**Table 93. CAN_Receive function**

| | |
|---|---|
| Function name | CAN_Receive |
| Function prototype | void CAN_Receive(u8 FIFONumber, CanRxMsg* RxMessage) |
| Behavior description | Receives a message. |
| Input parameter | FIFONumber: receive FIFO number, CANFIFO0 or CANFIFO1. |
| Output parameter | RxMessage: pointer to a structure which contains CAN Id, CAN DLC and CAN data. |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## CanRxMsg structure

The CanRxMsg structure is defined in the *stm32f10x_can.h* file:

```
typedef struct
{
  u32 StdId;
  u32 ExtId;
  u8 IDE;
  u8 RTR;
  u8 DLC;
  u8 Data[8];
```

```
  u8 FMI;
} CanRxMsg;
```

### StdId

StdId is used to configure the standard identifier. This member ranges from 0 to 0x7FF.

### ExtId

ExtId is used to configure the extended identifier. This member ranges from 0 to 0x3FFFF.

### IDE

IDE is used to configure the type of identifier for the message that will be received. See *Table 87* for the values taken by this member.

**Table 94. IDE values**

| IDE | Description |
|---|---|
| CAN_ID_STD | standard ID used |
| CAN_ID_EXT | extended ID + standard ID used |

### RTR

RTR is used to select the type of frame for the received message. It can be set either to data frame or remote frame.

**Table 95. RTR values**

| RTR | Description |
|---|---|
| CAN_RTR_DATA | Data frame |
| CAN_RTR_REMOTE | Remote frame |

### DLC

DLC is used to configure the length of the frame that will be transmitted. It ranges from 0 to 0x8.

### Data[8]

Data[8] contains the data to be received. It ranges from 0 to 0xFF.

### FMI

FMI configures the index of the filter the message stored in the mailbox passes through. FMI ranges from 0 to 0xFF.

**Example:**

```
/* Receive a message with the CAN */
CanRxMsg RxMessage;
CAN_Receive(&RxMessage);
```

### 6.2.12 CAN_Sleep function

*Table 96* describes the CAN_Sleep function.

**Table 96. CAN_Sleep function**

| | |
|---|---|
| Function name | CAN_Sleep |
| Function prototype | u8 CAN_Sleep(void) |
| Behavior description | Put the CAN in low power mode. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | CANSLEEPOK if sleep entered, CANSLEEPFAILED otherwisedata. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enter the CAN sleep mode*/
CAN_Sleep();
```

### 6.2.13 CAN_WakeUp function

*Table 97* describes the CAN_Wakeup function.

**Table 97. CAN_Wakeup function**

| | |
|---|---|
| Function name | CAN_WakeUp |
| Function prototype | u8 CAN_WakeUp(void) |
| Behavior description | Wakes up the CAN. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | CANWAKEUPOK if sleep mode left, CANWAKEUPFAILED otherwise. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* CAN waking up */
CAN_WakeUp();
```

### 6.2.14 CAN_GetFlagStatus function

*Table 98* describes the CAN_GetFlagStatus function.

**Table 98. CAN_GetFlagStatus function**

| | |
|---|---|
| Function name | CAN_GetFlagStatus |
| Function prototype | FlagStatus CAN_GetFlagStatus(u32 CAN_FLAG) |
| Behavior description | Checks whether the specified CAN flag is set or not. |
| Input parameter | CAN_FLAG: it specifies the flag to be checked.<br>Refer to *Section : CAN_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of CAN_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### CAN_FLAG

The CAN_FLAG is used to define the type of flag that will be checked. See *Table 99* for a description of CAN_FLAG values.

**Table 99. CAN_FLAG definition**

| CAN_FLAG | Description |
|---|---|
| CAN_FLAG_EWG | Error Warning Flag |
| CAN_FLAG_EPV | Error Passive Flag |
| CAN_FLAG_BOF | Bus-Off Flag |

**Example:**

```
/* Test if the CAN warning limit has been reached */
FlagStatus Status;
Status = CAN_GetFlagStatus(CAN_FLAG_EWG);
```

### 6.2.15 CAN_ClearFlag function

*Table 100* describes the CAN_ClearFlag function.

**Table 100. CAN_ClearFlag function**

| | |
|---|---|
| Function name | CAN_ClearFlag |
| Function prototype | void CAN_ClearFlag(u32 CAN_Flag) |
| Behavior description | Clears the CAN's pending flags. |
| Input parameter | CAN_FLAG specifies the flag to clear.<br>Refer to *Section : CAN_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the CAN bus-off state flag */
CAN_ClearFlag(CAN_FLAG_BOF);
```

### 6.2.16 CAN_GetITStatus function

*Table 101* describes the CAN_GetITStatus function.

**Table 101. CAN_GetITStatus function**

| | |
|---|---|
| Function name | CAN_GetITStatus |
| Function prototype | `ITStatus CAN_GetITStatus(u32 CAN_IT)` |
| Behavior description | Checks whether the specified CAN interrupt has occurred or not. |
| Input parameter | CAN_IT: CAN interrupt source to check.<br>Refer to *Section : CAN_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of CAN_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### CAN_IT

The CAN_IT input parameter selects the interrupt that will be checked. See *Table 102* for a description of CAN_IT values.

**Table 102. CAN_IT values**

| CAN_IT | Description |
|---|---|
| CAN_IT_RQCP0 | Request completed mailbox 0 |
| CAN_IT_RQCP1 | Request completed mailbox 1 |
| CAN_IT_RQCP2 | Request completed mailbox 2 |
| CAN_IT_FMP0 | FIFO 0 Message Pending |
| CAN_IT_FULL0 | FIFO 0 three messages stored |
| CAN_IT_FOVR0 | FIFO 0 Overrun |
| CAN_IT_FMP1 | FIFO 1 Message Pending |
| CAN_IT_FULL1 | FIFO 1 three messages stored |
| CAN_IT_FOVR1 | FIFO 1 Overrun |
| CAN_IT_EWGF | Warning limit reached |
| CAN_IT_EPVF | Error passive limit reached |
| CAN_IT_BOFF | Bus-of state entered |
| CAN_IT_WKUI | SOF detected whilst in sleep mode |

**Example:**

```
/* Test if the CAN FIFO 0 overrun interrupt has occurred or not */
ITStatus Status;
Status = CAN_GetITStatus(CAN_IT_FOVR0);
```

### 6.2.17 CAN_ClearITPendingBit function

*Table 103* describes the CAN_ClearITPendingBit function.

**Table 103. CAN_ClearITPendingBit function**

| | |
|---|---|
| Function name | CAN_ClearITPendingBit |
| Function prototype | void CAN_ClearITPendingBit(u32 CAN_IT) |
| Behavior description | Clears the CAN pending interrupt bits. |
| Input parameter | CAN_IT: pending interrupt bit to clear.<br>Refer to *Section : CAN_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the CAN error passive overflow interrupt pending bit */
CAN_ClearITPendingBit(CAN_IT_EPVF);
```

# 7 DMA controller (DMA)

The DMA controller provides access to seven data channels. Since peripherals are memory mapped, data transfers from/to peripherals are managed like memory/memory data transfers.

*Section 7.1: DMA register structures* describes the data structures used in the DMA Firmware Library. *Section 7.2: Firmware library functions* presents the Firmware Library functions.

## 7.1 DMA register structures

The DMA register structures, *DMA_Channel_TypeDef and DMA_TypeDef,* are defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CCR;
  vu32 CNDTR;
  vu32 CPAR;
  vu32 CMAR;
} DMA_Channel_TypeDef;

typedef struct
{
  vu32 ISR;
vu32 IFCR;
} DMA_TypeDef;
```

*Table 104* shows the list of all DMA registers.

**Table 104. DMA registers**

| Register | Description |
|---|---|
| ISR | DMA Interrupt Status register |
| IFCR | DMA Interrupt Flag Clear Register |
| CCRx | DMA Channelx Configuration register |
| CNDTRx | DMA Channelx Number of Data to Transfer register |
| CPARx | DMA Channelx Peripheral Address Register |
| CMARx | DMA Channelx Memory0 Address Register |

The DMA and its seven channels are also declared in *stm32f10x_map*:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
....
#define DMA_BASE              (AHBPERIPH_BASE + 0x0000)
```

```
#define DMA_Channel1_BASE      (AHBPERIPH_BASE + 0x0008)
#define DMA_Channel2_BASE      (AHBPERIPH_BASE + 0x001C)
#define DMA_Channel3_BASE      (AHBPERIPH_BASE + 0x0030)
#define DMA_Channel4_BASE      (AHBPERIPH_BASE + 0x0044)
#define DMA_Channel5_BASE      (AHBPERIPH_BASE + 0x0058)
#define DMA_Channel6_BASE      (AHBPERIPH_BASE + 0x006C)
#define DMA_Channel7_BASE      (AHBPERIPH_BASE + 0x0080)
....
#ifndef DEBUG
...
#ifdef _DMA
  #define DMA                  ((DMA_TypeDef *) DMA_BASE)
#endif /*_DMA */

#ifdef _DMA_Channel1
  #define DMA_Channel1         ((DMA_Channel_TypeDef *)
DMA_Channel1_BASE)
#endif /*_DMA_Channel1 */

#ifdef _DMA_Channel2
  #define DMA_Channel2         ((DMA_Channel_TypeDef *)
DMA_Channel2_BASE)
#endif /*_DMA_Channel2 */

#ifdef _DMA_Channel3
  #define DMA_Channel3         ((DMA_Channel_TypeDef *)
DMA_Channel3_BASE)
#endif /*_DMA_Channel3 */

#ifdef _DMA_Channel4
  #define DMA_Channel4         ((DMA_Channel_TypeDef *)
DMA_Channel4_BASE)
#endif /*_DMA_Channel4 */

#ifdef _DMA_Channel5
  #define DMA_Channel5         ((DMA_Channel_TypeDef *)
DMA_Channel5_BASE)
#endif /*_DMA_Channel5 */

#ifdef _DMA_Channel6
  #define DMA_Channel6         ((DMA_Channel_TypeDef *)
DMA_Channel6_BASE)
#endif /*_DMA_Channel6 */

#ifdef _DMA_Channel7
  #define DMA_Channel7         ((DMA_Channel_TypeDef *)
DMA_Channel7_BASE)
#endif /*_DMA_Channel7 */
...
#else   /* DEBUG */
...
#ifdef _DMA
```

```
  EXT DMA_TypeDef             *DMA;
#endif /*_DMA */

#ifdef _DMA_Channel1
  EXT DMA_Channel_TypeDef     *DMA_Channel1;
#endif /*_DMA_Channel1 */

#ifdef _DMA_Channel2
  EXT DMA_Channel_TypeDef     *DMA_Channel2;
#endif /*_DMA_Channel2 */

#ifdef _DMA_Channel3
  EXT DMA_Channel_TypeDef     *DMA_Channel3;
#endif /*_DMA_Channel3 */

#ifdef _DMA_Channel4
  EXT DMA_Channel_TypeDef     *DMA_Channel4;
#endif /*_DMA_Channel4 */

#ifdef _DMA_Channel5
  EXT DMA_Channel_TypeDef     *DMA_Channel5;
#endif /*_DMA_Channel5 */

#ifdef _DMA_Channel6
  EXT DMA_Channel_TypeDef     *DMA_Channel6;
#endif /*_DMA_Channel6 */

#ifdef _DMA_Channel7
  EXT DMA_Channel_TypeDef     *DMA_Channel7;
#endif /*_DMA_Channel7 */
...
#endif
```

When using the Debug mode, DMA, _DMA_Channel1, _DMA_Channel2, ..., and _DMA_Channel7 pointers are initialized in *stm32f10x_lib.c* file:

```
...
#ifdef _DMA
  DMA = (DMA_TypeDef *)  DMA_BASE;
#endif /*_DMA */

#ifdef _DMA_Channel1
  DMA_Channel1 = (DMA_Channel_TypeDef *)  DMA_Channel1_BASE;
#endif /*_DMA_Channel1 */

#ifdef _DMA_Channel2
  DMA_Channel2 = (DMA_Channel_TypeDef *)  DMA_Channel2_BASE;
#endif /*_DMA_Channel2 */

#ifdef _DMA_Channel3
  DMA_Channel3 = (DMA_Channel_TypeDef *)  DMA_Channel3_BASE;
#endif /*_DMA_Channel3 */
```

```
#ifdef _DMA_Channel4
  DMA_Channel4 = (DMA_Channel_TypeDef *)  DMA_Channel4_BASE;
#endif /*_DMA_Channel4 */

#ifdef _DMA_Channel5
  DMA_Channel5 = (DMA_Channel_TypeDef *)  DMA_Channel5_BASE;
#endif /*_DMA_Channel5 */

#ifdef _DMA_Channel6
  DMA_Channel6 = (DMA_Channel_TypeDef *)  DMA_Channel6_BASE;
#endif /*_DMA_Channel6 */

#ifdef _DMA_Channel7
  DMA_Channel7 = (DMA_Channel_TypeDef *)  DMA_Channel7_BASE;
#endif /*_DMA_Channel7 */
...
```

To access the DMA registers, _DMA, _DMA_Channel1 to _DMA_Channel7 must be defined in *stm32f10x_conf.h* as follows:

```
...
#define _DMA
#define _DMA_Channel1
#define _DMA_Channel2
#define _DMA_Channel3
#define _DMA_Channel4
#define _DMA_Channel5
#define _DMA_Channel6
#define _DMA_Channel7
...
```

## 7.2 Firmware library functions

*Table 105* lists the various functions of the DMA firmware library.

**Table 105. DMA firmware library functions**

| Function name | Description |
|---|---|
| DMA_DeInit | Resets the DMA Channelx registers to their default reset values. |
| DMA_Init | Initializes the DMA Channelx according to the specified parameters in the DMA_InitStruct. |
| DMA_StructInit | Fills each DMA_InitStruct member with its default value. |
| DMA_Cmd | Enables or disables the specified DMA Channelx. |
| DMA_ITConfig | Enables or disables the specified DMA Channelx interrupts. |
| DMA_GetCurrDataCounter | Returns the number of remaining data units in the current DMA Channelx transfer. |
| DMA_GetFlagStatus | Checks whether the specified DMA Channelx flag is set or not. |
| DMA_ClearFlag | Clears the DMA Channelx pending flags. |

**Table 105. DMA firmware library functions (continued)**

| Function name | Description |
|---|---|
| DMA_GetITStatus | Checks whether the specified DMA Channelx interrupt has occurred or not. |
| DMA_ClearITPendingBit | Clears the DMA Channelx interrupt pending bits. |

### 7.2.1 DMA_DeInit function

*Table 106* describes the DMA_DeInit function.

**Table 106. DMA_DeInit function**

| | |
|---|---|
| Function name | DMA_DeInit |
| Function prototype | void DMA_DeInit(DMA_Channel_TypeDef* DMA_Channelx) |
| Behavior description | Resets the DMA Channelx registers to their default reset values. |
| Input parameter | DMA_Channelx: where x can be 1,2,.., or 7 to select the DMA Channelx. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_AHBPeriphClockCmd(). |

**Example:**

```
/* Deinitialize the DMA Channel2 */
DMA_DeInit(DMA_Channel2);
```

### 7.2.2 DMA_Init function

*Table 107* describes the DMA_Init function.

**Table 107. DMA_Init function**

| | |
|---|---|
| Function name | DMA_Init |
| Function prototype | void DMA_Init(DMA_Channel_TypeDef* DMA_Channelx, DMA_InitTypeDef* DMA_InitStruct) |
| Behavior description | Initializes the DMA Channelx according to the parameters specified in the DMA_InitStruct. |
| Input parameter1 | DMA_Channelx: where x can be 1,2,..., or 7 to select the DMA Channelx. |
| Input parameter2 | DMA_InitStruct: pointer to a DMA_InitTypeDef structure that contains the configuration information for the specified DMA Channelx.<br>Refer to *Section : DMA_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## DMA_InitTypeDef structure

The DMA_InitTypeDef structure is defined in the *stm32f10x_dma.h* file:

```
typedef struct
{
  u32 DMA_PeripheralBaseAddr;
  u32 DMA_MemoryBaseAddr;
u32 DMA_DIR;
  u32 DMA_BufferSize;
  u32 DMA_PeripheralInc;
  u32 DMA_MemoryInc;
  u32 DMA_PeripheralDataSize;
  u32 DMA_MemoryDataSize;
  u32 DMA_Mode;
u32 DMA_Priority;
  u32 DMA_M2M;
} DMA_InitTypeDef;
```

### DMA_PeripheralBaseAddr

This member is used to define the peripheral base address for DMA Channelx.

### DMA_MemoryBaseAddr

This member is used to define the memory base address for DMA Channelx.

### DMA_DIR

DMA_DIR specifies if the peripheral is the source or destination. The values taken by this member are given in *Table 108*.

**Table 108. DMA_DIR definition**

| DMA_DIR | Description |
|---|---|
| DMA_DIR_PeripheralDST | Peripheral is the destination |
| DMA_DIR_PeripheralSRC | Peripheral is the source |

### DMA_BufferSize

DMA_BufferSize is used to define the buffer size, in data unit, of the specified Channel. The data unit is equal to the configuration set in DMA_PeripheralDataSize or DMA_MemoryDataSize members depending in the transfer direction.

### DMA_PeripheralInc

DMA_Peripheralinc specifies whether the Peripheral address register is incremented or not. The values taken by this member are given in *Table 109*.

**Table 109. DMA_PeripheralInc definition**

| DMA_PeripheralInc | Description |
|---|---|
| DMA_PeripheralInc_Enable | Current peripheral register incremented |
| DMA_PeripheralInc_Disable | Current peripheral register unchanged |

### DMA_MemoryInc

DMA_MemoryInc specifies whether the memory address register is incremented or not. The values taken by this member are given in *Table 110*.

**Table 110. DMA_MemoryInc definition**

| DMA_MemoryInc | Description |
|---|---|
| DMA_MemoryInc_Enable | Current memory register incremented |
| DMA_MemoryInc_Disable | Current memory register unchanged |

### DMA_PeripheralDataSize

DMA_PeripheralDataSize configures the Peripheral data width. The values taken by this member are given in *Table 111*.

**Table 111. DMA_PeripheralDataSize definition**

| DMA_PeripheralDataSize | Description |
|---|---|
| DMA_PeripheralDataSize_Byte | Data width = 8 bits |
| DMA_PeripheralDataSize_HalfWord | Data width = 16 bits |
| DMA_PeripheralDataSize_Word | Data width = 32 bits |

### DMA_MemoryDataSize

DMA_MemoryDataSize defines the Memory data width. The values taken by this member are given in *Table 112*.

**Table 112. DMA_MemoryDataSize definition**

| DMA_MemoryDataSize | Description |
|---|---|
| DMA_MemoryDataSize_Byte | Data width = 8 bits |
| DMA_MemoryDataSize_HalfWord | Data width = 16 bits |
| DMA_MemoryDataSize_Word | Data width = 32 bits |

### DMA_Mode

DMA_Mode configures the operation mode of the DMA Channelx. The values taken by this member are given in *Table 113*.

**Table 113. DMA_Mode definition**

| DMA_Mode | Description |
|---|---|
| DMA_Mode_Circular | Circular buffer mode is used |
| DMA_Mode_Normal | Normal buffer mode is used |

*Note: The circular buffer mode cannot be used if the memory-to-memory data transfer is configured on the selected Channel (see Section : DMA_M2M).*

### DMA_Priority

DMA_Priority configures the software priority for the DMA Channelx. The values taken by this member are given in *Table 114*.

**Table 114. DMA_Priority definition**

| DMA_Priority | Description |
|---|---|
| DMA_Priority_VeryHigh | DMA Channelx has a very high priority |
| DMA_Priority_High | DMA Channelx has a high priority |
| DMA_Priority_Medium | DMA Channelx has a medium priority |
| DMA_Priority_Low | DMA Channelx has a low priority |

### DMA_M2M

DMA_M2M enables the DMA Channel memory- to-memory transfer. The values taken by this member are given in *Table 115*.

**Table 115. DMA_M2M definition**

| DMA_M2M | Description |
|---|---|
| DMA_M2M_Enable | DMA Channelx configured for memory-to-memory transfer |
| DMA_M2M_Disable | DMA Channelx not configured for memory-to-memory transfer |

**Example:**

```
/* Initialize the DMA Channel1 according to the DMA_InitStructure
members */
  DMA_InitTypeDef  DMA_InitStructure;

  DMA_InitStructure.DMA_PeripheralBaseAddr = 0x40005400;
  DMA_InitStructure.DMA_MemoryBaseAddr = 0x20000100;
  DMA_InitStructure.DMA_DIR = DMA_DIR_PeripheralSRC;
  DMA_InitStructure.DMA_BufferSize = 256;
  DMA_InitStructure.DMA_PeripheralInc = DMA_PeripheralInc_Disable;
  DMA_InitStructure.DMA_MemoryInc = DMA_MemoryInc_Enable;
  DMA_InitStructure.DMA_PeripheralDataSize =
DMA_PeripheralDataSize_HalfWord;
  DMA_InitStructure.DMA_MemoryDataSize =
DMA_MemoryDataSize_HalfWord;
  DMA_InitStructure.DMA_Mode = DMA_Mode_Normal;
 DMA_InitStructure.DMA_Priority = DMA_Priority_Medium;
  DMA_InitStructure.DMA_M2M = DMA_M2M_Disable;
  DMA_Init(DMA_Channel1, &DMA_InitStructure);
```

### 7.2.3 DMA_StructInit function

*Table 116* describes the DMA_Init function.

**Table 116. DMA_StructInit function**

| | |
|---|---|
| Function name | DMA_StructInit |
| Function prototype | void DMA_StructInit(DMA_InitTypeDef* DMA_InitStruct) |
| Behavior description | Fills each DMA_InitStruct member with its default value. |
| Input parameter | DMA_InitStruct: pointer to the DMA_InitTypeDef structure to be initialized |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The DMA_InitStruct members have the following default values:

**Table 117. DMA_InitStruct default values**

| Member | Default value |
|---|---|
| DMA_PeripheralBaseAddr | 0 |
| DMA_MemoryBaseAddr | 0 |
| DMA_DIR | DMA_DIR_PeripheralSRC |
| DMA_BufferSize | 0 |
| DMA_PeripheralInc | DMA_PeripheralInc_Disable |
| DMA_MemoryInc | DMA_MemoryInc_Disable |
| DMA_PeripheralDataSize | DMA_PeripheralDataSize_Byte |
| DMA_MemoryDataSize | DMA_MemoryDataSize_Byte |
| DMA_Mode | DMA_Mode_Normal |
| DMA_Priority | DMA_Priority_Low |
| DMA_M2M | DMA_M2M_Disable |

**Example:**

```
/* Initialize a DMA_InitTypeDef structure */
DMA_InitTypeDef  DMA_InitStructure;
DMA_StructInit(&DMA_InitStructure);
```

## 7.2.4 DMA_Cmd function

*Table 118* describes DMA_Cmd function.

**Table 118. DMA_Cmd function**

| | |
|---|---|
| Function name | DMA_Cmd |
| Function prototype | void DMA_Cmd(DMA_Channel_TypeDef* DMA_Channelx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified DMA Channelx. |
| Input parameter1 | DMA_Channelx: where x can be 1,2,.., or 7 to select the DMA Channelx. |
| Input parameter2 | NewState: new state of the DMA Channelx.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable DMA Channel7 */
DMA_Cmd(DMA_Channel7, ENABLE);
```

### 7.2.5 DMA_ITConfig function

Table 119 describes DMA_ITConfig function.

**Table 119. DMA_ITConfig function**

| | |
|---|---|
| Function name | DMA_ITConfig |
| Function prototype | void DMA_ITConfig(DMA_Channel_TypeDef* DMA_Channelx, u32 DMA_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified DMA Channelx interrupts. |
| Input parameter1 | DMA_Channelx: where x can be 1,2,.., or 7 to select the DMA Channelx. |
| Input parameter2 | DMA_IT: specifies the DMA Channelx interrupt sources to be enabled or disabled. More than one interrupt can be selected using the "\|" operator.<br>Refer to Section : DMA_IT for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified DMA Channelx interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### DMA_IT

The DMA_IT input parameter enables or disables DMA Channelx interrupts. One or a combination of the following values can be used.

**Table 120. DMA_IT values**

| DMA_IT | Description |
|---|---|
| DMA_IT_TC | Transfer complete interrupt mask |
| DMA_IT_HT | Half transfer interrupt mask |
| DMA_IT_TE | Transfer error interrupt mask |

**Example:**

```
/* Enable DMA Channel5 complete transfer interrupt */
DMA_ITConfig(DMA_Channel5, DMA_IT_TC, ENABLE);
```

### 7.2.6 DMA_GetCurrDataCounter function

*Table 121* describes DMA_GetCurrDataCounter function.

**Table 121. DMA_GetCurrDataCounter function**

| | |
|---|---|
| Function name | DMA_GetCurrDataCounter |
| Function prototype | u16 DMA_GetCurrDataCounter(DMA_Channel_TypeDef* DMA_Channelx) |
| Behavior description | Returns the number of remaining data units in the current DMA Channelx transfer. |
| Input parameter | DMA_Channelx: where x can be 1,2,.., or 7 to select the DMA Channelx. |
| Output parameter | None |
| Return parameter | The number of remaining data units in the current DMA Channelx transfer. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get  the number of remaining data units in the current DMA
Channel2 transfer */
u16 CurrDataCount;
CurrDataCount = DMA_GetCurrDataCounter(DMA_Channel2);
```

### 7.2.7 DMA_GetFlagStatus function

*Table 122* describes DMA_GetFlagStatus function.

**Table 122. DMA_GetFlagStatus function**

| | |
|---|---|
| Function name | DMA_GetFlagStatus |
| Function prototype | FlagStatus DMA_GetFlagStatus(u32 DMA_FLAG) |
| Behavior description | Checks whether the specified DMA Channelx flag is set or not. |
| Input parameter | DMA_FLAG: specifies the flag to check.<br>Refer to *Section : DMA_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | New state of DMA_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### DMA_FLAG

The DMA_FLAG is used to define the type of flag that will be checked. See *Table 123* for a description of this input parameter.

**Table 123. DMA_FLAG definition**

| DMA_FLAG | Description |
|---|---|
| DMA_FLAG_GL1 | Channel1 global flag |
| DMA_FLAG_TC1 | Channel1 transfer complete flag |
| DMA_FLAG_HT1 | Channel1 half transfer flag |
| DMA_FLAG_TE1 | Channel1 transfer error flag |
| DMA_FLAG_GL2 | Channel2 global flag |
| DMA_FLAG_TC2 | Channel2 transfer complete flag |
| DMA_FLAG_HT2 | Channel2 half transfer flag |
| DMA_FLAG_TE2 | Channel2 transfer error flag |
| DMA_FLAG_GL3 | Channel3 global flag |
| DMA_FLAG_TC3 | Channel3 transfer complete flag |
| DMA_FLAG_HT3 | Channel3 half transfer flag |
| DMA_FLAG_TE3 | Channel3 transfer error flag |
| DMA_FLAG_GL4 | Channel4 global flag |
| DMA_FLAG_TC4 | Channel4 transfer complete flag |
| DMA_FLAG_HT4 | Channel4 half transfer flag |
| DMA_FLAG_TE4 | Channel4 transfer error flag |
| DMA_FLAG_GL5 | Channel5 global flag |
| DMA_FLAG_TC5 | Channel5 transfer complete flag |

**Table 123. DMA_FLAG definition (continued)**

| DMA_FLAG | Description |
|---|---|
| DMA_FLAG_HT5 | Channel5 half transfer flag |
| DMA_FLAG_TE5 | Channel5 transfer error flag |
| DMA_FLAG_GL6 | Channel6 global flag |
| DMA_FLAG_TC6 | Channel6 transfer complete flag |
| DMA_FLAG_HT6 | Channel6 half transfer flag |
| DMA_FLAG_TE6 | Channel6 transfer error flag |
| DMA_FLAG_GL7 | Channel7 global flag |
| DMA_FLAG_TC7 | Channel7 transfer complete flag |
| DMA_FLAG_HT7 | Channel7 half transfer flag |
| DMA_FLAG_TE7 | Channel7 transfer error flag |

**Example:**

```
/* Test if the DMA Channel6 half transfer interrupt flag is set or
not */
FlagStatus Status;
Status = DMA_GetFlagStatus(DMA_FLAG_HT6);
```

### 7.2.8 DMA_ClearFlag function

*Table 124* describes DMA_ClearFlag function.

**Table 124. DMA_ClearFlag function**

| | |
|---|---|
| Function name | DMA_ClearFlag |
| Function prototype | void DMA_ClearFlag(u32 DMA_FLAG) |
| Behavior description | Clears the DMA Channelx's pending flags. |
| Input parameter | DMA_FLAG: flag to be cleared. More than one flag can be cleared using the “\|” operator.<br>Refer to *Section : DMA_FLAG* for more details on the allowed values of this parameter.<br>The user can select more than one flag, by ‘ORing’ them. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the DMA Channel3 transfer error interrupt pending bit */
DMA_ClearFlag(DMA_FLAG_TE3);
```

### 7.2.9 DMA_GetITStatus function

*Table 125* describes DMA_GetITStatus function.

**Table 125. DMA_GetITStatus function**

| | |
|---|---|
| Function name | DMA_GetITStatus |
| Function prototype | ITStatus DMA_GetITStatus(u32 DMA_IT) |
| Behavior description | Checks whether the specified DMA Channelx interrupt has occurred or not. |
| Input parameter | DMA_IT: DMA Channelx interrupt source to check.<br>Refer to *Section : DMA_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of DMA_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### DMA_IT

The DMA_IT selects the interrupt that will be checked. See *Table 126* for a description of this input parameter.

**Table 126. DMA_IT values**

| DMA_IT | Description |
|---|---|
| DMA_IT_GL1 | Channel1 global interrupt |
| DMA_IT_TC1 | Channel1 transfer complete interrupt |
| DMA_IT_HT1 | Channel1 half transfer interrupt |
| DMA_IT_TE1 | Channel1 transfer error interrupt |
| DMA_IT_GL2 | Channel2 global interrupt |
| DMA_IT_TC2 | Channel2 transfer complete interrupt |
| DMA_IT_HT2 | Channel2 half transfer interrupt |
| DMA_IT_TE2 | Channel2 transfer error interrupt |
| DMA_IT_GL3 | Channel3 global interrupt |
| DMA_IT_TC3 | Channel3 transfer complete interrupt |
| DMA_IT_HT3 | Channel3 half transfer interrupt |
| DMA_IT_TE3 | Channel3 transfer error interrupt |
| DMA_IT_GL4 | Channel4 global interrupt |
| DMA_IT_TC4 | Channel4 transfer complete interrupt |
| DMA_IT_HT4 | Channel4 half transfer interrupt |
| DMA_IT_TE4 | Channel4 transfer error interrupt |
| DMA_IT_GL5 | Channel5 global interrupt |
| DMA_IT_TC5 | Channel5 transfer complete interrupt |

**Table 126. DMA_IT values (continued)**

| DMA_IT | Description |
|---|---|
| DMA_IT_HT5 | Channel5 half transfer interrupt |
| DMA_IT_TE5 | Channel5 transfer error interrupt |
| DMA_IT_GL6 | Channel6 global interrupt |
| DMA_IT_TC6 | Channel6 transfer complete interrupt |
| DMA_IT_HT6 | Channel6 half transfer interrupt |
| DMA_IT_TE6 | Channel6 transfer error interrupt |
| DMA_IT_GL7 | Channel7 global interrupt |
| DMA_IT_TC7 | Channel7 transfer complete interrupt |
| DMA_IT_HT7 | Channel7 half transfer interrupt |
| DMA_IT_TE7 | Channel7 transfer error interrupt |

**Example**:

```
/* Test if the DMA Channel7 transfer complete interrupt has occurred
or not */
ITStatus Status;
Status = DMA_GetITStatus(DMA_IT_TC7);
```

### 7.2.10 DMA_ClearITPendingBit function

*Table 127* describes DMA_ClearITPendingBit function.

**Table 127. DMA_ClearITPendingBit function**

| | |
|---|---|
| Function name | DMA_ClearITPending Bit |
| Function prototype | void DMA_ClearITPendingBit(u32 DMA_IT) |
| Behavior description | Clears the DMA Channelx's interrupt pending bits. |
| Input parameter | DMA_IT: DMA Channelx interrupt pending bit to clear.More than one interrupt can be cleared using the "\|" operator.<br>Refer to *Section : DMA_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the DMA Channel5 global interrupt pending bit */
DMA_ClearITPendingBit(DMA_IT_GL5);
```

# 8 External interrupt/event controller (EXTI)

The External interrupt/event controller (EXTI) consists of up to 19-edge detectors which are used to generate event/interrupt requests. Each input line can be independently configured to select the type (pulse or pending) and the corresponding trigger event (rising, falling or both). Each line can be masked independently. A pending register maintains the status of the interrupt requests.

*Section 8.1: EXTI register structure* describes the data structures used in the EXTI firmware library. *Section 8.2: Firmware library functions* presents the firmware library functions.

## 8.1 EXTI register structure

The EXTI register structure, EXTI_*TypeDef, is* defined in the *stm32f10xstm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 IMR;
  vu32 EMR;
  vu32 RTSR;
  vu32 FTSR;
  vu32 SWIER;
  vu32 PR;
} EXTI_TypeDef;
```

*Table 128* shows the list of all EXTI registers.

**Table 128. EXTI registers**

| Register | Description |
|---|---|
| IMR | Interrupt Mask Register |
| EMR | Event Mask Register |
| RTSR | Rising Trigger Selection Register |
| FTSR | Falling Trigger Selection Register |
| SWIR | Software Interrupt Event Register |
| PR | Pending Register |

The EXTI peripheral is declared in the same file, as follows:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
...
#define EXTI_BASE             (APB2PERIPH_BASE + 0x0400)

#ifndef DEBUG
...
#ifdef _EXTI
  #define EXTI                ((EXTI_TypeDef *) EXTI_BASE)
#endif /*_EXTI */
```

```
...
#else   /* DEBUG */
...
#ifdef _EXTI
  EXT EXTI_TypeDef            *EXTI;
#endif /*_EXTI */
...
#endif
```

When using the Debug mode, EXTI pointer is initialized in *stm32f10x_lib.c* file:

```
#ifdef _EXTI
EXTI = (EXTI_TypeDef *)  EXTI_BASE;
#endif /*_EXTI */
```

To access the EXTI registers, _EXTI must be defined in *stm32f10x_conf.h* as follows:

```
#define _EXTI
```

## 8.2 Firmware library functions

*Table 129* lists the various functions of the EXTI firmware library.

**Table 129. EXTI Firmware library functions**

| Function name | Description |
|---|---|
| EXTI_DeInit | Resets the EXTI peripheral registers to their default reset values. |
| EXTI_Init | Initializes the EXTI peripheral according to the specified parameters in the EXTI_InitStruct. |
| EXTI_StructInit | Fills each EXTI_InitStruct member with its default value. |
| EXTI_GenerateSWInterrupt | Generates a software interrupt. |
| EXTI_GetFlagStatus | Checks whether the specified EXTI line flag is set or not. |
| EXTI_ClearFlag | Clears the EXTI's line pending flags. |
| EXTI_GetITStatus | Checks whether the specified EXTI line is asserted or not. |
| EXTI_ClearITPendingBit | Clears the EXTI's line pending bits. |

### 8.2.1 EXTI_DeInit function

*Table 130* describes the EXTI_DeInit function.

**Table 130. EXTI_DeInit function**

| | |
|---|---|
| Function name | EXTI_DeInit |
| Function prototype | void EXTI_DeInit(void) |
| Behavior description | Resets the EXTI peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Resets the EXTI registers to their default reset value */
EXTI_DeInit();
```

### 8.2.2 EXTI_Init function

*Table 131* describes the EXTI_DeInit function.

**Table 131. EXTI_DeInit function**

| | |
|---|---|
| Function name | EXTI_Init |
| Function prototype | void EXTI_Init(EXTI_InitTypeDef* EXTI_InitStruct) |
| Behavior description | Initializes the EXTI peripheral according to the parameters specified in the EXTI_InitStruct. |
| Input parameter | EXTI_InitStruct: pointer to a EXTI_InitTypeDef structure that contains the configuration information for the specified EXTI peripheral.<br>Refer to *Section : EXTI_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## EXTI_InitTypeDef structure

The EXTI_InitTypeDef structure is defined in *stm32f10x_exti.h*:

```
typedef struct
{
  u32 EXTI_Line;
  EXTIMode_TypeDef EXTI_Mode;
  EXTIrigger_TypeDef EXTI_Trigger;
  FunctionalState EXTI_LineCmd;
} EXTI_InitTypeDef;
```

### EXTI_Line

EXTI_Line selects the external lines to be enabled or disabled. The values taken by this member are given in *Table 132*.

**Table 132. EXTI_Line values**

| EXTI_Line | Description |
|---|---|
| EXTI_Line0 | External interrupt line 0 |
| EXTI_Line1 | External interrupt line 1 |
| EXTI_Line2 | External interrupt line 2 |
| EXTI_Line3 | External interrupt line 3 |
| EXTI_Line4 | External interrupt line 4 |
| EXTI_Line5 | External interrupt line 5 |
| EXTI_Line6 | External interrupt line 6 |
| EXTI_Line7 | External interrupt line 7 |
| EXTI_Line8 | External interrupt line 8 |
| EXTI_Line9 | External interrupt line 9 |
| EXTI_Line10 | External interrupt line 10 |
| EXTI_Line11 | External interrupt line 11 |
| EXTI_Line12 | External interrupt line 12 |
| EXTI_Line13 | External interrupt line 13 |
| EXTI_Line14 | External interrupt line 14 |
| EXTI_Line15 | External interrupt line 15 |
| EXTI_Line16 | External interrupt line 16 |
| EXTI_Line17 | External interrupt line 17 |
| EXTI_Line18 | External interrupt line 18 |

### EXTI_Mode

EXTI_Mode configures the mode for the enabled lines. The values taken by this member are given in *Table 133*.

**Table 133. EXTI_Mode values**

| EXTI_Mode | Description |
|---|---|
| EXTI_Mode_Event | EXTI lines configured as event request |
| EXTI_Mode_Interrupt | EXTI lines configured as interrupt request |

### EXTI_Trigger

EXTI configures the trigger signal active edge for the enabled lines.The values taken by this member are given in *Table 134*.

**Table 134. EXT_Trigger values**

| EXTI_Trigger | Description |
|---|---|
| EXTI_Trigger_Falling | Interrupt request configured on falling edge of the input line |
| EXTI_Trigger_Rising | Interrupt request configured on rising edge of the input line |
| EXTI_Trigger_Rising_Falling | Interrupt request configured on rising and falling edge of the input line |

### EXTI_LineCmd

This member is used to define the new state of the selected line. It can be set either to ENABLE or DISABLE.

**Example**:

```
/* Enables external lines 12 and 14 interrupt generation on falling
edge */
EXTI_InitTypeDef EXTI_InitStructure;
EXTI_InitStructure.EXTI_Line = EXTI_Line12 | EXTI_Line14;
EXTI_InitStructure.EXTI_Mode = EXTI_Mode_Interrupt;
EXTI_InitStructure.EXTI_Trigger = EXTI_Trigger_Falling;
EXTI_InitStructure.EXTI_LineCmd = ENABLE;
EXTI_Init(&EXTI_InitStructure);
```

### 8.2.3 EXTI_Struct function

*Table 135* describes the EXTI_StructInit function.

**Table 135. EXTI_StructInit function**

| | |
|---|---|
| Function name | EXTI_StructInit |
| Function prototype | void EXTI_StructInit(EXTI_InitTypeDef*EXTI_InitStruct) |
| Behavior description | Fills each EXTI_InitStruct member with its default value. |
| Input parameter | EXTI_InitStruct: pointer to a EXTI_InitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

*Table 136* gives the EXTI_InitStruct members default values:

**Table 136. EXTI_InitStruct default values**

| Member | Default value |
|---|---|
| EXTI_Line | EXTI_LineNone |
| EXTI_Mode | EXTI_Mode_Interrupt |
| EXTI_Trigger | EXTI_Trigger_Falling |
| EXTI_LineCmd | DISABLE |

**Example**:

```
/* Initialize the EXTI Init Structure parameters */
EXTI_InitTypeDef EXTI_InitStructure;
EXTI_StructInit(&EXTI_InitStructure);
```

### 8.2.4 EXTI_GenerateSWInterrupt function

*Table 137* describes the EXTI_GenerateSWInterrupt function.

**Table 137. EXTI_GenerateSWInterrupt function**

| | |
|---|---|
| Function name | EXTI_GenerateSWInterrupt |
| Function prototype | void EXTI_GenerateSWInterrupt(u32 EXTI_Line) |
| Behavior description | Generates a software interrupt. |
| Input parameter | EXTI_Line: EXTI lines to be enabled or disabled.<br>Refer to *Section : EXTI_Line* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Generate a software interrupt request */
EXTI_GenerateSWInterrupt(EXTI_Line6);
```

### 8.2.5 EXTI_GetFlagStatus function

*Table 138* describes the EXTI_GetFlagStatus function.

**Table 138. EXTI_GetFlagStatus function**

| | |
|---|---|
| Function name | EXTI_GetFlagStatus |
| Function prototype | FlagStatus EXTI_GetFlagStatus(u32 EXTI_Line) |
| Behavior description | Checks whether the specified EXTI line flag is set or not. |
| Input parameter | EXTI_Line: EXTI lines flag to check.<br>Refer to *Section : EXTI_Line* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of EXTI_Line (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the status of EXTI line 8 */
FlagStatus EXTIStatus;
EXTIStatus = EXTI_GetFlagStatus(EXTI_Line8);
```

### 8.2.6 EXTI_ClearFlag function

*Table 139* describes the EXTI_ClearFlag function.

**Table 139. EXTI_ClearFlag function**

| | |
|---|---|
| Function name | EXTI_ClearFlag |
| Function prototype | `void EXTI_ClearFlag(u32 EXTI_Line)` |
| Behavior description | Clears the EXTI line pending flags. |
| Input parameter | EXTI_Line: EXTI lines flags to clear.<br>Refer to *Section : EXTI_Line* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Clear the EXTI line 2 pending flag */
EXTI_ClearFlag(EXTI_Line2);
```

### 8.2.7 EXTI_GetITStatus function

*Table 140* describes the EXTI_GetITStatus function.

**Table 140. EXTI_GetITStatus function**

| | |
|---|---|
| Function name | EXTI_GetITStatus |
| Function prototype | ITStatus EXTI_GetITStatus(u32 EXTI_Line) |
| Behavior description | Checks whether the specified EXTI line is asserted or not. |
| Input parameter | EXTI_Line: EXTI lines pending bits to check.<br>Refer to *Section : EXTI_Line* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of EXTI_Line (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get the status of EXTI line 8 */
ITStatus EXTIStatus;
EXTIStatus = EXTI_GetITStatus(EXTI_Line8);
```

### 8.2.8 EXTI_ClearITPendingBit function

*Table 141* describes the EXTI_ClearITPendingBit function.

**Table 141. EXTI_ClearITPendingBit function**

| | |
|---|---|
| Function name | EXTI_ClearITPendingBit |
| Function prototype | void EXTI_ClearITPendingBit(u32 EXTI_Line) |
| Behavior description | Clears the EXTI's line pending bits. |
| Input parameter | EXTI_Line: EXTI lines pending bits to clear.<br>Refer to *Section : EXTI_Line* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Clears the EXTI line 2 interrupt pending bit */
EXTI_ClearITpendingBit(EXTI_Line2);
```

# 9 Flash memory (FLASH)

*Section 9.1: FLASH register structures* describes the data structures used in the FLASH Firmware Library. *Section 9.2: Firmware library functions* presents the Firmware Library functions.

## 9.1 FLASH register structures

The FLASH register structures, *FLASH_TypeDef* and OB_TypeDef, are defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 ACR;
  vu32 KEYR;
  vu32 OPTKEYR;
  vu32 SR;
  vu32 CR;
  vu32 AR;
  vu32 RESERVED;
  vu32 OBR;
  vu32 WRPR;
} FLASH_TypeDef;

typedef struct
{
  vu16 RDP;
  vu16 USER;
  vu16 Data0;
  vu16 Data1;
  vu16 WRP0;
  vu16 WRP1;
  vu16 WRP2;
  vu16 WRP3;
} OB_TypeDef;
```

*Table 142* and *Table 143* give the list of the FLASH registers and Option Byte registers (OB), respectively.

**Table 142. FLASH registers**

| Register | Description |
|---|---|
| ACR | Flash Access Control Register |
| KEYR | FPEC Key Register |
| OPTKEYR | Option Byte Key Register |
| SR | Flash Status Register |
| CR | Flash Control Register |
| AR | Flash Address Register |

**Table 142. FLASH registers (continued)**

| Register | Description |
|---|---|
| OBR | Option Byte and Status Register |
| WRPR | Option Byte write protection Register |

**Table 143. Option Bytes registers (OB)**

| Register | Description |
|---|---|
| RDP | Read Out Option Byte |
| USER | User Option Byte |
| Data0 | Data0 Option Byte |
| Data1 | Data1 Option Byte |
| WRP0 | Write Protection 0 Option Byte |
| WRP1 | Write Protection 1 Option Byte |
| WRP2 | Write Protection 2 Option Byte |
| WRP3 | Write Protection 3 Option Byte |

The FLASH peripheral is declared in *stm32f10x_map.h*:

```
/* Flash registers base address */
#define FLASH_BASE              ((u32)0x40022000)

/* Flash Option Bytes base address */
#define OB_BASE                 ((u32)0x1FFFF800)
#ifndef DEBUG
...
#ifdef _FLASH
  #define FLASH                 ((FLASH_TypeDef *) FLASH_BASE)
  #define OB                    ((OB_TypeDef *) OB_BASE)
#endif /*_FLASH */
...
#else   /* DEBUG */
...
#ifdef _FLASH
  EXT FLASH_TypeDef              *FLASH;
  EXT OB_TypeDef                 *OB;
#endif /*_FLASH */
...
#endif
```

When using the Debug mode, FLASH and OB pointers are initialized in *stm32f10x_lib.c* file:

```
#ifdef _FLASH
FLASH = (FLASH_TypeDef *)  FLASH_BASE;
OB = (OB_TypeDef *)  OB_BASE;
#endif /*_FLASH */
```

To access the FLASH registers, _FLASH must be defined in *stm32f10x_conf.h* as follows:

```
#define _FLASH
```

By default only the functions performing FLASH configuration (latency, prefetch, half cycle) are enabled (see *Table 144*).

To enable FLASH program/erase/protections functions, `_FLASH_PROG` must be defined in *stm32f10x_conf.h* as follows:

```
#define _FLASH_PROG
```

## 9.2 Firmware library functions

*Table 144* lists the various functions of the FLASH library.

**Table 144. FLASH library function**

| Function name | Description |
|---|---|
| FLASH_SetLatency | Sets the code latency value. |
| FLASH_HalfCycleAccessCmd | Enables or disables the Half cycle FLASH access. |
| FLASH_PrefetchBufferCmd | Enables or disables the Prefetch Buffer. |
| FLASH_Unlock | Unlocks the FLASH Program Erase Controller. |
| FLASH_Lock | Locks the Flash Program Erase Controller. |
| FLASH_ErasePage | Erases a specified FLASH page. |
| FLASH_EraseAllPages | Erases all FLASH pages. |
| FLASH_EraseOptionBytes | Erases the FLASH option bytes. |
| FLASH_ProgramWord | Programs a word at a specified address. |
| FLASH_ProgramHalfWord | Programs a half word at a specified address. |
| FLASH_ProgramOptionByteData | Programs a half word at a specified Option Byte Data address. |
| FLASH_EnableWriteProtection | Write protects the desired pages |
| FLASH_ReadOutProtection | Enables or disables the read out protection. |
| FLASH_UserOptionByteConfig | Programs the FLASH User Option Byte: IWDG_SW / RST_STOP / RST_STDBY. |
| FLASH_GetUserOptionByte | Returns the FLASH User Option Bytes values. |
| FLASH_GetWriteProtectionOptionByte | Returns the FLASH Write Protection Option Bytes Register value. |
| FLASH_GetReadOutProtectionStatus | Checks whether the FLASH Read Out Protection Status is set or not. |
| FLASH_GetPrefetchBufferStatus | Checks whether the FLASH Prefetch Buffer status is set or not. |
| FLASH_ITConfig | Enables or disables the specified FLASH interrupts. |
| FLASH_GetFlagStatus | Checks whether the specified FLASH flag is set or not. |
| FLASH_ClearFlag | Clears the FLASH pending flags. |

Table 144. FLASH library function

| Function name | Description |
|---|---|
| FLASH_GetStatus | Returns the FLASH Status. |
| FLASH_WaitForLastOperation | Waits for a Flash operation to complete or a TIMEOUT to occur. |

### 9.2.1 FLASH_SetLatency function

*Table 145* describes the FLASH_SetLatency function.

Table 145. FLASH_SetLatency function

| | |
|---|---|
| Function name | FLASH_SetLatency |
| Function prototype | void FLASH_SetLatency(u32 FLASH_Latency) |
| Behavior description | Sets the code latency value. |
| Input parameter | FLASH_Latency specifies the FLASH Latency value.<br>Refer to *Section : FLASH_Latency* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_Latency

FLASH_Latency is used to configure the FLASH Latency value. See *Table 146* for the values of this parameter.

Table 146. FLASH_Latency values

| FLASH_Latency | Description |
|---|---|
| FLASH_Latency_0 | Zero Latency cycle. |
| FLASH_Latency_1 | One Latency cycle. |
| FLASH_Latency_2 | Two Latency cycles. |

**Example:**

```
/* Configure the Latency cycle: Set 2 Latency cycles */
FLASH_SetLatency(FLASH_Latency_2);
```

### 9.2.2 FLASH_HalfCycleAccessCmd function

*Table 147* describes the FLASH_HalfCycleAccessCmd function.

**Table 147. FLASH_HalfCycleAccessCmd function**

| | |
|---|---|
| Function name | FLASH_HalfCycleAccessCmd |
| Function prototype | void FLASH_HalfCycleAccessCmd(u32 FLASH_HalfCycleAccess) |
| Behavior description | Enables or disables the Half cycle Flash access. |
| Input parameter | FLASH_HalfCycle: FLASH Half cycle mode.<br>Refer to *Section : FLASH_HalfCycleAccess* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_HalfCycleAccess

FLASH_HalfCycleAccess is used to select the FLASH Half Cycle access mode. See *Table 148* for the values of this parameter.

**Table 148. FLASH_HalfCycleAccess values**

| FLASH_HalfCycleAccess | Description |
|---|---|
| FLASH_HalfCycleAccess_Enable | Half Cycle Access Enable |
| FLASH_HalfCycleAccess_Disable | Half Cycle Access Disable |

**Example:**

```
/* Enable the Half Cycle Flash access */
FLASH_HalfCycleAccessCmd(FLASH_HalfCycleAccess_Enable);
```

### 9.2.3 FLASH_PrefetchBufferCmd function

*Table 149* describes the FLASH_PrefetchBufferCmd function.

**Table 149. FLASH_PrefetchBufferCmd function**

| | |
|---|---|
| Function name | FLASH_PrefetchBufferCmd |
| Function prototype | void FLASH_PrefetchBufferCmd(u32 FLASH_PrefetchBuffer) |
| Behavior description | Enables or disables the Prefetch Buffer. |
| Input parameter | FLASH_PrefetchBuffer: Prefetch buffer status.<br>Refer to *Section : FLASH_PrefetchBuffer* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_PrefetchBuffer

FLASH_PrefetchBuffer is used to select the FLASH Prefetch Buffer status. See *Table 150* for the values of this parameter.

**Table 150. FLASH_PrefetchBuffer values**

| FLASH_PrefetchBuffer | Description |
|---|---|
| FLASH_PrefetchBuffer_Enable | Prefetch Buffer Enable |
| FLASH_PrefetchBuffer_Disable | Prefetch Buffer Disable |

**Example:**

```
/* Enable The Prefetch Buffer */
FLASH_PrefetchBufferCmd(FLASH_PrefetchBuffer_Enable);
```

### 9.2.4 FLASH_Unlock function

*Table 151* describes the FLASH_Unlock function.

**Table 151. FLASH_Unlock function**

| | |
|---|---|
| Function name | FLASH_Unlock |
| Function prototype | void FLASH_Unlock(void) |
| Behavior description | Unlocks the FLASH Program Erase Controller. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Unlocks the Flash */
FLASH_Unlock();
```

### 9.2.5 FLASH_Lock function

*Table 152* describes the FLASH_Lock function.

**Table 152. FLASH_Lock function**

| | |
|---|---|
| Function name | FLASH_Lock |
| Function prototype | void FLASH_Lock(void) |
| Behavior description | Locks the FLASH Program Erase Controller. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Locks the Flash */
FLASH_Lock();
```

### 9.2.6 FLASH_ErasePage function

Table 153 describes the FLASH_ErasePage function.

**Table 153. FLASH_ErasePage function**

| | |
|---|---|
| Function name | FLASH_ErasePage |
| Function prototype | FLASH_Status FLASH_ErasePage(u32 Page_Address) |
| Behavior description | Erases a FLASH page. |
| Input parameter | FLASH_Page: page to be erased |
| Output parameter | None |
| Return parameter | The Erase operation Status. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Erases the Flash Page 0 */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_ErasePage(0x08000000);
```

### 9.2.7 FLASH_EraseAllPages function

Table 154 describes FLASH_EraseAllPages function.

**Table 154. FLASH_EraseAllPages function**

| | |
|---|---|
| Function name | FLASH_EraseAllPages |
| Function prototype | FLASH_Status FLASH_EraseAllPages(void) |
| Behavior description | Erases all FLASH pages. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The Erase operation Status |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Erases the Flash */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_EraseAllPages();
```

### 9.2.8 FLASH_EraseOptionBytes function

*Table 155* describes the FLASH_EraseOptionBytes function.

**Table 155. FLASH_EraseOptionBytes function**

| | |
|---|---|
| Function name | FLASH_EraseOptionBytes |
| Function prototype | FLASH_Status FLASH_EraseOptionBytes(void) |
| Behavior description | Erases the FLASH option bytes. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The Erase operation Status |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Erases the Flash Option Bytes */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_EraseOptionBytes();
```

### 9.2.9 FLASH_ProgramWord function

*Table 156* describes the FLASH_ProgramWord function.

**Table 156. FLASH_ProgramWord function**

| | |
|---|---|
| Function name | FLASH_ProgramWord |
| Function prototype | FLASH_Status FLASH_ProgramWord(u32 Address, u32 Data) |
| Behavior description | Programs a word at a specified address. |
| Input parameter1 | Address: address to be programmed. |
| Input parameter2 | Data: specifies the data to be programmed. |
| Output parameter | None |
| Return parameter | The Program operation Status. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Writes the Data1 at the Address1 */
FLASH_Status status = FLASH_COMPLETE;
u32 Data1 = 0x1234567;
u32 Address1 = 0x8000000;
status = FLASH_ProgramWord(Address1, Data1);
```

### 9.2.10 FLASH_ProgramHalfWord function

*Table 157* describes the FLASH_ProgramHalfWord function.

**Table 157. FLASH_ProgramHalfWord function**

| | |
|---|---|
| Function name | FLASH_ProgramHalfWord |
| Function prototype | FLASH_Status FLASH_ProgramHalfWord(u32 Address, u16 Data) |
| Behavior description | Programs a half word at a specified address. |
| Input parameter1 | Address: address to be programmed. |
| Input parameter2 | Data: half-word data to be programmed. |
| Output parameter | None |
| Return parameter | The Program operation Status. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Writes the Data1 at the Address1 */
FLASH_Status status = FLASH_COMPLETE;
u16 Data1 = 0x1234;
u32 Address1 = 0x8000004;
status = FLASH_ProgramHalfWord(Address1, Data1);
```

### 9.2.11 FLASH_ProgramOptionByteData function

*Table 158* describes the FLASH_ProgramOptionByteData function.

**Table 158. FLASH_ProgramOptionByteData function**

| | |
|---|---|
| Function name | FLASH_ProgramOptionByteData |
| Function prototype | FLASH_Status FLASH_ProgramOptionByteData(u32 Address, u8 Data) |
| Behavior description | Programs a half word at a specified Option Byte Data address. |
| Input parameter1 | Address: address to be programmed. This parameter can be 0x1FFFF804 or 0x1FFFF806. |
| Input parameter2 | Data: specifies the data to be programmed. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Writes the Data1 at the Address1 */
FLASH_Status status = FLASH_COMPLETE;
u8 Data1 = 0x12;
u32 Address1 = 0x1FFFF804;
status = FLASH_ProgramOptionByteData(Address1, Data1);
```

### 9.2.12 FLASH_EnableWriteProtection function

*Table 159* describes the FLASH_EnableWriteProtection function.

**Table 159. FLASH_EnableWriteProtection function**

| | |
|---|---|
| Function name | FLASH_EnableWriteProtection |
| Function prototype | FLASH_Status FLASH_EnableWriteProtection(u32 FLASH_Pages) |
| Behavior description | Write protects the desired pages. |
| Input parameter | FLASH_Pages: address of the pages to be write protected.<br>Refer to *Section : FLASH_Pages* for more details on the values of this parameter. |
| Output parameter | None |
| Return parameter | The write protection operation Status. |
| Required preconditions | None |
| Called functions | None |

#### FLASH_Pages

FLASH_Pages is used to configure the FLASH write protection pages. See *Table 160* for the values taken by this parameter.

**Table 160. FLASH_Pages values**

| FLASH_Pages | Description |
|---|---|
| FLASH_WRProt_Pages0to3 | Write protection of page 0 to 3. |
| FLASH_WRProt_Pages4to7 | Write protection of page 4 to 7. |
| FLASH_WRProt_Pages8to11 | Write protection of page 8 to 11. |
| FLASH_WRProt_Pages12to15 | Write protection of page 12 to 15. |
| FLASH_WRProt_Pages16to19 | Write protection of page 16 to 19. |
| FLASH_WRProt_Pages20to23 | Write protection of page 20 to 23. |
| FLASH_WRProt_Pages24to27 | Write protection of page 24 to 27. |
| FLASH_WRProt_Pages28to31 | Write protection of page 28 to 31. |
| FLASH_WRProt_Pages32to35 | Write protection of page 32 to 35. |
| FLASH_WRProt_Pages36to39 | Write protection of page 36 to 39. |
| FLASH_WRProt_Pages40to43 | Write protection of page 40 to 43. |
| FLASH_WRProt_Pages44to47 | Write protection of page 44 to 47. |
| FLASH_WRProt_Pages48to51 | Write protection of page 48 to 51. |
| FLASH_WRProt_Pages52to55 | Write protection of page 52 to 55. |
| FLASH_WRProt_Pages56to59 | Write protection of page 56 to 59. |
| FLASH_WRProt_Pages60to63 | Write protection of page 60 to 63. |
| FLASH_WRProt_Pages64to67 | Write protection of page 64 to 67. |
| FLASH_WRProt_Pages68to71 | Write protection of page 68 to 71. |

Table 160. FLASH_Pages values (continued)

| FLASH_Pages | Description |
|---|---|
| FLASH_WRProt_Pages72to75 | Write protection of page 72 to 75. |
| FLASH_WRProt_Pages76to79 | Write protection of page 76 to 79. |
| FLASH_WRProt_Pages80to83 | Write protection of page 80 to 83. |
| FLASH_WRProt_Pages84to87 | Write protection of page 84 to 87. |
| FLASH_WRProt_Pages88to91 | Write protection of page 88 to 91. |
| FLASH_WRProt_Pages92to95 | Write protection of page 92 to 95. |
| FLASH_WRProt_Pages96to99 | Write protection of page 96 to 99. |
| FLASH_WRProt_Pages100to103 | Write protection of page 100 to 103. |
| FLASH_WRProt_Pages104to107 | Write protection of page 104 to 107. |
| FLASH_WRProt_Pages108to111 | Write protection of page 108 to 111. |
| FLASH_WRProt_Pages112to115 | Write protection of page 112 to 115. |
| FLASH_WRProt_Pages116to119 | Write protection of page 115 to 119. |
| FLASH_WRProt_Pages120to123 | Write protection of page 120 to 123. |
| FLASH_WRProt_Pages124to127 | Write protection of page 124 to 127. |
| FLASH_WRProt_AllPages | Write protection all Pages. |

**Example:**

```
/* Protects the Pages0to3 and Pages108to111 */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_EnableWriteProtection
(FLASH_WRProt_Pages0to3|FLASH_WRProt_Pages108to111);
```

### 9.2.13 FLASH_ReadOutProtection function

*Table 161* describes the FLASH_ReadOutProtection function.

Table 161. FLASH_ReadOutProtection function

| | |
|---|---|
| Function name | FLASH_ReadOutProtection |
| Function prototype | FLASH_Status FLASH_ReadOutProtection(FunctionalState NewState) |
| Behavior description | Enables or disables the read out protection. |
| Input parameter | NewState: new state of the Read Out protection. This parameter can be set either to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | The protection operation Status. |
| Required preconditions | If the user has already programmed the other option bytes before calling this function, he must re-program them since this function erases all option bytes. |
| Called functions | None |

### Example:

```
/* Disables the ReadOut Protection */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_ReadOutProtection(DISABLE);
```

*Note: To safely program the option bytes, the user has to follow the order of the operations described below:*

1. *Call the FLASH_ReadOutProtection function, if there is a need to read-protect the Flash memory*
2. *Call the FLASH_EnableWriteProtection function in order to write-protect some pages or all the Flash memory*
3. *Call the FLASH_UserOptionByteConfig to program the user option byte: IWDG_SW / RST_STOP /RST_STDBY*
4. *Call the FLASH_ProgramOptionByteData to program a half-word to the specified option byte data addresses*
5. *Generate a reset to load the new option bytes*

## 9.2.14 FLASH_UserOptionByteConfig function

*Table 162* describes the FLASH_UserOptionByteConfig function.

**Table 162. FLASH_UserOptionByteConfig function**

| | |
|---|---|
| Function name | FLASH_UserOptionByteConfig |
| Function prototype | FLASH_Status FLASH_UserOptionByteConfig(u16 OB_IWDG, u16 OB_STOP, u16 OB_STDBY) |
| Behavior description | Programs the FLASH User Option Byte: IWDG_SW / RST_STOP RST_STDBY. |
| Input parameter1 | OB_IWDG: Selects the IWDG mode.<br>Refer to *Section : OB_IWDG* for more details on the values of this parameter. |
| Input parameter2 | OB_STOP: Reset event when entering STOP mode.<br>Refer to *Section : OB_STOP* for more details on the values of this parameter. |
| Input parameter3 | OB_STDBY: Reset event when entering Standby mode.<br>Refer to *Section : OB_STDBY* for more details on the values of this parameter. |
| Output parameter | None |
| Return parameter | The Option Byte program Status. |
| Required preconditions | None |
| Called functions | None |

### OB_IWDG

This parameter configures the IWDG mode. See *Table 163* for the values taken by OB_IWDG.

**Table 163. OB_IWDG values**

| OB_IWDG | Description |
|---|---|
| OB_IWDG_SW | Software IWDG selected. |
| OB_IWDG_HW | Hardware IWDG selected. |

### OB_STOP

This parameter specifies if a Reset is generated or not when entering STOP mode. See *Table 164* for the values taken by OB_STOP.

**Table 164. OB_STOP values**

| OB_STOP | Description |
|---|---|
| OB_STOP_NoRST | No reset generated when entering STOP mode |
| OB_STOP_RST | Reset generated when entering STOP mode |

### OB_STDBY

This parameter specifies if a Reset is generated or not when entering STANDBY mode. See *Table 165* for the values taken by OB_STBY.

**Table 165. OB_STDBY values**

| OB_STDBY | Description |
|---|---|
| OB_STDBY_NoRST | No reset generated when entering STANDBY mode |
| OB_STDBY_RST | Reset generated when entering STANDBY mode |

**Example:**

```
/* Option Bytes Configuration: software watchdog, Reset generation
when entering in STOP and No reset generation when entering in
STANDBY */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_UserOptionByteConfig(OB_IWDG_SW, OB_STOP_RST,
OB_STDBY_NoRST);
```

## 9.2.15 FLASH_GetUserOptionByte function

*Table 166* describes the FLASH_GetUserOptionByte function.

**Table 166. FLASH_GetUserOptionByte function**

| | |
|---|---|
| Function name | FLASH_GetUserOptionByte |
| Function prototype | u32 FLASH_GetUserOptionByte(void) |
| Behavior description | Returns the FLASH User Option Bytes values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The FLASH User Option Bytes values:IWDG_SW(Bit0), RST_STOP(Bit1) and RST_STDBY(Bit2). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the user option byte values */
u32 UserByteValue = 0x0;
u32 IWDGValue = 0x0, RST_STOPValue = 0x0, RST_STDBYValue = 0x0;
UserByteValue = FLASH_GetUserOptionByte();
IWDGValue = UserByteValue & 0x0001;
RST_STOPValue = UserByteValue & 0x0002;
RST_STDBYValue = UserByteValue & 0x0004;
```

## 9.2.16 FLASH_GetWriteProtectionOptionByte function

*Table 167* describes the FLASH_GetWriteProtectionOptionByte function.

**Table 167. FLASH_GetWriteProtectionOptionByte function**

| | |
|---|---|
| Function name | FLASH_GetWriteProtectionOptionByte |
| Function prototype | u32 FLASH_GetWriteProtectionOptionByte(void) |
| Behavior description | Returns the FLASH Write Protection Option Bytes Register value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The FLASH Write Protection Option Bytes Register value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Write Protection option byte values */
u32 WriteProtectionValue = 0x0;
WriteProtectionValue = FLASH_GetWriteProtectionOptionByte();
```

### 9.2.17 FLASH_GetReadOutProtectionStatus function

*Table 168* describes the FLASH_GetReadOutProtectionStatus function.

**Table 168. FLASH_GetReadOutProtectionStatus function**

| | |
|---|---|
| Function name | FLASH_GetReadOutProtectionStatus |
| Function prototype | FlagStatus FLASH_GetReadOutProtectionStatus(void) |
| Behavior description | Checks whether the FLASH Read Out Protection Status is set or not. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | FLASH ReadOut Protection Status (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the ReadOut Protection status */
FlagStatus status = RESET;
status = FLASH_GetReadOutProtectionStatus();
```

### 9.2.18 FLASH_GetPrefetchBufferStatus function

*Table 169* describes the FLASH_GetPrefetchBufferStatus function.

**Table 169. FLASH_GetPrefetchBufferStatus function**

| | |
|---|---|
| Function name | FLASH_GetPrefetchBufferStatus |
| Function prototype | FlagStatus FLASH_GetPrefetchBufferStatus(void) |
| Behavior description | Checks whether the FLASH Prefetch Buffer status is set or not. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | FLASH Prefetch Buffer Status (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Prefetch Buffer status */
FlagStatus status = RESET;
status = FLASH_GetPrefetchBufferStatus();
```

### 9.2.19 FLASH_ITConfig function

*Table 170* describes the FLASH_ITConfig function.

**Table 170. FLASH_ITConfig function**

| | |
|---|---|
| Function name | FLASH_ITConfig |
| Function prototype | void FLASH_ITConfig(u16 FLASH_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified FLASH interrupts. |
| Input parameter1 | FLASH_IT: FLASH interrupt sources to be enabled or disabled.<br>Refer to *Section : FLASH_IT* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified FLASH interrupts.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_IT

This parameter is used to enable or disable FLASH interrupts. One or a combination of the following values can be used:

**Table 171. FLASH_IT values**

| FLASH_IT | Description |
|---|---|
| FLASH_IT_ERROR | FPEC error interrupt source |
| FLASH_IT_EOP | End of FLASH Operation Interrupt source |

**Example:**

```
/* Enables the EOP Interrupt source */
FLASH_ITConfig(FLASH_IT_EOP, ENABLE);
```

### 9.2.20 FLASH_GetFlagStatus function

*Table 172* describes the FLASH_GetFlagStatus function.

**Table 172. Flah_GetFlagStatus function**

| | |
|---|---|
| Function name | FLASH_GetFlagStatus |
| Function prototype | FlagStatus FLASH_GetFlagStatus(u16 FLASH_FLAG) |
| Behavior description | Checks whether the specified FLASH flag is set or not. |
| Input parameter | None |
| Input parameter | FLASH_FLAG: flag to be checked.<br>Refer to *Section : FLASH_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_FLAG

The FLASH flags which can be checked by issuing the FLASH_GetFlagStatus function are listed in the following table:

**Table 173. FLASH_FLAG definition**

| FLASH_FLAG | Description |
|---|---|
| FLASH_FLAG_BSY | FLASH Busy flag |
| FLASH_FLAG_EOP | FLASH end of operation flag |
| FLASH_FLAG_PGERR | FLASH Program error flag |
| FLASH_FLAG_WRPRTERR | FLASH Page Write protected error flag |
| FLASH_FLAG_OPTERR | FLASH Option Byte error flag |

**Example**:

```
/* Checks whether the EOP Flag Status is SET or not */
FlagStatus status = RESET;
status = FLASH_GetFlagStatus(FLASH_FLAG_EOP);
```

### 9.2.21 FLASH_ClearFlag function

*Table 174* describes the FLASH_ClearFlag function.

**Table 174. FLASH_ClearFlag function**

| | |
|---|---|
| Function name | FLASH_ClearFlag |
| Function prototype | void FLASH_ClearFlag(u16 FLASH_Flag) |
| Behavior description | Clears the FLASH pending flags |
| Input parameter | FLASH_FLAG: flag to be cleared<br>Refer to *Section : FLASH_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### FLASH_FLAG

The FLASH flags that can be cleared by issuing the FLASH_ClearFlag function are listed in the following table:

**Table 175. FLASH_FLAG definition**

| FLASH_FLAG | Description |
|---|---|
| FLASH_FLAG_BSY | FLASH Busy flag |
| FLASH_FLAG_EOP | FLASH end of operation flag |
| FLASH_FLAG_PGERR | FLASH Program error flag |
| FLASH_FLAG_WRPRTERR | FLASH Page Write protected error flag |

**Example:**

```
/* Clears all flags */
FLASH_ClearFlag(FLASH_FLAG_BSY|FLASH_FLAG_EOP|FLASH_FLAG_PGER
|FLASH_FLAG_WRPRTERR);
```

### 9.2.22 FLASH_GetStatus function

*Table 176* describes the FLASH_GetStatus function.

**Table 176. FLASH_GetStatus function**

| | |
|---|---|
| Function name | FLASH_GetStatus |
| Function prototype | FLASH_Status FLASH_GetStatus(void) |
| Behavior description | Returns the FLASH Status. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | FLASH Status: The returned value can be: FLASH_BUSY, FLASH_ERROR_PG or FLASH_ERROR_WRP or FLASH_COMPLETE |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Check for the Flash status */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_GetStatus();
```

### 9.2.23 FLASH_WaitForLastOperation function

*Table 177* describes the FLASH_WaitForLastOperation function.

**Table 177. FLASH_WaitForLastOperation function**

| | |
|---|---|
| Function name | FLASH_WaitForLastOperation |
| Function prototype | FLASH_Status FLASH_WaitForLastOperation(u32 Timeout) |
| Behavior description | Waits for a Flash operation to complete or a TIMEOUT to occur. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | Return the appropriate operation Status.<br>This parameter can be FLASH_BUSY, FLASH_ERROR_PG or FLASH_ERROR_WRP or FLASH_COMPLETE or FLASH_TIMEOUT |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Waits for the Flash operation to be completed */
FLASH_Status status = FLASH_COMPLETE;
status = FLASH_WaitForLastOperation();
```

# 10 General purpose I/O (GPIO)

The GPIO driver can be used for several purposes, including pin configuration, single bit set/reset, lock mechanism, reading from a port pin, and writing data into a port pin.

*Section 10.1: GPIO register structure* describes the data structures used in the GPIO Firmware Library. *Section 10.2: Firmware library functions* presents the Firmware Library functions.

## 10.1 GPIO register structure

The GPIO register structure, GPIO_*TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CRL;
  vu32 CRH;
  vu32 IDR;
  vu32 ODR;
  vu32 BSRR;
  vu32 BRR;
  vu32 LCKR;
} GPIO_TypeDef;

typedef struct
{
  vu32 EVCR;
  vu32 MAPR;
  vu32 EXTICR[4];
} AFIO_TypeDef;
```

*Table 178* gives the list of the GPIO registers:

**Table 178. GPIO registers**

| Register | Description |
|---|---|
| CRL | Port Control Register low |
| CRH | Port Control Register High |
| IDR | Input Data Register |
| ODR | Output Data Register |
| BSRR | Bit Set Reset Register |
| BRR | Bit Reset Register |
| LCKR | Lock Register |
| EVCR | Event Control Register |
| MAPR | Remap Debug and AF Register |
| EXTICR | EXTI Line 0 to Line 15 Configuration Register |

The five GPIO peripherals are declared in *stm32f10x_map*.h:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
...
#define AFIO_BASE             (APB2PERIPH_BASE + 0x0000)
#define GPIOA_BASE            (APB2PERIPH_BASE + 0x0800)
#define GPIOB_BASE            (APB2PERIPH_BASE + 0x0C00)
#define GPIOC_BASE            (APB2PERIPH_BASE + 0x1000)
#define GPIOD_BASE            (APB2PERIPH_BASE + 0x1400)
#define GPIOE_BASE            (APB2PERIPH_BASE + 0x1800)

#ifndef DEBUG
...
#ifdef _AFIO
  #define AFIO                  ((AFIO_TypeDef *) AFIO_BASE)
#endif /*_AFIO */

#ifdef _GPIOA
  #define GPIOA                 ((GPIO_TypeDef *) GPIOA_BASE)
#endif /*_GPIOA */

#ifdef _GPIOB
  #define GPIOB                 ((GPIO_TypeDef *) GPIOB_BASE)
#endif /*_GPIOB */

#ifdef _GPIOC
  #define GPIOC                 ((GPIO_TypeDef *) GPIOC_BASE)
#endif /*_GPIOC */

#ifdef _GPIOD
  #define GPIOD                 ((GPIO_TypeDef *) GPIOD_BASE)
#endif /*_GPIOD */

#ifdef _GPIOE
  #define GPIOE                 ((GPIO_TypeDef *) GPIOE_BASE)
#endif /*_GPIOE */
...
#else   /* DEBUG */
...
#ifdef _AFIO
  EXT AFIO_TypeDef            *AFIO;
#endif /*_AFIO */

#ifdef _GPIOA
  EXT GPIO_TypeDef            *GPIOA;
#endif /*_GPIOA */

#ifdef _GPIOB
  EXT GPIO_TypeDef            *GPIOB;
```

```
#endif /*_GPIOB */

#ifdef _GPIOC
  EXT GPIO_TypeDef            *GPIOC;
#endif /*_GPIOC */

#ifdef _GPIOD
  EXT GPIO_TypeDef            *GPIOD;
#endif /*_GPIOD */

#ifdef _GPIOE
  EXT GPIO_TypeDef            *GPIOE;
#endif /*_GPIOE */
...
#endif
```

When using the Debug mode, _AFIO, _GPIOA, _GPIOB, _GPIOC, _GPIOD and _GPIOE pointers are initialized in *stm32f10x_lib.c* file:

```
#ifdef _GPIOA
  GPIOA = (GPIO_TypeDef *)  GPIOA_BASE;
#endif /*_GPIOA */

#ifdef _GPIOB
  GPIOB = (GPIO_TypeDef *)  GPIOB_BASE;
#endif /*_GPIOB */

#ifdef _GPIOC
  GPIOC = (GPIO_TypeDef *)  GPIOC_BASE;
#endif /*_GPIOC */

#ifdef _GPIOD
  GPIOD = (GPIO_TypeDef *)  GPIOD_BASE;
#endif /*_GPIOD */

#ifdef _GPIOE
  GPIOE = (GPIO_TypeDef *)  GPIOE_BASE;
#endif /*_GPIOE */

#ifdef _AFIO
  AFIO = (AFIO_TypeDef *)  AFIO_BASE;
#endif /*_AFIO */
```

To access the GPIO registers, _GPIO, _AFIO, _GPIOA, _GPIOB, _GPIOC, _GPIOD and _GPIOE must be defined in stm32f10x_conf.h:

```
#define _GPIO
#define _GPIOA
#define _GPIOB
#define _GPIOC
#define _GPIOD
#define _GPIOE
#define _AFIO
```

## 10.2 Firmware library functions

*Table 179* gives the list of the GPIO firmware library functions.

**Table 179. GPIO firmware library functions**

| Function name | Description |
|---|---|
| GPIO_DeInit | Resets the GPIOx peripheral registers to their default reset values. |
| GPIO_AFIODeInit | Resets the Alternate Functions (remap, event control and EXTI configuration) registers to their default reset values. |
| GPIO_Init | Initializes the GPIOx peripheral according to the specified parameters in the GPIO_InitStruct. |
| GPIO_StructInit | Fills each GPIO_InitStruct member with its default value. |
| GPIO_ReadInputDataBit | Reads the specified input port pin |
| GPIO_ReadInputData | Reads the specified GPIO input data port |
| GPIO_ReadOutputDataBit | Reads the specified output data port bit |
| GPIO_ReadOutputData | Reads the specified GPIO output data port |
| **GPIO_SetBits** | Sets the selected data port bits |
| **GPIO_ResetBits** | Clears the selected data port bits |
| GPIO_WriteBit | Sets or clears the selected data port bit |
| GPIO_Write | Writes data to the specified GPIO data port |
| GPIO_PinLockConfig | Locks GPIO Pins configuration registers |
| GPIO_EventOutputConfig | Selects the GPIO pin used as Event output. |
| GPIO_EventOutputCmd | Enables or disables the Event Output. |
| GPIO_PinRemapConfig | Changes the mapping of the specified pin. |
| GPIO_EXTILineConfig | Selects the GPIO pin used as EXTI Line. |

### 10.2.1 GPIO_DeInit function

*Table 180* describes the GPIO_DeInit function.

**Table 180. GPIO_DeInit function**

| | |
|---|---|
| Function name | GPIO_DeInit |
| Function prototype | void GPIO_DeInit(GPIO_TypeDef* GPIOx) |
| Behavior description | Resets the GPIOx peripheral registers to their default reset values. |
| Input parameter | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphResetCmd() |

**Example:**

```
/* Resets the GPIOA peripheral registers to their default reset
values */
GPIO_DeInit(GPIOA);
```

### 10.2.2 GPIO_AFIODeInit function

Table 181 describes the GPIO_AFIODeInit function.

**Table 181. GPIO_AFIODeInit function**

| | |
|---|---|
| Function name | GPIO_AFIODeInit |
| Function prototype | void GPIO_AFIODeInit(void) |
| Behavior description | Resets the Alternate functions registers (remap, event control and EXTI configuration) to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphResetCmd() |

**Example:**

```
/* Resets the Alternate functions registers to their default reset
values */
GPIO_AFIODeInit();
```

### 10.2.3 GPIO_Init function

Table 182 describes the GPIO_Init function.

**Table 182. GPIO_Init function**

| | |
|---|---|
| Function name | GPIO_Init |
| Function prototype | void GPIO_Init(GPIO_TypeDef* GPIOx, GPIO_InitTypeDef* GPIO_InitStruct) |
| Behavior description | Initializes the GPIOx peripheral according to the specified parameters in the GPIO_InitStruct. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_InitStruct: pointer to a GPIO_InitTypeDef structure that contains the configuration information for the specified GPIO peripheral. Refer to *Section : GPIO_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## GPIO_InitTypeDef structure

The GPIO_InitTypeDef structure is defined in the *stm32f10x_gpio.h* file:

```
typedef struct

{
  u16 GPIO_Pin;
  GPIOSpeed_TypeDef GPIO_Speed;
  GPIOMode_TypeDef GPIO_Mode;
} GPIO_InitTypeDef;
```

### GPIO_Pin

This member selects the GPIO pins to configure. Multiple-pin configuration can be performed by using the '|' operator. Any combination of the following values can be used:

**Table 183. GPIO_Pin values**

| GPIO_Pin | Description |
|---|---|
| GPIO_Pin_None | No pin selected |
| GPIO_Pin_0 | Pin 0 Selected |
| GPIO_Pin_1 | Pin 1 Selected |
| GPIO_Pin_2 | Pin 2 Selected |
| GPIO_Pin_3 | Pin 3 Selected |
| GPIO_Pin_4 | Pin 4 Selected |
| GPIO_Pin_5 | Pin 5 Selected |
| GPIO_Pin_6 | Pin 6 Selected |
| GPIO_Pin_7 | Pin 7 Selected |
| GPIO_Pin_8 | Pin 8 Selected |
| GPIO_Pin_9 | Pin 9 Selected |
| GPIO_Pin_10 | Pin 10 Selected |
| GPIO_Pin_11 | Pin 11 Selected |
| GPIO_Pin_12 | Pin 12 Selected |
| GPIO_Pin_13 | Pin 13 Selected |
| GPIO_Pin_14 | Pin 14 Selected |
| GPIO_Pin_15 | Pin 15 Selected |
| GPIO_Pin_All | All Pins Selected |

### GPIO_Speed

GPIO_Speed is used to configure the speed for the selected pins.See *Table 184* for the values taken by this member.

**Table 184. GPIO_Speed values**

| GPIO_Speed | Description |
|---|---|
| GPIO_Speed_10MHz | Output Maximum Frequency = 10 MHz |
| GPIO_Speed_2MHz | Output Maximum Frequency = 2 MHz |
| GPIO_Speed_50MHz | Output Maximum Frequency = 50 MHz |

### GPIO_Mode

GPIO_Mode configures the operating mode for the selected pins.See *Table 185* for the values taken by this member.

**Table 185. GPIO_Mode values**

| GPIO_Mode | Description |
|---|---|
| GPIO_Mode_AIN | Analog Input |
| GPIO_Mode_IN_FLOATING | Input Floating |
| GPIO_Mode_IPD | Input Pull-Down |
| GPIO_Mode_IPU | Input Pull-up |
| GPIO_Mode_Out_OD | Open Drain Output |
| GPIO_Mode_Out_PP | Push-Pull Output |
| GPIO_Mode_AF_OD | Open Drain Output Alternate-Function |
| GPIO_Mode_AF_PP | Push-Pull Output Alternate-Function |

*Note:* 1 *When a pin is configured in input pull-up or pull-down mode, the Px_BSRR and Px_BRR registers are used.*

2 *GPIO_Mode allows to configure both the GPIO direction (Input/Output) and the corresponding input/output configuration: bits[7:4] GPIO_Mode configure the GPIO direction, while bits [4:0] define the configuration. The GPIO direction have the following indexes:*

– *GPIO in input mode = 0x00*

– *GPIO in output mode = 0x01*

*Table 186* shows all the GPIO_Mode indexes and codes.

**Table 186. GPIO_Mode indexes and codes**

| GPIO Direction | Index | Mode | Configuration | Mode Code |
|---|---|---|---|---|
| GPIO Input | 0x00 | GPIO_Mode_AIN | 0x00 | 0x00 |
| | | GPIO_Mode_IN_FLOATING | 0x04 | 0x04 |
| | | GPIO_Mode_IPD | 0x08 | 0x28 |
| | | GPIO_Mode_IPU | 0x08 | 0x48 |
| GPIO Output | 0x01 | GPIO_Mode_Out_OD | 0x04 | 0x14 |
| | | GPIO_Mode_Out_PP | 0x00 | 0x10 |
| | | GPIO_Mode_AF_OD | 0x0C | 0x1C |
| | | GPIO_Mode_AF_PP | 0x08 | 0x18 |

**Example:**

```
/* Configure all the GPIOA in Input Floating mode */
GPIO_InitTypeDef GPIO_InitStructure;
GPIO_InitStructure.GPIO_Pin = GPIO_Pin_All;
GPIO_InitStructure.GPIO_Speed = GPIO_Speed_10MHz;
GPIO_InitStructure.GPIO_Mode = GPIO_Mode_IN_FLOATING;
GPIO_Init(GPIOA, &GPIO_InitStructure);
```

### 10.2.4 GPIO_StructInit function

*Table 187* describes the GPIO_StructInit function.

**Table 187. GPIO_StructInit function**

| | |
|---|---|
| Function name | GPIO_StructInit |
| Function prototype | void GPIO_StructInit(GPIO_InitTypeDef* GPIO_InitStruct) |
| Behavior description | Fills each GPIO_InitStruct member with its default value. |
| Input parameter | GPIO_InitStruct: pointer to a GPIO_InitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The GPIO_InitStruct default values are given in *Table 188*.

**Table 188. GPIO_InitStruct default values**

| Member | Default value |
|---|---|
| GPIO_Pin | GPIO_Pin_All |
| GPIO_Speed | GPIO_Speed_2MHz |
| GPIO_Mode | GPIO_Mode_IN_FLOATING |

**Example:**

```
/* Initialize the GPIO Init Structure parameters */
GPIO_InitTypeDef GPIO_InitStructure;
GPIO_StructInit(&GPIO_InitStructure);
```

### 10.2.5 GPIO_ReadInputDataBit function

*Table 189* describes the GPIO_ReadInputDataBit function.

**Table 189. GPIO_ReadInputDataBit function**

| | |
|---|---|
| Function name | GPIO_ReadInputDataBit |
| Function prototype | u8 GPIO_ReadInputDataBit(GPIO_TypeDef* GPIOx, u16 GPIO_Pin) |
| Behavior description | Reads the specified input port pin. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: port bit to be read.<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The input port pin value. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Reads the seventh pin of the GPIOB and store it in ReadValue
variable */
u8 ReadValue;
ReadValue = GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_7);
```

### 10.2.6 GPIO_ReadInputData function

*Table 190* describes the GPIO_ReadInputData function.

**Table 190. GPIO_ReadInputData function**

| | |
|---|---|
| Function name | GPIO_ReadInputData |
| Function prototype | u16 GPIO_ReadInputData(GPIO_TypeDef* GPIOx) |
| Behavior description | Reads the specified GPIO input data port. |
| Input parameter | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Output parameter | None |
| Return parameter | GPIO input data port value. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/*Read the GPIOC input data port and store it in ReadValue
variable*/
u16 ReadValue;
ReadValue = GPIO_ReadInputData(GPIOC);
```

### 10.2.7 GPIO_ReadOutputDataBit function

*Table 191* describes the GPIO_ReadOutputDataBit function.

**Table 191. GPIO_ReadOutputDataBit function**

| | |
|---|---|
| Function name | GPIO_ReadOutputDataBit |
| Function prototype | u8 GPIO_ReadOutputDataBit(GPIO_TypeDef* GPIOx, u16 GPIO_Pin) |
| Behavior description | Reads the specified output data port bit. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: port bit to read.<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The output port pin value. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Reads the seventh pin of the GPIOB and store it in ReadValue
variable */
u8 ReadValue;
ReadValue = GPIO_ReadOutputDataBit(GPIOB, GPIO_Pin_7);
```

### 10.2.8 GPIO_ReadOutputData function

*Table 192* describes the GPIO_ReadOutputData function.

**Table 192. GPIO_ReadOutputData function**

| | |
|---|---|
| Function name | GPIO_ReadOutputData |
| Function prototype | u16 GPIO_ReadOutputData(GPIO_TypeDef* GPIOx) |
| Behavior description | Reads the specified GPIO output data port. |
| Input parameter | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Output parameter | None |
| Return parameter | GPIO output data port value. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Read the GPIOC output data port and store it in ReadValue
variable */
u16 ReadValue;
ReadValue = GPIO_ReadOutputData(GPIOC);
```

### 10.2.9 GPIO_SetBits

*Table 192* describes the GPIO_SetBits function.

**Table 193. GPIO_SetBits function**

| | |
|---|---|
| Function name | GPIO_SetBits |
| Function prototype | void GPIO_SetBits(GPIO_TypeDef* GPIOx, u16 GPIO_Pin) |
| Behavior description | Sets the selected data port bits. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: specifies the port bits to be written.<br>This parameter can be any combination of GPIO_Pin_x where x can be (0..15).<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Set the GPIOA port pin 10 and pin 15 */
GPIO_SetBits(GPIOA, GPIO_Pin_10 | GPIO_Pin_15);
```

### 10.2.10 GPIO_ResetBits

*Table 194* describes the GPIO_ResetBits function.

**Table 194. GPIO_ResetBits function**

| | |
|---|---|
| Function name | GPIO_ResetBits |
| Function prototype | void GPIO_ResetBits(GPIO_TypeDef* GPIOx, u16 GPIO_Pin) |
| Behavior description | Clears the selected data port bits. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: specifies the port bits to be written.<br>This parameter can be any combination of GPIO_Pin_x where x can be (0..15).<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Clears the GPIOA port pin 10 and pin 15 */
GPIO_ResetBits(GPIOA, GPIO_Pin_10 | GPIO_Pin_15);
```

### 10.2.11 GPIO_WriteBit function

*Table 195* describes the GPIO_WriteBit function.

**Table 195. GPIO_WriteBit function**

| | |
|---|---|
| Function name | GPIO_WriteBit |
| Function prototype | void GPIO_WriteBit(GPIO_TypeDef* GPIOx, u16 GPIO_Pin, BitAction BitVal) |
| Behavior description | Sets or clears the selected data port bit. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: port bit to be written.<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Input parameter3 | BitVal: this parameter specifies the value to be written to the selected bit.<br>BitVal must be one of the BitAction enum values:<br>Bit_RESET: to clear the port pin.<br>Bit_SET: to set the port pin. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Set the GPIOA port pin 15 */
GPIO_WriteBit(GPIOA, GPIO_Pin_15, Bit_SET);
```

### 10.2.12 GPIO_Write function

*Table 196* describes the GPIO_Write function.

**Table 196. GPIO_Write function**

| | |
|---|---|
| Function name | GPIO_Write |
| Function prototype | void GPIO_Write(GPIO_TypeDef* GPIOx, u16 PortVal) |
| Behavior description | Writes the passed value in the selected data GPIOx port register. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | PortVal: the value to be written to the data port register. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Write data to GPIOA data port */
GPIO_Write(GPIOA, 0x1101);
```

### 10.2.13 GPIO_PinLockConfig function

*Table 197* describes the GPIO_PinLockConfig function.

**Table 197. GPIO_PinLockConfig function**

| | |
|---|---|
| Function name | GPIO_PinLockConfig |
| Function prototype | void GPIO_PinLockConfig(GPIO_TypeDef* GPIOx, u16 GPIO_Pin) |
| Behavior description | Locks GPIO pins configuration registers. |
| Input parameter1 | GPIOx: where x can be A, B, C, D or E to select the GPIO peripheral. |
| Input parameter2 | GPIO_Pin: port bit to be written.<br>Refer to *Section : GPIO_Pin* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Lock GPIOA Pin0 and Pin1 */
GPIO_PinLockConfig(GPIOA, GPIO_Pin_0 | GPIO_Pin_1);
```

### 10.2.14 GPIO_EventOutputConfig function

Table 198 describes the GPIO_EventOutputConfig function.

**Table 198. GPIO_EventOutputConfig function**

| | |
|---|---|
| Function name | GPIO_EventOuputConfig |
| Function prototype | void GPIO_EventOutputConfig(u8 GPIO_PortSource, u8 GPIO_PinSource) |
| Behavior description | Selects the GPIO pin used as Event output. |
| Input parameter1 | GPIO_PortSource: selects the GPIO port to be used as source for Event output.<br>Refer to *Section : GPIO_PortSource* for more details on the allowed values of this parameter. |
| Input parameter2 | GPIO_PinSource: pin for the Event output. This parameter can be GPIO_PinSourcex where x can be (0..15). |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### GPIO_PortSource

This parameter is used to select the GPIO port source used as Event output. See Table 199 for the values taken by GPIO_PortSource.

**Table 199. GPIO_PortSource values**

| GPIO_PortSource | Description |
|---|---|
| GPIO_PortSourceGPIOA | GPIOA Selected |
| GPIO_PortSourceGPIOB | GPIOB Selected |
| GPIO_PortSourceGPIOC | GPIOC Selected |
| GPIO_PortSourceGPIOD | GPIOD Selected |
| GPIO_PortSourceGPIOE | GPIOE Selected |

**Example**:

```
/* Selects the GPIOE pin 5 for EVENT output */
GPIO_EventOutputConfig(GPIO_PortSourceGPIOE, GPIO_PinSource5);
```

### 10.2.15 GPIO_EventOutputCmd function

*Table 200* describes the GPIO_EventOutputCmd function.

**Table 200. GPIO_EventOutputCmd function**

| | |
|---|---|
| Function name | GPIO_EventOuputCmd |
| Function prototype | void GPIO_EventOutputCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the Event Output. |
| Input parameter | NewState: new state of the Event output.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable Event Ouput to the GPIOC pin 6 */
GPIO_EventOutputConfig(GPIO_PortSourceGPIOC, GPIO_PinSource6);
GPIO_EventOutputCmd(ENABLE);
```

### 10.2.16 GPIO_PinRemapConfig function

*Table 201* describes the GPIO_PinRemapConfig function.

**Table 201. GPIO_PinRemapConfig function**

| | |
|---|---|
| Function name | GPIO_PinRemapConfig |
| Function prototype | void GPIO_PinRemapConfig(u32 GPIO_Remap, FunctionalState NewState) |
| Behavior description | Changes the mapping of the specified pin. |
| Input parameter1 | GPIO_Remap: selects the pin to remap.<br>Refer to *Section : GPIO_Remap* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the port pin remapping.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### GPIO_Remap

GPIO_Remap parameter is used to change the alternate function mapping. See *Table 202* for the values taken by this parameter.

**Table 202. GPIO_Remap values**

| GPIO_Remap | Description |
|---|---|
| GPIO_Remap_SPI1 | SPI1 Alternate Function mapping |
| GPIO_Remap_I2C1 | I2C1 Alternate Function mapping |
| GPIO_Remap_USART1 | USART1 Alternate Function mapping |
| GPIO_Remap_USART2 | USART2 Alternate Function mapping |
| GPIO_PartialRemap_USART3 | USART3 Partial Alternate Function mapping |
| GPIO_FullRemap_USART3 | USART3 Full Alternate Function mapping |
| GPIO_PartialRemap_TIM1 | TIM1 Partial Alternate Function mapping |
| GPIO_FullRemap_TIM1 | TIM1 Full Alternate Function mapping |
| GPIO_PartialRemap1_TIM2 | TIM2 Partial1 Alternate Function mapping |
| GPIO_PartialRemap2_TIM2 | TIM2 Partial2 Alternate Function mapping |
| GPIO_FullRemap_TIM2 | TIM2 Full Alternate Function mapping |
| GPIO_PartialRemap_TIM3 | TIM3 Partial Alternate Function mapping |
| GPIO_FullRemap_TIM3 | TIM3 Full Alternate Function mapping |
| GPIO_Remap_TIM4 | TIM4 Alternate Function mapping |
| GPIO_Remap1_CAN | CAN Alternate Function mapping |
| GPIO_Remap2_CAN | CAN Alternate Function mapping |
| GPIO_Remap_PD01 | PD01 Alternate Function mapping |
| GPIO_Remap_SWJ_NoJTRST | Full SWJ Enabled (JTAG-DP + SW-DP) but without JTRST |
| GPIO_Remap_SWJ_JTAGDisable | JTAG-DP Disabled and SW-DP Enabled |
| GPIO_Remap_SWJ_Disable | Full SWJ Disabled (JTAG-DP + SW-DP) |

**Example**:

```
/* I2C1_SCL on PB.08, I2C1_SDA on PB.09 */
GPIO_PinRemapConfig(GPIO_Remap_I2C1, ENABLE);
```

### 10.2.17 GPIO_EXTILineConfig function

*Table 203* describes the GPIO_EXTILineConfig function.

**Table 203. GPIO_EXTILineConfig function**

| | |
|---|---|
| Function name | GPIO_EXTILineConfig |
| Function prototype | void GPIO_EXTILineConfig(u8 GPIO_PortSource, u8 GPIO_PinSource) |
| Behavior description | Selects the GPIO pin used as EXTI Line. |
| Input parameter1 | GPIO_PortSource: selects the GPIO port to be used as source for EXTI lines.<br>Refer to *Section : GPIO_PortSource* for more details on the allowed values of this parameter. |
| Input parameter2 | GPIO_PinSource: EXTI line to be configured.<br>This parameter can be GPIO_PinSourcex where x can be (0..15). |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Selects PB.08 as EXTI Line 8 */
GPIO_EXTILineConfig(GPIO_PortSource_GPIOB, GPIO_PinSource8);
```

# 11 Inter-integrated circuit ($I^2C$)

The $I^2C$ bus interface module is the interface between the microcontroller and the serial $I^2C$ bus. It provides both multi-master and slave functions. It controls all $I^2C$ bus specific sequencing, protocol, arbitration and timing. It can also perform additional functions such as CRC generation and checking, SMBus and PMBus.

The $I^2C$ driver can be used to transmit and receive data through the $I^2C$ interface. The status of the executed action is returned by the $I^2C$ driver.

*Section 11.1: I2C register structure* describes the register structure used in the $I^2C$ Firmware Library. *Section 11.2: Firmware library functions* presents the Firmware Library functions.

## 11.1 $I^2C$ register structure

The $I^2C$ register structure, *I2C_TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 CR1;
u16 RESERVED0;
vu16 CR2;
u16 RESERVED1;
  vu16 OAR1;
  u16 RESERVED2;
  vu16 OAR2;
  u16 RESERVED3;
  vu16 DR;
  u16 RESERVED4;
  vu16 SR1;
  u16 RESERVED5;
  vu16 SR2;
  u16 RESERVED6;
  vu16 CCR;
  u16 RESERVED7;
vu16 TRISE;
  u16 RESERVED8;
} I2C_TypeDef;
```

*Table 204* gives the list of $I^2C$ registers:

**Table 204. $I^2C$ registers**

| Register | Description |
|---|---|
| CR1 | $I^2C$ Control Register1 |
| CR2 | $I^2C$ Control Register2 |
| OAR1 | $I^2C$ Own Address Register1 |
| OAR2 | $I^2C$ Own Address Register2 (Dual Address) |
| DR | $I^2C$ Data Register |
| SR1 | $I^2C$ Status Register1 |
| SR2 | $I^2C$ Status Register2 |
| CCR | $I^2C$ Clock Control Register |
| TRISE | $I^2C$ Rise Time Register |

The two $I^2C$ peripherals are declared in *stm32f10x_map*.h:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
....
#define I2C1_BASE             (APB1PERIPH_BASE + 0x5400)
#define I2C2_BASE             (APB1PERIPH_BASE + 0x5800)
....
#ifndef DEBUG
...
#ifdef _I2C1
  #define I2C1                ((I2C_TypeDef *) I2C1_BASE)
#endif /*_I2C1 */

#ifdef _I2C2
  #define I2C2                ((I2C_TypeDef *) I2C2_BASE)
#endif /*_I2C2 */
...
#else   /* DEBUG */
...
#ifdef _I2C1
  EXT I2C_TypeDef             *I2C1;
#endif /*_I2C1 */

#ifdef _I2C2
  EXT I2C_TypeDef             *I2C2;
#endif /*_I2C2 */
...
#endif
```

When using the Debug mode, _I2C1 and _I2C2 pointers are initialized in *stm32f10x_lib.c* file.

```
...
#ifdef _I2C1
  I2C1 = (I2C_TypeDef *)  I2C1_BASE;
#endif /*_I2C1 */

#ifdef _I2C2
  I2C2 = (I2C_TypeDef *)  I2C2_BASE;
#endif /*_I2C2 */
...
```

To access the $I^2C$ registers, _I2C, _I2C1 and _I2C2 must be defined in *stm32f10x_conf.h* as follows:

```
...
#define _I2C
#define _I2C1
#define _I2C2
...
```

## 11.2 Firmware library functions

*Table 205* gives the list of the $I^2C$ firmware library functions.

**Table 205. $I^2C$ firmware library functions**

| Function name | Description |
|---|---|
| I2C_DeInit | Resets the I2Cx peripheral registers to their default reset values. |
| I2C_Init | Initializes the I2Cx peripheral according to the specified parameters in the I2C_InitStruct. |
| I2C_StructInit | Fills each I2C_InitStruct member with its default value. |
| I2C_Cmd | Enables or disables the specified $I^2C$ peripheral. |
| I2C_DMACmd | Enables or disables the specified $I^2C$ DMA requests. |
| I2C_DMALastTransferCmd | Specifies that the next DMA transfer is the last one. |
| I2C_GenerateSTART | Generates I2Cx communication START condition. |
| I2C_GenerateSTOP | Generates I2Cx communication STOP condition. |
| I2C_AcknowledgeConfig | Enables or disables the specified $I^2C$ acknowledge feature. |
| I2C_OwnAddress2Config | Configures the specified $I^2C$ own address2. |
| I2C_DualAddressCmd | Enables or disables the specified $I^2C$ dual addressing mode. |
| I2C_GeneralCallCmd | Enables or disables the specified $I^2C$ general call feature. |
| I2C_ITConfig | Enables or disables the specified $I^2C$ interrupts. |
| I2C_SendData | Sends a data byte through the I2Cx peripheral. |
| I2C_ReceiveData | Returns the most recent received data by the I2Cx peripheral. |
| I2C_Send7bitAddress | Transmits the address byte to select the slave device. |
| I2C_ReadRegister | Reads the specified $I^2C$ register and returns its value. |
| I2C_SoftwareResetCmd | Enables or disables the specified $I^2C$ software reset. |
| I2C_SMBusAlertConfig | Drives the SMBAlert pin high or low for the specified $I^2C$. |
| I2C_TransmitPEC | Enables or disables the specified $I^2C$ PEC transfer. |
| I2C_PECPositionConfig | Selects the specified $I^2C$ PEC position. |
| I2C_CalculatePEC | Enables or disables the PEC value calculation of the transferred bytes. |
| I2C_GetPEC | Returns the PEC value for the specified $I^2C$. |
| I2C_ARPCmd | Enables or disables the specified $I^2C$ ARP. |
| I2C_StretchClockCmd | Enables or disables the specified $I^2C$ clock stretching. |
| I2C_FastModeDutyCycleConfig | Selects the specified $I^2C$ fast mode duty cycle. |
| I2C_GetLastEvent | Returns the last I2Cx event |
| I2C_CheckEvent | Checks whether the last I2Cx event is equal to the one passed as parameter. |

**Table 205. $I^2C$ firmware library functions (continued)**

| Function name | Description |
|---|---|
| I2C_GetFlagStatus | Checks whether the specified $I^2C$ flag is set or not. |
| I2C_ClearFlag | Clears the I2Cx's pending flags. |
| I2C_GetITStatus | Checks whether the specified $I^2C$ interrupt has occurred or not. |
| I2C_ClearITPendingBit | Clears the I2Cx's interrupt pending bits. |

### 11.2.1 I2C_DeInit function

*Table 206* describes the I2C_DeInit function.

**Table 206. I2C_DeInit function**

| | |
|---|---|
| Function name | I2C_DeInit |
| Function prototype | void I2C_DeInit(I2C_TypeDef* I2Cx) |
| Behavior description | Resets the I2Cx peripheral registers to their default reset values. |
| Input parameter | I2C*x*: where x can be 1 or 2 to select the I2C peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB1PeriphClockCmd(). |

**Example:**

```
/* Deinitialize I2C2 interface*/
I2C_DeInit(I2C2);
```

### 11.2.2 I2C_Init function

*Table 207* describes the I2C_Init function.

**Table 207. I2C_Init function**

| | |
|---|---|
| Function name | I2C_Init |
| Function prototype | void I2C_Init(I2C_TypeDef* I2Cx, I2C_InitTypeDef* I2C_InitStruct) |
| Behavior description | Initializes the I2Cx peripheral according to the specified parameters in the I2C_InitStruct. |
| Input parameter1 | I2C*x*: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_InitStruct: pointer to a I2C_InitTypeDef structure that contains the configuration information for the specified $I^2C$ peripheral.<br>Refer to the *Section : I2C_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### I2C_InitTypeDef structure

The I2C_InitTypeDef structure is defined in the *stm32f10x_i2c.h* file:

```
typedef struct
{
u16 I2C_Mode;
u16 I2C_DutyCycle;
  u16 I2C_OwnAddress1;
u16 I2C_Ack;
u16 I2C_AcknowledgedAddress;
u32 I2C_ClockSpeed;
} I2C_InitTypeDef;
```

#### I2C_Mode

I2C_Mode is used to configure the $I^2C$ mode. See *Table 212* for the values taken by this member.

**Table 208. I2C_Mode definition**

| I2C_Mode | Description |
|---|---|
| I2C_Mode_I2C | $I^2C$ is configured in $I^2C$ mode |
| I2C_Mode_SMBusDevice | $I^2C$ is configured in SMBus device mode |
| I2C_Mode_SMBusHost | $I^2C$ is configured in SMBus host mode |

### I2C_DutyCycle

I2C_DutyCycle is used to select the $I^2C$ fast mode duty cycle. See *Table 209* for the values taken by this member.

**Table 209. I2C_DutyCycle definition**

| I2C_DutyCycle | Description |
| --- | --- |
| I2C_DutyCycle_16_9 | $I^2C$ fast mode Tlow/Thigh=16/9 |
| I2C_DutyCycle_2 | $I^2C$ fast mode Tlow/Thigh=2 |

*Note: This member is meaningful only when the $I^2C$ operates in Fast mode (working clock speed greater than 100 kHz).*

### I2C_OwnAddress1

This member is used to configure the first device own address. It can be a 7-bit or 10-bit address.

### I2C_Ack

I2C_Ack enables or disables the acknowledgement. See *Table 210* for the values taken by this member.

**Table 210. I2C_Ack definition**

| I2C_Ack | Description |
| --- | --- |
| I2C_Ack_Enable | Enables the acknowledgement |
| I2C_Ack_Disable | Disables the acknowledgement |

### I2C_AcknowledgedAddress

I2C_AcknowledgedAddress defines whether if 7-bit or 10-bit address is acknowledged. See *Table 211* for the values taken by this member.

**Table 211. I2C_AcknowledgedAddress values**

| I2C_AcknowledgedAddress | Description |
| --- | --- |
| I2C_AcknowledgeAddress_7bit | Acknowledge 7-bit address |
| I2C_AcknowledgeAddress_10bit | Acknowledge 10-bit address |

### I2C_ClockSpeed

This member is used to configure the clock frequency. It must be set to a value lower than 400kHz.

**Example**:

```
/* Initialize the I2C1 according to the I2C_InitStructure members */
I2C_InitTypeDef  I2C_InitStructure;
I2C_InitStructure.I2C_Mode = I2C_Mode_SMBusHost;
I2C_InitStructure.I2C_DutyCycle = I2C_DutyCycle_2;
I2C_InitStructure.I2C_OwnAddress1 = 0x03A2;
I2C_InitStructure.I2C_Ack = I2C_Ack_Enable;
```

```
I2C_InitStructure.I2C_AcknowledgedAddress =
I2C_AcknowledgedAddress_7bit;
I2C_InitStructure.I2C_ClockSpeed = 200000;
I2C_Init(I2C1, &I2C_InitStructure);
```

### 11.2.3 I2C_StructInit function

*Table 212* describes the I2C_StructInit function.

**Table 212. I2C_StructInit function**

| | |
|---|---|
| Function name | I2C_StructInit |
| Function prototype | void I2C_StructInit(I2C_InitTypeDef* I2C_InitStruct) |
| Behavior description | Fills each I2C_InitStruct member with its default value. |
| Input parameter | I2C_InitStruct: pointer to the I2C_InitTypeDef structure to be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The I2C_InitStruct members have the following default values:

**Table 213. I2C_InitStruct default values**

| Member | Default value |
|---|---|
| I2C_Mode | I2C_Mode_I2C |
| I2C_DutyCycle | I2C_DutyCycle_2 |
| I2C_OwnAddress1 | 0 |
| I2C_Ack | I2C_Ack_Disable |
| I2C_AcknowledgedAddress | I2C_AcknowledgedAddress_7bit |
| I2C_ClockSpeed | 5000 |

**Example:**

```
/* Initialize an I2C_InitTypeDef structure */
I2C_InitTypeDef  I2C_InitStructure;
I2C_StructInit(&I2C_InitStructure);
```

### 11.2.4 I2C_Cmd function

*Table 214* describes the I2C_Cmd function.

**Table 214. I2C_Cmd function**

| | |
|---|---|
| Function name | I2C_Cmd |
| Function prototype | void I2C_Cmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified I2C peripheral. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the I2Cx peripheral.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable I2C1 peripheral */
I2C_Cmd(I2C1, ENABLE);
```

### 11.2.5 I2C_DMACmd function

*Table 215* describes the I2C_DMACmd function.

**Table 215. I2C_DMACmd function**

| | |
|---|---|
| Function name | I2C_DMACmd |
| Function prototype | I2C_DMACmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified I2C DMA requests. |
| Input parameter1 | I2C*x*: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ DMA transfer.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable I2C2 DMA transfer */
I2C_DMACmd(I2C2, ENABLE);
```

### 11.2.6 I2C_DMALastTransferCmd function

*Table 216* describes the I2C_DMALastTransferCmd function.

**Table 216. I2C_DMALastTransferCmd function**

| | |
|---|---|
| Function name | I2C_DMALastTransferCmd |
| Function prototype | I2C_DMALastTransferCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Specifies that the next DMA transfer is the last one. |
| Input parameter1 | I2C*x*: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ DMA last transfer.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Specify that the next I2C2 DMA transfer is the last one */
I2C_DMALastTransferCmd(I2C2, ENABLE);
```

### 11.2.7 I2C_GenerateSTART function

*Table 217* describes the I2C_GenerateSTART function.

**Table 217. I2C_GenerateSTART function**

| | |
|---|---|
| Function name | I2C_GenerateSTART |
| Function prototype | void I2C_GenerateSTART(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Generates I2Cx communication START condition. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the I2C START condition generation.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Generate a START condition on I2C1 */
I2C_GenerateSTART(I2C1, ENABLE);
```

### 11.2.8 I2C_GenerateSTOP function

*Table 218* describes the I2C_GenerateSTOP function.

**Table 218. I2C_GenerateSTOP function**

| | |
|---|---|
| Function name | I2C_GenerateSTOP |
| Function prototype | void I2C_GenerateSTOP(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Generates I2Cx communication STOP condition. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ STOP condition generation.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Generate a STOP condition on I2C2 */
I2C_GenerateSTOP(I2C2, ENABLE);
```

### 11.2.9 I2C_AcknowledgeConfig function

*Table 219* describes the I2C_AcknowledgeConfig function.

**Table 219. I2C_AcknowledgeConfig function**

| | |
|---|---|
| Function name | I2C_AcknowledgeConfig |
| Function prototype | void I2C_AcknowledgeConfig(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ acknowledge feature. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ Acknowledgement.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the I2C1 Acknowledgement */
I2C_AcknowledgeConfig(I2C1, ENABLE);
```

### 11.2.10 I2C_OwnAddress2Config function

*Table 220* describes the I2C_OwnAddress2Config function.

**Table 220. I2C_OwnAddress2Config function**

| | |
|---|---|
| Function name | I2C_OwnAddress2Config |
| Function prototype | void I2C_OwnAddress2Config(I2C_TypeDef* I2Cx, u8 Address) |
| Behavior description | Configures the specified $I^2C$ own address2. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | Address: specifies the 7-bit $I^2C$ own address2. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Set the I2C1 own address2 to 0x38 */
I2C_OwnAddress2Config(I2C1, 0x38);
```

### 11.2.11 I2C_DualAddressCmd function

*Table 221* describes the I2C_DualAddressCmd function.

**Table 221. I2C_DualAddressCmd function**

| | |
|---|---|
| Function name | I2C_DualAddressCmd |
| Function prototype | void I2C_DualAddressCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ dual addressing mode. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ dual addressing mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the I2C2 dual addressing mode*/
I2C_DualAdressCmd(I2C2, ENABLE);
```

### 11.2.12 I2C_GeneralCallCmd function

*Table 222* describes the I2C_GeneralCallCmd function.

**Table 222. I2C_GeneralCallCmd function**

| | |
|---|---|
| Function name | I2C_GeneralCallCmd |
| Function prototype | void I2C_GeneralCallCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified I$^2$C general call feature. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the I$^2$C peripheral. |
| Input parameter2 | NewState: new state of the I$^2$C general call.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the I2C1 general call feature */
I2C_GeneralCallCmd(I2C1, ENABLE);
```

### 11.2.13 I2C_ITConfig function

*Table 223* describes the I2C_ITConfig function.

**Table 223. I2C_ITConfig function**

| | |
|---|---|
| Function name | I2C_ITConfig |
| Function prototype | void I2C_ITConfig(I2C_TypeDef* I2Cx, u16 I2C_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ interrupts. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_IT: $I^2C$ interrupts sources to be enabled or disabled.<br>Refer to *Section : I2C_IT* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified $I^2C$ interrupts.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### I2C_IT

This parameter enables or disables $I^2C$ interrupts. One or a combination of the following values can be used:

**Table 224. I2C_IT values**

| I2C_IT | Description |
|---|---|
| I2C_IT_BUF | Buffer interrupt mask |
| I2C_IT_EVT | Event interrupt mask |
| I2C_IT_ERR | Error interrupt mask |

**Example:**

```
/* Enable I2C2 event and buffer interrupts */
I2C_ITConfig(I2C2, I2C_IT_BUF | I2C_IT_EVT, ENABLE);
```

### 11.2.14 I2C_SendData function

*Table 225* describes the I2C_SendData function.

**Table 225. I2C_SendData function**

| | |
|---|---|
| Function name | I2C_SendData |
| Function prototype | void I2C_SendData(I2C_TypeDef* I2Cx, u8 Data) |
| Behavior description | Sends a data byte through the I2Cx peripheral. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | Data: byte to be transmitted. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Transmit 0x5D byte on I2C2 */
I2C_SendData(I2C2, 0x5D);
```

### 11.2.15 I2C_ReceiveData function

*Table 226* describes the I2C_ReceiveData function.

**Table 226. I2C_ReceiveData function**

| | |
|---|---|
| Function name | I2C_ReceiveData |
| Function prototype | u8 I2C_ReceiveData(I2C_TypeDef* I2Cx) |
| Behavior description | Returns the most recent received data by the I2Cx peripheral. |
| Input parameter | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Output parameter | None |
| Return parameter | Received byte. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Read the received byte on I2C1 */
u8 ReceivedData;
ReceivedData = I2C_ReceiveData(I2C1);
```

### 11.2.16 I2C_Send7bitAddress function

*Table 227* describes the I2C_Send7bitAddress function.

**Table 227. I2C_Send7bitAddress function**

| | |
|---|---|
| Function name | I2C_Send7bitAddress |
| Function prototype | void I2C_Send7bitAddress(I2C_TypeDef* I2Cx, u8 Address, u8 I2C_Direction) |
| Behavior description | Transmits the address byte to select the slave device. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | Address: slave address to be transmitted. |
| Input parameter3 | I2C_Direction: specifies whether the $I^2C$ device will act as a transmitter or a receiver.<br>Refer to *Section : I2C_Direction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### I2C_Direction

This parameter configures the $I^2C$ interface in transmitter or receiver mode (see *Table 228*).

**Table 228. I2C_Direction**

| I2C_Direction | Description |
|---|---|
| I2C_Direction_Transmitter | Selects transmission direction |
| I2C_Direction_Receiver | Selects receive direction |

**Example**:

```
/* Send, as transmitter, the Slave device address 0xA8 in 7-bit
addressing mode in I2C1 */
I2C_Send7bitAddress(I2C1, 0xA8, I2C_Direction_Transmitter);
```

### 11.2.17 I2C_ReadRegister function

*Table 229* describes the I2C_ReadRegister function.

**Table 229. I2C_ReadRegister function**

| | |
|---|---|
| Function name | I2C_ReadRegister |
| Function prototype | u16 I2C_ReadRegister(I2C_TypeDef* I2Cx, u8 I2C_Register) |
| Behavior description | Reads the specified I2C register and returns its value. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_Register: register to be read.<br>Refer to *Section : I2C_Register* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The value of the read register. (1) |
| Required preconditions | None |
| Called functions | None |

1. Some flags could be cleared when the register is read.

#### I2C_Register

The list of the $I^2C$ registers that can be read by issuing a I2C_ReadRegister function are listed in *Table 230*.

**Table 230. Readable I2C registers**

| I2C_Register | Description |
|---|---|
| I2C_Register_CR1 | I2C_CR1 register selected for read. |
| I2C_Register_CR2 | I2C_CR2 register selected for read. |
| I2C_Register_OAR1 | I2C_OAR1 register selected for read. |
| I2C_Register_OAR2 | I2C_OAR2 register selected for read. |
| I2C_Register_DR | I2C_DR register selected for read. |
| I2C_Register_SR1 | I2C_SR1 register selected for read. |
| I2C_Register_SR2 | I2C_SR2 register selected for read. |
| I2C_Register_CCR | I2C_CCR register selected for read. |
| I2C_Register_TRISE | I2C_TRISE register selected for read. |

**Example**:

```
/* Return the I2C_CR1 register value of I2C2 peripheral */
u16 RegisterValue;
RegisterValue = I2C_ReadRegister(I2C2, I2C_Register_CR1);
```

### 11.2.18 I2C_SoftwareResetCmd function

Table 231 describes the I2C_SoftwareResetCmd function.

**Table 231. I2C_SoftwareResetCmd function**

| | |
|---|---|
| Function name | I2C_SoftwareResetCmd |
| Function prototype | I2C_SoftwareResetCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ software reset. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the $I^2C$ software reset.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Put under reset the I2C1 peripheral */
I2C_SoftwareResetCmd(I2C1, ENABLE);
```

### 11.2.19 I2C_SMBusAlertConfig function

*Table 232* describes the I2C_SMBusAlertConfig function.

**Table 232. I2C_SMBusAlertConfig function**

| | |
|---|---|
| Function name | I2C_SMBusAlertConfig |
| Function prototype | void I2C_SMBusAlertConfig(I2C_TypeDef* I2Cx, u16 I2C_SMBusAlert) |
| Behavior description | Drives the SMBusAlert pin High or Low for the specified $I^2C$. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_SMBusAlert: SMBAlert pin level.<br>Refer to *Section : I2C_SMBusAlert* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### I2C_SMBusAlert

This parameter selects the SMBusAlert pin active level (see *Table 233*).

**Table 233. I2C_SMBusAlert values**

| I2C_SMBusAlert | Description |
|---|---|
| I2C_SMBusAlert_Low | SMBAlert pin driven Low |
| I2C_SMBusAlert_High | SMBAlert pin driven High |

**Example:**

```
/* Let the I2C2 SMBusAlert pin High */
I2C_SMBusAlertConfig(I2C2, I2C_SMBusAlert_High);
```

### 11.2.20 I2C_TransmitPEC function

*Table 234* describes the I2C_TransmitPEC function.

**Table 234. I2C_TransmitPEC function**

| | |
|---|---|
| Function name | I2C_TransmitPEC |
| Function prototype | I2C_TransmitPEC(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ PEC transfer. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the I2C PEC transfer.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the I2C1 PEC transfer */
I2C_TransmitPEC(I2C1, ENABLE);
```

### 11.2.21 I2C_PECPositionConfig function

*Table 235* describes the I2C_PECPositionConfig function.

**Table 235. I2C_PECPositionConfig function**

| | |
|---|---|
| Function name | I2C_PECPositionConfig |
| Function prototype | void I2C_PECPositionConfig(I2C_TypeDef* I2Cx, u16 I2C_PECPosition) |
| Behavior description | Selects the specified I2C PEC position. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_PECPosition: PEC position.<br>Refer to *Section : I2C_PECPosition* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### I2C_PECPosition

This parameter selects the PEC position (see *Table 236*).

**Table 236. I2C_PECPosition values**

| I2C_PECPosition | Description |
|---|---|
| I2C_PECPosition_Next | PEC bit indicates that the next byte is PEC |
| I2C_PECPosition_Current | PEC bit indicates that current byte is PEC |

**Example:**

```
/* Configure the PEC bit to indicvates that the next byte in shift
register is PEC for I2C2 */
I2C_PECPositionConfig(I2C2, I2C_PECPosition_Next);
```

## 11.2.22 I2C_CalculatePEC function

*Table 237* describes the I2C_CalculatePEC function.

**Table 237. I2C_CalculatePEC function**

| | |
|---|---|
| Function name | I2C_CalculatePEC |
| Function prototype | void I2C_CalculatePEC(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the PEC calculation for the transferred bytes. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the PEC value calculation.<br>This parameter can be ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the PEC calculation for the transfered bytes from I2C2 */
I2C_CalculatePEC(I2C2, ENABLE);
```

### 11.2.23 I2C_GetPEC function

*Table 238* describes the I2C_GetPEC function.

**Table 238. I2C_GetPEC function**

| | |
|---|---|
| Function name | I2C_GetPEC |
| Function prototype | u8 I2C_GetPEC(I2C_TypeDef* I2Cx) |
| Behavior description | Returns the PEC value for the specified $I^2C$ interface |
| Input parameter | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Output parameter | None |
| Return parameter | The PEC value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Returns the I2C2 PEC value */
u8 PECValue;
PECValue = I2C_GetPEC(I2C2);
```

### 11.2.24 I2C_ARPCmd function

*Table 239* describes the I2C_ARPCmd function.

**Table 239. I2C_ARPCmd function**

| | |
|---|---|
| Function name | I2C_ARPCmd |
| Function prototype | void I2C_ARPCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified $I^2C$ ARP. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | NewState: new state of the I2C xARP.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Enable the I2C1 ARP feature */
I2C_ARPCmd(I2C1, ENABLE);
```

### 11.2.25 I2C_StretchClockCmd function

*Table 240* describes the I2C_StretchClockCmd function.

**Table 240. I2C_StretchClockCmd function**

| | |
|---|---|
| Function name | I2C_StretchClockCmd |
| Function prototype | void I2C_StretchClockCmd(I2C_TypeDef* I2Cx, FunctionalState NewState) |
| Behavior description | Enables or disables the specified I2C Clock stretching. |
| Input parameter1 | I2Cx: where x can be 1or 2 to select the I$^2$C peripheral. |
| Input parameter2 | NewState: new state of the Clock stretching.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the I2C2 clock stretching */
I2C_StretchClockCmd(I2C2, ENABLE);
```

### 11.2.26 I2C_FastModeDutyCycleConfig function

*Table 241* describes the I2C_FastModeDutyCycleConfig function.

**Table 241. I2C_FastModeDutyCycleConfig function**

| | |
|---|---|
| Function name | I2C_FastModeDutyCycleConfig |
| Function prototype | void I2C_FastModeDutyCycleConfig(I2C_TypeDef* I2Cx, u16 I2C_DutyCycle) |
| Behavior description | Selects the specified I$^2$C fast mode duty cycle. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the I$^2$C peripheral. |
| Input parameter2 | I2C_DutyCycle: fast mode duty cycle.<br>Refer to *Section : I2C_DutyCycle* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### I2C_DutyCycle

This parameter configures the I2C fast mode duty cycle (see *Table 242*).

**Table 242. I2C_DutyCycle**

| I2C_DutyCycle | Description |
|---|---|
| I2C_DutyCycle_2 | I2C fast mode Tlow/Thigh=2 |
| I2C_DutyCycle_16_9 | I2C fast mode Tlow/Thigh=16/9 |

**Example:**

```
/* Set the fast mode duty cyle to 16/9 for I2C2 */
I2C_FastModeDutyCycleConfig(I2C2, I2C_DutyCycle_16_9);
```

## 11.2.27 I2C_GetLastEvent function

*Table 243* describes the I2C_GetLastEvent function.

**Table 243. I2C_GetLastEvent function**

| | |
|---|---|
| Function name | I2C_GetLastEvent |
| Function prototype | u32 I2C_GetLastEvent(I2C_TypeDef* I2Cx) |
| Behavior description | Returns the last I2Cx event |
| Input parameter | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Output parameter | None |
| Return parameter | last I2Cx event |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Get last I2C1 event */
u32 Event;
Event = I2C_GetLastEvent(I2C1);
```

### 11.2.28 I2C_CheckEvent function

*Table 244* describes the I2C_CheckEvent function.

**Table 244. I2C_CheckEvent function**

| | |
|---|---|
| Function name | I2C_CheckEvent |
| Function prototype | ErrorStatus I2C_CheckEvent(I2C_TypeDef* I2Cx, u32 I2C_EVENT) |
| Behavior description | Checks whether the last I2Cx event is equal to the one passed as parameter. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_EVENT: specifies the event to be checked.<br>Refer to *Section : I2C_EVENT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | An ErrorStatus enumeration value:<br>SUCCESS: Last event is equal to the I2C_EVENT<br>ERROR: Last event is different from the I2C_EVENT |
| Required preconditions | None |
| Called functions | None |

#### I2C_EVENT

The events that can be checked by issuing an I2C_CheckEvent function are listed in *Table 245*.

**Table 245. I2C_Event**

| I2C_EVENT | Description |
|---|---|
| I2C_EVENT_SLAVE_RECEIVER_ADDRESS_MATCHED | EV1 |
| I2C_EVENT_SLAVE_TRANSMITTER_ADDRESS_MATCHED | EV1 |
| I2C_EVENT_SLAVE_RECEIVER_SECONDADDRESS_MATCHED | EV1 |
| I2C_EVENT_SLAVE_TRANSMITTER_SECONDADDRESS_MATCHED | EV1 |
| I2C_EVENT_SLAVE_GENERALCALLADDRESS_MATCHED | EV1 |
| I2C_EVENT_SLAVE_BYTE_RECEIVED | EV2 |
| I2C_EVENT_SLAVE_BYTE_TRANSMITTED | EV3 |
| I2C_EVENT_SLAVE_ACK_FAILURE | EV3-1 |
| I2C_EVENT_SLAVE_STOP_DETECTED | EV4 |
| I2C_EVENT_MASTER_MODE_SELECT | EV5 |
| I2C_EVENT_MASTER_RECEIVER_MODE_SELECTED | EV6 |
| I2C_EVENT_MASTER_TRANSMITTER_MODE_SELECTED | EV6 |
| I2C_EVENT_MASTER_BYTE_RECEIVED | EV7 |
| I2C_EVENT_MASTER_BYTE_TRANSMITTED | EV8 |
| I2C_EVENT_MASTER_MODE_ADDRESS10 | EV9 |

**Example**:

```
/* Check if the event happen on I2C1 is equal to
I2C_EVENT_MASTER_BYTE_RECEIVED */
ErrorStatus  Status;
Status = I2C_CheckEvent(I2C1, I2C_EVENT_MSTER_BYTE_RECEIVED);
```

### 11.2.29 I2C_GetFlagStatus function

*Table 246* describes the I2C_GetFlagStatus function.

**Table 246. I2C_GetFlagStatus function**

| | |
|---|---|
| Function name | I2C_GetFlagStatus |
| Function prototype | FlagStatus I2C_GetFlagStatus(I2C_TypeDef* I2Cx, u32 I2C_FLAG) |
| Behavior description | Checks whether the specified $I^2C$ flag is set or not. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_FLAG: specifies the flag to be checked<br>Refer to *Section : I2C_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of I2C_FLAG (SET or RESET).(1) |
| Required preconditions | None |
| Called functions | None |

1. Some flags could be cleared when the register is read.

#### I2C_FLAG

The I2C flags that can be checked by issuing an I2C_GetFlagStatus function are listed in *Table 247*.

**Table 247. I2C_FLAG definition**

| I2C_FLAG | Description |
|---|---|
| I2C_FLAG_DUALF | Dual flag (Slave mode) |
| I2C_FLAG_SMBHOST | SMBus host header (Slave mode) |
| I2C_FLAG_SMBDEFAULT | SMBus default header (Slave mode) |
| I2C_FLAG_GENCALL | General call header flag (Slave mode) |
| I2C_FLAG_TRA | Transmitter/Receiver flag |
| I2C_FLAG_BUSY | Bus busy flag |
| I2C_FLAG_MSL | Master/Slave flag |
| I2C_FLAG_SMBALERT | SMBus Alert flag |
| I2C_FLAG_TIMEOUT | Timeout or Tlow error flag |
| I2C_FLAG_PECERR | PEC error in reception flag |
| I2C_FLAG_OVR | Overrun/Underrun flag (Slave mode) |
| I2C_FLAG_AF | Acknowledge failure flag |

**Table 247. I2C_FLAG definition (continued)**

| I2C_FLAG | Description |
|---|---|
| I2C_FLAG_ARLO | Arbitration lost flag (Master mode) |
| I2C_FLAG_BERR | Bus error flag |
| I2C_FLAG_TXE | Data register empty flag (Transmitter) |
| I2C_FLAG_RXNE | Data register not empty (Receiver) flag |
| I2C_FLAG_STOPF | Stop detection flag (Slave mode) |
| I2C_FLAG_ADD10 | 10-bit header sent flag (Master mode) |
| I2C_FLAG_BTF | Byte transfer finished flag |
| I2C_FLAG_ADDR | Address sent flag (Master mode) “ADSL”<br>Address matched flag (Slave mode)”ENDAD” |
| I2C_FLAG_SB | Start bit flag (Master mode) |

*Note: Only bits[27:0] are used by the I2C_GetFlagStatus function to return the selected flag status. This value corresponds to the flag position in the calculated register which contains the two I2C status register I2C_SR1 and I2C_SR2.*

**Example**:

```
/* Return the I2C_FLAG_AF flag state of I2C2 peripheral */
Flagstatus Status;
Status = I2C_GetFlagStatus(I2C2, I2C_FLAG_AF);
```

### 11.2.30 I2C_ClearFlag function

*Table 248* describes the I2C_ClearFlag function.

**Table 248. I2C_ClearFlag function**

| | |
|---|---|
| Function name | I2C_ClearFlag |
| Function prototype | void I2C_ClearFlag(I2C_TypeDef* I2Cx, u32 I2C_FLAG) |
| Behavior description | Clears the I2Cx’s pending flags. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_FLAG: flag to clear.<br>Refer to *Section : I2C_FLAG* for more details on the allowed values of this parameter.<br>Note: DUALF, SMBHOST, SMBDEFAULT, GENCALL, TRA, BUSY, MSL, TXE and RXNE flags cannot be cleared by issuing this function |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### I2C_FLAG

The $I^2C$ flags that can be cleared by issuing an I2C_ClearFlag function are listed in *Table 249*.

**Table 249. I2C_FLAG definition**

| I2C_FLAG | Description |
|---|---|
| I2C_FLAG_SMBALERT | SMBus Alert flag |
| I2C_FLAG_TIMEOUT | Timeout or Tlow error flag |
| I2C_FLAG_PECERR | PEC error in reception flag |
| I2C_FLAG_OVR | Overrun/Underrun flag (Slave mode) |
| I2C_FLAG_AF | Acknowledge failure flag |
| I2C_FLAG_ARLO | Arbitration lost flag (Master mode) |
| I2C_FLAG_BERR | Bus error flag |
| I2C_FLAG_STOPF | Stop detection flag (Slave mode) |
| I2C_FLAG_ADD10 | 10-bit header sent flag (Master mode) |
| I2C_FLAG_BTF | Byte transfer finished flag |
| I2C_FLAG_ADDR | Address sent flag (Master mode) “ADSL”<br>Address matched flag (Slave mode) ”ENDAD” |
| I2C_FLAG_SB | Start bit flag (Master mode) |

**Example**:

```
/* Clear the Stop detection flag on I2C2 */
I2C_ClearFlag(I2C2, I2C_FLAG_STOPF);
```

### 11.2.31 I2C_GetITStatus function

*Table 250* describes the I2C_GetITStatus function.

**Table 250. I2C_GetITStatus function**

| | |
|---|---|
| Function name | I2C_GetITStatus |
| Function prototype | ITStatus I2C_GetITStatus(I2C_TypeDef* I2Cx, u32 I2C_IT) |
| Behavior description | Checks whether the specified $I^2C$ interrupt has occurred or not. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the $I^2C$ peripheral. |
| Input parameter2 | I2C_IT: specifies the interrupt source to check.<br>Refer to *Section : I2C_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | New state of I2C_IT (SET or RESET)(1) |
| Required preconditions | None |
| Called functions | None |

1. Some flags could be cleared when the register is read.

#### I2C_IT

The I2C_IT parameter is used to select the $I^2C$ interrupt flags that can be checked by issuing an I2C_GetITStatus function (see *Table 251*).

**Table 251. I2C_IT definition**

| I2C_IT | Description |
|---|---|
| I2C_IT_SMBALERT | SMBus Alert flag |
| I2C_IT_TIMEOUT | Timeout or Tlow error flag |
| I2C_IT_PECERR | PEC error in reception flag |
| I2C_IT_OVR | Overrun/Underrun flag (Slave mode) |
| I2C_IT_AF | Acknowledge failure flag |
| I2C_IT_ARLO | Arbitration lost flag (Master mode) |
| I2C_IT_BERR | Bus error flag |
| I2C_IT_TXE | Data register empty flag (Transmitter) |
| I2C_IT_RXNE | Data register not empty (Receiver) flag |
| I2C_IT_STOPF | Stop detection flag (Slave mode) |
| I2C_IT_ADD10 | 10-bit header sent flag (Master mode) |
| I2C_IT_BTF | Byte transfer finished flag |
| I2C_IT_ADDR | Address sent flag (Master mode) “ADSL”<br>Address matched flag (Slave mode) ”ENDAD” |
| I2C_IT_SB | Start bit flag (Master mode) |

**Example**:

```
/* Return the I2C_IT_OVR flag state of I2C1 peripheral */
ITstatus Status;
Status = I2C_GetITStatus(I2C1, I2C_IT_OVR);
```

### 11.2.32 I2C_ClearITPendingBit function

*Table 252* describes the I2C_ClearITPendingBit function.

**Table 252. I2C_ClearITPendingBit function**

| | |
|---|---|
| Function name | I2C_ClearITPendingBit |
| Function prototype | void I2C_ClearITPendingBit(I2C_TypeDef* I2Cx, u32 I2C_IT) |
| Behavior description | Clears the I2Cx's interrupt pending bits. |
| Input parameter1 | I2Cx: where x can be 1 or 2 to select the I$^2$C peripheral. |
| Input parameter2 | I2C_IT: specifies the interrupt pending bit to clear.<br>Refer to *Section : I2C_IT* for more details on the allowed values of this parameter.<br>Note: DUALF, SMBHOST, SMBDEFAULT, GENCALL, TRA, BUSY, MSL, TXE and RXNE flags cannot be cleared by issuing this function |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### I2C_IT

The I2C_IT parameter is used to select the I$^2$C interrupt pending flags that can be cleared by issuing an I2C_ClearITPendingBit function (see *Table 253*).

**Table 253. I2C_IT definition**

| I2C_IT | Description |
|---|---|
| I2C_IT_SMBALERT | SMBus Alert flag |
| I2C_IT_TIMEOUT | Timeout or Tlow error flag |
| I2C_IT_PECERR | PEC error in reception flag |
| I2C_IT_OVR | Overrun/Underrun flag (Slave mode) |
| I2C_IT_AF | Acknowledge failure flag |
| I2C_IT_ARLO | Arbitration lost flag (Master mode) |
| I2C_IT_BERR | Bus error flag |
| I2C_IT_STOPF | Stop detection flag (Slave mode) |
| I2C_IT_ADD10 | 10-bit header sent flag (Master mode) |
| I2C_IT_BTF | Byte transfer finished flag |
| I2C_IT_ADDR | Address sent flag (Master mode) “ADSL”<br>Address matched flag (Slave mode) ”ENDAD” |
| I2C_IT_SB | Start bit flag (Master mode) |

**Example**:

```
/* Clear the Timeout interrupt opending bit on I2C2 */
I2C_ClearITPendingBit(I2C2, I2C_IT_TIMEOUT);
```

# 12 Independent watchdog (IWDG)

The Independent watchdog (IWDG) can be used to resolve processor malfunctions due to hardware or software failures. It can operate either in stop or in standby mode.

*Section 12.1: IWDG register structure* describes the data structures used in the IWDG Firmware Library. *Section 12.2: Firmware library functions* presents the Firmware Library functions.

## 12.1 IWDG register structure

The IWDG register structure, *IWDG_TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 KR;
  vu32 PR;
  vu32 RLR;
  vu32 SR;
} IWDG_TypeDef;
```

*Table 254* gives the list of IWDG registers.

**Table 254. IWDG registers**

| Register | Description |
|---|---|
| KR | IWDG Key Register |
| PR | IWDG Prescaler Register |
| RLR | IWDG Reload Register |
| SR | IWDG Status Register |

The IWDG peripheral is declared in *stm32f10x_map.h*:

```
#define PERIPH_BASE            ((u32)0x40000000)
#define APB1PERIPH_BASE        PERIPH_BASE
#define APB2PERIPH_BASE        (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE         (PERIPH_BASE + 0x20000)

#define IWDG_BASE              (APB1PERIPH_BASE + 0x3000)

#ifndef DEBUG
...
#ifdef _IWDG
  #define IWDG                  ((IWDG_TypeDef *) IWDG_BASE)
#endif /*_IWDG */
...
#else   /* DEBUG */
...
#ifdef _IWDG
  EXT IWDG_TypeDef             *IWDG;
#endif /*_IWDG */
...
#endif
```

When using the Debug mode, the IWDG pointer is initialized in *stm32f10x_lib.c*:

```
#ifdef _IWDG
IWDG = (IWDG_TypeDef *) IWDG_BASE;
#endif /*_IWDG */
```

To access the independent watchdog registers, _IWDG must be defined in *stm32f10x_conf.h* as follows:

```
#define _IWDG
```

## 12.2 Firmware library functions

*Table 255* gives the list of IWDG firmware library functions.

**Table 255. IWDG firmware library functions**

| Function name | Description |
|---|---|
| IWDG_WriteAccessCmd | Enables or disables write access to IWDG_PR and IWDG_RLR registers. |
| IWDG_SetPrescaler | Sets IWDG Prescaler value |
| IWDG_SetReload | Sets IWDG Reload value |
| IWDG_ReloadCounter | Reloads IWDG counter with value defined in the reload register |
| IWDG_Enable | Enables IWDG |
| IWDG_GetFlagStatus | Checks whether the specified IWDG flag is set or not |

### 12.2.1 IWDG_WriteAccessCmd function

*Table 256* describes the IWDG_WriteAccessCmd function.

**Table 256. IWDG_WriteAccessCmd function**

| | |
|---|---|
| Function name | IWDG_WriteAccessCmd |
| Function prototype | void IWDG_WriteAccessCmd(u16 IWDG_WriteAccess) |
| Behavior description | Enables or disables write access to IWDG_PR and IWDG_RLR registers. |
| Input parameter | IWDG_WriteAccess: new state of write access to IWDG_PR and IWDG_RLR registers.<br>Refer to *Section : IWDG_WriteAccess* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### IWDG_WriteAccess

This parameter enables or disables write access to IWDG_PR and IWDG_RLR registers (see Table 257).

**Table 257. IWDG_WriteAccess definition**

| IWDG_WriteAccess | Description |
|---|---|
| IWDG_WriteAccess_Enable | Write access to IWDG_PR and IWDG_RLR registers enabled |
| IWDG_WriteAccess_Disable | Write access to IWDG_PR and IWDG_RLR registers disabled |

**Example:**

```
/* Enable write access to IWDG_PR and IWDG_RLR registers */
IWDG_WriteAccessCmd(IWDG_WriteAccess_Enable);
```

## 12.2.2 IWDG_SetPrescaler function

Table 258 describes the IWDG_SetPrescaler function.

**Table 258. IWDG_SetPrescaler function**

| | |
|---|---|
| Function name | IWDG_SetPrescaler |
| Function prototype | void IWDG_SetPrescaler(u8 IWDG_Prescaler) |
| Behavior description | Sets IWDG Prescaler value. |
| Input parameter | IWDG_Prescaler: IWDG Prescaler value.<br>Refer to Section : IWDG_Prescaler for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### IWDG_Prescaler

This parameter selects the IWDG prescaler (see Table 259).

**Table 259. IWDG_Prescaler definition**

| IWDG_Prescaler | Description |
|---|---|
| IWDG_Prescaler_4 | IWDG prescaler set to 4 |
| IWDG_Prescaler_8 | IWDG prescaler set to 8 |
| IWDG_Prescaler_16 | IWDG prescaler set to 16 |
| IWDG_Prescaler_32 | IWDG prescaler set to 32 |
| IWDG_Prescaler_64 | IWDG prescaler set to 64 |
| IWDG_Prescaler_128 | IWDG prescaler set to 128 |
| IWDG_Prescaler_256 | IWDG prescaler set to 256 |

**Example:**

```
/* Set IWDG prescaler to 8 */
IWDG_SetPrescaler(IWDG_Prescaler_8);
```

### 12.2.3 IWDG_SetReload function

*Table 260* describes the IWDG_SetReload function.

**Table 260. IWDG_SetReload function**

| | |
|---|---|
| Function name | IWDG_SetReload |
| Function prototype | void IWDG_SetReload(u16 Reload) |
| Behavior description | Sets IWDG Reload value. |
| Input parameter | Reload: IWDG Reload value.<br>This parameter must be a number between 0 and 0x0FFF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set IWDG reload value to 0xFFF */
IWDG_SetReload(0xFFF);
```

### 12.2.4 IWDG_ReloadCounter function

*Table 261* describes the IWDG_ReloadCounter function.

**Table 261. IWDG_ReloadCounter function**

| | |
|---|---|
| Function name | IWDG_ReloadCounter |
| Function prototype | void IWDG_ReloadCounter(void) |
| Behavior description | Reloads IWDG counter with the value defined in the reload register (write access to IWDG_PR and IWDG_RLR registers disabled). |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Reload IWDG counter */
IWDG_ReloadCounter();
```

### 12.2.5 IWDG_Enable function

*Table 262* describes the IWDG_Enable function.

**Table 262. IWDG_Enable function**

| | |
|---|---|
| Function name | IWDG_Enable |
| Function prototype | void IWDG_Enable(void) |
| Behavior description | Enables IWDG (write access to IWDG_PR and IWDG_RLR registers disabled). |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable IWDG */
IWDG_Enable();
```

### 12.2.6 IWDG_GetFlagStatus function

*Table 263* describes the IWDG_GetFlagStatus function.

**Table 263. IWDG_GetFlagStatus function**

| | |
|---|---|
| Function name | IWDG_GetFlagStatus |
| Function prototype | `FlagStatus IWDG_GetFlagStatus(u16 IWDG_FLAG)` |
| Behavior description | Checks whether the specified IWDG flag is set or not. |
| Input parameter | IWDG_FLAG: flag to be checked.<br>Refer to *Section : IWDG_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of IWDG_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### IWDG_FLAG

The IWDG flags that can be checked by issuing an IWDG_GetFlagStatus are listed in *Table 264*.

**Table 264. IWDG_FLAG definition**

| IWDG_FLAG | Description |
|---|---|
| IWDG_FLAG_PVU | Prescaler Value Update on going |
| IWDG_FLAG_RVU | Reload Value Update on going |

**Example:**

```
/* Test if a prescaler value update is on going */
FlagStatus Status;
Status = IWDG_GetFlagStatus(IWDG_FLAG_PVU);
if(Status == RESET)
{
...
}
else
{
...
}
```

# 13 Nested vectored interrupt controller (NVIC)

The NVIC driver can be used for several purposes, such as enabling and disabling IRQ interrupts, enabling and disabling individual IRQ channels, and changing IRQ channel priorities.

*Section 13.1: NVIC register structure* describes the data structures used in the NVIC Firmware Library.*Section 13.2: Firmware library functions* presents the Firmware Library functions.

## 13.1 NVIC register structure

The NVIC register structure, NVIC_*TypeDef*, is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 Enable[2];
  u32 RESERVED0[30];
  vu32 Disable[2];
  u32 RSERVED1[30];
  vu32 Set[2];
  u32 RESERVED2[30];
  vu32 Clear[2];
  u32 RESERVED3[30];
  vu32 Active[2];
  u32 RESERVED4[62];
  vu32 Priority[11];
} NVIC_TypeDef;/* NVIC Structure */
```

```
typedef struct
{
  vu32 CPUID;
  vu32 IRQControlState;
  vu32 ExceptionTableOffset;
  vu32 AIRC;
  vu32 SysCtrl;
  vu32 ConfigCtrl;
  vu32 SystemPriority[3];
  vu32 SysHandlerCtrl;
  vu32 ConfigFaultStatus;
  vu32 HardFaultStatus;
  vu32 DebugFaultStatus;
  vu32 MemoryManageFaultAddr;
  vu32 BusFaultAddr;
} SCB_TypeDef; /* System Control Block Structure */
```

*Table 265* gives the list of the NVIC registers.

**Table 265. NVIC registers**

| Register | Description |
|---|---|
| Enable | Interrupt Set Enable Register |
| Disable | Interrupt Clear Enable Register |
| Set | Interrupt Set Pending Register |
| Clear | Interrupt Clear Pending Register |
| Active | Interrupt Active Bit Register |
| Priority | Interrupt Priority Register |
| CPUID | CPUID Base Register |
| IRQControlState | Interrupt Control State Register |
| ExceptionTableOffset | Vector Table Offset Register |
| AIRC | Application Interrupt/Reset Control Register |
| SysCtrl | System Control Register |
| ConfigCtrl | Configuration Control Register |
| SystemPriority | System Handlers Priority Register |
| SysHandlerCtrl | System Handler Control and State Register |
| ConfigFaultStatus | Configurable Fault Status Registers |
| HardFaultStatus | Hard Fault Status Register |
| DebugFaultStatus | Debug Fault Register |
| MemoryManangeFaultAddr | Memory Manage Fault Address Register |
| BusFaultAddr | Bus Fault Address |

The NVIC peripheral is declared in *stm32f10x_map*.h:

```
...
#define SCS_BASE              ((u32)0xE000E000)

#define NVIC_BASE             (SCS_BASE + 0x0100)
#define SCB_BASE              (SCS_BASE + 0x0D00)
...

#ifndef DEBUG
...
#ifdef _NVIC
  #define NVIC                ((NVIC_TypeDef *) NVIC_BASE)
  #define SCB                 ((SCB_TypeDef *) SCB_BASE)
#endif /*_NVIC */
...
#else   /* DEBUG */
...
#ifdef _NVIC
  EXT NVIC_TypeDef            *NVIC;
  EXT SCB_TypeDef             *SCB;
#endif /*_NVIC */
...
#endif
```

When using the Debug mode, NVIC and SCB pointers are initialized in *stm32f10x_lib.c* file:

```
#ifdef _NVIC
  NVIC = (NVIC_TypeDef *)  NVIC_BASE;
  SCB = (SCB_TypeDef *)  SCB_BASE;
#endif /*_NVIC */
```

To access the NVIC registers, _NVIC must be defined in stm32f10x_conf.h, as follows:

```
#define _NVIC
```

## 13.2 Firmware library functions

*Table 266* gives the list of the NVIC firmware library functions.

**Table 266. NVIC firmware library functions**

| Function name | Description |
|---|---|
| NVIC_DeInit | Resets the NVIC peripheral registers to their default reset values. |
| NVIC_SCBDeInit | Resets the SCB peripheral registers to their default reset values. |
| NVIC_PriorityGroupConfig | Configures the priority grouping: pre-emption priority and subpriority. |
| NVIC_Init | Initializes the NVIC peripheral according to the specified parameters in the NVIC_InitStruct. |
| NVIC_StructInit | Fills each NVIC_InitStruct member with its default value. |
| NVIC_SETPRIMASK | Enables the PRIMASK priority: Raises the execution priority to 0. |
| NVIC_RESETPRIMASK | Disables the PRIMASK priority. |
| NVIC_SETFAULTMASK | Enables the FAULTMASK priority: Raises the execution priority to -1. |
| NVIC_RESETFAULTMASK | Disables the FAULTMASK priority. |
| NVIC_BASEPRICONFIG | The execution priority can be changed from N (lowest configurable priority) to 1. |
| NVIC_GetBASEPRI | Returns the BASEPRI mask value. |
| NVIC_GetCurrentPendingIRQChannel | Returns the current pending served IRQ channel identifier. |
| NVIC_GetIRQChannelPendingBitStatus | Checks whether the specified IRQ Channel pending bit is set or not. |
| NVIC_SetIRQChannelPendingBit | Sets the NVIC interrupt pending bits. |
| NVIC_ClearIRQChannelPendingBit | Clears the NVIC interrupt pending bits. |
| NVIC_GetCurrentActiveHandler | Returns the current active Handler (IRQ Channel and SystemHandler) identifier. |
| NVIC_GetIRQChannelActiveBitStatus | Checks whether the specified IRQ Channel active bit is set or not. |

Table 266. NVIC firmware library functions (continued)

| Function name | Description |
|---|---|
| NVIC_GetCPUID | Returns the ID number, the version number and the implementation details of the Cortex-M3 core. |
| NVIC_SetVectorTable | Sets the vector table location and offset. |
| NVIC_GenerateSystemReset | Generate a system reset. |
| NVIC_GenerateCoreReset | Generate a Core (Core + NVIC) reset. |
| NVIC_SystemLPConfig | Selects the condition for the system to enter low power mode. |
| NVIC_SystemHandlerConfig | Enables or disables the specified System Handlers. |
| NVIC_SystemHandlerPriorityConfig | Configures the specified System Handlers priority. |
| NVIC_GetSystemHandlerPendingBitStatus | Checks whether the specified System handlers pending bit is set or not. |
| NVIC_SetSystemHandlerPendingBit | Sets System Handler pending bit. |
| NVIC_ClearSystemHandlerPendingBit | Clears System Handler pending bit. |
| NVIC_GetSystemHandlerActiveBitStatus | Checks whether the specified System handlers active bit is set or not. |
| NVIC_GetFaultHandlerSources | Returns the system fault handlers sources. |
| NVIC_GetFaultAddress | Returns the address of the location that generated a fault handler. |

### 13.2.1 NVIC_DeInit function

*Table 267* describes the NVIC_DeInit function.

Table 267. NVIC_DeInit function

| | |
|---|---|
| Function name | NVIC_DeInit |
| Function prototype | void NVIC_DeInit(void) |
| Behavior description | Resets the NVIC peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Resets the NVIC registers to their default reset value */
NVIC_DeInit();
```

### 13.2.2 NVIC_SCBDeInit function

Table 268 describes the NVIC_SCBDeInit function.

**Table 268. NVIC_SCBDeInit function**

| | |
|---|---|
| Function name | NVIC_SCBDeInit |
| Function prototype | void NVIC_SCBDeInit(void) |
| Behavior description | Resets the SCB peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Resets the SCB registers to their default reset value */
NVIC_SCBDeInit();
```

### 13.2.3 NVIC_PriorityGoupConfig function

Table 269 describes the NVIC_PriorityGoupConfig function.

**Table 269. NVIC_PriorityGoupConfig function**

| | |
|---|---|
| Function name | NVIC_PriorityGroupConfig |
| Function prototype | void NVIC_PriorityGroupConfig(u32 NVIC_PriorityGroup) |
| Behavior description | Configures the priority grouping: pre-emption priority and subpriority. |
| Input parameter | NVIC_PriorityGroup: priority grouping bits length.<br>Refer to *Section : NVIC_PriorityGroup* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Priority grouping should be configured only once. |
| Called functions | None |

### NVIC_PriorityGroup

This parameter configures the priority grouping bit length (see *Table 270*).

**Table 270. NVIC_PriorityGroup**

| NVIC_PriorityGroup | Description |
|---|---|
| NVIC_PriorityGroup_0 | 0 bits for pre-emption priority<br>4 bits for subpriority |
| NVIC_PriorityGroup_1 | 1 bits for pre-emption priority<br>3 bits for subpriority |
| NVIC_PriorityGroup_2 | 2 bits for pre-emption priority<br>2 bits for subpriority |
| NVIC_PriorityGroup_3 | 3 bits for pre-emption priority<br>1 bits for subpriority |
| NVIC_PriorityGroup_4 | 4 bits for pre-emption priority<br>0 bits for subpriority |

**Example:**

```
/* Configure the Priority Grouping with 1 bit */
NVIC_PriorityGroupConfig(NVIC_PriorityGroup_1);
```

### 13.2.4 NVIC_Init function

*Table 271* describes the NVIC_Init function.

**Table 271. NVIC_Init function**

| | |
|---|---|
| Function name | NVIC_Init |
| Function prototype | void NVIC_Init(NVIC_InitTypeDef* NVIC_InitStruct) |
| Behavior description | Initializes the NVIC peripheral according to the parameters specified in the NVIC_InitStruct. |
| Input parameter | NVIC_InitStruct: pointer to a NVIC_InitTypeDef structure that contains the configuration information for the specified NVIC peripheral.<br>Refer to *Section : NVIC_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## NVIC_InitTypeDef structure

The NVIC_InitTypeDef structure is defined in the *stm32f10x_nvic.h* file:

```
typedef struct
{
  u8 NVIC_IRQChannel;
  u8 NVIC_IRQChannelPreemptionPriority;
  u8 NVIC_IRQChannelSubPriority;
  FunctionalState NVIC_IRQChannelCmd;
} NVIC_InitTypeDef;
```

### NVIC_IRQChannel

This member specifies the IRQ channel to be enabled or disabled. The list of the IRQ channels is given in *Table 272*.

**Table 272. NVIC_IRQChannels**

| NVIC_IRQChannel | Description |
|---|---|
| WWDG_IRQChannel | Window WatchDog Interrupt |
| PVD_IRQChannel | PVD through EXTI Line detection Interrupt |
| TAMPER_IRQChannel | Tamper Interrupt |
| RTC_IRQChannel | RTC global Interrupt |
| FlashItf_IRQChannel | FLASH global Interrupt |
| RCC_IRQChannel | RCC global Interrupt |
| EXTI0_IRQChannel | EXTI Line0 Interrupt |
| EXTI1_IRQChannel | EXTI Line1 Interrupt |
| EXTI2_IRQChannel | EXTI Line2 Interrupt |

Table 272. NVIC_IRQChannels (continued)

| NVIC_IRQChannel | Description |
|---|---|
| EXTI3_IRQChannel | EXTI Line3 Interrupt |
| EXTI4_IRQChannel | EXTI Line4 Interrupt |
| DMAChannel1_IRQChannel | DMA Channel1 global Interrupt |
| DMAChannel2_IRQChannel | DMA Channel2 global Interrupt |
| DMAChannel3_IRQChannel | DMA Channel3 global Interrupt |
| DMAChannel4_IRQChannel | DMA Channel4 global Interrupt |
| DMAChannel5_IRQChannel | DMA Channel5 global Interrupt |
| DMAChannel6_IRQChannel | DMA Channel6 global Interrupt |
| DMAChannel7_IRQChannel | DMA Channel7 global Interrupt |
| ADC_IRQChannel | ADC global Interrupt |
| USB_HP_CANTX_IRQChannel | USB High Priority or CAN TX Interrupts |
| USB_LP_CAN_RX0_IRQChannel | USB Low Priority or CAN RX0 Interrupts |
| CAN_RX1_IRQChannel | CAN RX1 Interrupt |
| CAN_SCE_IRQChannel | CAN SCE Interrupt |
| EXTI9_5_IRQChannel | EXTI Line[9:5] Interrupts |
| TIM1_BRK_IRQChannel | TIM1 Break Interrupt |
| TIM1_UP_IRQChannel | TIM1 UP Interrupt |
| TIM1_TRG_COM_IRQChannel | TIM1 Trigger and Commutation Interrupts |
| TIM1_CC_IRQChannel | TIM1 Capture Compare Interrupt |
| TIM2_IRQChannel | TIM2 global Interrupt |
| TIM3_IRQChannel | TIM3 global Interrupt |
| TIM4_IRQChannel | TIM4 global Interrupt |
| I2C1_EV_IRQChannel | I2C1 Event Interrupt |
| I2C1_ER_IRQChannel | I2C1 Error Interrupt |
| I2C2_EV_IRQChannel | I2C2 Event Interrupt |
| I2C2_ER_IRQChannel | I2C2 Error Interrupt |
| SPI1_IRQChannel | SPI1 global Interrupt |
| SPI2_IRQChannel | SPI2 global Interrupt |
| USART1_IRQChannel | USART1 global Interrupt |
| USART2_IRQChannel | USART2 global Interrupt |
| USART3_IRQChannel | USART3 global Interrupt |
| EXTI15_10_IRQChannel | EXTI Line[15:10] Interrupts |
| RTCAlarm_IRQChannel | RTC Alarm through EXTI Line Interrupt |
| USBWakeUp_IRQChannel | USB WakeUp from suspend through EXTI Line Interrupt |

### NVIC_IRQChannelPreemptionPriority

This member configures the pre-emption priority for the IRQ channel specified in the NVIC_IRQChannel member. The values taken by this member are listed in *Table 273*.

### NVIC_IRQChannelSubPriority

This member configures the subpriority level for the IRQ channel specified in the NVIC_IRQChannel member. The values taken by this member are listed in *Table 273*.

*Table 273* gives the allowed values of the pre-emption priority and subpriority according to the Priority Grouping configuration performed by NVIC_PriorityGroupConfig function:

**Table 273. Pre-emption priority and subpriority values(1)(2)**

| NVIC_PriorityGroup | NVIC_IRQChannelPreemptionPriority | NVIC_IRQChannelSubPriority | Description |
|---|---|---|---|
| NVIC_PriorityGroup_0 | 0 | 0-15 | 0 bits for pre-emption priority<br>4 bits for subpriority |
| NVIC_PriorityGroup_1 | 0-1 | 0-7 | 1 bits for pre-emption priority<br>3 bits for subpriority |
| NVIC_PriorityGroup_2 | 0-3 | 0-3 | 2 bits for pre-emption priority<br>2 bits for subpriority |
| NVIC_PriorityGroup_3 | 0-7 | 0-1 | 3 bits for pre-emption priority<br>1 bits for subpriority |
| NVIC_PriorityGroup_4 | 0-15 | 0 | 4 bits for pre-emption priority<br>0 bits for subpriority |

1. When PriorityGroup_0 is selected, NVIC_IRQChannelPreemptionPriority member has no effect on the interrupt channel configuration.
2. When PriorityGroup_4 is selected, NVIC_IRQChannelSubPriority member has no effect on the interrupt channel configuration.

### NVIC_IRQChannelCmd

This member specifies whether the IRQ channel defined in the *NVIC_IRQChannel* member will be enabled or disabled. This member can be set either to ENABLE or DISABLE.

**Example:**

```
NVIC_InitTypeDef NVIC_InitStructure;
/* Configure the Priority Grouping with 1 bit */
NVIC_PriorityGroupConfig(NVIC_PriorityGroup_1);

/* Enable TIM3 global interrupt with Preemption Priority 0 and Sub
Priority as 2 */
NVIC_InitStructure.NVIC_IRQChannel = TIM3_IRQChannel;
NVIC_InitStructure.NVIC_IRQChannelPreemptionPriority = 0;
NVIC_InitStructure.NVIC_IRQChannelSubPriority = 2;
NVIC_InitStructure.NVIC_IRQChannelCmd = ENABLE;
NVIC_InitStructure(&NVIC_InitStructure);

/* Enable USART1 global interrupt with Preemption Priority 1 and Sub
Priority as 5 */
```

```
NVIC_InitStructure.NVIC_IRQChannel = USART1_IRQChannel;
NVIC_InitStructure.NVIC_IRQChannelPreemptionPriority = 1;
NVIC_InitStructure.NVIC_IRQChannelSubPriority = 5;
NVIC_InitStructure(&NVIC_InitStructure);

/* Enable RTC global interrupt with Preemption Priority 1 and Sub
Priority as 7 */
NVIC_InitStructure.NVIC_IRQChannel = RTC_IRQChannel;
NVIC_InitStructure.NVIC_IRQChannelSubPriority = 7;
NVIC_InitStructure(&NVIC_InitStructure);

/* Enable EXTI4 interrupt with Preemption Priority 1 and Sub
Priority as 7 */
NVIC_InitStructure.NVIC_IRQChannel = EXTI4_IRQChannel;
NVIC_InitStructure.NVIC_IRQChannelSubPriority = 7;
NVIC_InitStructure(&NVIC_InitStructure);

/* TIM3 interrupt priority is higher than USART1, RTC and EXTI4
interrupts priorities. USART1 interrupt priority is higher than RTC
and EXTI4 interrupts priorities. RTC interrupt priority is higher
than EXTI4 interrupt prioriy. */
```

### 13.2.5 NVIC_StructInit function

*Table 274* describes the NVIC_StructInit function.

**Table 274. NVIC_StructInit function**

| | |
|---|---|
| Function name | NVIC_StructInit |
| Function prototype | void NVIC_StructInit (NVIC_InitTypeDef* NVIC_InitStruct) |
| Behavior description | Fills each NVIC_InitStruct member with its default value. |
| Input parameter | NVIC_InitStruct: pointer to a NVIC_InitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The NVIC_InitStruct members have the following default values:

**Table 275. NVIC_InitStruct default values**

| Member | Default value |
|---|---|
| NVIC_IRQChannel | 0x0 |
| NVIC_IRQChannelPreemptionPriority | 0 |
| NVIC_IRQChannelSubPriority | 0 |
| NVIC_IRQChannelCmd | DISABLE |

**Example:**

```
/* The following example illustrates how to initialize a
NVIC_InitTypeDef structure */
NVIC_InitTypeDef NVIC_InitStructure;
NVIC_StructInit(&NVIC_InitStructure);
```

### 13.2.6 NVIC_SETPRIMASK function

Table 276 describes the NVIC_SETPRIMASK function.

**Table 276. NVIC_SETPRIMASK function(1)(2)(3)**

| | |
|---|---|
| Function name | NVIC_SETPRIMASK |
| Function prototype | void NVIC_SETPRIMASK(void) |
| Behavior description | Enables the PRIMASK priority: raises the execution priority to 0. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __SETPRIMASK() |

1. This function is coded in assembler.
2. This function only affects the group priority. It has no effect on the sub-priority.
3. Before setting the PRIMASK register, it is recommended to clear it when returning from exception to enable other exceptions.

**Example:**

```
/* Enable the PRIMASK priority */
NVIC_SETPRIMASK();
```

### 13.2.7 NVIC_RESETPRIMASK function

Table 277 describes the NVIC_RESETPRIMASK function.

**Table 277. NVIC_RESETPRIMASK function(1)**

| | |
|---|---|
| Function name | NVIC_RESETPRIMASK |
| Function prototype | void NVIC_RESETPRIMASK(void) |
| Behavior description | Disables the PRIMASK priority. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __RESETPRIMASK() |

1. This function is coded in assembler.

**Example:**

```
/* Enable the PRIMASK priority */
NVIC_RESETPRIMASK();
```

### 13.2.8 NVIC_SETFAULTMASK function

*Table 278* describes the NVIC_SETFAULTMASK function.

**Table 278. NVIC_SETFAULTMASK function(1)(2)(3)**

| | |
|---|---|
| Function name | NVIC_SETFAULTMASK |
| Function prototype | void NVIC_SETFAULTMASK(void) |
| Behavior description | Enables the FAULTMASK priority: raises the execution priority to -1. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __SETFAULTMASK() |

1. This function is coded in assembler.
2. This function only affects the group priority. It has no effect on the sub-priority.
3. FAULTMASK can only be set when the execution priority is lower than -1. Setting the FaultMask raises the priority of the exception handler to the level of a HardFault. FAULTMASK is cleared automatically on all exception returns except a return from NMI.

**Example:**

```
/* Enable the FAULTMASK priority */
NVIC_SETFAULTMASK();
```

### 13.2.9 NVIC_RESETFAULTMASK function

*Table 279* describes the NVIC_RESETFAULTMASK function.

**Table 279. NVIC_RESETFAULTMASK function(1)**

| | |
|---|---|
| Function name | NVIC_RESETFAULTMASK |
| Function prototype | void NVIC_SETFAULTMASK(void) |
| Behavior description | Disables the FAULTMASK priority. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __RESETFAULTMASK() |

1. This function is coded in assembler.

**Example:**

```
/* Disable the FAULTMASK priority */
NVIC_RESETFAULTMASK();
```

### 13.2.10 NVIC_BASEPRICONFIG function

Table 280 describes the NVIC_BASEPRICONFIG function.

**Table 280. NVIC_BASEPRICONFIG function(1)(2)(3)**

| | |
|---|---|
| Function name | NVIC_BASEPRICONFIG |
| Function prototype | void NVIC_BASEPRICONFIG(u32 NewPriority) |
| Behavior description | Changes the execution priority from N (lowest configurable priority) to 1. |
| Input parameter | NewPriority: new priority value of the execution priority. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __BASEPRICONFIG() |

1. This function is coded in assembler.
2. This function only affects the group priority. It has no effect on the sub-priority.
3. BASEPRI value can be changed from N (lowest configurable priority) to 1. Clearing this register to ‘0’ has no effect on the current priority. A non-zero value will act as a priority mask, affecting the execution priority when the priority defined by BASEPRI is higher than the current executing priority.

**Example:**

```
/* Mask the execution priority to 10 */
__BASEPRICONFIG(10);
```

### 13.2.11 NVIC_GetBASEPRI function

Table 281 describes the NVIC_GetBASEPRI function.

**Table 281. NVIC_GetBASEPRI function(1)**

| | |
|---|---|
| Function name | NVIC_GetBASEPRI |
| Function prototype | u32 NVIC_GetBASEPRI(void) |
| Behavior description | Returns the BASEPRI mask value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __GetBASEPRI() |

1. This function is coded in assembler.

**Example:**

```
/* Get the execution priority to value */
u32 BASEPRI_Mask = 0;
BASEPRI_Mask = NVIC_GetBASEPRI();
```

### 13.2.12 NVIC_GetCurrentPendingIRQChannel function

*Table 282* describes the NVIC_GetCurrentPendingIRQChannel function.

**Table 282. NVIC_GetCurrentPendingIRQChannel function**

| | |
|---|---|
| Function name | NVIC_GetCurrentPendingIRQChannel |
| Function prototype | u16 NVIC_GetCurrentPendingIRQChannel(void) |
| Behavior description | Returns the current pending IRQ channel identifier. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | Pending IRQ Channel Identifier. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Get the current pending IRQ channel identifier */
u16 CurrentPendingIRQChannel;
CurrentPendingIRQChannel = NVIC_GetCurrentPendingIRQChannel();
```

### 13.2.13 NVIC_GetIRQChannelPendingBitStatus function

*Table 283* describes the NVIC_GetIRQChannelPendingBitStatus function.

**Table 283. NVIC_GetIRQChannelPendingBitStatus function**

| | |
|---|---|
| Function name | NVIC_GetIRQChannelPendingBitStatus |
| Function prototype | ITStatus NVIC_GetIRQChannelPendingBitStatus(u8 NVIC_IRQChannel) |
| Behavior description | Checks whether the specified IRQ Channel pending bit is set or not. |
| Input parameter | NVIC_IRQChannel: interrupt pending bit to check.<br>Refer to *Section : NVIC_IRQChannel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of IRQ Channel pending bit (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Get the IRQ channel pending bit status of the ADC_IRQChannel */
ITStatus IRQChannelPendingBitStatus;
IRQChannelPendingBitStatus =
NVIC_GetIRQChannelPendingBitStatus(ADC_IRQChannel);
```

### 13.2.14 NVIC_SetIRQChannelPendingBit function

*Table 284* describes the NVIC_SetIRQChannelPendingBitStatus function.

**Table 284. NVIC_SetIRQChannelPendingBitStatus function**

| | |
|---|---|
| Function name | NVIC_SetIRQChannelPendingBit |
| Function prototype | void NVIC_SetIRQChannelPendingBit(u8 NVIC_IRQChannel) |
| Behavior description | Sets the NVIC interrupt pending bit. |
| Input parameter | NVIC_IRQChannel: specifies the interrupt pending bit to Set.<br>Refer to *Section : NVIC_IRQChannel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set SPI1 Global interrupt pending bit */
NVIC_SetIRQChannelPendingBit(SPI1_IRQChannel);
```

### 13.2.15 NVIC_ClearIRQChannelPendingBit function

*Table 285* describes the NVIC_ClearIRQChannelPendingBit function.

**Table 285. NVIC_ClearIRQChannelPendingBit function**

| | |
|---|---|
| Function name | NVIC_ClearIRQChannelPendingBit |
| Function prototype | void NVIC_ClearIRQChannelPendingBit(u8 NVIC_IRQChannel) |
| Behavior description | Clears the NVIC interrupt pending bit. |
| Input parameter | NVIC_IRQChannel: specifies the interrupt pending bit to clear.<br>Refer to *Section : NVIC_IRQChannel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear ADC IRQ Channel Pending bit */
NVIC_ClearIRQChannelPendingBit(ADC_IRQChannel);
```

### 13.2.16 NVIC_GetCurrentActiveHandler function

*Table 286* describes the NVIC_GetCurrentActiveHandler function.

**Table 286. NVIC_GetCurrentActiveHandler function**

| | |
|---|---|
| Function name | NVIC_GetCurrentActiveHandler |
| Function prototype | u16 NVIC_GetCurrentActiveHandler(void) |
| Behavior description | Returns the current active Handler (IRQ Channel and SystemHandler) identifier. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | Active Handler Identifier. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Get the current active Handler identifier */
u16 CurrentActiveHandler;
CurrentActiveHandler = NVIC_GetCurrentActiveHandler();
```

### 13.2.17 NVIC_GetIRQChannelActiveBitStatus function

*Table 287* describes the NVIC_GetIRQChannelActiveBitStatus function.

**Table 287. NVIC_GetIRQChannelActiveBitStatus function**

| | |
|---|---|
| Function name | NVIC_GetIRQChannelActiveBitStatus |
| Function prototype | ITStatus NVIC_GetIRQChannelActiveBitStatus(u8 NVIC_IRQChannel) |
| Behavior description | Checks whether the specified IRQ Channel active bit is set or not. |
| Input parameter | NVIC_IRQChannel: specifies the interrupt active bit to check.<br>Refer to *Section : NVIC_IRQChannel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of IRQ Channel active bit (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Get the active IRQ channel status of the ADC_IRQChannel */
ITStatus IRQChannelActiveBitStatus;
IRQChannelActiveBitStatus =
NVIC_GetIRQChannelActiveBitStatus(ADC_IRQChannel);
```

### 13.2.18 NVIC_GetCPUID function

*Table 288* describes the NVIC_GetCPUID function.

**Table 288. NVIC_GetCPUID function**

| | |
|---|---|
| Function name | NVIC_GetCPUID |
| Function prototype | u32 NVIC_GetCPUID(void) |
| Behavior description | Returns the ID number, version number and the implementation details of the Cortex-M3 core. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | CPU ID. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the CPU ID */
u32 CM3_CPUID;
CM3_CPUID = NVIC_GetCPUID();
```

### 13.2.19 NVIC_SetVectorTable function

*Table 289* describes the NVIC_SetVectorTable function.

**Table 289. NVIC_SetVectorTable function**

| | |
|---|---|
| Function name | NVIC_SetVectorTable |
| Function prototype | void NVIC_SetVectorTable(u32 NVIC_VectTab, u32 Offset) |
| Behavior description | Sets the vector table location and Offset. |
| Input parameter1 | NVIC_VectTab: specifies if the vector table is in RAM or code memory.<br>Refer to *Section : NVIC_VectTab* for more details on the allowed values of this parameter. |
| Input parameter2 | Offset: Vector Table base offset field.<br>This Value must be higher than 0x08000100 for FLASH and 0x100 for RAM. It must also be a multiple of 256 (64 * 4). |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### NVIC_VectTab

This parameter defines the table base address (see *Table 290*).

**Table 290. NVIC_VectTab values**

| NewTableBase | Description |
|---|---|
| NVIC_VectTab_FLASH | Vector Table is in FLASH |
| NVIC_VectTab_RAM | Vector Table is in RAM |

**Example:**

```
/* Vector Table is in FLASH at 0x0 */
NVIC_SetVectorTable(NVIC_VectTab_FLASH, 0x0);
```

### 13.2.20 NVIC_GenerateSystemReset function

*Table 291* describes the NVIC_GenerateSystemReset function.

**Table 291. NVIC_GenerateSystemReset function**

| | |
|---|---|
| Function name | NVIC_GenerateSystemReset |
| Function prototype | void NVIC_GenerateSystemReset(void) |
| Behavior description | Generate a system reset. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Generate a system reset */
NVIC_GenerateSystemReset();
```

### 13.2.21 NVIC_GenerateCoreReset function

*Table 292* describes the NVIC_GenerateCoreReset function.

**Table 292. NVIC_GenerateCoreReset function**

| | |
|---|---|
| Function name | NVIC_GenerateCoreReset |
| Function prototype | void NVIC_GenerateCoreReset(void) |
| Behavior description | Generate a core (core + NVIC) reset. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Generate a core reset */
NVIC_GenerateCoreReset();
```

### 13.2.22 NVIC_SystemLPConfig function

*Table 293* describes the NVIC_SystemLPConfig function.

**Table 293. NVIC_SystemLPConfig function**

| | |
|---|---|
| Function name | NVIC_SystemLPConfig |
| Function prototype | void NVIC_SystemLPConfig(u8 LowPowerMode, FunctionalState NewState) |
| Behavior description | Selects the condition for the system to enter low power mode. |
| Input parameter1 | LowPowerMode: new mode for the system to enter low power mode.<br>Refer to *Section : LowPowerMode* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the LP condition.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### LowPowerMode

This parameter configures the low power mode of the device (see *Table 294*).

**Table 294. LowerPowerMode definition**

| LowPowerMode | Description |
|---|---|
| NVIC_LP_SEVONPEND | Wake-up on Pend |
| NVIC_LP_SLEEPDEEP | Deep Sleep Enable |
| NVIC_LP_SLEEPONEXIT | Sleep on ISR exit |

**Example:**

```
/* wakeup the system on interrupt pending */
NVIC_SystemLPConfig(SEVONPEND, ENABLE);
```

### 13.2.23 NVIC_SystemHandlerConfig function

*Table 295* describes the NVIC_SystemHandlerConfig function.

**Table 295. NVIC_SystemHandlerConfig function**

| | |
|---|---|
| Function name | NVIC_SystemHandlerConfig |
| Function prototype | void NVIC_SystemHandlerConfig(u32 SystemHandler, FunctionalState NewState) |
| Behavior description | Enables or disables the specified System Handlers. |
| Input parameter1 | SystemHandler: system handler to be enabled or disabled.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified System Handlers.<br>This parameter can be set to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler to be enabled or disabled (see *Table 296*).

**Table 296. SystemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |
| SystemHandler_UsageFault | Usage Fault Handler |

The SystemHandler parameter values allow to configure at the same time the NVIC register, the SCB register, and the index bits. The SystemHandler is coded on 23 bits as shown in *Table 297*, *Table 298*, *Table 299*, *Table 300*, *Table 301*, *Table 302*, *Table 303*, *Table 304*, *Table 305*, and *Table 306*.

**Example:**

```
/* Enable the Memory Manage Handler */
NVIC_SystemHandlerConfig(SystemHandler_MemoryManage, ENABLE);
```

**Table 297. SystemHandler definition**

| System Handler | Bits 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SystemHandler_NMI (see *Table 298*) | Reserved | | | | | | | | | | | | | | | | | | 0x1F | | | | | 0x1F |
| SystemHandler_HardFault (see *Table 299*) | Reserved | | | 0 | | Reserved | | | | | | | | | | | | | | | | | | 0x0 |
| SystemHandler_MemoryManage (see *Table 300*) | 0 | 0 | | 1 | | 0x0 | | | | 0xD | | | | 0 | | 0 | | Res | 0x10 | | | | | 0x43430 |
| SystemHandler_BusFault (see *Table 301*) | 1 | 1 | | 1 | | 1 | | | | 0xE | | | | 1 | | 0 | | Res | 0x11 | | | | | 0x547931 |
| SystemHandler_UsageFault (see *Table 302*) | - | 2 | | 1 | | 0x3 | | | | Reserved | | | | 2 | | 0 | | Res | 0x12 | | | | | 0x24C232 |
| SystemHandler_SVCall (see *Table 303*) | Reserved | | | | | 0x7 | | | | 0xF | | | | 3 | | 1 | | Reserved | | | | | | 0x1FF40 |
| SystemHandler_DebugMonitor (see *Table 304*) | Reserved | | | 2 | | 0x8 | | | | Reserved | | | | 0 | | 2 | | Reserved | | | | | | 0xA0080 |
| SystemHandler_PSV (see *Table 305*) | Reserved | | | | | 0xA | | | | Reserved | | | | 2 | | 2 | | | 0x1C | | | | | 0x2829C |
| SystemHandler_SysTick (see *Table 306*) | Reserved | | | | | 0xB | | | | Reserved | | | | 3 | | 2 | | | 0x1A | | | | | 0x2C39A |

**Table 298. SystemHandler_NMI definition**

| Bits | NMI Registers/Bits | NMI Functions |
|---|---|---|
| [4:0] | - IRQControlState<br>- NMIPENDSET[31] | NVIC_SetSystemHandlerPendingBit |
| 5 | Not Used | |
| [7:6] | Not Used | |
| [9:8] | Not Used | |
| [13:10] | Not Used | |
| [17:14] | Not Used | |
| [19:18] | Not Used | |
| [21:20] | Not Used | |
| 22 | Not Used | |

**Table 299. SystemHandler_HardFault definition**

| Bits | Hard Fault | |
|---|---|---|
| | Registers/Bits | Functions |
| [4:0] | Not Used | |
| 5 | Not Used | |
| [7:6] | Not Used | |
| [9:8] | Not Used | |
| [13:10] | Not Used | |
| [17:14] | Not Used | |
| [19:18] | - HardFaultStatus | NVIC_GetFaultHandlerSources |
| [21:20] | | |
| 22 | Not Used | |

**Table 300. SystemHandler_MemoryManage definition**

| Bits | Memory Manage | |
|---|---|---|
| | Registers/Bits | Functions |
| [4:0] | - SysHandlerCtrl<br>- MEMFAULTENA[16] | NVIC_SystemHandlerConfig |
| 5 | Not Used | |
| [7:6] | - SystemPriority[0]<br>- PRI_4[7:0] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | - SysHandlerCtrl<br>- MEMFAULTPENDED[13] | NVIC_GetSystemHandlerPendingBitStatus |
| [17:14] | - SysHandlerCtrl<br>- MEMFAULTACT[0] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | - ConfigFaultStatus<br>- [7:0] | NVIC_GetFaultHandlerSources |
| [21:20] | | |
| 22 | - MemoryManageFaultAddr | NVIC_GetFaultAddress |

**Table 301. SystemHandler_BusFault definition**

| Bits | Bus Fault | |
|---|---|---|
| | **Registers/Bits** | **Functions** |
| [4:0] | - SysHandlerCtrl<br>- BUSFAULTENA[17] | NVIC_SystemHandlerConfig |
| 5 | Not Used | |
| [7:6] | - SystemPriority[0]<br>- PRI_5[15:8] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | - SysHandlerCtrl<br>- BUSFAULTPENDED[14] | NVIC_GetSystemHandlerPendingBitStatus |
| [17:14] | - SysHandlerCtrl<br>- BUSFAULTACT[1] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | - ConfigFaultStatus<br>- [15:8] | NVIC_GetFaultHandlerSources |
| [21:20] | | |
| 22 | - BusFaultAddr | NVIC_GetFaultAddress |

**Table 302. SystemHandler_UsageFault definition**

| Bits | Usage Fault | |
|---|---|---|
| | **Registers/Bits** | **Functions** |
| [4:0] | - SysHandlerCtrl<br>- USGFAULTENA[18] | NVIC_SystemHandlerConfig |
| 5 | Not Used | |
| [7:6] | - SystemPriority[0]<br>- PRI_6[23:16] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | Not Used | |
| [17:14] | - SysHandlerCtrl<br>- USGFAULTACT[3] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | - ConfigFaultStatus<br>- [31:16] | NVIC_GetFaultHandlerSources |
| [21:20] | | |
| 22 | Not Used | |

**Table 303. SystemHandler_SVCall definition**

| Bits | SVCall | |
|---|---|---|
| | **Registers/Bits** | **Functions** |
| [4:0] | Not Used | |
| 5 | Not Used | |
| [7:6] | - SystemPriority[1]<br>- PRI_11[31:24] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | - SysHandlerCtrl<br>- SVCALLPENDED[15] | NVIC_GetSystemHandlerPendingBitStatus |
| [17:14] | - SysHandlerCtrl<br>- SVCALLACT[7] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | Not Used | |
| [21:20] | Not Used | |
| 22 | Not Used | |

**Table 304. SystemHandler_DebugMonitor definition**

| Bits | Debug Monitor | |
|---|---|---|
| | **Registers/Bits** | **Functions** |
| [4:0] | Not Used | |
| 5 | Not Used | |
| [7:6] | - SystemPriority[2]<br>- PRI_12[7:0] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | Not Used | |
| [17:14] | - SysHandlerCtrl<br>- MONITORACT[8] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | - DebugFaultStatus | NVIC_GetFaultHandlerSources |
| [21:20] | | |
| 22 | Not Used | |

**Table 305. SystemHandler_PSV definition**

| Bits | PSV | |
|---|---|---|
| | Registers/Bits | Functions |
| [4:0] | - IRQControlState<br>- PENDSVSET[28] | NVIC_SetSystemHandlerPendingBit |
| | - IRQControlState<br>- PENDSVCLR[27] | NVIC_ClearSystemHandlerPendingBit |
| 5 | Not Used | |
| [7:6] | - SystemPriority[2]<br>- PRI_14[23:16] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | Not Used | |
| [17:14] | - SysHandlerCtrl<br>- PENDSVACT[10] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | Not Used | |
| [21:20] | Not Used | |
| 22 | Not Used | |

**Table 306. SystemHandler_SysTick definition**

| Bits | SysTick | |
|---|---|---|
| | Registers/Bits | Functions |
| [4:0] | - IRQControlState<br>- PENDSTSET[26] | NVIC_SetSystemHandlerPendingBit |
| | - IRQControlState<br>- PENDSVCLR[25] | NVIC_ClearSystemHandlerPendingBit |
| 5 | Not Used | |
| [7:6] | - SystemPriority[2]<br>- PRI_15[31:24] | NVIC_SystemHandlerPriorityConfig |
| [9:8] | | |
| [13:10] | Not Used | |
| [17:14] | - SysHandlerCtrl<br>- SYSTICKACT[11] | NVIC_GetSystemHandlerActiveBitStatus |
| [19:18] | Not Used | |
| [21:20] | Not Used | |
| 22 | Not Used | |

### 13.2.24 NVIC_SystemHandlerPriorityConfig function

*Table 307* describes the NVIC_SystemHandlerPriorityConfig function.

**Table 307. NVIC_SystemHandlerPriorityConfig function**

| | |
|---|---|
| Function name | NVIC_SystemHandlerPriorityConfig |
| Function prototype | void NVIC_SystemHandlerPriorityConfig(u32 SystemHandler, u8 SystemHandlerPreemptionPriority, u8 SystemHandlerSubPriority) |
| Behavior description | Configures the specified System Handlers priority. |
| Input parameter1 | SystemHandler: system handler to be enabled or disabled.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Input parameter2 | SystemHandlerPreemptionPriority: new priority group of the specified system handlers.<br>Refer to *Section : NVIC_IRQChannelPreemptionPriority* for more details on the allowed values of this parameter. |
| Input parameter3 | SystemHandlerSubPriority: new sub priority of the specified system handlers.<br>Refer to *Section : NVIC_IRQChannelSubPriority* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler which will be configured (see *Table 308*).

**Table 308. SystemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |
| SystemHandler_UsageFault | Usage Fault Handler |
| SystemHandler_SVCall | SVCall Handler |
| SystemHandler_DebugMonitor | Debug Monitor Handler |
| SystemHandler_PSV | PSV Handler |
| SystemHandler_SysTick | SysTick Handler |

**Example:**

```
/* Enable the Memory Manage Handler */
NVIC_SystemHandlerPriorityConfig(SystemHandler_MemoryManage, 2, 8);
```

### 13.2.25 NVIC_GetSystemHandlerPendingBitStatus function

*Table 309* describes the NVIC_GetSystemHandlerPendingBitStatus function.

**Table 309. NVIC_GetSystemHandlerPendingBitStatus function**

| | |
|---|---|
| Function name | NVIC_GetSystemHandlerPendingBitStatus |
| Function prototype | ITStatus NVIC_GetSystemHandlerPendingBitStatus(u32 SystemHandler) |
| Behavior description | Checks whether the specified System handlers pending bit is set or not. |
| Input parameter | SystemHandler: system handler pending bit to check.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of System Handler pending bit (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see *Table 310*).

**Table 310. systemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |
| SystemHandler_SVCall | SVCall Handler |

**Example:**

```
/* Check if the Memory Manage Fault has occured */
ITStatus MemoryHandlerStatus;
MemoryHandlerStatus
=NVIC_GetSystemHandlerPendingBitStatus(SystemHandler_MemoryManage);
```

### 13.2.26 NVIC_SetSystemHandlerPendingBit function

*Table 311* describes the NVIC_SetSystemHandlerPendingBit function.

**Table 311. NVIC_SetSystemHandlerPendingBit function**

| | |
|---|---|
| Function name | NVIC_SetSystemHandlerPendingBit |
| Function prototype | void NVIC_SetSystemHandlerPendingBit(u32 SystemHandler) |
| Behavior description | Sets System Handler pending bit. |
| Input parameter | SystemHandler: system handler pending bit to be set.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see *Table 312*).

**Table 312. systemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_NMI | NMI Handler |
| SystemHandler_PSV | PSV Handler |
| SystemHandler_SysTick | SysTick Handler |

**Example:**

```
/* Set NMI Pending Bit */
NVIC_SetSystemHandlerPendingBit(SystemHandler_NMI);
```

### 13.2.27 NVIC_ClearSystemHandlerPendingBit function

*Table 313* describes the NVIC_ClearSystemHandlerPendingBit function.

**Table 313. NVIC_ClearSystemHandlerPendingBit function**

| | |
|---|---|
| Function name | NVIC_ClearSystemHandlerPendingBit |
| Function prototype | void NVIC_ClearSystemHandlerPendingBit(u32 SystemHandler) |
| Behavior description | Clears System Handler pending bit. |
| Input parameter | SystemHandler: system handler pending bit to be reset.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see *Table 314*).

**Table 314. systemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_PSV | PSV Handler |
| SystemHandler_SysTick | SysTick Handler |

**Example:**

```
/* Clear SysTick Pending Bit */
NVIC_ClearSystemHandlerPendingBit(SystemHandler_SysTick);
```

### 13.2.28 NVIC_GetSystemHandlerActiveBitStatus function

*Table 315* describes the NVIC_GetSystemHandlerActiveBitStatus function.

**Table 315. NVIC_GetSystemHandlerActiveBitStatus function**

| | |
|---|---|
| Function name | NVIC_GetSystemHandlerActiveBitStatus |
| Function prototype | ITStatus NVIC_GetSystemHandlerActiveBitStatus(u32 SystemHandler) |
| Behavior description | Checks whether the specified System handlers active bit is set or not. |
| Input parameter | SystemHandler: system handler active bit to be checked.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of System Handler active bit (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see *Table 316*).

**Table 316. systemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |
| SystemHandler_UsageFault | Usage Fault Handler |
| SystemHandler_SVCall | SVCall Handler |
| SystemHandler_DebugMonitor | Debug Monitor Handler |
| SystemHandler_PSV | PSV Handler |
| SystemHandler_SysTick | SysTick Handler |

**Example:**

```
/* Check if the Bus Fault is active or stacked */
ITStatus BusFaultHandlerStatus;
BusFaultHandlerStatus =
NVIC_GetSystemHandlerActiveBitStatus(SystemHandler_BusFault);
```

### 13.2.29 NVIC_GetFaultHandlerSources function

*Table 317* describes the NVIC_GetFaultHandlerSources function.

**Table 317. NVIC_GetFaultHandlerSources function**

| | |
|---|---|
| Function name | NVIC_GetFaultHandlerSources |
| Function prototype | u32 NVIC_GetFaultHandlerSources(u32 SystemHandler) |
| Behavior description | Returns the system handler fault sources. |
| Input parameter | SystemHandler: system handler of which the fault sources will be returned.<br>Refer to *Section : SystemHandler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | Source of the fault handler. |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see *Table 318*).

**Table 318. systemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_HardFault | Hard Fault Handler |
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |
| SystemHandler_UsageFault | Usage Fault Handler |
| SystemHandler_DebugMonitor | Debug Monitor Handler |

**Example:**

```
/* Gets the sources of the Bus Fault Handler */
u32 BusFaultHandlerSource;
BusFaultHandlerSource
=NVIC_GetFaultHandlerSources(SystemHandler_BusFault);
```

### 13.2.30 NVIC_GetFaultAddress function

Table 319 describes the NVIC_GetFaultAddress function

**Table 319. NVIC_GetFaultAddress function**

| | |
|---|---|
| Function name | NVIC_GetFaultAddress |
| Function prototype | u32 NVIC_GetFaultAddress(u32 SystemHandler) |
| Behavior description | Returns the address of the location that generated a fault handler. |
| Input parameter | SystemHandler: system handler of which the fault address will be returned<br>Refer to Section : SystemHandler for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | Fault address. |
| Required preconditions | None |
| Called functions | None |

#### SystemHandler

This parameter selects the system handler (see Table 320).

**Table 320. SystemHandler types**

| SystemHandler | Description |
|---|---|
| SystemHandler_MemoryManage | Memory Manage Handler |
| SystemHandler_BusFault | Bus Fault Handler |

**Example:**

```
/* Gets the address of the Bus Fault Handler */
u32 BusFaultHandlerAddress;
BusFaultHandlerAddress =
NVIC_GetFaultAddress(SystemHandler_BusFault);
```

# 14 Power control (PWR)

The PWR is used for a variety of purposes including power management and low power mode selection.

*Section 14.1: PWR register structure* describes the data structures used in the PWR Firmware Library. *Section 14.2: Firmware library functions* presents the Firmware Library functions.

## 14.1 PWR register structure

The PWR register structure, *PWR_TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CR;
  vu32 CSR;
} PWR_TypeDef;
```

*Table 321* gives the list of PWR registers.

**Table 321. PWR registers**

| Register | Description |
|---|---|
| CR | Power Control Register |
| CSR | Power Control Status Register |

The PWR peripheral is declared in *stm32f10x_map.h*:

```
#define PERIPH_BASE          ((u32)0x40000000)
#define APB1PERIPH_BASE      PERIPH_BASE
#define APB2PERIPH_BASE      (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE       (PERIPH_BASE + 0x20000)

#define PWR_BASE             (APB1PERIPH_BASE + 0x7000)

#ifndef DEBUG
...
#ifdef _PWR
  #define PWR                  ((PWR_TypeDef *) PWR_BASE)
#endif /*_PWR */
...
#else   /* DEBUG */
...
#ifdef _PWR
  EXT PWR_TypeDef            *PWR;
#endif /*_PWR */
...
#endif
```

When using the Debug mode, PWR pointer is initialized in *stm32f10x_lib.c* file:

```
#ifdef _PWR
PWR = (PWR_TypeDef *)  PWR_BASE;
#endif /*_PWR */
```

To access the PWR registers, _PWR must be defined in *stm32f10x_conf.h* as follows:

```
#define _PWR
```

## 14.2 Firmware library functions

*Table 322* gives the list of the various PWR library functions.

**Table 322. PWR firmware library functions**

| Function name | Description |
|---|---|
| PWR_DeInit | Resets the PWR peripheral registers to their default reset values. |
| PWR_BackupAccessCmd | Enables or disables access to the RTC and backup registers. |
| PWR_PVDCmd | Enables or disables the Power Voltage Detector(PVD). |
| PWR_PVDLevelConfig | Configures the voltage threshold detected by the Power Voltage Detector(PVD). |
| PWR_WakeUpPinCmd | Enables or disables the WakeUp Pin functionality. |
| PWR_EnterSTOPMode | Enters STOP mode. |
| PWR_EnterSTANDBYMode | Enters STANDBY mode. |
| PWR_GetFlagStatus | Checks whether the specified PWR flag is set or not. |
| PWR_ClearFlag | Clears the PWR's pending flags. |

### 14.2.1 PWR_DeInit function

*Table 323* describes the PWR_DeInit function.

**Table 323. PWR_DeInit function**

| | |
|---|---|
| Function name | PWR_DeInit |
| Function prototype | void PWR_DeInit(void) |
| Behavior description | Resets the PWR peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB1PeriphResetCmd |

**Example:**

```
/* Deinitialize the PWR registers */
PWR_DeInit();
```

### 14.2.2 PWR_BackupAccessCmd function

*Table 324* describes the PWR_BackupAccessCmd function.

**Table 324. PWR_BackupAccessCmd function**

| | |
|---|---|
| Function name | PWR_BackupAccessCmd |
| Function prototype | void PWR_BackupAccessCmd(FunctionalState NewState) |
| Behavior description | Enables or disables access to the RTC and backup registers. |
| Input parameter | NewState: new state of the access to the RTC and backup registers.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable access to the RTC and backup registers */
PWR_BackupAccessCmd(ENABLE);
```

### 14.2.3 PWR_PVDCmd function

*Table 325* describes the PWR_PVDCmd function.

**Table 325. PWR_PVDCmd function**

| | |
|---|---|
| Function name | PWR_PVDCmd |
| Function prototype | void PWR_PVDCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the Power Voltage Detector(PVD). |
| Input parameter | NewState: new state of the PVD.<br>This parameter can be set either to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the Power Voltage Detector(PVD) */
PWR_PVDCmd(ENABLE);
```

### 14.2.4 PWR_PVDLevelConfig function

*Table 326* describes the PWR_PVDLevelConfig function.

**Table 326. PWR_PVDLevelConfig function**

| | |
|---|---|
| Function name | PWR_PVDLevelConfig |
| Function prototype | void PWR_PVDLevelConfig(u32 PWR_PVDLevel) |
| Behavior description | Configures the voltage threshold detected by the Power Voltage Detector (PVD). |
| Input parameter | PWR_PVDLevel: PVD detection level<br>Refer to *Section : PWR_PVDLevel* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### PWR_PVDLevel

This parameter configures the PVD detection level value (see *Table 327*).

**Table 327. PWR_PVDLevel values**

| PWR_PVDLevel | Description |
|---|---|
| PWR_PVDLevel_2V2 | PVD detection level set to 2.2V |
| PWR_PVDLevel_2V3 | PVD detection level set to 2.3V |
| PWR_PVDLevel_2V4 | PVD detection level set to 2.4V |
| PWR_PVDLevel_2V5 | PVD detection level set to 2.5V |
| PWR_PVDLevel_2V6 | PVD detection level set to 2.6V |
| PWR_PVDLevel_2V7 | PVD detection level set to 2.7V |
| PWR_PVDLevel_2V8 | PVD detection level set to 2.8V |
| PWR_PVDLevel_2V9 | PVD detection level set to 2.9V |

**Example:**

```
/* Set PVD detection level to 2.5V */
PWR_PVDLevelConfig(PWR_PVDLevel_2V5);
```

### 14.2.5 PWR_WakeUpPinCmd function

*Table 328* describes the PWR_WakeUpPinCmd function.

**Table 328. PWR_WakeUpPinCmd function**

| | |
|---|---|
| Function name | PWR_WakeUpPinCmd |
| Function prototype | void PWR_WakeUpPinCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the WakeUp Pin functionality. |
| Input parameter | NewState: new state of the WakeUp Pin functionality.<br>This parameter can be set either to ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* WakeUp pin used for wake-up function */
PWR_WakeUpPinCmd(ENABLE);
```

### 14.2.6 PWR_EnterSTOPMode function

*Table 329* describes the PWR_EnterSTOPMode function.

**Table 329. PWR_EnterSTOPMode function**

| | |
|---|---|
| Function name | PWR_EnterSTOPMode |
| Function prototype | void PWR_EnterSTOPMode(u32 PWR_Regulator, u8 PWR_STOPEntry) |
| Behavior description | Enters STOP mode. |
| Input parameter1 | PWR_Regulator: regulator state in STOP mode.<br>Refer to *Section : PWR_Regulator* for more details on the allowed values of this parameter. |
| Input parameter2 | PWR_STOPEntry: specifies if STOP mode in entered with WFI or WFE instruction.<br>Refer to *Section : PWR_STOPEntry* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __WFI(), __WFE() |

### PWR_Regulator

This parameter configures the regulator state in STOP mode. See *Table 330* for the possible values of PWR_Regulator.

**Table 330. PWR_Regulator definition**

| PWR_Regulator | Description |
|---|---|
| PWR_Regulator_ON | STOP mode with regulator ON |
| PWR_Regulator_LowPower | STOP mode with regulator in low power mode |

### PWR_STOPEntry

This parameter defines the STOP entry mode.

**Table 331. PWR_STOPEntry definition**

| PWR_Regulator | Description |
|---|---|
| PWR_STOPEntry_WFI | Enter STOP mode with WFI instruction |
| PWR_STOPEntry_WFE | Enter STOP mode with WFE instruction |

**Example:**

```
/* Put the system in STOP mode with regulator on */
PWR_EnterSTOPMode(PWR_Regulator_ON, PWR_STOPEntry_WFE);
```

### 14.2.7 PWR_EnterSTANDBYMode function

*Table 332* describes the PWR_EnterSTANDBYMode function.

**Table 332. PWR_EnterSTANDBYMode function**

| | |
|---|---|
| Function name | PWR_EnterSTANDBYMode |
| Function prototype | void PWR_EnterSTANDBYMode(void) |
| Behavior description | Enters STANDBY mode. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | __WFI() |

**Example:**

```
/* Put the system in STANDBY mode */
PWR_EnterSTANDBYMode();
```

### 14.2.8 PWR_GetFlagStatus function

*Table 333* describes the PWR_GetFlagStatus function.

**Table 333. PWR_GetFlagStatus function**

| | |
|---|---|
| Function name | PWR_GetFlagStatus |
| Function prototype | FlagStatus PWR_GetFlagStatus(u32 PWR_FLAG) |
| Behavior description | Checks whether the specified PWR flag is set or not. |
| Input parameter | PWR_FLAG: flag to be checked.<br>Refer to *Section : PWR_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of PWR_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### PWR_FLAG

The PWR flags that can be checked by issuing a PWR_GetFlagStatus function are listed in *Table 334*.

**Table 334. PWR_Flag values**

| PWR_FLAG | Description |
|---|---|
| PWR_FLAG_WU | Wake-up flag |
| PWR_FLAG_SB | StandBy flag |
| PWR_FLAG_PVDO | PVD Output[(1)] |

1. This flag is read only. It cannot be cleared.

**Example:**

```
/* Test if the StandBy flag is set or not */
FlagStatus Status;
Status = PWR_GetFlagStatus(PWR_FLAG_SB);
if(Status == RESET)
{
...
}
else
{
...
}
```

## 14.2.9 PWR_ClearFlag function

*Table 335* describes the PWR_ClearFlag function.

**Table 335. PWR_ClearFlag function**

| | |
|---|---|
| Function name | PWR_ClearFlag |
| Function prototype | void PWR_ClearFlag(u32 PWR_FLAG) |
| Behavior description | Clears the PWR's pending flags. |
| Input parameter | PWR_FLAG: flag to be cleared.<br>Refer to *Section : PWR_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the StandBy pending flag */
PWR_ClearFlag(PWR_FLAG_SB);
```

# 15 Reset and clock control (RCC)

The RCC can be used for a variety of purposes, including clock configuration, peripheral reset and clock management.

*Section 15.1: RCC register structure* describes the data structures used in the RCC Firmware Library. *Section 15.2: Firmware library functions* presents the Firmware Library functions.

## 15.1 RCC register structure

The RCC register structure, *RCC_TypeDef, is* defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CR;
  vu32 CFGR;
  vu32 CIR;
  vu32 APB2RSTR;
  vu32 APB1RSTR;
  vu32 AHBENR;
  vu32 APB2ENR;
  vu32 APB1ENR;
  vu32 BDCR;
  vu32 CSR;
} RCC_TypeDef;
```

*Table 336* gives the list of RCC registers.

**Table 336. RCC registers**

| Register | Description |
|---|---|
| CR | Clock control register |
| CFGR | Clock configuration register |
| CIR | Clock interrupt register |
| APB2RSTR | APB2 Peripheral reset register |
| APB1RSTR | APB1 Peripheral reset register |
| AHBENR | AHB Peripheral Clock enable register |
| APB2ENR | APB2 Peripheral Clock enable register |
| APB1ENR | APB1 Peripheral Clock enable register |
| BDCR | Backup domain control register |
| CSR | Control/status register |

The RCC peripheral is declared in the same file:

```
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
#define RCC_BASE              (AHBPERIPH_BASE + 0x1000)

#ifndef DEBUG
...
#ifdef _RCC
  #define RCC                 ((RCC_TypeDef *) RCC_BASE)
#endif /*_RCC */
...
#else   /* DEBUG */
...
#ifdef _RCC
  EXT RCC_TypeDef             *RCC;
#endif /*_RCC */
...
#endif
```

When using the Debug mode, RCC pointer is initialized in *stm32f10x_lib.c* file:

```
#ifdef _RCC
  RCC = (RCC_TypeDef *)  RCC_BASE;
#endif /*_RCC */
```

To access the reset and clock control registers, _RCC must be defined in *stm32f10x_conf.h* as follows:

```
#define _RCC
```

## 15.2 Firmware library functions

Table 337 gives the list of the various functions of the RCC library.

**Table 337. RCC firmware library functions**

| Function name | Description |
|---|---|
| RCC_DeInit | Resets the RCC peripheral registers to their default reset values. |
| RCC_HSEConfig | Configures the External High Speed oscillator (HSE). |
| RCC_WaitForHSEStartUp | Waits for HSE start-up. |
| RCC_AdjustHSICalibrationValue | Adjusts the Internal High Speed oscillator (HSI) calibration value. |
| RCC_HSICmd | Enables or disables the Internal High Speed oscillator (HSI). |
| RCC_PLLConfig | Configures the PLL clock source and multiplication factor. |
| RCC_PLLCmd | Enables or disables the PLL. |
| RCC_SYSCLKConfig | Configures the system clock (SYSCLK). |
| RCC_GetSYSCLKSource | Returns the clock source used as system clock. |
| RCC_HCLKConfig | Configures the AHB clock (HCLK). |
| RCC_PCLK1Config | Configures the Low Speed APB clock (PCLK1). |
| RCC_PCLK2Config | Configures the High Speed APB clock (PCLK2). |
| RCC_ITConfig | Enables or disables the specified RCC interrupts. |
| RCC_USBCLKConfig | Configures the USB clock (USBCLK). |
| RCC_ADCCLKConfig | Configures the ADC clock (ADCCLK). |
| RCC_LSEConfig | Configures the External Low Speed oscillator (LSE). |
| RCC_LSICmd | Enables or disables the Internal Low Speed oscillator (LSI). |
| RCC_RTCCLKConfig | Configures the RTC clock (RTCCLK). |
| RCC_RTCCLKCmd | Enables or disables the RTC clock. |
| RCC_GetClocksFreq | Returns the frequencies of different on chip clocks. |
| RCC_AHBPeriphClockCmd | Enables or disables the AHB peripheral clock. |
| RCC_APB2PeriphClockCmd | Enables or disables the High Speed APB (APB2) peripheral clock. |
| RCC_APB1PeriphClockCmd | Enables or disables the Low Speed APB (APB1) peripheral clock. |
| RCC_APB2PeriphResetCmd | Forces or releases High Speed APB (APB2) peripheral reset. |
| RCC_APB1PeriphResetCmd | Forces or releases Low Speed APB (APB1) peripheral reset. |
| RCC_BackupResetCmd | Forces or releases the Backup domain reset. |
| RCC_ClockSecuritySystemCmd | Enables or disables the Clock Security System. |
| RCC_MCOConfig | Selects the clock source to output on MCO pin. |
| RCC_GetFlagStatus | Checks whether the specified RCC flag is set or not. |
| RCC_ClearFlag | Clears the RCC reset flags. |

**Table 337. RCC firmware library functions**

| Function name | Description |
|---|---|
| RCC_GetITStatus | Checks whether the specified RCC interrupt has occurred or not. |
| RCC_ClearITPendingBit | Clears the RCC's interrupt pending bits. |

### 15.2.1 RCC_DeInit function

*Table 338* describes the RCC_DeInit function.

**Table 338. RCC_DeInit function[(1)(2)]**

| | |
|---|---|
| Function name | RCC_DeInit |
| Function prototype | void RCC_DeInit(void) |
| Behavior description | Resets the RCC peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

1. This function does not modify the HSITRIM[4:0] bits in RCC_CR register.
2. This function does not reset the RCC_BDCR and RCC_CSR registers.

**Example:**

```
/* Deinitialize the RCC registers */
RCC_DeInit();
```

### 15.2.2 RCC_HSEConfig function

*Table 339* describes the RCC_HSEConfig function.

**Table 339. RCC_HSEConfig function**

| | |
|---|---|
| Function name | RCC_HSEConfig |
| Function prototype | void RCC_HSEConfig(u32 RCC_HSE) |
| Behavior description | Configures the External High Speed oscillator (HSE). |
| Input parameter | RCC_HSE: new state of the HSE.<br>Refer to *Section : RCC_HSE* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | HSE can not be stopped if it is used directly or through the PLL as system clock. |
| Called functions | None |

#### RCC_HSE

This parameter configures the HSE state (see *Table 340*).

**Table 340. RCC_HSE definition**

| RCC_HSE | Description |
|---|---|
| RCC_HSE_OFF | HSE oscillator OFF |
| RCC_HSE_ON | HSE oscillator ON |
| RCC_HSE_Bypass | HSE oscillator bypassed with external clock |

**Example:**

```
/* Enable the HSE */
RCC_HSEConfig(RCC_HSE_ON);
```

### 15.2.3 RCC_WaitForHSEStartUp function

*Table 341* describes the RCC_WaitForHSEStartUp function.

**Table 341. RCC_WaitForHSEStartUp function**

| | |
|---|---|
| Function name | RCC_WaitForHSEStartUp |
| Function prototype | ErrorStatus RCC_WaitForHSEStartUp(void) |
| Behavior description | Waits for HSE start-up.<br>This functions waits till HSE is ready and exit if Time out is reached. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | An ErrorStatus enumuration value:<br>- SUCCESS: HSE oscillator is stable and ready to use<br>- ERROR: HSE oscillator not yet ready |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
ErrorStatus HSEStartUpStatus;

/* Enable HSE */
RCC_HSEConfig(RCC_HSE_ON);

/* Wait till HSE is ready and if Time out is reached exit */
HSEStartUpStatus = RCC_WaitForHSEStartUp();

  if(HSEStartUpStatus == SUCCESS)
  {
    /* Add here PLL ans system clock config */
  }
  else
  {
    /* Add here some code to deal with this error */
  }
```

### 15.2.4 RCC_AdjustHSICalibrationValue function

*Table 342* describes the RCC_AdjustHSICalibrationValue function.

**Table 342. RCC_AdjustHSICalibrationValue function**

| | |
|---|---|
| Function name | RCC_AdjustHSICalibrationValue |
| Function prototype | void RCC_AdjustHSICalibrationValue(u8 HSICalibrationValue) |
| Behavior description | Adjusts the Internal High Speed oscillator (HSI) calibration value. |
| Input parameter | HSICalibrationValue: calibration trimming value.<br>This parameter must be a number between 0 and 0x1F. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set HSI calibration value to c0x1F (maximum) */
RCC_AdjustHSICalibrationValue(0x1F);
```

### 15.2.5 RCC_HSICmd function

*Table 343* describes the RCC_HSICmd function.

**Table 343. RCC_HSICmd function**

| | |
|---|---|
| Function name | RCC_HSICmd |
| Function prototype | void RCC_HSICmd(FunctionalState NewState) |
| Behavior description | Enables or disables the Internal High Speed oscillator (HSI). |
| Input parameter | NewState: new state of the HSI.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | HSI can not be stopped if it is used directly or through the PLL as system clock, or if a Flash program operation is ongoing. |
| Called functions | None |

**Example:**

```
/* Enable Internal High Speed oscillator */
RCC_HSICmd(ENABLE);
```

### 15.2.6 RCC_PLLConfig function

*Table 344* describes the RCC_PLLConfig function.

**Table 344. RCC_PLLConfig function**

| | |
|---|---|
| Function name | RCC_PLLConfig |
| Function prototype | void RCC_PLLConfig(u32 RCC_PLLSource, u32 RCC_PLLMul) |
| Behavior description | Configures the PLL clock source and multiplication factor. |
| Input parameter1 | RCC_PLLSource: PLL entry clock source.<br>Refer to *Section : RCC_PLLSource* for more details on the allowed values of this parameter. |
| Input parameter2 | RCC_PLLMul: PLL multiplication factor.<br>Refer to *Section : RCC_PLLMul* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | This function must be used only when the PLL is disabled. |
| Called functions | None |

#### RCC_PLLSource

This parameter selects the PLL entry clock source (see *Table 345*).

**Table 345. RCC_PLLSource definition**

| RCC_PLLSource | Description |
|---|---|
| RCC_PLLSource_HSI_Div2 | PLL clock entry = HSI oscillator clock divided by 2 |
| RCC_PLLSource_HSE_Div1 | PLL clock entry = HSE oscillator clock |
| RCC_PLLSource_HSE_Div2PL L clock entry | PLL clock entry = HSE oscillator clock divided by 2 |

#### RCC_PLLMul

This parameter selects the PLL multiplication factor (see *Table 346*).

**Table 346. RCC_PLLMul definition**

| RCC_PLLMul | Description |
|---|---|
| RCC_PLLMul_2 | PLL clock entry x 2 |
| RCC_PLLMul_3 | PLL clock entry x 3 |
| RCC_PLLMul_4 | PLL clock entry x 4 |
| RCC_PLLMul_5 | PLL clock entry x 5 |
| RCC_PLLMul_6 | PLL clock entry x 6 |
| RCC_PLLMul_7 | PLL clock entry x 7 |
| RCC_PLLMul_8 | PLL clock entry x 8 |
| RCC_PLLMul_9 | PLL clock entry x 9 |

Table 346. RCC_PLLMul definition (continued)

| RCC_PLLMul | Description |
|---|---|
| RCC_PLLMul_10 | PLL clock entry x 10 |
| RCC_PLLMul_11 | PLL clock entry x 11 |
| RCC_PLLMul_12 | PLL clock entry x12 |
| RCC_PLLMul_13 | PLL clock entry x 13 |
| RCC_PLLMul_14 | PLL clock entry x 14 |
| RCC_PLLMul_15 | PLL clock entry x 15 |
| RCC_PLLMul_16 | PLL clock entry x 16 |

**Warning: The software must configure correctly the PLL to generate a PLL output frequency that does not exceed 72 MHz.**

**Example:**

```
/* Set PLL clock output to 72MHz using HSE (8MHz) as entry clock */
RCC_PLLConfig(RCC_PLLSource_HSE_Div1, RCC_PLLMul_9);
```

### 15.2.7 RCC_PLLCmd function

*Table 347* describes the RCC_PLLCmd function.

Table 347. RCC_PLLCmd function

| | |
|---|---|
| Function name | RCC_PLLCmd |
| Function prototype | void RCC_PLLCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the PLL. |
| Input parameter | NewState: new state of the PLL.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | The PLL can not be disabled if it is used as system clock. |
| Called functions | None |

**Example:**

```
/* Enable the PLL */
RCC_PLLCmd(ENABLE);
```

### 15.2.8 RCC_SYSCLKConfig function

*Table 348* describes the RCC_SYSCLKConfig function.

**Table 348. RCC_SYSCLKConfig function**

| | |
|---|---|
| Function name | RCC_SYSCLKConfig |
| Function prototype | void RCC_SYSCLKConfig(u32 RCC_SYSCLKSource) |
| Behavior description | Configures the system clock (SYSCLK). |
| Input parameter | RCC_SYSCLKSource: clock source used as system clock.<br>Refer to *Section : RCC_SYSCLKSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_SYSCLKSource

This parameter selects the system clock source (see *Table 349*).

**Table 349. RCC_SYSCLKSource definition**

| RCC_SYSCLKSource | Description |
|---|---|
| RCC_SYSCLKSource_HSI | HSI selected as system clock |
| RCC_SYSCLKSource_HSE | HSE selected as system clock |
| RCC_SYSCLKSource_PLLCLK | PLL selected as system clock |

**Example:**

```
/* Select the PLL as system clock source */
RCC_SYSCLKConfig(RCC_SYSCLKSource_PLLCLK);
```

### 15.2.9 RCC_GetSYSCLKSource function

*Table 350* describes the RCC_GetSYSCLKSource function.

**Table 350. RCC_GetSYSCLKSource function**

| | |
|---|---|
| Function name | RCC_GetSYSCLKSource |
| Function prototype | u8 RCC_GetSYSCLKSource(void) |
| Behavior description | Returns the clock source used as system clock. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The clock source used as system clock.The returned value can be one of the following:<br>- 0x00: HSI used as system clock<br>- 0x04: HSE used as system clock<br>- 0x08: PLL used as system clock |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Test if HSE is used as system clock */
if(RCC_GetSYSCLKSource() != 0x04)
{
}
else
{
}
```

### 15.2.10 RCC_HCLKConfig function

*Table 351* describes the RCC_HCLKConfig function.

**Table 351. RCC_HCLKConfig function**

| | |
|---|---|
| Function name | RCC_HCLKConfig |
| Function prototype | void RCC_HCLKConfig(u32 RCC_HCLK) |
| Behavior description | Configures the AHB clock(HCLK). |
| Input parameter | RCC_HCLK: defines the AHB clock. This clock is derived from the system clock (SYSCLK).<br>Refer to *Section : RCC_HCLK* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_HCLK

RCC_HCLK configures the AHB clock. Refer to *Table 352* for the values taken by this parameter.

**Table 352. RCC_HCLK values**

| RCC_HCLK | Description |
|---|---|
| RCC_SYSCLK_Div1 | AHB clock = SYSCLK |
| RCC_SYSCLK_Div2 | AHB clock = SYSCLK/2 |
| RCC_SYSCLK_Div4 | AHB clock = SYSCLK/4 |
| RCC_SYSCLK_Div8 | AHB clock = SYSCLK/8 |
| RCC_SYSCLK_Div16 | AHB clock = SYSCLK/16 |
| RCC_SYSCLK_Div64 | AHB clock = SYSCLK/64 |
| RCC_SYSCLK_Div128 | AHB clock = SYSCLK/128 |
| RCC_SYSCLK_Div256 | AHB clock = SYSCLK/256 |
| RCC_SYSCLK_Div512 | AHB clock = SYSCLK/512 |

**Example:**

```
/* Configure HCLK such as HCLK = SYSCLK */
RCC_HCLKConfig(RCC_SYSCLK_Div1);
```

### 15.2.11 RCC_PCLK1Config function

Table 353 describes the RCC_PCLK1Config function.

**Table 353. RCC_PCLK1Config function**

| | |
|---|---|
| Function name | RCC_PCLK1Config |
| Function prototype | `void RCC_PCLK1Config(u32 RCC_PCLK1)` |
| Behavior description | Configures the Low Speed APB clock (PCLK1). |
| Input parameter | RCC_PCLK1: defines the APB1 clock. This clock is derived from the AHB clock (HCLK).<br>Refer to *Section : RCC_PCLK1* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_PCLK1

RCC_PCLK1 configures the APB1 clock. Refer to Table 354 for the values taken by this parameter.

**Table 354. RCC_PCLK1 values**

| RCC_PCLK1 | Description |
|---|---|
| RCC_HCLK_Div1 | APB1 clock = HCLK |
| RCC_HCLK_Div2 | APB1 clock = HCLK/2 |
| RCC_HCLK_Div4 | APB1 clock = HCLK/4 |
| RCC_HCLK_Div8 | APB1 clock = HCLK/8 |
| RCC_HCLK_Div16 | APB1 clock = HCLK/16 |

**Example:**

```
/* Configure PCLK1 such as PCLK1 = HCLK/2 */
RCC_PCLK1Config(RCC_HCLK_Div2);
```

### 15.2.12 RCC_PCLK2Config function

*Table 355* describes the RCC_PCLK2Config function.

**Table 355. RCC_PCLK2Config function**

| | |
|---|---|
| Function name | RCC_PCLK2Config |
| Function prototype | `void RCC_PCLK2Config(u32 RCC_PCLK2)` |
| Behavior description | Configures the High Speed APB clock (PCLK2). |
| Input parameter | RCC_PCLK2: defines the APB2 clock. This clock is derived from the AHB clock (HCLK).<br>Refer to *Section : RCC_PCLK2* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_PCLK2

RCC_PCLK2 configures the APB2 clock. Refer to *Table 356* for the values taken by this parameter.

**Table 356. RCC_PCLK2 values**

| RCC_PCLK2 | Description |
|---|---|
| RCC_HCLK_Div1 | APB2 clock = HCLK |
| RCC_HCLK_Div2 | APB2 clock = HCLK/2 |
| RCC_HCLK_Div4 | APB2 clock = HCLK/4 |
| RCC_HCLK_Div8 | APB2 clock = HCLK/8 |
| RCC_HCLK_Div16 | APB2 clock = HCLK/16 |

**Example:**

```
/* Configure PCLK2 such as PCLK2 = HCLK */
RCC_PCLK2Config(RCC_HCLK_Div1);
```

### 15.2.13 RCC_ITConfig function

Table 357 describes the RCC_ITConfig function.

**Table 357. RCC_ITConfig function**

| | |
|---|---|
| Function name | RCC_ITConfig |
| Function prototype | `void RCC_ITConfig(u8 RCC_IT, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified RCC interrupts. |
| Input parameter1 | RCC_IT: specifies the RCC interrupt sources to be enabled or disabled.<br>Refer to *Section : RCC_IT* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified RCC interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_IT

RCC_IT enables or disables RCC interrupts. One or a combination of the following values can be used:

**Table 358. RCC_IT values**

| RCC_IT | Description |
|---|---|
| RCC_IT_LSIRDY | LSI ready interrupt |
| RCC_IT_LSERDY | LSE ready interrupt |
| RCC_IT_HSIRDY | HSI ready interrupt |
| RCC_IT_HSERDY | HSE ready interrupt |
| RCC_IT_PLLRDY | PLL ready interrupt |

**Example:**

```
/* Enable PLL Ready interrupt */
RCC_ITConfig(RCC_IT_PLLRDY, ENABLE);
```

### 15.2.14 RCC_USBCLKConfig function

*Table 359* describes the RCC_USBCLKConfig function.

**Table 359. RCC_USBCLKConfig function**

| | |
|---|---|
| Function name | RCC_USBCLKConfig |
| Function prototype | `void RCC_USBCLKConfig(u32 RCC_USBCLKSource)` |
| Behavior description | Configures the USB clock (USBCLK). |
| Input parameter | RCC_USBCLKSource specifies the USB clock source. This clock is derived from the PLL output.<br>Refer to *Section : RCC_USBCLKSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | The USB needs a 48 MHz clock to operate correctly. The user must select the USB division factor according to the PLL multiplication factor and PLL clock source frequency in order to obtain a 48 MHz frequency. Once the USB clock is enabled, the USB division factor cannot be modified. |
| Called functions | None |

#### RCC_USBCLKSource

This parameter selects the USB clock source (see *Table 360*).

**Table 360. RCC_USBCLKSource values**

| RCC_USBCLKSource | Description |
|---|---|
| RCC_USBCLKSource_PLLCLK_1Div5 | USB clock source = PLL clock divided by 1.5 selected |
| RCC_USBCLKSource_PLLCLK_Div1 | USB clock source = PLL clock selected |

**Example:**

```
/* PLL clock divided by 1.5 used as USB clock source */
RCC_USBCLKConfig(RCC_USBCLKSource_PLLCLK_1Div5);
```

### 15.2.15 RCC_ADCCLKConfig function

*Table 361* describes the RCC_ADCCLKConfig function.

**Table 361. RCC_ADCCLKConfig function**

| | |
|---|---|
| Function name | RCC_ADCCLKConfig |
| Function prototype | `void RCC_ADCCLKConfig(u32 RCC_ADCCLK)` |
| Behavior description | Configures the ADC clock (ADCCLK). |
| Input parameter | RCC_ADCCLK defines the ADC clock. This clock is derived from the APB2 clock (PCLK2).<br>Refer to *Section : RCC_ADCCLK* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_ADCCLK

RCC_ADCCLK configures the ADC clock. Refer to *Table 362* for the values taken by this parameter.

**Table 362. RCC_ADCCLK values**

| RCC_ADCCLK | Description |
|---|---|
| RCC_PCLK2_Div2 | ADC clock = PCLK2/2 |
| RCC_PCLK2_Div4 | ADC clock = PCLK2/4 |
| RCC_PCLK2_Div6 | ADC clock = PCLK2/6 |
| RCC_PCLK2_Div8 | ADC clock = PCLK2/8 |

**Example:**

```
/* Configure ADCCLK such as ADCCLK = PCLK2/2 */
RCC_ADCCLKConfig(RCC_PCLK2_Div2);
```

### 15.2.16 RCC_LSEConfig function

Table 363 describes the RCC_LSEConfig function.

**Table 363. RCC_LSEConfig function**

| | |
|---|---|
| Function name | RCC_LSEConfig |
| Function prototype | `void RCC_LSEConfig(u32 RCC_LSE)` |
| Behavior description | Configures the External Low Speed oscillator (LSE). |
| Input parameter | RCC_LSE: new state of the LSE.<br>Refer to Section : RCC_LSE for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_LSE

This parameter configures the LSE state (see Table 364).

**Table 364. RCC_LSE values**

| RCC_LSE | Description |
|---|---|
| RCC_LSE_OFF | LSE oscillator OFF |
| RCC_LSE_ON | LSE oscillator ON |
| RCC_LSE_Bypass | LSE oscillator bypassed with external clock |

**Example:**

```
/* Enable the LSE */
RCC_LSEConfig(RCC_LSE_ON);
```

### 15.2.17 RCC_LSICmd function

*Table 365* describes the RCC_LSICmd function.

**Table 365. RCC_LSICmd function**

| | |
|---|---|
| Function name | RCC_LSICmd |
| Function prototype | `void RCC_LSICmd(FunctionalState NewState)` |
| Behavior description | Enables or disables the Internal Low Speed oscillator (LSI). |
| Input parameter | NewState: new state of the LSI.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | LSI can not be disabled if the IWDG is running. |
| Called functions | None |

**Example:**

```
/* Enable the Internal Low Speed oscillator */
RCC_LSICmd(ENABLE);
```

### 15.2.18 RCC_RTCCLKConfig function

*Table 366* describes the RCC_RTCCLKConfig function.

**Table 366. RCC_RTCCLKConfig function**

| | |
|---|---|
| Function name | RCC_RTCCLKConfig |
| Function prototype | `void RCC_RTCCLKConfig(u32 RCC_RTCCLKSource)` |
| Behavior description | Configures the RTC clock (RTCCLK). |
| Input parameter | RCC_RTCCLKSource: RTC clock source.<br>Refer to *Section : RCC_RTCCLKSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Once the RTC clock is selected it cannot be changed unless the Backup domain is reset. |
| Called functions | None |

### RCC_RTCCLKSource

This parameter selects the RTC clock source (see *Table 367*).

**Table 367. RCC_RTCCLKSource values**

| RCC_RTCCLKSource | Description |
|---|---|
| RCC_RTCCLKSource_LSE | LSE selected as RTC clock |
| RCC_RTCCLKSource_LSI | LSI selected as RTC clock |
| RCC_RTCCLKSource_HSE_Div128 | HSE clock divided by 128 selected as RTC clock |

**Example:**

```
/* Select the LSE as RTC clock source */
RCC_RTCCLKConfig(RCC_RTCCLKSource_LSE);
```

## 15.2.19 RCC_RTCCLKCmd function

*Table 368* describes the RCC_RTCCLKCmd function.

**Table 368. RCC_RTCCLKCmd function**

| | |
|---|---|
| Function name | RCC_RTCCLKCmd |
| Function prototype | `void RCC_RTCCLKCmd(FunctionalState NewState)` |
| Behavior description | Enables or disables the RTC clock. |
| Input parameter | NewState: new state of the RTC clock.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | This function must be used only after the RTC clock was selected using the RCC_RTCCLKConfig function. |
| Called functions | None |

**Example:**

```
/* Enable the RTC clock */
RCC_RTCCLKCmd(ENABLE);
```

### 15.2.20 RCC_GetClocksFreq function

Table 369 describes the RCC_GetClocksFreq function.

**Table 369. RCC_GetClocksFreq function**

| | |
|---|---|
| Function name | RCC_GetClocksFreq |
| Function prototype | `void RCC_GetClocksFreq(RCC_ClocksTypeDef* RCC_Clocks)` |
| Behavior description | Returns the frequencies of different on chip clocks. |
| Input parameter | RCC_Clocks: pointer to an RCC_ClocksTypeDef structure which contains the clock frequencies.<br>Refer to the *Section : RCC_ClocksTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## RCC_ClocksTypeDef structure

The RCC_ClocksTypeDef structure is defined in the *stm32f10x_rcc.h* file:

```
typedef struct
{
  u32 SYSCLK_Frequency;
  u32 HCLK_Frequency;
  u32 PCLK1_Frequency;
  u32 PCLK2_Frequency;
  u32 ADCCLK_Frequency;
}RCC_ClocksTypeDef;
```

### SYSCLK_Frequency

This member returns SYSCLK clock frequency expressed in Hz.

### HCLK_Frequency

This member returns HCLK clock frequency expressed in Hz.

### PCLK1_Frequency

This member returns PCLK1 clock frequency expressed in Hz.

### PCLK2_Frequency

This member returns PCLK2 clock frequency expressed in Hz.

### ADCCLK_Frequency

This member returns ADCCLK clock frequency expressed in Hz.

**Example:**

```
/* Get the frequencies of different on chip clocks */
RCC_ClocksTypeDef RCC_Clocks;
RCC_GetClocksFreq(&RCC_Clocks);
```

### 15.2.21 RCC_AHBPeriphClockCmd function

*Table 370* describes the RCC_AHBPeriphClockCmd function.

**Table 370. RCC_AHBPeriphClockCmd function**

| | |
|---|---|
| Function name | RCC_AHBPeriphClockCmd |
| Function prototype | void RCC_AHBPeriphClockCmd(u32 RCC_AHBPeriph, FunctionalState NewState) |
| Behavior description | Enables or disables the AHB peripheral clock. |
| Input parameter1 | RCC_AHBPeriph: AHB peripheral to gate the clock.<br>Refer to *Section : RCC_AHBPeriph* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified peripheral clock.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_AHBPeriph

This parameter selects the AHB peripheral that gates the clock. One or a combination of the following values can be used:

**Table 371. RCC_AHBPeriph values(1)**

| RCC_AHBPeriph | Description |
|---|---|
| RCC_AHBPeriph_DMA | DMA clock |
| RCC_AHBPeriph_SRAM | SRAM clock |
| RCC_AHBPeriph_FLITF | FLITF clock |

1. SRAM and FLITF clock can be disabled only during sleep mode.

**Example:**

```
/* Enable DMA clock */
RCC_AHBPeriphClockCmd(RCC_AHBPeriph_DMA);
```

### 15.2.22 RCC_APB2PeriphClockCmd function

*Table 372* describes the RCC_APB2PeriphClockCmd function.

**Table 372. RCC_APB2PeriphClockCmd function**

| | |
|---|---|
| Function name | RCC_APB2PeriphClockCmd |
| Function prototype | void RCC_APB2PeriphClockCmd(u32 RCC_APB2Periph, FunctionalState NewState) |
| Behavior description | Enables or disables the High Speed APB (APB2) peripheral clock. |
| Input parameter1 | RCC_APB2Periph: APB2 peripheral to gate the clock.<br>Refer to *Section : RCC_APB2Periph* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified peripheral clock.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_APB2Periph

This parameter selects the APB2 peripheral that gates the clock. One or a combination of the following values can be used:

**Table 373. RCC_APB2Periph values**

| RCC_APB2Periph | Description |
|---|---|
| RCC_APB2Periph_AFIO | Alternate Function I/O clock |
| RCC_APB2Periph_GPIOA | IO port A clock |
| RCC_APB2Periph_GPIOB | IO port B clock |
| RCC_APB2Periph_GPIOC | IO port C clock |
| RCC_APB2Periph_GPIOD | IO port D clock |
| RCC_APB2Periph_GPIOE | IO port E clock |
| RCC_APB2Periph_ADC1 | ADC 1 interface clock |
| RCC_APB2Periph_ADC2 | ADC 2 interface clock |
| RCC_APB2Periph_TIM1 | TIM1 clock |
| RCC_APB2Periph_SPI1 | SPI1 clock |
| RCC_APB2Periph_USART1 | USART1 clock |
| RCC_APB2Periph_ALL | All APB2 peripheral clock |

**Example:**

```
/* Enable GPIOA, GPIOB and SPI1 clocks */
RCC_APB2PeriphClockCmd(RCC_APB2Periph_GPIOA | RCC_APB2Periph_GPIOB |
                       RCC_APB2Periph_SPI1, ENABLE);
```

### 15.2.23 RCC_APB1PeriphClockCmd function

Table 374 describes the RCC_APB1PeriphClockCmd function.

**Table 374. RCC_APB1PeriphClockCmd function**

| | |
|---|---|
| Function name | RCC_APB1PeriphClockCmd |
| Function prototype | void RCC_APB1PeriphClockCmd(u32 RCC_APB1Periph, FunctionalState NewState) |
| Behavior description | Enables or disables the Low Speed APB (APB1) peripheral clock. |
| Input parameter1 | RCC_APB1Periph: APB1 peripheral to gates its clock.<br>Refer to *Section : RCC_APB1Periph* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified peripheral clock.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### RCC_APB1Periph

This parameter selects the APB1 peripheral that gates the clock. One or a combination of the following values can be used:

**Table 375. RCC_APB1Periph values**

| RCC_APB1Periph | Description |
|---|---|
| RCC_APB1Periph_TIM2 | TIM2 clock |
| RCC_APB1Periph_TIM3 | TIM3 clock |
| RCC_APB1Periph_TIM4 | TIM4 clock |
| RCC_APB1Periph_WWDG | Window Watchdog clock |
| RCC_APB1Periph_SPI2 | SPI2 clock |
| RCC_APB1Periph_USART2 | USART2 clock |
| RCC_APB1Periph_USART3 | USART3 clock |
| RCC_APB1Periph_I2C1 | I2C1 clock |
| RCC_APB1Periph_I2C2 | I2C2 clock |
| RCC_APB1Periph_USB | USB clock |
| RCC_APB1Periph_CAN | CAN clock |
| RCC_APB1Periph_BKP | Backup interface clock |
| RCC_APB1Periph_PWR | Power Controller interface clock |
| RCC_APB1Periph_ALL | All APB1 peripheral clock |

**Example:**

```
/* Enable BKP and PWR clocks */
RCC_APB1PeriphClockCmd(RCC_APB1Periph_BKP | RCC_APB1Periph_PWR,
ENABLE);
```

### 15.2.24 RCC_APB2PeriphResetCmd function

*Table 376* describes the RCC_APB2PeriphResetCmd function.

**Table 376. RCC_APB2PeriphResetCmd function**

| | |
|---|---|
| Function name | RCC_APB2PeriphResetCmd |
| Function prototype | void RCC_APB2PeriphResetCmd(u32 RCC_APB2Periph, FunctionalState NewState) |
| Behavior description | Forces or releases High Speed APB (APB2) peripheral reset. |
| Input parameter1 | RCC_APB2Periph: APB2 peripheral to reset.<br>Refer to *Section : RCC_APB2Periph* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified peripheral reset.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enter the SPI1 peripheral to reset */
RCC_APB2PeriphResetCmd(RCC_APB2Periph_SPI1, ENABLE);

/* Exit the SPI1 peripheral from reset */
RCC_APB2PeriphResetCmd(RCC_APB2Periph_SPI1, DISABLE);
```

### 15.2.25 RCC_APB1PeriphResetCmd function

*Table 377* describes the RCC_APB1PeriphResetCmd function.

**Table 377. RCC_APB1PeriphResetCmd function**

| | |
|---|---|
| Function name | RCC_APB1PeriphResetCmd |
| Function prototype | void RCC_APB1PeriphResetCmd(u32 RCC_APB1Periph, FunctionalState NewState) |
| Behavior description | Forces or releases Low Speed APB (APB1) peripheral reset. |
| Input parameter1 | RCC_APB1Periph: specifies the APB1 peripheral to reset.<br>Refer to *Section : RCC_APB1Periph* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified peripheral reset.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enter the SPI2 peripheral to reset */
RCC_APB1PeriphResetCmd(RCC_APB1Periph_SPI2, ENABLE);

/* Exit the SPI2 peripheral from reset */
RCC_APB1PeriphResetCmd(RCC_APB1Periph_SPI2, DISABLE);
```

### 15.2.26 RCC_BackupResetCmd function

*Table 378* describes the RCC_BackupResetCmd function.

**Table 378. RCC_BackupResetCmd function**

| | |
|---|---|
| Function name | RCC_BackupResetCmd |
| Function prototype | `void RCC_BackupResetCmd(FunctionalState NewState)` |
| Behavior description | Forces or releases the Backup domain reset. |
| Input parameter | NewState: new state of the Backup domain reset.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Reset the entire Backup domain */
RCC_BackupResetCmd(ENABLE);
```

### 15.2.27 RCC_ClockSecuritySystemCmd function

*Table 379* describes the RCC_ClockSecuritySystemCmd function.

**Table 379. RCC_ClockSecuritySystemCmd function**

| | |
|---|---|
| Function name | RCC_ClockSecuritySystemCmd |
| Function prototype | void RCC_ClockSecuritySystemCmd(FunctionalState NewState) |
| Behavior description | Enables or disables the Clock Security System. |
| Input parameter | NewState: new state of the Clock Security System.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the Clock Security System */
RCC_ClockSecuritySystemCmd(ENABLE);
```

### 15.2.28 RCC_MCOConfig function

*Table 380* describes the RCC_MCOConfig function.

**Table 380. RCC_MCOConfig function**

| | |
|---|---|
| Function name | RCC_MCOConfig |
| Function prototype | `void RCC_MCOConfig(u8 RCC_MCO)` |
| Behavior description | Selects the clock source to output on MCO pin. |
| Input parameter | RCC_MCO: specifies the clock source to output.<br>Refer to *Section : RCC_MCO* or more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### RCC_MCO

RCC_MCO selects the clock source to output on MCO pin. Refer to *Table 381* for the values taken by this parameter.

**Table 381. RCC_MCO values**

| RCC_MCO | Description |
|---|---|
| RCC_MCO_NoClock | No clock selected |
| RCC_MCO_SYSCLK | System clock selected |
| RCC_MCO_HSI | HSI oscillator clock selected |
| RCC_MCO_HSE | HSE oscillator clock selected |
| RCC_MCO_PLLCLK_Div2 | PLL clock divided by 2 selected |

**Warning: When selecting the System Clock to be output onto MCO, make sure that its frequency does not exceed 50 MHz (the maximum I/O speed).**

**Example:**

```
/* Output PLL clock divided by 2 on MCO pin */
RCC_MCOConfig(RCC_MCO_PLLCLK_Div2);
```

### 15.2.29 RCC_GetFlagStatus function

*Table 382* describes the RCC_GetFlagStatus function.

**Table 382. RCC_GetFlagStatus function**

| | |
|---|---|
| Function name | RCC_GetFlagStatus |
| Function prototype | FlagStatus RCC_GetFlagStatus(u8 RCC_FLAG) |
| Behavior description | Checks whether the specified RCC flag is set or not. |
| Input parameter | RCC_FLAG: the flag to check.<br>Refer to *Section : RCC_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of RCC_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**RCC_FLAG**

The RCC flags that can be checked by issuing an RCC_GetFlagStatus function are listed in *Table 383*.

**Table 383. RCC_FLAG values**

| RCC_FLAG | Description |
|---|---|
| RCC_FLAG_HSIRDY | HSI oscillator clock ready |
| RCC_FLAG_HSERDY | HSE oscillator clock ready |
| RCC_FLAG_PLLRDY | PLL clock ready |
| RCC_FLAG_LSERDY | LSE oscillator clock ready |
| RCC_FLAG_LSIRDY | LSI oscillator clock ready |
| RCC_FLAG_PINRST | Pin reset |
| RCC_FLAG_PORRST | POR/PDR reset |
| RCC_FLAG_SFTRST | Software reset |
| RCC_FLAG_IWDGRST | Independent Watchdog reset |
| RCC_FLAG_WWDGRST | Window Watchdog reset |
| RCC_FLAG_LPWRRST | Low Power reset |

**Example:**

```
/* Test if the PLL clock is ready or not */
FlagStatus Status;
Status = RCC_GetFlagStatus(RCC_FLAG_PLLRDY);
if(Status == RESET)
{
...
}
else
{
...
}
```

### 15.2.30 RCC_ClearFlag function

*Table 384* describes the RCC_ClearFlag function.

**Table 384. RCC_ClearFlag function**

| | |
|---|---|
| Function name | RCC_ClearFlag |
| Function prototype | `void RCC_ClearFlag(void)` |
| Behavior description | Clears the RCC reset flags.<br>The reset flags are:<br>RCC_FLAG_PINRST, RCC_FLAG_PORRST, RCC_FLAG_SFTRST, RCC_FLAG_IWDGRST, RCC_FLAG_WWDGRST, RCC_FLAG_LPWRRST |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the reset flags */
RCC_ClearFlag();
```

### 15.2.31 RCC_GetITStatus function

*Table 385* describes the RCC_GetITStatus function.

**Table 385. RCC_GetITStatus function**

| | |
|---|---|
| Function name | RCC_GetITStatus |
| Function prototype | ITStatus RCC_GetITStatus(u8 RCC_IT) |
| Behavior description | Checks whether the specified RCC interrupt has occurred or not. |
| Input parameter | RCC_IT: RCC interrupt source to check.<br>Refer to *Section : RCC_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of RCC_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### RCC_IT

RCC_IT enables or disables RCC interrupts. One or a combination of the following values can be used:

**Table 386. RCC_IT values**

| RCC_IT | Description |
|---|---|
| RCC_IT_LSIRDY | LSI ready interrupt |
| RCC_IT_LSERDY | LSE ready interrupt |
| RCC_IT_HSIRDY | HSI ready interrupt |
| RCC_IT_HSERDY | HSE ready interrupt |
| RCC_IT_PLLRDY | PLL ready interrupt |
| RCC_IT_CSS | Clock Security System interrupt |

**Example:**

```
/* Test if the PLL Ready interrupt has occurred or not */
ITStatus Status;
Status = RCC_GetITStatus(RCC_IT_PLLRDY);
if(Status == RESET)
{
...
}
else
{
...
}
```

## 15.2.32 RCC_ClearITPendingBit function

*Table 387* describes the RCC_ClearITPendingBit function.

**Table 387. RCC_ClearITPendingBit function**

| | |
|---|---|
| Function name | RCC_ClearITPendingBit |
| Function prototype | void RCC_ClearITPendingBit(u8 RCC_IT) |
| Behavior description | Clears the RCC's interrupt pending bits. |
| Input parameter | RCC_IT: specifies the interrupt pending bit to clear.<br>Refer to *Section : RCC_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### RCC_IT

RCC_IT enables or disables RCC interrupts. One or a combination of the following values can be used:

**Table 388. RCC_IT values**

| RCC_IT | Description |
|---|---|
| RCC_IT_LSIRDY | LSI ready interrupt |
| RCC_IT_LSERDY | LSE ready interrupt |
| RCC_IT_HSIRDY | HSI ready interrupt |
| RCC_IT_HSERDY | HSE ready interrupt |
| RCC_IT_PLLRDY | PLL ready interrupt |
| RCC_IT_CSS | Clock Security System interrupt |

**Example:**

```
/* Clear the PLL Ready interrupt pending bit */
RCC_ClearITPendingBit(RCC_IT_PLLRDY);
```

# 16 Real-time clock (RTC)

The RTC provides a set of continuously running counters which can be used, with suitable software, to provide a clock-calendar function. The counter values can be written to set the current time/date of the system.

*Section 16.1: RTC register structure* describes the data structures used in the RTC Firmware Library. *Section 16.2: Firmware library functions* presents the Firmware Library functions.

## 16.1 RTC register structure

The RTC register structure, RTC_*TypeDef*, is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 CRH;
  u16 RESERVED1;
  vu16 CRL;
  u16 RESERVED2;
  vu16 PRLH;
  u16 RESERVED3;
  vu16 PRLL;
  u16 RESERVED4;
  vu16 DIVH;
  u16 RESERVED5;
  vu16 DIVL;
  u16 RESERVED6;
  vu16 CNTH;
  u16 RESERVED7;
  vu16 CNTL;
  u16 RESERVED8;
  vu16 ALRH;
  u16 RESERVED9;
  vu16 ALRL;
  u16 RESERVED10;
} RTC_TypeDef;
```

*Table 389* gives the list of the RTC registers.

**Table 389. RTC registers**

| Register | Description |
|---|---|
| CRH | Control Register High |
| CRL | Control Register Low |
| PRLH | Prescaler Load Register High |
| PRLL | Prescaler Load Register Low |
| DIVH | Divider Register High |
| DIVL | Divider Register Low |
| CNTH | Counter Register High |
| CNTL | Counter Register Low |

**Table 389. RTC registers (continued)**

| Register | Description |
|---|---|
| ALRH | Alarm Register High |
| ALRL | Alarm Register Low |

The RTC peripheral is declared in *stm32f10x_map.h*:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)
...
#define RTC_BASE              (APB1PERIPH_BASE + 0x2800)

#ifndef DEBUG
...
#ifdef _RTC
  #define RTC                 ((RTC_TypeDef *) RTC_BASE)
#endif /*_RTC */
...
#else   /* DEBUG */
...
#ifdef _RTC
  EXT RTC_TypeDef           *RTC;
#endif /*_RTC */
...
#endif
```

When using the Debug mode, RTC pointer is initialized in *stm32f10x_lib.c* file:

```
#ifdef _RTC
  RTC = (RTC_TypeDef *)  RTC_BASE;
#endif /*_RTC */
```

To access the RTC registers, _RTC must be defined in *stm32f10x*_conf.h as follows:

```
#define _RTC
```

## 16.2 Firmware library functions

*Table 390* gives the list of the various RTC library functions.

**Table 390. RTC firmware library functions**

| Function name | Description |
|---|---|
| RTC_ITConfig | Enables or disables the specified RTC interrupts. |
| RTC_EnterConfigMode | Enters the RTC configuration mode. |
| RTC_ExitConfigMode | Exits from the RTC configuration mode. |
| RTC_GetCounter | Gets the RTC counter value. |
| RTC_SetCounter | Sets the RTC counter value. |
| RTC_SetPrescaler | Sets the RTC prescaler value. |
| RTC_SetAlarm | Sets the RTC Alarm value. |
| RTC_GetDivider | Gets the RTC Divider value. |
| RTC_WaitForLastTask | Waits until last write operation on RTC registers is completed |
| RTC_WaitForSynchro | Waits until the RTC registers (RTC_CNT, RTC_ALR and RTC_PRL) are synchronized with RTC APB clock. |
| RTC_GetFlagStatus | Checks whether the specified RTC flag is set or not. |
| RTC_ClearFlag | Clears the RTC pending flags. |
| RTC_GetITStatus | Checks whether the specified RTC interrupt has occurred or not. |
| RTC_ClearITPendingBit | Clears the RTC interrupt pending bits. |

### 16.2.1 RTC_ITConfig function

*Table 391* describes the RTC_ITConfig function.

**Table 391. RTC_ITConfig function**

| | |
|---|---|
| Function name | RTC_ITConfig |
| Function prototype | void RTC_ITConfig(u16 RTC_IT, FunctionalState NewState) |
| Behavior description | Enables or disables the specified RTC interrupts. |
| Input parameter1 | RTC_IT: RTC interrupts sources to be enabled or disabled.<br>Refer to *Section : RTC_IT* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified RTC interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before using this function, you must call RTC_WaitForLastTask() function (wait until RTOFF flag is set). |
| Called functions | None |

#### RTC_IT

RTC_IT enables or disables RTC interrupts. One or a combination of the following values can be used:

**Table 392. RTC_IT values**

| RTC_IT | Description |
|---|---|
| RTC_IT_OW | Overflow interrupt enabled |
| RTC_IT_ALR | Alarm interrupt enabled |
| RTC_IT_SEC | Second interrupt enabled |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Alarm interrupt enabled */
RTC_ITConfig(RTC_IT_ALR, ENABLE);
```

### 16.2.2 RTC_EnterConfigMode function

*Table 393* describes RTC_EnterConfigMode function.

**Table 393. RTC_EnterConfigMode function**

| | |
|---|---|
| Function name | RTC_EnterConfigMode |
| Function prototype | `void RTC_EnterConfigMode(void)` |
| Behavior description | Enters the RTC configuration mode. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the configuration mode */
RTC_EnterConfigMode();
```

### 16.2.3 RTC_ExitConfigMode function

*Table 394* describes the RTC_ExitConfigMode function.

**Table 394. RTC_ExitConfigMode function**

| | |
|---|---|
| Function name | RTC_ExitConfigMode |
| Function prototype | `void RTC_ExitConfigMode(void)` |
| Behavior description | Exits from the RTC configuration mode. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Exit the configuration mode */
RTC_ExitConfigMode();
```

### 16.2.4 RTC_GetCounter function

*Table 395* describes the RTC_GetCounter function.

**Table 395. RTC_GetCounter function**

| | |
|---|---|
| Function name | RTC_GetCounter |
| Function prototype | `u32 RTC_GetCounter(void)` |
| Behavior description | Gets the RTC counter value. |
| Output parameter | None |
| Return parameter | RTC counter value |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Gets the counter value */
u32 RTCCounterValue;
RTCCounterValue = RTC_GetCounter();
```

### 16.2.5 RTC_SetCounter function

*Table 396* describes RTC_SetCounter function.

**Table 396. RTC_SetCounter function**

| | |
|---|---|
| Function name | RTC_SetCounter |
| Function prototype | `void RTC_SetCounter(u32 CounterValue)` |
| Behavior description | Sets the RTC counter value. |
| Input parameter | CounterValue: RTC counter new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before issuing this function, call RTC_WaitForLastTask() function (wait until RTOFF flag is set) |
| Called functions | RTC_EnterConfigMode()<br>RTC_ExitConfigMode() |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Sets Counter value to 0xFFFF5555 */
RTC_SetCounter(0xFFFF5555);
```

### 16.2.6 RTC_SetPrescaler function

Table 397 describes the RTC_SetPrescaler function.

**Table 397. RTC_SetPrescaler function**

| | |
|---|---|
| Function name | RTC_SetPrescaler |
| Function prototype | `void RTC_SetPrescaler(u32 PrescalerValue)` |
| Behavior description | Sets the RTC prescaler value. |
| Input parameter | PrescalerValue: RTC prescaler new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before using this function, call RTC_WaitForLastTask() function (wait until RTOFF flag is set). |
| Called functions | RTC_EnterConfigMode()<br>RTC_ExitConfigMode() |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Sets Prescaler value to 0x7A12 */
RTC_SetPrescaler(0x7A12);
```

### 16.2.7 RTC_SetAlarm function

*Table 398* describes the RTC_SetAlarm function.

**Table 398. RTC_SetAlarm function**

| | |
|---|---|
| Function name | RTC_SetAlarm |
| Function prototype | `void RTC_SetAlarm(u32 AlarmValue)` |
| Behavior description | Sets the RTC alarm value. |
| Input parameter | AlarmValue: RTC alarm new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before using this function, call *RTC_WaitForLastTask()* function (wait until RTOFF flag is set). |
| Called functions | RTC_EnterConfigMode()<br>RTC_ExitConfigMode() |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Sets Alarm value to 0xFFFFFFFA */
RTC_SetAlarm(0xFFFFFFFA);
```

### 16.2.8 RTC_GetDivider function

*Table 399* describes RTC_GetDivider function.

**Table 399. RTC_GetDivider function**

| | |
|---|---|
| Function name | RTC_GetDivider |
| Function prototype | `u32 RTC_GetDivider(void)` |
| Behavior description | Gets the RTC Divider value. |
| Output parameter | None |
| Return parameter | RTC divider value |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the current RTC Divider value */
u32 RTCDividerValue;
RTCDividerValue = RTC_GetDivider();
```

### 16.2.9 RTC_WaitForLastTask function

*Table 400* describes RTC_WaitForLastTask function.

**Table 400. RTC_WaitForLastTask function**

| | |
|---|---|
| Function name | RTC_WaitForLastTask |
| Function prototype | `void RTC_WaitForLastTask(void)` |
| Behavior description | Waits until last write operation on RTC registers is completed.<br>This function must be called before any write operation to an RTC register. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();
/* Sets Alarm value to 0x10 */
RTC_SetAlarm(0x10);
```

### 16.2.10 RTC_WaitForSynchro function

*Table 401* describes RTC_WaitForSynchro function.

**Table 401. RTC_WaitForSynchro function**

| | |
|---|---|
| Function name | RTC_WaitForSynchro |
| Function prototype | `void RTC_WaitForSynchro(void)` |
| Behavior description | Waits until the RTC registers (RTC_CNT, RTC_ALR and RTC_PRL) are synchronized with RTC APB clock.<br>This function must be called before any read operation after an APB reset or an APB clock stop. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Wait until the RTC registers are synchronized with RTC APB clock */
RTC_WaitForSynchro();
```

### 16.2.11 RTC_GetFlagStatus function

*Table 402* describes RTC_GetFlagStatus function

**Table 402. RTC_GetFlagStatus function**

| | |
|---|---|
| Function name | RTC_GetFlagStatus |
| Function prototype | `FlagStatus RTC_GetFlagStatus(u16 RTC_FLAG)` |
| Behavior description | Checks whether the specified RTC flag is set or not. |
| Input parameter | RTC_FLAG: specifies the flag to check.<br>Refer to *Section : RTC_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of RTC_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**RTC_FLAG**

The RTC flags that can be checked by issuing an RTC_GetFlagStatus function are listed in *Table 403*.

**Table 403. RTC_FLAG values**

| RTC_FLAG | Description |
|---|---|
| RTC_FLAG_RTOFF | RTC operation OFF Flag |
| RTC_FLAG_RSF | Registers Synchronized Flag |
| RTC_FLAG_OW | Overflow interrupt Flag |
| RTC_FLAG_ALR | Alarm interrupt Flag |
| RTC_FLAG_SEC | Second interrupt Flag |

**Example:**

```
/* Gets the RTC overflow interrupt status */
FlagStatus OverrunFlagStatus;
OverrunFlagStatus = RTC_GetFlagStatus(RTC_Flag_OW);
```

### 16.2.12 RTC_ClearFlag function

Table 404 describes RTC_ClearFlag function.

**Table 404. RTC_ClearFlag function**

| | |
|---|---|
| Function name | RTC_ClearFlag |
| Function prototype | `void RTC_ClearFlag(u16 RTC_FLAG)` |
| Behavior description | Clears the RTC's pending flags. |
| Input parameter | RTC_FLAG: flag to be cleared.<br>Refer to Section : RTC_FLAG for more details on the allowed values of this parameter.<br>The RTC_FLAG_RTOFF cannot be cleared by software. The RTC_FLAG_RSF is cleared only after an APB reset or an APB clock stop. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before using this function, call RTC_WaitForLastTask() function (wait until RTOFF flag is set). |
| Called functions | None |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Clears the RTC overflow flag */
RTC_ClearFlag(RTC_FLAG_OW);
```

### 16.2.13 RTC_GetITStatus function

Table 405 describes the RTC_GetITStatus function.

**Table 405. RTC_GetITStatus function**

| | |
|---|---|
| Function name | RTC_GetITStatus |
| Function prototype | `ITStatus RTC_GetITStatus(u16 RTC_IT)` |
| Behavior description | Checks whether the specified RTC interrupt has occurred or not. |
| Input parameter | RTC_IT: RTC interrupt source to check.<br>Refer to Section : RTC_IT or more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of the RTC_IT(SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the RTC Second interrupt status */
ITStatus SecondITStatus;
SecondITStatus = RTC_GetITStatus(RTC_IT_SEC);
```

### 16.2.14 RTC_ClearITPendingBit function

*Table 406* describes the RTC_ClearITPendingBit function.

**Table 406. RTC_ClearITPendingBit function**

| | |
|---|---|
| Function name | RTC_ClearITPendingBit |
| Function prototype | `void RTC_ClearITPendingBit(u16 RTC_IT)` |
| Behavior description | Clears the RTC's interrupt pending bits. |
| Input parameter | RTC_IT: interrupt pending bit to clear.<br>Refer to *Section : RTC_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | Before using this function, call RTC_WaitForLastTask() function (wait until RTOFF flag is set). |
| Called functions | None |

**Example:**

```
/* Wait until last write operation on RTC registers is terminated */
RTC_WaitForLastTask();

/* Clears the RTC Second interrupt */
RTC_ClearITPendingBit(RTC_IT_SEC);
```

# 17 Serial peripheral interface (SPI)

The Serial Peripheral Interface (SPI) allows synchronous serial communication with external devices. The interface can be configured to operate in master or slave mode.

*Section 17.1: SPI register structure* describes the data structures used in the SPI Firmware Library. *Section 17.2: Firmware library functions* presents the Firmware Library functions.

## 17.1 SPI register structure

The SPI register structure, *SPI_TypeDef*, is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 CR1;
  u16 RESERVED0;
  vu16 CR2;
  u16 RESERVED1;
  vu16 SR;
  u16  RESERVED2;
  vu16 DR;
  u16  RESERVED3;
  vu16 CRCPR;
  u16 RESERVED4;
  vu16 RXCRCR;
  u16  RESERVED5;
  vu16 TXCRCR;
  u16  RESERVED6;
} SPI_TypeDef;
```

*Table 407* gives the list of SPI registers.

**Table 407. SPI registers**

| Register | Description |
|---|---|
| CR1 | SPI Control Register1 |
| CR2 | SPI Control Register2 |
| SR | SPI Status Register |
| DR | SPI Data Register |
| CRCPR | SPI CRC Polynomial Register |
| RxCRCR | SPI Rx CRC Register |
| TxCRCR | SPI Tx CRC Register |

The two SPI peripherals are declared in *stm32f10x_map.h*:

```
...
#define PERIPH_BASE             ((u32)0x40000000)
#define APB1PERIPH_BASE         PERIPH_BASE
#define APB2PERIPH_BASE         (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE          (PERIPH_BASE + 0x20000)
....
#define SPI1_BASE               (APB2PERIPH_BASE + 0x3000)
#define SPI2_BASE               (APB1PERIPH_BASE + 0x3800)
....
#ifndef DEBUG
...
#ifdef _SPI1
  #define SPI1                  ((SPI_TypeDef *) SPI1_BASE)
#endif /*_SPI1 */

#ifdef _SPI2
  #define SPI2                  ((SPI_TypeDef *) SPI2_BASE)
#endif /*_SPI2 */
...
#else   /* DEBUG */
...
#ifdef _SPI1
  EXT SPI_TypeDef               *SPI1;
#endif /*_SPI1 */

#ifdef _SPI2
  EXT SPI_TypeDef               *SPI2;
#endif /*_SPI2 */
...
#endif
```

When using the Debug mode, _SPI1 and _SPI2 pointers are initialized in *stm32f10x_lib.c* file:

```
...
#ifdef _SPI1
  SPI1 = (SPI_TypeDef *)  SPI1_BASE;
#endif /*_SPI1 */

#ifdef _SPI2
  SPI2 = (SPI_TypeDef *)  SPI2_BASE;
#endif /*_SPI2 */
...
```

To access the SPI registers, _SPI, _SPI1 and _SPI2 must be defined in *stm32f10x_conf.h* as follows:

```
...
#define _SPI
#define _SPI1
#define _SPI2
...
```

## 17.2 Firmware library functions

*Table 408* lists the various functions of the SPI library.

**Table 408. SPI firmware library functions**

| Function name | Description |
|---|---|
| SPI_DeInit | Resets the SPIx peripheral registers to their default reset values. |
| SPI_Init | Initializes the SPIx peripheral according to the specified parameters in the SPI_InitStruct. |
| SPI_StructInit | Fills each SPI_InitStruct member with its default value. |
| SPI_Cmd | Enables or disables the specified SPI peripheral. |
| SPI_ITConfig | Enables or disables the specified SPI interrupts. |
| SPI_DMACmd | Enables or disables the SPIx DMA interface. |
| SPI_SendData | Transmits data through the SPIx peripheral. |
| SPI_ReceiveData | Returns the most recent received data by the SPIx peripheral. |
| SPI_NSSInternalSoftwareConfig | Configures internally by software the NSS pin for the selected SPI. |
| SPI_SSOutputCmd | Enables or disables the SS output for the selected SPI. |
| SPI_DataSizeConfig | Configures the data size for the selected SPI. |
| SPI_TransmitCRC | Transmits the SPIx CRC value |
| SPI_CalculateCRC | Enables or disables the CRC value calculation of the transferred bytes. |
| SPI_GetCRC | Returns the transmit or the receive CRC register value for the specified SPI. |
| SPI_GetCRCPolynomial | Returns the CRC Polynomial register value for the specified SPI. |
| SPI_BiDirectionalLineConfig | Selects the data transfer direction in bidirectional mode for the specified SPI. |
| SPI_GetFlagStatus | Checks whether the specified SPI flag is set or not. |
| SPI_ClearFlag | Clears the SPIx pending flags. |
| SPI_GetITStatus | Checks whether the specified SPI interrupt has occurred or not. |
| SPI_ClearITPendingBit | Clears the SPIx interrupt pending bits. |

### 17.2.1 SPI_DeInit function

*Table 409* describes the SPI_DeInit function.

**Table 409. SPI_DeInit function**

| | |
|---|---|
| Function name | SPI_DeInit |
| Function prototype | void SPI_DeInit(SPI_TypeDef* SPIx) |
| Behavior description | Resets the SPIx peripheral registers to their default reset values. |
| Input parameter | SPIx: where x can be 1 or 2 to select the SPI peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphClockCmd() for SPI1<br>RCC_APB1PeriphClockCmd() for SPI2 |

**Example:**

```
/* Deinitialize the SPI2 */
SPI_DeInit(SPI2);
```

### 17.2.2 SPI_Init function

*Table 410* describes the SPI_Init function.

**Table 410. SPI_Init function**

| | |
|---|---|
| Function name | SPI_Init |
| Function prototype | void SPI_Init(SPI_TypeDef* SPIx, SPI_InitTypeDef* SPI_InitStruct) |
| Behavior description | Initializes the SPIx peripheral according to the parameters specified in the SPI_InitStruct. |
| Input parameter1 | SPIx: where x can be 1 or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_InitStruct: pointer to a SPI_InitTypeDef structure that contains the configuration information for the specified SPI peripheral.<br>Refer to the *Section : SPI_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## SPI_InitTypeDef structure

The SPI_InitTypeDef structure is defined in the *stm32f10x_spi.h* file:

```
typedef struct
{
u16 SPI_Direction;
  u16 SPI_Mode;
u16 SPI_DataSize;
  u16 SPI_CPOL;
  u16 SPI_CPHA;
  u16 SPI_NSS;
  u16 SPI_BaudRatePrescaler;
  u16 SPI_FirstBit;
  u16 SPI_CRCPolynomial;
} SPI_InitTypeDef;
```

### SPI_Direction

SPI_Direction configures the SPI unidirectional or bidirectional data mode. Refer to *Table 411* for the values taken by this member.

**Table 411. SPI_Direction definition**

| SPI_Direction | Description |
|---|---|
| SPI_Direction_2Lines_FullDuplex | SPI configured as 2 lines unidirectional full duplex |
| SPI_Direction_2Lines_RxOnly | SPI configured as 2 lines unidirectional Rx only |
| SPI_Direction_1Line_Rx | SPI configured as 1 line bidirectional Rx only |
| SPI_Direction_1Line_Tx | SPI configured as 1 line bidirectional Tx only |

### SPI_Mode

SPI_Mode configures the SPI operating mode. Refer to *Table 412* for the values taken by this member.

**Table 412. SPI_Mode definition**

| SPI_Mode | Description |
|---|---|
| SPI_Mode_Master | SPI configured as a master |
| SPI_Mode_Slave | SPI configured as a slave |

### SPI_DataSize

SPI_DataSize configures the SPI data size. Refer to *Table 413* for the values taken by this member.

**Table 413. SPI_DataSize definition**

| SPI_DataSize | Description |
|---|---|
| SPI_DataSize_16b | SPI 16-bit data frame format for transmission and reception |
| SPI_DataSize_8b | SPI 8-bit data frame format for transmission and reception |

### SPI_CPOL

SPI_CPOL selects the serial clock steady state. Refer to *Table 414* for the values taken by this member.

**Table 414. SPI_CPOL definition**

| SPI_CPOL | Description |
|---|---|
| SPI_CPOL_High | Clock idle high |
| SPI_CPOL_Low | Clock idle low |

### SPI_CPHA

SPI_CPHA configures the clock active edge for the bit capture. Refer to *Table 415* for the values taken by this member.

**Table 415. SPI_CPHA definition**

| SPI_CPHA | Description |
|---|---|
| SPI_CPHA_2Edge | Data is captured on the second edge |
| SPI_CPHA_1Edge | Data is captured on the first edge |

### SPI_NSS

SPI_NSS specifies whether the NSS signal is managed by hardware (NSS pin) or by software using the SSI bit. Refer to *Table 416* for the values taken by this member.

**Table 416. SPI_NSS definition**

| SPI_NSS | Description |
|---|---|
| SPI_NSS_Hard | NSS managed by external pin |
| SPI_NSS_Soft | Internal NSS signal controlled by SSI bit |

### SPI_BaudRatePrescaler

SPI_BaudRatePrescaler is used to define the Baud Rate prescaler value which will be used to configure the transmit and receive SCK clock. Refer to *Table 417* for the values taken by this member.

**Table 417. SPI_BaudRatePrescaler definition**

| SPI_BaudratePrescaler | Description |
|---|---|
| SPI_BaudRatePrescaler2 | Baud Rate Prescaler equal to 2 |
| SPI_BaudRatePrescaler4 | Baud Rate Prescaler equal to 4 |
| SPI_BaudRatePrescaler8 | Baud Rate Prescaler equal to 8 |
| SPI_BaudRatePrescaler16 | Baud Rate Prescaler equal to 16 |
| SPI_BaudRatePrescaler32 | Baud Rate Prescaler equal to 32 |
| SPI_BaudRatePrescaler64 | Baud Rate Prescaler equal to 64 |
| SPI_BaudRatePrescaler128 | Baud Rate Prescaler equal to 128 |
| SPI_BaudRatePrescaler256 | Baud Rate Prescaler equal to 256 |

*Note: The communication clock is derived from the master clock. The slave clock does not need to be set.*

### SPI_FirstBit

SPI_FirstBit specifies whether data transfers start from MSB or LSB bit. Refer to *Table 418* for the values taken by this member.

**Table 418. SPI_FirstBit definition**

| SPI_FirstBit | Description |
|---|---|
| SPI_FisrtBit_MSB | First bit to transfer is the MSB |
| SPI_FisrtBit_LSB | First bit to transfer is the LSB |

### SPI_CRCPolynomial

SPI_CRCPolynomial defines the polynomial used for the CRC calculation.

**Example**:

```
/* Initialize the SPI1 according to the SPI_InitStructure members */
SPI_InitTypeDef  SPI_InitStructure;
SPI_InitStructure.SPI_Direction = SPI_Direction_2Lines_FullDuplex;
SPI_InitStructure.SPI_Mode = SPI_Mode_Master;
SPI_InitStructure.SPI_DatSize = SPI_DatSize_16b;
SPI_InitStructure.SPI_CPOL = SPI_CPOL_Low;
SPI_InitStructure.SPI_CPHA = SPI_CPHA_2Edge;
SPI_InitStructure.SPI_NSS = SPI_NSS_Soft;
SPI_InitStructure.SPI_BaudRatePrescaler =
SPI_BaudRatePrescaler_128;
SPI_InitStructure.SPI_FirstBit = SPI_FirstBit_MSB;
SPI_InitStructure.SPI_CRCPolynomial = 7;
SPI_Init(SPI1, &SPI_InitStructure);
```

## 17.2.3 SPI_StructInit function

*Table 419* describes the SPI_StructInit function.

**Table 419. SPI_StructInit function**

| | |
|---|---|
| Function name | SPI_StructInit |
| Function prototype | `void SPI_StructInit(SPI_InitTypeDef* SPI_InitStruct)` |
| Behavior description | Fills each SPI_InitStruct member with its default value. |
| Input parameter | SPI_InitStruct: pointer to a SPI_InitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

Refer to *Table 420* for the SPI_InitStruct member default values.

**Table 420. SPI_InitStruct default values**

| Member | Default value |
|---|---|
| SPI_Direction | SPI_Direction_2Lines_FullDuplex |
| SPI_Mode | SPI_Mode_Slave |
| SPI_DataSize | SPI_DataSize_8b |
| SPI_CPOL | SPI_CPOL_Low |
| SPI_CPHA | SPI_CPHA_1Edge |
| SPI_NSS | SPI_NSS_Hard |
| SPI_BaudRatePrescaler | SPI_BaudRatePrescaler_2 |
| SPI_FirstBit | SPI_FirstBit_MSB |
| SPI_CRCPolynomial | 7 |

**Example:**

```
/* Initialize an SPI_InitTypeDef structure */
SPI_InitTypeDef  SPI_InitStructure;
SPI_StructInit(&SPI_InitStructure);
```

## 17.2.4 SPI_Cmd function

*Table 421* describes the SPI_Cmd function.

**Table 421. SPI_Cmd function**

| | |
|---|---|
| Function name | SPI_Cmd |
| Function prototype | `void SPI_Cmd(SPI_TypeDef* SPIx, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified SPI peripheral. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | NewState: new state of the SPIx peripheral.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable SPI1 */
SPI_Cmd(SPI1, ENABLE);
```

### 17.2.5 SPI_ITConfig function

*Table 422* describes the SPI_ITConfig function.

**Table 422. SPI_ITConfig function**

| | |
|---|---|
| Function name | SPI_ITConfig |
| Function prototype | `void SPI_ITConfig(SPI_TypeDef* SPIx, u8 SPI_IT, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified SPI interrupts. |
| Input parameter1 | SPIx: where x can be 1 or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_IT: SPI interrupt source to be enabled or disabled.<br>Refer to *Section : SPI_IT* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified SPI interrupt.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SPI_IT

SPI_IT enables or disables SPI interrupts. See *Table 423* for the values taken by this parameter.

**Table 423. SPI_IT flags**

| SPI_IT | Description |
|---|---|
| SPI_IT_TXE | Tx buffer empty interrupt mask |
| SPI_IT_RXNE | Rx buffer not empty interrupt mask |
| SPI_IT_ERR | Error interrupt mask |

**Example:**

```
/* Enable SPI2 Tx buffer empty interrupt */
SPI_ITConfig(SPI2, SPI_IT_TXE, ENABLE);
```

### 17.2.6 SPI_DMACmd function

*Table 424* describes the SPI_DMACmd function.

**Table 424. SPI_DMACmd function**

| | |
|---|---|
| Function name | SPI_DMACmd |
| Function prototype | `void SPI_DMACmd(SPI_TypeDef* SPIx, u16 SPI_DMAReq, FunctionalState NewState)` |
| Behavior description | Enables or disables the SPIx DMA interface. |
| Input parameter1 | SPIx: where x can be 1 or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_DMAReq: SPI DMA transfer request to be enabled or disabled.<br>Refer to *Section : SPI_DMAReq* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the selected SPI DMA transfer request.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SPI_DMAReq

SPI_DMAReq enables or disables SPI Tx or/and Rx DMA transfer requests. See *Table 425* for the values taken by this parameter.

**Table 425. SPI_DMAReq values**

| SPI_DMAReq | Description |
|---|---|
| SPI_DMAReq_Tx | Selects Tx buffer DMA transfer request |
| SPI_DMAReq_Rx | Selects Rx buffer DMA transfer request |

**Example**:

```
/* Enable SPI2 Rx buffer DMA transfer request */
SPI_DMACmd(SPI2, SPI_DMAReq_Rx, ENABLE);
```

### 17.2.7 SPI_SendData function

*Table 426* describes the SPI_SendData function.

**Table 426. SPI_SendData function**

| | |
|---|---|
| Function name | SPI_SendData |
| Function prototype | `void SPI_SendData(SPI_TypeDef* SPIx, u16 Data)` |
| Behavior description | Transmits data through the SPIx peripheral. |
| Input parameter1 | SPIx: where x can be 1 or 2 to select the SPI peripheral. |
| Input parameter 2 | Data: Byte or half word to be transmitted. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Send 0xA5 through the SPI1 peripheral */
SPI_SendData(SPI1, 0xA5);
```

### 17.2.8 SPI_ReceiveData function

*Table 427* describes the SPI_ReceiveData function.

**Table 427. SPI_ReceiveData function**

| | |
|---|---|
| Function name | SPI_ReceiveData |
| Function prototype | `u16 SPI_ReceiveData(SPI_TypeDef* SPIx)` |
| Behavior description | Returns the most recent data received through the SPIx peripheral. |
| Input parameter | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Output parameter | None |
| Return parameter | The value of the received data. |
| Required preconditions | None |
| Called functions | None |

**Example**:

```
/* Read the most recent data received by the SPI2 peripheral */
u16 ReceivedData;
ReceivedData = SPI_ReceiveData(SPI2);
```

### 17.2.9 SPI_NSSInternalSoftwareConfig function

*Table 428* describes the SPI_NSSInternalSoftwareConfig function.

**Table 428. SPI_NSSInternalSoftwareConfig function**

| | |
|---|---|
| Function name | SPI_NSSInternalSoftwareConfig |
| Function prototype | `void SPI_NSSInternalSoftwareConfig(SPI_TypeDef* SPIx, u16 SPI_NSSInternalSoft)` |
| Behavior description | Internally configures by software the NSS pin for the specified SPIx interface. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_NSSInternalSoft: SPI NSS internal state.<br>Refer to *Section : SPI_NSSInternalSoft* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SPI_NSSInternalSoft

SPI_NSSInternalSoft internally sets or resets the NSS pin. See *Table 429* for the values taken by this parameter.

**Table 429. SPI_NSSInternalSoft values**

| SPI_NSSInternalSoft | Description |
|---|---|
| SPI_NSSInternalSoft_Set | Set NSS pin internally |
| SPI_NSSInternalSoft_Reset | Reset NSS pin internally |

**Example:**

```
/* Set internaly by software the SPI1 NSS pin */
SPI_NSSInternalSoftwareConfig(SPI1, SPI_NSSInternalSoft_Set);

/* Reset internaly by sofwtare the SPI2 NSS pin */
SPI_NSSInternalSoftwareConfig(SPI2, SPI_NSSInternalSoft_Reset);
```

### 17.2.10 SPI_SSOutputCmd function

*Table 430* describes the SPI_SSOutputCmd function.

**Table 430. SPI_SSOutputCmd function**

| | |
|---|---|
| Function name | SPI_SSOutputCmd |
| Function prototype | `void SPI_SSOutputCmd(SPI_TypeDef* SPIx, FunctionalState NewState)` |
| Behavior description | Enables or disables the SS output for the selected SPI. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | NewState: new state of the SPIx SS output.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the SPI1 SS output: single master mode */
SPI_SSOutputCmd(SPI1, ENABLE);
```

### 17.2.11 SPI_DatSizeConfig function

*Table 431* describes the SPI_DatSizeConfig function.

**Table 431. SPI_DatSizeConfig function**

| | |
|---|---|
| Function name | SPI_DataSizeConfig |
| Function prototype | `void SPI_DataSizeConfig(SPI_TypeDef* SPIx, u16 SPI_DatSize)` |
| Behavior description | Configures the data size for the selected SPI peripheral |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_DataSize: SPI data size.<br>Refer to *Section : SPI_DataSize* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SPI_DataSize

SPI_DataSize sets 8-bit or 16-bit data frame format. See *Table 432* for the values taken by this parameter.

**Table 432. SPI_DataSize values**

| SPI_NSSInternalSoft | Description |
|---|---|
| SPI_DataSize_8b | Set 8bit data size |
| SPI_DataSize_16b | Set 16bit data size |

**Example:**

```
/* Set 8bit data frame format for SPI1 */
SPI_DataSizeConfig(SPI1, SPI_DataSize_8b);

/* Set 16bit data frame format for SPI2 */
SPI_DataSizeConfig(SPI2, SPI_DataSize_16b);
```

### 17.2.12 SPI_TransmitCRC function

*Table 433* describes the SPI_TransmitCRC function.

**Table 433. SPI_TransmitCRC function**

| | |
|---|---|
| Function name | SPI_TransmitCRC |
| Function prototype | `void SPI_TransmitCRC(SPI_TypeDef* SPIx)` |
| Behavior description | Transmit of the SPIx CRC value. |
| Input parameter | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the CRC transfer for SPI1 */
SPI_TransmitCRC(SPI1);
```

### 17.2.13 SPI_CalculateCRC function

*Table 434* describes the SPI_CalculateCRC function.

**Table 434. SPI_CalculateCRC function**

| | |
|---|---|
| Function name | SPI_CalculateCRC |
| Function prototype | `void SPI_CalculateCRC(SPI_TypeDef* SPIx, FunctionalState NewState)` |
| Behavior description | Enables or disables the CRC value calculation of the transferred bytes. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | NewState: new state of the SPIx CRC value calculation.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the CRC calculation for the transfered bytes from SPI2 */
SPI_CalculateCRC(SPI2, ENABLE);
```

### 17.2.14 SPI_GetCRC function

Table 435 describes the SPI_GetCRC function.

**Table 435. SPI_GetCRC function**

| | |
|---|---|
| Function name | SPI_GetCRC |
| Function prototype | `u16 SPI_GetCRC(SPI_TypeDef* SPIx, u8 SPI_CRC)` |
| Behavior description | Returns the transmit or the receive CRC register value for the specified SPI peripheral. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_CRC: CRC register to be read.<br>Refer to *Section : SPI_CRC* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The selected CRC register value. |
| Required preconditions | None |
| Called functions | None |

#### SPI_CRC

SPI_CRC selects the SPI Rx or SPI Tx CRC register. See *Table 436* for the values taken by this parameter.

**Table 436. SPI_CRC values**

| SPI_CRC | Description |
|---|---|
| SPI_CRC_Tx | Selects Tx CRC register |
| SPI_CRC_Rx | Selects Rx CRC register |

**Example:**

```
/* Returns the SPI1 transmit CRC register */
u16 CRCValue;
CRCValue = SPI_GetCRC(SPI1, SPI_CRC_Tx);
```

### 17.2.15 SPI_GetCRCPolynomial function

*Table 437* describes the SPI_GetCRCPolynomial function.

**Table 437. SPI_GetCRCPolynomial function**

| | |
|---|---|
| Function name | SPI_GetCRCPolynomial |
| Function prototype | `u16 SPI_GetCRCPolynomial(SPI_TypeDef* SPIx)` |
| Behavior description | Returns the CRC Polynomial register value for the specified SPI. |
| Input parameter | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Output parameter | None |
| Return parameter | The CRC Polynomial register value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Returns the SPI2 CRC polynomial register */
u16 CRCPolyValue;
CRCPolyValue = SPI_GetCRCPolynomial(SPI2);
```

### 17.2.16 SPI_BiDirectionalLineConfig function

*Table 438* describes the SPI_BiDirectionalLineConfig function.

**Table 438. SPI_BiDirectionalLineConfig function**

| | |
|---|---|
| Function name | SPI_BiDirectionalLineConfig |
| Function prototype | `SPI_BiDirectionalLineConfig(SPI_TypeDef* SPIx, u16 SPI_Direction)` |
| Behavior description | Selects the data transfer direction in bidirectional mode for the specified SPI. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_Direction: data transfer direction in bidirectional mode.<br>Refer to *Section : SPI_Direction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SPI_Direction

SPI_Direction configures data transfer direction in bidirectional mode. See *Table 439* for the values taken by this parameter.

**Table 439. SPI_Direction values**

| SPI_Direction | Description |
|---|---|
| SPI_Direction_Tx | Selects Tx transmission direction |
| SPI_Direction_Rx | Selects Rx receive direction |

**Example:**

```
/* Set the SPI2 in bidirectional transmit only mode */
SPI_BiDirectionalLineConfig(SPI_Direction_Tx);
```

### 17.2.17 SPI_GetFlagStatus function

Table 440 describes the SPI_GetFlagStatus function.

**Table 440. SPI_GetFlagStatus function**

| | |
|---|---|
| Function name | SPI_GetFlagStatus |
| Function prototype | `FlagStatus SPI_GetFlagStatus(SPI_TypeDef* SPIx, u16 SPI_FLAG)` |
| Behavior description | Checks whether the specified SPI flag is set or not. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_FLAG: flag to be checked.<br>Refer to Section : SPI_FLAG for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of SPI_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**SPI_FLAG**

The SPI flags that can be checked by issuing an SPI_GetFlagStatus function are listed in Table 441.

**Table 441. SPI_FLAG flags**

| SPI_FLAG | Description |
|---|---|
| SPI_FLAG_BSY | Busy flag |
| SPI_FLAG_OVR | Overrun flag |
| SPI_FLAG_MODF | Mode Fault flag |
| SPI_FLAG_CRCERR | CRC Error flag |
| SPI_FLAG_TXE | Transmit buffer empty flag |
| SPI_FLAG_RXNE | Receive buffer not empty flag |

**Example:**

```
/* Test if the SPI1 transmit buffer empty flag is set or not */
FlagStatus Status;
Status = SPI_GetFlagStatus(SPI1, SPI_FLAG_TXE);
```

### 17.2.18 SPI_ClearFlag function

Table 442 describes the SPI_ClearFlag function.

**Table 442. SPI_ClearFlag function**

| | |
|---|---|
| Function name | SPI_ClearFlag |
| Function prototype | `void SPI_ClearFlag(SPI_TypeDef* SPIx, u16 SPI_FLAG)` |
| Behavior description | Clears the SPIx pending flags. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_FLAG: flag to be cleared.<br>Refer to Section : SPI_FLAG for more details on the allowed values of this parameter.<br>Note: BSY, TXE and RXNE flags are reset by hardware |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the SPI2 Overrun pending bit */
SPI_ClearFlag(SPI2, SPI_FLAG_OVR);
```

### 17.2.19 SPI_GetITStatus function

*Table 443* describes the SPI_GetITStatus function.

**Table 443. SPI_GetITStatus function**

| | |
|---|---|
| Function name | SPI_GetITStatus |
| Function prototype | `ITStatus SPI_GetITStatus(SPI_TypeDef* SPIx, u8 SPI_IT)` |
| Behavior description | Checks whether the specified SPI interrupt has occurred or not. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_IT: SPI interrupt source to be checked.<br>Refer to *Section : SPI_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of SPI_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### SPI_IT

The SPI interrupt that can be checked by issuing an SPI_GetITStatus function are listed in *Table 444*.

**Table 444. SPI_IT flags**

| SPI_IT | Description |
|---|---|
| SPI_IT_OVR | Overrun interrupt flag |
| SPI_IT_MODF | Mode Fault interrupt flag |
| SPI_IT_CRCERR | CRC Error interrupt flag |
| SPI_IT_TXE | Transmit buffer empty interrupt flag |
| SPI_IT_RXNE | Receive buffer not empty interrupt flag |

**Example**:

```
/* Test if the SPI1 Overrun interrupt has occurred or not */
ITStatus Status;
Status = SPI_GetITStatus(SPI1, SPI_IT_OVR);
```

### 17.2.20 SPI_ClearITPendingBit function

Table 445 describes the SPI_ClearITPendingBit function.

**Table 445. SPI_ClearITPendingBit function**

| | |
|---|---|
| Function name | SPI_ClearITPending Bit |
| Function prototype | `void SPI_ClearITPendingBit(SPI_TypeDef* SPIx, u8 SPI_IT)` |
| Behavior description | Clears the SPIx interrupt pending bits. |
| Input parameter1 | SPIx: where x can be 1or 2 to select the SPI peripheral. |
| Input parameter2 | SPI_IT: specifies the SPI interrupt pending bit to clear.<br>Refer to Section : SPI_IT for more details on the allowed values of this parameter.<br>Note: TXE and RXNE interrupt flags are reset by hardware |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the SPI2 CRC error interrupt pending bit */
SPI_ClearITPendingBit(SPI2, SPI_IT_CRCERR);
```

# 18 Cortex system timer (SysTick)

The Systick provides a simple 24-bit decrementing wrap-on-zero clear-on-write counter with a flexible control mechanism.

*Section 18.1: SysTick register structure* describes the data structures used in the SysTick Firmware Library. *Section 18.2: Firmware library functions* presents the Firmware Library functions.

## 18.1 SysTick register structure

The SysTick register structure, *SysTick_TypeDef, is* defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CTRL;
  vu32 LOAD;
  vu32 VAL;
  vuc32 CALIB;
} SysTick_TypeDef;
```

*Table 446* gives the list of the SysTick registers.

**Table 446. SysTick registers**

| Register | Description |
|---|---|
| CTRL | SysTick Control and Status Register |
| LOAD | SysTick Reload value Register |
| VAL | SysTick Current value Register |
| CALIB | SysTick Calibration value Register |

The SysTick peripheral is declared in *stm32f10x_map*.h:

```
#define SCS_BASE              ((u32)0xE000E000)
#define SysTick_BASE          (SCS_BASE + 0x0010)
#ifndef DEBUG
...
#ifdef _SysTick
  #define SysTick             ((SysTick_TypeDef *) SysTick_BASE)
#endif /*_SysTick */
...
#else   /* DEBUG */
...
#ifdef _SysTick
  EXT SysTick_TypeDef         *SysTick;
#endif /*_SysTick */
...
#endif
```

When using the Debug mode, SysTick pointer is initialized in *stm32f10x_lib.c* file:

```
#ifdef _SysTick
SysTick = (SysTick_TypeDef *)  SysTick_BASE;
#endif /*_SysTick */
```

To access the SysTick registers, _SysTick must be defined in *stm32f10x_conf.h* as follows:

```
#define _SysTick
```

## 18.2 Firmware library functions

*Table 447* gives the list of the various functions of the SysTick library.

**Table 447. SysTick firmware library functions**

| Function name | Description |
|---|---|
| SysTick_CLKSourceConfig | Configures the SysTick clock source. |
| SysTick_SetReload | Sets SysTick Reload value. |
| SysTick_CounterCmd | Enables or disables the SysTick counter. |
| SysTick_ITConfig | Enables or disables the SysTick Interrupt. |
| SysTick_GetCounter | Gets SysTick counter value. |
| SysTick_GetFlagStatus | Checks whether the specified SysTick flag is set or not. |

### 18.2.1 SysTick_CLKSourceConfig function

*Table 448* describes the SysTick_CLKSourceConfig function.

**Table 448. SysTick_CLKSourceConfig function**

| | |
|---|---|
| Function name | SysTick_CLKSourceConfig |
| Function prototype | `void SysTick_CLKSourceConfig(u32 SysTick_CLKSource)` |
| Behavior description | Configures the SysTick clock source. |
| Input parameter | SysTick_CLKSource: SysTick clock source.<br>Refer to *Section : SysTick_CLKSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### SysTick_CLKSource

SysTick_CLKSource selects the SysTick clock source. Refer to *Table 449* for the values taken by this parameter.

**Table 449. SysTick_CLKSource values**

| SysTick_CLKSource | Description |
|---|---|
| SysTick_CLKSource_HCLK_Div8 | SysTick clock source = AHB clock divided by 8 |
| SysTick_CLKSource_HCLK | SysTick clock source = AHB clock |

**Example:**

```
/* AHB clock selected as SysTick clock source */
SysTick_CLKSourceConfig(SysTick_CLKSource_HCLK);
```

## 18.2.2 SysTick_SetReload function

*Table 450* describes the SysTick_SetReload function.

**Table 450. SysTick_SetReload function**

| | |
|---|---|
| Function name | SysTick_SetReload |
| Function prototype | `void SysTick_SetReload(u32 Reload)` |
| Behavior description | Sets SysTick Reload value. |
| Input parameter | Reload: SysTick Reload new value.<br>This parameter must be a number between 1 and 0x00FFFFFF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set SysTick reload value to 0xFFFF */
SysTick_SetReload(0xFFFF);
```

### 18.2.3 SysTick_CounterCmd function

*Table 451* describes the SysTick_CounterCmd function.

**Table 451. SysTick_CounterCmd function**

| | |
|---|---|
| Function name | SysTick_CounterCmd |
| Function prototype | `void SysTick_CounterCmd(u32 SysTick_Counter)` |
| Behavior description | Enables or disables the SysTick counter. |
| Input parameter | SysTick_Counter: new state of the SysTick counter.<br>Refer to *Section : SysTick_Counter* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### SysTick_Counter

SysTick_Counter selects the SysTick counter state. Refer to *Table 452* for the values taken by this parameter.

**Table 452. SysTick_Counter values**

| SysTick_Counter | Description |
|---|---|
| SysTick_Counter_Disable | Disable counter |
| SysTick_Counter_Enable | Enable counter |
| SysTick_Counter_Clear | Clear counter value to 0 |

**Example:**

```
/* Enable SysTick counter */
SysTick_CounterCmd(SysTick_Counter_Enable);
```

### 18.2.4 SysTick_ITConfig function

*Table 453* describes the SysTick_ITConfig function.

**Table 453. SysTick_ITConfig function**

| | |
|---|---|
| Function name | SysTick_ITConfig |
| Function prototype | `void SysTick_ITConfig(FunctionalState NewState)` |
| Behavior description | Enables or disables the SysTick Interrupt. |
| Input parameter | NewState: new state of the SysTick Interrupt.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable SysTick interrupt */
SysTick_ITConfig(ENABLE);
```

### 18.2.5 SysTick_GetCounter function

*Table 454* describes the SysTick_GetCounter function.

**Table 454. SysTick_GetCounter function**

| | |
|---|---|
| Function name | SysTick_GetCounter |
| Function prototype | `u32 SysTick_GetCounter(void)` |
| Behavior description | Gets SysTick counter value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | SysTick current value. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Get SysTick current counter value */
u32 SysTickCurrentCounterValue;
SysTickCurrentCounterValue = SysTick_GetCounter();
```

### 18.2.6 SysTick_GetFlagStatus function

*Table 455* describes the SysTick_GetFlagStatus function.

**Table 455. SysTick_GetFlagStatus function**

| | |
|---|---|
| Function name | SysTick_GetFlagStatus |
| Function prototype | `FlagStatus SysTick_GetFlagStatus(u8 SysTick_FLAG)` |
| Behavior description | Checks whether the specified SysTick flag is set or not. |
| Input parameter | SysTick_FLAG: flag to be checked.<br>Refer to *Section : SysTick_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of SysTick_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### SysTick_FLAG

The SysTick flags that can be checked by issuing a SysTick_GetFlagStatus function are listed in the following table:

**Table 456. SysTick flags**

| SysTick_FLAG | Description |
|---|---|
| SysTick_FLAG_COUNT | 1 = timer counted to 0 since last time this was read. |
| SysTick_FLAG_SKEW | 1 = the calibration value is not exactly 10ms because of clock frequency. |
| SysTick_FLAG_NOREF | 1 = the reference clock is not provided |

**Example:**

```
/* Test if the Count flag is set or not */
FlagStatus Status;
Status = SysTick_GetFlagStatus(SysTick_FLAG_COUNT);
if(Status == RESET)
{
...
}
else
{
...
}
```

# 19 General-purpose timer (TIM)

The timer consists of a 16-bit auto-reload counter driven by a programmable prescaler.

It can be used for a variety of purposes, including measurement of input signal pulse lengths (input capture) or generation of output waveforms (output compare, PWM).

Pulse lengths and waveform periods can be modulated from a few microseconds to several milliseconds using the timer prescaler and the CPU clock prescaler.

*Section 18.1: SysTick register structure* describes the data structures used in the TIM Firmware Library. *Section 18.2: Firmware library functions* presents the Firmware Library functions.

## 19.1 TIM register structure

The TIM register structure, TIM_*TypeDef*, is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 CR1;
  u16 RESERVED0;
  vu16 CR2;
  u16 RESERVED1;
  vu16 SMCR;
  u16 RESERVED2;
  vu16 DIER;
  u16 RESERVED3;
  vu16 SR;
  u16 RESERVED4;
  vu16 EGR;
  u16 RESERVED5;
  vu16 CCMR1;
  u16 RESERVED6;
  vu16 CCMR2;
  u16 RESERVED7;
  vu16 CCER;
  u16 RESERVED8;
  vu16 CNT;
  u16 RESERVED9;
  vu16 PSC;
  u16 RESERVED10;
  vu16 ARR;
  u16 RESERVED11[3];
  vu16 CCR1;
  u16 RESERVED12;
  vu16 CCR2;
  u16 RESERVED13;
  vu16 CCR3;
  u16 RESERVED14;
  vu16 CCR4;
  u16 RESERVED15[3];
```

```
  vu16 DCR;
  u16 RESERVED16;
  vu16 DMAR;
  u16 RESERVED17;
} TIM_TypeDef;
```

*Table 457* gives the list of the TIM registers.

**Table 457. TIM registers**

| Register | Description |
|---|---|
| CR1 | Control Register1 |
| CR2 | Control Register2 |
| SMCR | Slave Mode Control Register |
| DIER | DMA and Interrupt Enable Register |
| SR | Status Register |
| EGR | Event Generation Register |
| CCMR1 | Capture/Compare Mode Register 1 |
| CCMR2 | Capture/Compare Mode Register 2 |
| CCER | Capture/Compare Enable Register |
| CNT | Counter Register |
| PSC | Prescaler Register |
| ARR | Auto-Reload Register |
| CCR1 | Capture/Compare Register 1 |
| CCR2 | Capture/Compare Register 2 |
| CCR3 | Capture/Compare Register 3 |
| CCR4 | Capture/Compare Register 4 |
| DCR | DMA Control Register |
| DMAR | DMA Address for Burst mode Register |

The three TIM peripherals are declared in the same file:

```
...
#define PERIPH_BASE          ((u32)0x40000000)
#define APB1PERIPH_BASE      PERIPH_BASE
#define APB2PERIPH_BASE      (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE       (PERIPH_BASE + 0x20000)

#define TIM2_BASE            (APB1PERIPH_BASE + 0x0000)
#define TIM3_BASE            (APB1PERIPH_BASE + 0x0400)
#define TIM4_BASE            (APB1PERIPH_BASE + 0x0800)
...
#ifndef DEBUG
...
#ifdef _TIM2
  #define TIM2               ((TIM_TypeDef *) TIM2_BASE)
```

```
#endif /*_TIM2 */

#ifdef _TIM3
  #define TIM3                ((TIM_TypeDef *) TIM3_BASE)
#endif /*_TIM3 */

#ifdef _TIM4
  #define TIM4                ((TIM_TypeDef *) TIM4_BASE)
#endif /*_TIM4 */
...
#else   /* DEBUG */
...
#ifdef _TIM2
  EXT TIM_TypeDef             *TIM2;
#endif /*_TIM2 */

#ifdef _TIM3
  EXT TIM_TypeDef             *TIM3;
#endif /*_TIM3 */

#ifdef _TIM4
  EXT TIM_TypeDef             *TIM4;
#endif /*_TIM4 */

...
#endif
```

When using the Debug mode, TIM2, TIM3 and TIM4 pointers are initialized in *stm32f10x_lib.c* as follows:

```
...
#ifdef _TIM2
  TIM2 = (TIM_TypeDef *)  TIM2_BASE;
#endif /*_TIM2 */

#ifdef _TIM3
  TIM3 = (TIM_TypeDef *)  TIM3_BASE;
#endif /*_TIM3 */

#ifdef _TIM4
  TIM4 = (TIM_TypeDef *)  TIM4_BASE;
#endif /*_TIM4 */
...
To access the TIM registers, _TIM, _TIM2, _TIM3 and _TIM4 must be
defined in stm32f10x_conf.h as follows:
...
#define _TIM
#define _TIM2
#define _TIM3
#define _TIM4
...
```

## 19.2 Firmware library functions

*Table 458* gives the list of the various functions of the TIM library.

**Table 458. TIM library firmware functions**

| Function name | Description |
|---|---|
| TIM_DeInit | Resets the TIMx peripheral registers to their default reset values. |
| TIM_TimeBaseInit | Initializes the TIMx Time Base Unit according to the specified parameters in the TIM_TimeBaseInitStruct. |
| TIM_OCInit | Initializes the TIMx peripheral according to the specified parameters in the TIM_OCInitStruct. |
| TIM_ICInit | Initializes the TIMx peripheral according to the specified parameters in the TIM_ICInitStruct. |
| TIM_TimeBaseStructInit | Fills each TIM_TimeBaseInitStruct member with its default value. |
| TIM_OCStructInit | Fills each TIM_OCInitStruct member with its default value. |
| TIM_ICStructInit | Fills each TIM_ICInitStruct member with its default value. |
| TIM_Cmd | Enables or disables the specified TIM peripheral. |
| TIM _ITConfig | Enables or disables the specified TIM interrupts. |
| TIM_DMAConfig | Configures the TIMx DMA interface. |
| TIM_DMACmd | Enables or disables the TIMx DMA Requests. |
| TIM_InternalClockConfig | Configures the TIMx internal clock. |
| TIM_ITRxExternalClockConfig | Configures the TIMx Internal Trigger as External Clock. |
| TIM_TIxExternalClockConfig | Configures the TIMx Trigger as External Clock. |
| TIM_ETRClockMode1Config | Configures the TIMx External clock Mode1. |
| TIM_ETRClockMode2Config | Configures the TIMx External clock Mode2. |
| TIM_ETRConfig | Configures the TIMx External Trigger (ETR). |
| TIM_SelectInputTrigger | Selects the TIMx Input Trigger source. |
| TIM_PrescalerConfig | Configures the TIMx Prescaler. |
| TIM_CounterModeConfig | Specifies the TIMx counter Mode to be used. |
| TIM_ForcedOC1Config | Forces the TIMx output 1 waveform to active or inactive level. |
| TIM_ForcedOC2Config | Forces the TIMx output 2 waveform to active or inactive level. |
| TIM_ForcedOC3Config | Forces the TIMx output 3 waveform to active or inactive level. |
| TIM_ForcedOC4Config | Forces the TIMx output 4 waveform to active or inactive level. |
| TIM_ARRPreloadConfig | Enables or disables the TIMx peripheral Preload register on ARR. |
| TIM_SelectCCDMA | Selects the TIMx peripheral Capture Compare DMA source. |
| TIM_OC1PreloadConfig | Enables or disables the TIMx peripheral Preload register on CCR1. |
| TIM_OC2PreloadConfig | Enables or disables the TIMx peripheral Preload register on CCR2. |

Table 458. TIM library firmware functions (continued)

| Function name | Description |
|---|---|
| TIM_OC3PreloadConfig | Enables or disables the TIMx peripheral Preload register on CCR3. |
| TIM_OC4PreloadConfig | Enables or disables the TIMx peripheral Preload register on CCR4. |
| TIM_OC1FastConfig | Configures the TIMx Output Compare 1 Fast feature. |
| TIM_OC2FastConfig | Configures the TIMx Output Compare 2 Fast feature. |
| TIM_OC3FastConfig | Configures the TIMx Output Compare 3 Fast feature. |
| TIM_OC4FastConfig | Configures the TIMx Output Compare 4 Fast feature. |
| TIM_ClearOC1Ref | Clears or safeguards the OCREF1 signal on an external event. |
| TIM_ClearOC2Ref | Clears or safeguards the OCREF2 signal on an external event. |
| TIM_ClearOC3Ref | Clears or safeguards the OCREF3 signal on an external event. |
| TIM_ClearOC4Ref | Clears or safeguards the OCREF4 signal on an external event. |
| TIM_UpdateDisableConfig | Enables or Disables the TIMx Update event. |
| TIM_EncoderInterfaceConfig | Configures the TIMx Encoder Interface. |
| TIM_GenerateEvent | Configures the TIMx event to be generate by software. |
| TIM_OC1PolarityConfig | Configures the TIMx channel 1 polarity. |
| TIM_OC2PolarityConfig | Configures the TIMx channel 2 polarity. |
| TIM_OC3PolarityConfig | Configures the TIMx channel 3 polarity. |
| TIM_OC4PolarityConfig | Configures the TIMx channel 4 polarity. |
| TIM_UpdateRequestConfig | Configures the TIMx Update Request source. |
| TIM_SelectHallSensor | Enables or disables the TIMx Hall sensor interface. |
| TIM_SelectOnePulseMode | Selects the TIMx One Pulse Mode. |
| TIM_SelectOutputTrigger | Selects the TIMx Trigger Output Mode. |
| TIM_SelectSlaveMode | Selects the TIMx Slave Mode. |
| TIM_SelectMasterSlaveMode | Sets or Resets the TIMx Master/Slave Mode. |
| TIM_SetAutoreload | Sets the TIMx Autoreload Register value. |
| TIM_SetCompare1 | Sets the TIMx Capture Compare1 Register value. |
| TIM_SetCompare2 | Sets the TIMx Capture Compare2 Register value. |
| TIM_SetCompare3 | Sets the TIMx Capture Compare3 Register value. |
| TIM_SetCompare4 | Sets the TIMx Capture Compare4 Register value. |
| TIM_SetIC1Prescaler | Sets the TIMx Input Capture 1 prescaler. |
| TIM_SetIC2Prescaler | Sets the TIMx Input Capture 2 prescaler. |
| TIM_SetIC3Prescaler | Sets the TIMx Input Capture 3 prescaler. |
| TIM_SetIC4Prescaler | Sets the TIMx Input Capture 4 prescaler. |
| TIM_SetClockDivision | Sets the TIMx Clock Division value. |

**Table 458. TIM library firmware functions (continued)**

| Function name | Description |
|---|---|
| TIM_GetCapture1 | Gets the TIMx Input Capture 1 value. |
| TIM_GetCapture2 | Gets the TIMx Input Capture 2 value. |
| TIM_GetCapture3 | Gets the TIMx Input Capture 3 value. |
| TIM_GetCapture4 | Gets the TIMx Input Capture 4 value. |
| TIM_GetCounter | Gets the TIMx Counter value. |
| TIM_GetPrescaler | Gets the TIMx Prescaler value. |
| TIM_GetFlagStatus | Checks whether the specified TIMx flag is set or not. |
| TIM_ClearFlag | Clears the TIMx pending flags. |
| TIM_GetITStatus | Checks whether the specified TIM interrupt has occurred or not. |
| TIM_ClearITPendingBit | Clears the TIMx interrupt pending bits. |

## 19.2.1 TIM_DeInit function

*Table 459* describes the TIM_DeInit function.

**Table 459. TIM_DeInit function**

| | |
|---|---|
| Function name | TIM_DeInit |
| Function prototype | `void TIM_DeInit(TIM_TypeDef* TIMx)` |
| Behavior description | Resets the TIMx peripheral registers to their default reset values. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB1PeriphResetCmd |

**Example:**

```
/* Resets the TIM2 */
TIM_DeInit(TIM2);
```

### 19.2.2 TIM_TimeBaseInit function

*Table 460* describes the TIM_TimeBaseInit function.

**Table 460. TIM_TimeBaseInit function**

| | |
|---|---|
| Function name | TIM_TimeBaseInit |
| Function prototype | `void TIM_TimeBaseInit(TIM_TypeDef* TIMx, TIM_TimeBaseInitTypeDef* TIM_TimeBaseInitStruct)` |
| Behavior description | Initializes the TIMx Time Base Unit according to the parameters specified in the TIM_TimeBaseInitStruct. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_TimeBaseInitStruct: pointer to a TIM_TimeBaseInitTypeDef structure that contains the configuration information for the specified TIMx Time Base Unit.<br>Refer to *Section : TIM_TimeBaseInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_TimeBaseInitTypeDef structure

The TIM_TimeBaseInitTypeDef structure is defined in the *stm32f10x_tim.h* file:

```
typedef struct
{
  u16 TIM_Period;
  u16 TIM_Prescaler;
  u8 TIM_ClockDivision;
  u16 TIM_CounterMode;
} TIM_TimeBaseInitTypeDef;
```

#### TIM_Period

TIM_Period configures the value of the period to be loaded in the active Auto-Reload Register at the next update event. This member must be a number between 0x0000 and 0xFFFF.

#### TIM_Prescaler

TIM_Prescaler configures the prescaler value used to divide the TIMx clock. This member must be a number between 0x0000 and 0xFFFF.

### TIM_ClockDivision

TIM_ClockDivision configures the clock division. This member can be set to the following values:

**Table 461. TIM_ClockDivision definition**

| TIM_ClockDivision | Description |
|---|---|
| TIM_CKD_DIV1 | $T_{DTS} = T_{ck\_tim}$ |
| TIM_CKD_DIV2 | $T_{DTS} = 2T_{ck\_tim}$ |
| TIM_CKD_DIV4 | $T_{DTS} = 4T_{ck\_tim}$ |

### TIM_CounterMode

TIM_CounterMode selects the counter mode. This member can be set to one of the following values:

**Table 462. TIM_CounterMode definition**

| TIM_CounterMode | Description |
|---|---|
| TIM_CounterMode_Up | TIM Up Counting Mode. |
| TIM_CounterMode_Down | TIM Down Counting Mode. |
| TIM_CounterMode_CenterAligned1 | TIM CenterAligned Mode1 Counting Mode. |
| TIM_CounterMode_CenterAligned2 | TIM CenterAligned Mode2 Counting Mode. |
| TIM_CounterMode_CenterAligned3 | TIM CenterAligned Mode3 Counting Mode. |

**Example:**

```
TIM_TimeBaseInitTypeDef TIM_TimeBaseStructure;

TIM_TimeBaseStructure.TIM_Period = 0xFFFF;
TIM_TimeBaseStructure.TIM_Prescaler = 0xF;
TIM_TimeBaseStructure.TIM_ClockDivision = 0x0;
TIM_TimeBaseStructure.TIM_CounterMode = TIM_CounterMode_Up;

TIM_TimeBaseInit(TIM2, & TIM_TimeBaseStructure);
```

### 19.2.3 TIM_OCInit function

*Table 463* describes the TIM_OCInit function.

**Table 463. TIM_OCInit function**

| | |
|---|---|
| Function name | TIM_OCInit |
| Function prototype | `void TIM_OCInit(TIM_TypeDef* TIMx, TIM_OCInitTypeDef* TIM_OCInitStruct)` |
| Behavior description | Initializes the TIMx peripheral according to the parameters specified in the TIM_OCInitStruct. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCInitStruct: pointer to a TIM_OCInitTypeDef structure that contains the configuration information for the specified TIMx peripheral.<br>Refer to *Section : TIM_OCInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## TIM_OCInitTypeDef structure

The TIM_OCInitTypeDef structure is defined in the *stm32f10x_tim.h* file:

```
typedef struct
{
  u16 TIM_OCMode;
  u16 TIM_Channel;
  u16 TIM_Pulse;
  u16 TIM_OCPolarity;
} TIM_OCInitTypeDef;
```

### TIM_OCMode

TIM_OCMode selects the timer mode. This member can be set to one of the following values:

**Table 464. TIM_OCMode definition**

| TIM_OCMode | Description |
|---|---|
| TIM_OCMode_Timing | TIM Output Compare Timing Mode. |
| TIM_OCMode_Active | TIM Output Compare Active Mode. |
| TIM_OCMode_Inactive | TIM Output Compare Inactive Mode. |
| TIM_OCMode_Toggle | TIM Output Compare Toggle Mode. |
| TIM_OCMode_PWM1 | TIM Pulse Width Modulation Mode1. |
| TIM_OCMode_PWM2 | TIM Pulse Width Modulation Mode2. |

### TIM_Channel

TIM_Channel selects the channel. This member can be set to one of the following values:

**Table 465. TIM_Channel definition**

| TIM_Channel | Description |
|---|---|
| TIM_Channel_1 | TIM Channel 1 is used. |
| TIM_Channel_2 | TIM Channel 2 is used. |
| TIM_Channel_3 | TIM Channel 3 is used. |
| TIM_Channel_4 | TIM Channel 4 is used. |

### TIM_Pulse

TIM_Pulse configures the pulse value that will be loaded in the Capture Compare Register. This member must be a number between 0x0000 and 0xFFFF.

### TIM_OCPolarity

TIM_OCPolarity configures the output polarity. This member can be set to one of the following values:

**Table 466. TIM_OCPolarity definition**

| TIM_OCPolarity | Description |
|---|---|
| TIM_OCPolarity_High | TIM Output Compare Polarity High. |
| TIM_OCPolarity_Low | TIM Output Compare Polarity Low. |

**Example:**

```
/* Configures the TIM2 Channel1 in PWM Mode */
TIM_OCInitTypeDef TIM_OCInitStructure;

TIM_OCInitStructure.TIM_OCMode = TIM_OCMode_PWM1;
TIM_OCInitStructure.TIM_Channel = TIM_Channel_1;
TIM_OCInitStructure.TIM_Pulse = 0x3FFF;
TIM_OCInitStructure.TIM_OCPolarity = TIM_OCPolarity_High;

TIM_OCInit(TIM2, & TIM_OCInitStructure);
```

### 19.2.4 TIM_ICInit function

*Table 467* describes the TIM_ICInit function.

**Table 467. TIM_ICInit function**

| | |
|---|---|
| Function name | TIM_ICInit |
| Function prototype | `void TIM_ICInit(TIM_TypeDef* TIMx, TIM_ICInitTypeDef* TIM_ICInitStruct)` |
| Behavior description | Initializes the TIMx according to the parameters specified in the TIM_ICInitStruct. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ICInitStruct: pointer to a TIM_ICInitTypeDef structure that contains the configuration information for the specified TIMx peripheral.<br>Refer to *Section : TIM_ICInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## TIM_ICInitTypeDef structure

The TIM_ICInitTypeDef structure is defined in the *stm32f10x_tim.h* file:

```
typedef struct
{
  u16 TIM_ICMode;
u16 TIM_Channel;
u16 TIM_ICPolarity;
u16 TIM_ICSelection;
u16 TIM_ICPrescaler;
u16 TIM_ICFilter;
} TIM_ICInitTypeDef;
```

### TIM_ICMode

TIM_ICMode selects the TIM Input Capture mode. This member can be set to one of the following values:

**Table 468. TIL_ICMode definition**

| TIM_ICMode | Description |
|---|---|
| TIM_ICMode_ICAP | TIM used in Input Capture mode. |
| TIM_ICMode_PWMI | TIM used in PWM Input mode. |

### TIM_Channel

TIM_Channel selects the channel. This member can be set to one of the following values:

**Table 469. TIM_Channel definition**

| TIM_Channel | Description |
|---|---|
| TIM_Channel_1 | TIM Channel 1 is used. |
| TIM_Channel_2 | TIM Channel 2 is used. |
| TIM_Channel_3 | TIM Channel 3 is used. |
| TIM_Channel_4 | TIM Channel 4 is used. |

### TIM_ICPolarity

TIM_ICPolarity configures the input signal active edge. This member can be set to one of the following values:

**Table 470. TIM_ICPolarity definition**

| TIM_ICPolarity | Description |
|---|---|
| TIM_ICPolarity_Rising | TIM Input Capture Rising Edge. |
| TIM_ICPolarity_Falling | TIM Input Capture Falling Edge. |

### TIM_ICSelection

TIM_ICSelection selects the input. This member can be set to one of the following values:

**Table 471. TIM_ICSelection definition**

| TIM_ICSelection | Description |
|---|---|
| TIM_ICSelection_DirectTI | TIM Input 2, 3 or 4 are selected to be connected respectively to IC1 or IC2 or IC3 or IC4. |
| TIM_ICSelection_IndirectTI | TIM Input 2, 3 or 4 are selected to be connected respectively to IC2 or IC1 or IC4 or IC3. |
| TIM_ICSelection_TRC | TIM Input 2, 3 or 4 are selected to be connected to TRC. |

### TIM_ICPrescaler

TIM_ICPrescaler configures the Input Capture Prescaler. This member can be set to one of the following value:

**Table 472. TIM_ICPrescaler definition**

| TIM_ICPrescaler | Description |
|---|---|
| TIM_ICPSC_DIV1 | TIM Capture performed each time an edge is detected on the capture input. |
| TIM_ICPSC_DIV2 | TIM Capture performed once every 2 events. |
| TIM_ICPSC_DIV4 | TIM Capture performed once every 4 events. |
| TIM_ICPSC_DIV8 | TIM Capture performed once every 8 events. |

### TIM_ICFilter

TIM_ICFilter selects the Input Capture Filter. This member can be set to a value between 0x0 and 0xF.

**Example:**

```
/* The following example illustrates how to configure the TIM2 in
PWM Input mode : The external signal is connected to TIM2 CH1 pin,
the Rising edge is used as active edge, the TIM2 CCR1 is used to
compute the frequency value the TIM2 CCR2 is used to compute the
duty cycle value */
TIM_DeInit(TIM2);
TIM_ICStructInit(&TIM_ICInitStructure);
TIM_ICInitStructure.TIM_ICMode = TIM_ICMode_PWMI;
TIM_ICInitStructure.TIM_Channel = TIM_Channel_1;
TIM_ICInitStructure.TIM_ICPolarity = TIM_ICPolarity_Rising;
TIM_ICInitStructure.TIM_ICSelection = TIM_ICSelection_DirectTI;
TIM_ICInitStructure.TIM_ICPrescaler = TIM_ICPSC_DIV1;
TIM_ICInitStructure.TIM_ICFilter = 0x0;
TIM_ICInit(TIM2, &TIM_ICInitStructure);
```

## 19.2.5 TIM_TimeBaseStructInit function

*Table 473* describes the TIM_TimeBaseStructInit function.

**Table 473. TIM_TimeBaseStructInit function**

| | |
|---|---|
| Function name | TIM_TimeBaseStructInit |
| Function prototype | `void TIM_TimeBaseStructInit(TIM_TimeBaseInitTypeDef* TIM_TimeBaseInitStruct)` |
| Behavior description | Fills each TIM_TimeBaseInitStruct member with its default value. |
| Input parameter | TIM_TimeBaseInitStruct: pointer to a TIM_TimeBaseInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM_TimeBaseInitStruct members have the following default values:

**Table 474. TIM_TimeBaseInitStruct default values**

| Member | Default value |
|---|---|
| TIM_Period | TIM_Period_Reset_Mask |
| TIM_Prescaler | TIM_Prescaler_Reset_Mask |
| TIM_CKD | TIM_CKD_DIV1 |
| TIM_CounterMode | TIM_CounterMode_Up |

**Example:**

```
/* The following example illustrates how to initialize a
TIM_BaseInitTypeDef structure */
TIM_TimeBaseInitTypeDef TIM_TimeBaseInitStructure;
TIM_TimeBaseStructInit(& TIM_TimeBaseInitStructure);
```

### 19.2.6 TIM_OCStructInit function

*Table 475* describes the TIM_OCStructInit function.

**Table 475. TIM_OCStructInit function**

| | |
|---|---|
| Function name | TIM_OCStructInit |
| Function prototype | `void TIM_OCStructInit(TIM_OCInitTypeDef* TIM_OCInitStruct)` |
| Behavior description | Fills each TIM_OCInitStruct member with its default value. |
| Input parameter | TIM_OCInitStruct: pointer to a TIM_OCInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM_OCInitStruct members have the following default values:

**Table 476. TIM_OCInitStruct default values**

| Member | Default value |
|---|---|
| TIM_OCMode | TIM_OCMode_Timing |
| TIM_Channel | TIM_Channel_1 |
| TIM_Pulse | TIM_Pulse_Reset_Mask |
| TIM_OCPolarity | TIM_OCPolarity_High |

**Example:**

```
/* The following example illustrates how to initialize a
TIM_OCInitTypeDef structure */
TIM_OCInitTypeDef TIM_OCInitStructure;
TIM_OCStructInit(& TIM_OCInitStructure);
```

### 19.2.7 TIM_ICStructInit function

*Table 477* describes the TIM_ICStructInit function.

**Table 477. TIM_ICStructInit function**

| | |
|---|---|
| Function name | TIM_ICStructInit |
| Function prototype | `void TIM_ICStructInit(TIM_ICInitTypeDef* TIM_ICInitStruct)` |
| Behavior description | Fills each TIM_ICInitStruct member with its default value. |
| Input parameter | TIM_ICInitStruct: pointer to a TIM_ICInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM_ICInitStruct members have the following default values:

**Table 478. TIM_ICInitStruct default values**

| Member | Default value |
|---|---|
| TIM_ICMode | TIM_ICMode_ICAP |
| TIM_Channel | TIM_Channel_1 |
| TIM_ICPolarity | TIM_ICPolarity_Rising |
| TIM_ICSelection | TIM_ICSelection_DirectTI |
| TIM_ICPrescaler | TIM_ICPSC_DIV1 |
| TIM_ICFilter | TIM_ICFilter_Mask |

**Example:**

```
/* The following example illustrates how to initialize a
TIM_ICInitTypeDef structure */
TIM_ICInitTypeDef TIM_ICInitStructure;
TIM_ICStructInit(& TIM_ICInitStructure);
```

### 19.2.8 TIM_Cmd function

*Table 479* describes the TIM_Cmd function.

**Table 479. TIM_Cmd function**

| | |
|---|---|
| Function name | TIM_Cmd |
| Function prototype | `void TIM_Cmd(TIM_TypeDef* TIMx, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified TIMx peripheral. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | NewState: new state of the TIMx peripheral.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM2 counter */
TIM_Cmd(TIM2, ENABLE);
```

### 19.2.9 TIM_ITConfig function

*Table 480* describes the TIM_ITConfig function.

**Table 480. TIM_ITConfig function**

| | |
|---|---|
| Function name | TIM_ITConfig |
| Function prototype | `void TIM_ITConfig(TIM_TypeDef* TIMx, u16 TIM_IT, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified TIMx interrupts. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IT: TIMx interrupt sources to be enabled or disabled.<br>Refer to *Section : TIM_IT* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified TIMx interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_IT

TIM_IT enables or disables TIMx interrupts. One or a combination of the following values can be used:

**Table 481. TIM_IT values**

| TIM_IT | Description |
|---|---|
| TIM_IT_Update | TIM Update Interrupt source |
| TIM_IT_CC1 | TIM Capture/Compare 1 Interrupt source |
| TIM_IT_CC2 | TIM Capture/Compare 2 Interrupt source |
| TIM_IT_CC3 | TIM Capture/Compare 3 Interrupt source |
| TIM_IT_CC4 | TIM Capture/Compare 4 Interrupt source |
| TIM_IT_Trigger | TIM Trigger Interrupt source |

**Example:**

```
/* Enables the TIM2 Capture Compare channel 1 Interrupt source */
TIM_ITConfig(TIM2, TIM_IT_CC1, ENABLE );
```

## 19.2.10 TIM_DMAConfig function

*Table 482* describes the TIM_DMAConfig function.

**Table 482. TIM_DMAConfig function**

| | |
|---|---|
| Function name | TIM_DMAConfig |
| Function prototype | `void TIM_DMAConfig(TIM_TypeDef* TIMx,u8 TIM_DMABase, u16 TIM_DMABurstLength)` |
| Behavior description | Configures the TIMx's DMA interface. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_DMABase: DMA Base address.<br>Refer to *Section : TIM_DMABase* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_DMABurstLength: DMA Burst length.<br>Refer to *Section : TIM_DMABurstLength* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_DMABase

TIM_DMABase selects the TIM DMA base address. It can be set to one of the following values:

**Table 483. TIM_DMABase values**

| TIM_DMABase | Description |
|---|---|
| TIM_DMABase_CR1 | TIM CR1 register used as DMA Base |
| TIM_DMABase_CR2 | TIM CR2 register used as DMA Base |
| TIM_DMABase_SMCR | TIM SMCR register used as DMA Base |
| TIM_DMABase_DIER | TIM DIER register used as DMA Base |
| TIM_DMABase_SR | TIM SR register used as DMA Base |
| TIM_DMABase_EGR | TIM EGR register used as DMA Base |
| TIM_DMABase_CCMR1 | TIM CCMR1 register used as DMA Base |
| TIM_DMABase_CCMR2 | TIM CCMR2 register used as DMA Base |
| TIM_DMABase_CCER | TIM CCER register used as DMA Base |
| TIM_DMABase_CNT | TIM CNT register used as DMA Base |
| TIM_DMABase_PSC | TIM PSC register used as DMA Base |
| TIM_DMABase_ARR | TIM ARR register used as DMA Base |
| TIM_DMABase_CCR1 | TIM CCR1 register used as DMA Base |
| TIM_DMABase_CCR2 | TIM CCR2 register used as DMA Base |
| TIM_DMABase_CCR3 | TIM CCR3 register used as DMA Base |
| TIM_DMABase_CCR4 | TIM CCR4 register used as DMA Base |
| TIM_DMABase_DCR | TIM DCR register used as DMA Base |

### TIM_DMABurstLength

TIM_DMABurstLength selects the TIM DMA Burst length. See *Table 484* for the values of this parameter.

**Table 484. TIM_DMABurstLength values**

| TIM_DMABurstLength | Description |
|---|---|
| TIM_DMABurstLength_1Byte | TIM DMA Burst length 1 byte |
| TIM_DMABurstLength_2Bytes | TIM DMA Burst length 2 bytes |
| TIM_DMABurstLength_3Bytes | TIM DMA Burst length 3 bytes |
| TIM_DMABurstLength_4Bytes | TIM DMA Burst length 4 bytes |
| TIM_DMABurstLength_5Bytes | TIM DMA Burst length 5 bytes |
| TIM_DMABurstLength_6Bytes | TIM DMA Burst length 6 bytes |
| TIM_DMABurstLength_7Bytes | TIM DMA Burst length 7 bytes |
| TIM_DMABurstLength_8Bytes | TIM DMA Burst length 8 bytes |
| TIM_DMABurstLength_9Bytes | TIM DMA Burst length 9 bytes |

**Table 484. TIM_DMABurstLength values (continued)**

| TIM_DMABurstLength | Description |
|---|---|
| TIM_DMABurstLength_10Bytes | TIM DMA Burst length 10 bytes |
| TIM_DMABurstLength_11Bytes | TIM DMA Burst length 11 bytes |
| TIM_DMABurstLength_12Bytes | TIM DMA Burst length 12 bytes |
| TIM_DMABurstLength_13Bytes | TIM DMA Burst length 13 bytes |
| TIM_DMABurstLength_14Bytes | TIM DMA Burst length 14 bytes |
| TIM_DMABurstLength_15Bytes | TIM DMA Burst length 15 bytes |
| TIM_DMABurstLength_16Bytes | TIM DMA Burst length 16 bytes |
| TIM_DMABurstLength_17Bytes | TIM DMA Burst length 17 bytes |
| TIM_DMABurstLength_18Bytes | TIM DMA Burst length 18 bytes |

**Example:**

```
/* Configures the TIM2 DMA Interface to transfer 1 byte and to use
the CCR1 as base address */
TIM_DMAConfig(TIM2, TIM_DMABase_CCR1, TIM_DMABurstLength_1Byte)
```

### 19.2.11 TIM_DMACmd function

*Table 485* describes the TIM_DMACmd function.

**Table 485. TIM_DMACmd function**

| | |
|---|---|
| Function name | TIM_DMACmd |
| Function prototype | `void TIM_DMACmd(TIM_TypeDef* TIMx, u16 TIM_DMASource, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIMx's DMA Requests. |
| Input parameter1 | TIMx: where x can be 1, 2 or 3 to select the TIM peripheral. |
| Input parameter2 | TIM_DMASource: DMA Request sources.<br>Refer to *Section : TIM_DMASource* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the DMA Request sources.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_DMASource

TIM_DMASource selects the TIM DMA Request Source. One or a combination of the following values can be used:

**Table 486. TIM_DMASource values**

| TIM_DMASource | Description |
|---|---|
| TIM_DMA_Update | TIM Update DMA source |
| TIM_DMA_CC1 | TIM Capture/Compare 1 DMA source |
| TIM_DMA_CC2 | TIM Capture/Compare 2 DMA source |
| TIM_DMA_CC3 | TIM Capture/Compare 3 DMA source |
| TIM_DMA_CC4 | TIM Capture/Compare 4 DMA source |
| TIM_DMA_Trigger | TIM Trigger DMA source |

**Example:**

```
/* TIM2 Capture Compare 1 DMA Request Configuration */
TIM_DMACmd(TIM2, TIM_DMA_CC1, ENABLE);
```

## 19.2.12 TIM_InternalClockConfig function

*Table 487* describes the TIM_InternalClockConfig function.

**Table 487. TIM_InternalClockConfig function**

| | |
|---|---|
| Function name | TIM_InternalClockConfig |
| Function prototype | `void TIM_InternalClockConfig(TIM_TypeDef* TIMx)` |
| Behavior description | Configures the TIMx internal clock |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the internal clock for TIM2 */
TIM_InternalClockConfig(TIM2);
```

### 19.2.13 TIM_ITRxExternalClockConfig function

Table 488 describes the TIM_ITRxExternalClockConfig function.

**Table 488. TIM_ITRxExternalClockConfig function**

| | |
|---|---|
| Function name | TIM_ITRxExternalClockConfig |
| Function prototype | `void TIM_ITRxExternalClockConfig(TIM_TypeDef* TIMx, u16 TIM_InputTriggerSource)` |
| Behavior description | Configures the TIMx internal Trigger as external clock. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_InputTriggerSource: Input Trigger source.<br>Refer to *Section : TIM_InputTriggerSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_InputTriggerSource

TIM_InputTriggerSource selects the TIM Input trigger. See Table 489 for the values of this parameter.

**Table 489. TIM_InputTriggerSource values**

| TIM_InputTriggerSource | Description |
|---|---|
| TIM_TS_ITR0 | TIM Internal Trigger 0 |
| TIM_TS_ITR1 | TIM Internal Trigger 1 |
| TIM_TS_ITR2 | TIM Internal Trigger 2 |
| TIM_TS_ITR3 | TIM Internal Trigger 3 |

**Example:**

```
/* TIM2 internal trigger 3 used as clock source */
TIM_ITRxExternalClockConfig(TIM2, TIM_TS_ITR3);
```

### 19.2.14 TIM_TIxExternalClockConfig function

*Table 490* describes the TIM_TIxExternalClockConfig function.

**Table 490. TIM_TIxExternalClockConfig function**

| | |
|---|---|
| Function name | TIM_TIxExternalClockConfig |
| Function prototype | `void TIM_TIxExternalClockConfig(TIM_TypeDef* TIMx, u16 TIM_TIxExternalCLKSource, u8 TIM_ICPolarity, u8 ICFilter)` |
| Behavior description | Configures the TIMx Trigger as external clock. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_TIxExternalCLKSource: Trigger source.<br>Refer to *Section : TIM_TIxExternalCLKSource* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_ICPolarity: specifies the TI polarity.<br>Refer to *Section : TIM_ICPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | ICFilter: Specifies the Input Capture Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_TIxExternalCLKSource

TIM_TIxExternalCLKSource selects the TIM TIx external clock source. One or a combination of the following values can be used:

**Table 491. TIM_TIxExternalCLKSource values**

| TIM_TIxExternalCLKSource | Description |
|---|---|
| TIM_TS_TI1FP1 | TIM IC1 is mapped on TI1. |
| TIM_TS_TI2FP2 | TIM IC2 is mapped on TI2. |
| TIM_TS_TI1F_ED | TIM IC1 is mapped on TI1: edge detector is used |

**Example:**

```
/* Selects the TI1 as clock for TIM2: the external clock is
connected to TI1 input pin, the rising edge is the active edge and
no filter sampling is done (ICFilter = 0) */
TIM_TIxExternalClockConfig(TIM2, TIM_TS_TI1FP1,
TIM_ICPolarity_Rising, 0);
```

### 19.2.15 TIM_ETRClockMode1Config function

Table 492 describes the TIM_ETRClockMode1Config function.

**Table 492. TIM_ETRClockMode1Config function**

| | |
|---|---|
| Function name | TIM_ETRClockMode1Config |
| Function prototype | `void TIM_ETRClockMode1Config(TIM_TypeDef* TIMx, u16 TIM_ExtTRGPrescaler, u16 TIM_ExtTRGPolarity, u16 ExtTRGFilter)` |
| Behavior description | Configures the TIMx External clock Mode1. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ExtTRGPrescaler: external trigger prescaler.<br>Refer to *Section : TIM_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_ExtTRGPolarity: external clock polarity.<br>Refer to *Section : TIM_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | ExtTRGFilter: external trigger Filter.<br>This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_ExtTRGPrescaler

TIM_ExtTRGPrescaler configures the TIMx external trigger prescaler. This member can be set to one of the following values:

**Table 493. TIM_ExtTRGPrescaler values**

| TIM_ExtTRGPrescaler | Description |
|---|---|
| TIM_ExtTRGPSC_OFF | TIM ETRP Prescaler OFF. |
| TIM_ExtTRGPSC_DIV2 | TIM ETRP frequency divided by 2. |
| TIM_ExtTRGPSC_DIV4 | TIM ETRP frequency divided by 4. |
| TIM_ExtTRGPSC_DIV8 | TIM ETRP frequency divided by 8. |

### TIM_ExtTRGPolarity

TIM_ExtTRGPolarity configures the TIMx external trigger polarity. This member can be set to one of the following values:

**Table 494. TIM_ExtTRGPolarity values**

| TIM_ExtTRGPolarity | Description |
|---|---|
| TIM_ExtTRGPolarity_Inverted | TIM External Trigger Polarity Inverted: active Low or falling edge active. |
| TIM_ExtTRGPolarity_NonInverted | TIM External Trigger Polarity non Inverted: active High or rising edge active. |

**Example:**

```
/* Selects the external clock Mode 1 for TIM2: the external clock is
connected to ETR input pin, the rising edge is the active edge, no
filter sampling is done (ExtTRGFilter = 0) and the prescaler is
fixed to TIM_ExtTRGPSC_DIV2 */
TIM_ExternalCLK1Config(TIM2, TIM_ExtTRGPSC_DIV2,
TIM_ExtTRGPolarity_NonInverted, 0x0);
```

## 19.2.16 TIM_ETRClockMode2Config function

*Table 495* describes the TIM_ETRClockMode2Config function.

**Table 495. TIM_ETRClockMode2Config function**

| | |
|---|---|
| Function name | TIM_ETRClockMode2Config |
| Function prototype | `void TIM_ETRClockMode2Config(TIM_TypeDef* TIMx, u16 TIM_ExtTRGPrescaler, u16 TIM_ExtTRGPolarity, u16 ExtTRGFilter)` |
| Behavior description | Configures the TIMx External clock Mode2. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ExtTRGPrescaler: external trigger prescaler.<br>Refer to *Section : TIM_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_ExtTRGPolarity: external clock polarity.<br>Refer to *Section : TIM_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | ExtTRGFilter: external trigger Filter.<br>This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the external clock Mode 2 for TIM2: the external clock is
connected to ETR input pin, the rising edge is the active edge, no
filter sampling is done (ExtTRGFilter = 0) and the prescaler is
fixed to TIM_ExtTRGPSC_DIV2 */
TIM_ExternalCLK2Config(TIM2, TIM_ExtTRGPSC_DIV2,
TIM_ExtTRGPolarity_NonInverted, 0x0);
```

### 19.2.17 TIM_ETRConfig

*Table 495* describes the TIM_ETRConfig function.

**Table 496. TIM_ETRConfig function**

| | |
|---|---|
| Function name | TIM_ETRConfig |
| Function prototype | void TIM_ETRConfig(TIM_TypeDef* TIMx, u16 TIM_ExtTRGPrescaler, u16 TIM_ExtTRGPolarity, u8 ExtTRGFilter) |
| Behavior description | Configures the TIMx External Trigger (ETR). |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ExtTRGPrescaler: external trigger prescaler.<br>Refer to *Section : TIM_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_ExtTRGPolarity: external clock polarity.<br>Refer to *Section : TIM_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | ExtTRGFilter: external trigger Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Configure the External Trigger (ETR) for TIM2: the rising edge is
the active edge, no filter sampling is done (ExtTRGFilter = 0) and
the prescaler is fixed to TIM_ExtTRGPSC_DIV2 */
TIM_ExternalCLK2Config(TIM2, TIM_ExtTRGPSC_DIV2,
TIM_ExtTRGPolarity_NonInverted, 0x0);
```

### 19.2.18 TIM_SelectInputTrigger function

*Table 497* describes the TIM_SelectInputTrigger function.

**Table 497. TIM_SelectInputTrigger function**

| | |
|---|---|
| Function name | TIM_SelectInputTrigger |
| Function prototype | `void TIM_SelectInputTrigger(TIM_TypeDef* TIMx, u16 TIM_InputTriggerSource)` |
| Behavior description | Selects the TIMx Input Trigger source. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_InputTriggerSource: Input Trigger source.<br>Refer to *Section : TIM_InputTriggerSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_InputTriggerSource

TIM_InputTriggerSource selects the TIMx input trigger source. This member can be set to one of the following values:

**Table 498. TIM_InputTriggerSource values**

| TIM_InputTriggerSource | Description |
|---|---|
| TIM_TS_ITR0 | TIM Internal Trigger 0. |
| TIM_TS_ITR1 | TIM Internal Trigger 1. |
| TIM_TS_ITR2 | TIM Internal Trigger 2. |
| TIM_TS_ITR3 | TIM Internal Trigger 3. |
| TIM_TS_TI1F_ED | TIM TI1 Edge Detector. |
| TIM_TS_TI1FP1 | TIM Filtered Timer Input 1. |
| TIM_TS_TI2FP2 | TIM Filtered Timer Input 2. |
| TIM_TS_ETRF | TIM External Trigger input. |

**Example:**

```
/* Selects the Internal Trigger 3 as input trigger fot TIM2 */
void TIM_SelectInputTrigger(TIM2, TIM_TS_ITR3);
```

### 19.2.19 TIM_PrescalerConfig function

*Table 499* describes the TIM_PrescalerConfig function.

**Table 499. TIM_PrescalerConfig function**

| | |
|---|---|
| Function name | TIM_PrescalerConfig |
| Function prototype | `void TIM_PrescalerConfig(TIM_TypeDef* TIMx, u16 Prescaler, u16 TIM_PSCReloadMode)` |
| Behavior description | Configures the TIMx Prescaler |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Prescaler: TIMx prescaler new value. |
| Input parameter3 | TIM_PSCReloadMode: TIM prescaler reload mode.<br>Refer to *Section : TIM_PSCReloadMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_PSCReloadMode

TIM_PSCReloadMode selects the TIMx Prescaler Reload mode. It can be set to one of the following values:

**Table 500. TIM_PSCReloadMode values**

| TIM_PSCReloadMode | Description |
|---|---|
| TIM_PSCReloadMode_Update | TIM the Prescaler is loaded at the update event. |
| TIM_PSCReloadMode_Immediate | TIM the Prescaler is loaded immediately. |

**Example:**

```
/* Configures the TIM2 new Prescaler value */
u16 TIMPrescaler = 0xFF00;
TIM_PrescalerConfig(TIM2, TIMPrescaler,
TIM_PSCReloadMode_Immediate);
```

### 19.2.20 TIM_CounterModeConfig function

*Table 501* describes the TIM_CounterModeConfig function.

**Table 501. TIM_CounterModeConfig function**

| | |
|---|---|
| Function name | TIM_CounterModeConfig |
| Function prototype | `void TIM_CounterModeConfig(TIM_TypeDef* TIMx, u16 TIM_CounterMode)` |
| Behavior description | Specifies the TIMx counter mode |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_CounterMode: Counter Mode to be used.<br>Refer to *Section : TIM_CounterMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Center Aligned counter Mode 1 for the TIM2 */
TIM_CounterModeConfig(TIM2, TIM_Counter_CenterAligned1);
```

### 19.2.21 TIM_ForcedOC1Config function

*Table 502* describes the TIM_ForcedOC1Config function.

**Table 502. TIM_ForcedOC1Config function**

| | |
|---|---|
| Function name | TIM_ForcedOC1Config |
| Function prototype | `void TIM_ForcedOC1Config(TIM_TypeDef* TIMx, u16 TIM_ForcedAction)` |
| Behavior description | Forces the TIMx output 1 signal to the active or inactive level. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ForcedAction: action to be forced on the output signal.<br>Refer to *Section : TIM_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_ForcedAction

The forced actions are listed in the following table:

**Table 503. TIM_ForcedAction values**

| TIM_ForcedAction | Description |
|---|---|
| TIM_ForcedAction_Active | Force active level on OCxREF. |
| TIM_ForcedAction_InActive | Force inactive level on OCxREF. |

**Example:**

```
/* Forces the TIM2 Output Compare 1 signal to the active level */
TIM_ForcedOC1Config(TIM2, TIM_ForcedAction_Active);
```

## 19.2.22 TIM_ForcedOC2Config function

*Table 504* describes the TIM_ForcedOC2Config function.

**Table 504. TIM_ForcedOC2Config function**

| | |
|---|---|
| Function name | TIM_ForcedOC2Config |
| Function prototype | `void TIM_ForcedOC2Config(TIM_TypeDef* TIMx, u16 TIM_ForcedAction)` |
| Behavior description | Forces the TIMx output 2 signal to active or inactive level. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ForcedAction: action to forced on the output signal.<br>Refer to *Section : TIM_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM2 Output Compare 2 signal to the active level */
TIM_ForcedOC2Config(TIM2, TIM_ForcedAction_Active);
```

### 19.2.23 TIM_ForcedOC3Config function

*Table 505* describes the TIM_ForcedOC3Config function.

**Table 505. TIM_ForcedOC3Config function**

| | |
|---|---|
| Function name | TIM_ForcedOC3Config |
| Function prototype | `void TIM_ForcedOC3Config(TIM_TypeDef* TIMx, u16 TIM_ForcedAction)` |
| Behavior description | Forces the TIMx output 3 signal to active or inactive level. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ForcedAction: action to forced on the output signal.<br>Refer to section *TIM_ForcedAction on page 355* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM2 Output Compare 3 signal to the active level */
TIM_ForcedOC3Config(TIM2, TIM_ForcedAction_Active);
```

### 19.2.24 TIM_ForcedOC4Config function

*Table 506* describes the TIM_ForcedOC4Config function.

**Table 506. TIM_ForcedOC4Config function**

| | |
|---|---|
| Function name | TIM_ForcedOC4Config |
| Function prototype | `void TIM_ForcedOC4Config(TIM_TypeDef* TIMx, u16 TIM_ForcedAction)` |
| Behavior description | Forces the TIMx output 4 signal to active or inactive level. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_ForcedAction: action to forced on the output signal.<br>Refer to *Section : TIM_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM2 Output Compare 4 signal to the active level */
TIM_ForcedOC4Config(TIM2, TIM_ForcedAction_Active);
```

### 19.2.25 TIM_ARRPreloadConfig function

*Table 507* describes the TIM_ARRPreloadConfig function.

**Table 507. TIM_ARRPreloadConfig function**

| | |
|---|---|
| Function name | TIM_ARRPreloadConfig |
| Function prototype | `void TIM_ARRPreloadConfig(TIM_TypeDef* TIMx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIMx peripheral Preload register on ARR. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter3 | NewState: new state of the ARPE bit in the TIMx_CR1 register.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM2 Preload on ARR Register */
TIM_ARRPreloadConfig(TIM2, ENABLE);
```

### 19.2.26 TIM_SelectCCDMA function

*Table 508* describes the TIM_SelectCCDMA function.

**Table 508. TIM_SelectCCDMA function**

| | |
|---|---|
| Function name | TIM_SelectCCDMA |
| Function prototype | `void TIM_SelectCCDMA(TIM_TypeDef* TIMx, FunctionalState Newstate)` |
| Behavior description | Selects the TIMx peripheral Capture Compare DMA source. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter3 | NewState: new state of the Capture Compare DMA source.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the TIM2 Capture Compare DMA source */
TIM_SelectCCDMA(TIM2, ENABLE);
```

### 19.2.27 TIM_OC1PreloadConfig function

*Table 509* describes the TIM_OC1PreloadConfig function.

**Table 509. TIM_OC1PreloadConfig function**

| | |
|---|---|
| Function name | TIM_OC1PreloadConfig |
| Function prototype | `void TIM_OC1PreloadConfig(TIM_TypeDef* TIMx, u16 TIM_OCPreload)` |
| Behavior description | Enables or Disables the TIMx Preload register on CCR1. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_OCPreload

The Output Compare Preload states that can be enabled or disabled are listed in the following table:

**Table 510. TIM_OCPreload states**

| TIM_OCPreload | Description |
|---|---|
| TIM_OCPreload_Enable | TIMx Preload register on CCR1 enable. |
| TIM_OCPreload_Disable | TIMx Preload register on CCR1 disable. |

**Example:**

```
/* Enables the TIM2 Preload on CC1 Register */
TIM_OC1PreloadConfig(TIM2, TIM_OCPreload_Enable);
```

### 19.2.28 TIM_OC2PreloadConfig function

*Table 511* describes the TIM_OC2PreloadConfig function.

**Table 511. TIM_OC2PreloadConfig function**

| | |
|---|---|
| Function name | TIM_OC2PreloadConfig |
| Function prototype | `void TIM_OC2PreloadConfig(TIM_TypeDef* TIMx, u16 TIM_OCPreload)` |
| Behavior description | Enables or Disables the TIMx Preload register on CCR2. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM2 Preload on CC2 Register */
TIM_OC2PreloadConfig(TIM2, TIM_OCPreload_Enable);
```

### 19.2.29 TIM_OC3PreloadConfig function

*Table 512* describes the TIM_OC3PreloadConfig function.

**Table 512. TIM_OC3PreloadConfig function**

| | |
|---|---|
| Function name | TIM_OC3PreloadConfig |
| Function prototype | `void TIM_OC3PreloadConfig(TIM_TypeDef* TIMx, u16 TIM_OCPreload)` |
| Behavior description | Enables or Disables the TIMx Preload register on CCR3. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPreload: specifies the Output Compare Preload state.<br>Refer to *Section : TIM_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM2 Preload on CC3 Register */
TIM_OC3PreloadConfig(TIM2, TIM_OCPreload_Enable);
```

### 19.2.30 TIM_OC4PreloadConfig function

Table 513 describes the TIM_OC4PreloadConfig function.

**Table 513. TIM_OC4PreloadConfig function**

| | |
|---|---|
| Function name | TIM_OC4PreloadConfig |
| Function prototype | `void TIM_OC4PreloadConfig(TIM_TypeDef* TIMx, u16 TIM_OCPreload)` |
| Behavior description | Enables or Disables the TIMx Preload register on CCR4. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM2 Preload on CC4 Register */
TIM_OC4PreloadConfig(TIM2, TIM_OCPreload_Enable);
```

## 19.2.31 TIM_OC1FastConfig function

*Table 514* describes the TIM_OC1FastConfig function.

**Table 514. TIM_OC1FastConfig function**

| | |
|---|---|
| Function name | TIM_OC1FastConfig |
| Function prototype | `void TIM_OC1FastConfig(TIM_TypeDef* TIMx, u16 TIM_OCFast)` |
| Behavior description | Configures the TIMx Output Compare 1 Fast feature. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_OCFast

The Output Compare Preload states that can be used are listed in the following table:

**Table 515. TIM_OCFast states**

| TIM_OCFast | Description |
|---|---|
| TIM_OCFast_Enable | TIMx Output Compare Fast capability enable. |
| TIM_OCFast_Disable | TIMx Output Compare Fast capability disable. |

**Example:**

```
/* Use the TIM2 OC1 in fast Mode */
TIM_OC1FastConfig(TIM2, TIM_OCFast_Enable);
```

### 19.2.32 TIM_OC2FastConfig function

*Table 516* describes the TIM_OC2FastConfig function.

**Table 516. TIM_OC2FastConfig function**

| | |
|---|---|
| Function name | TIM_OC2FastConfig |
| Function prototype | `void TIM_OC2FastConfig(TIM_TypeDef* TIMx, u16 TIM_OCFast)` |
| Behavior description | Configures the TIMx Output Compare 2 Fast feature. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM2 OC2 in fast Mode */
TIM_OC2FastConfig(TIM2, TIM_OCFast_Enable);
```

### 19.2.33 TIM_OC3FastConfig function

*Table 517* describes the TIM_OC3FastConfig function.

**Table 517. TIM_OC3FastConfig function**

| | |
|---|---|
| Function name | TIM_OC3FastConfig |
| Function prototype | `void TIM_OC3FastConfig(TIM_TypeDef* TIMx, u16 TIM_OCFast)` |
| Behavior description | Configures the TIMx Output Compare 3 Fast feature. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM2 OC3 in fast Mode */
TIM_OC3FastConfig(TIM2, TIM_OCFast_Enable);
```

### 19.2.34 TIM_OC4FastConfig function

*Table 518* describes the TIM_OC4FastConfig function.

**Table 518. TIM_OC4FastConfig function**

| | |
|---|---|
| Function name | TIM_OC4FastConfig |
| Function prototype | `void TIM_OC4FastConfig(TIM_TypeDef* TIMx, u16 TIM_OCFast)` |
| Behavior description | Configures the TIMx Output Compare 4 Fast feature. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM2 OC4 in fast Mode */
TIM_OC4FastConfig(TIM2, TIM1_OCFast_Enable);
```

### 19.2.35 TIM_ClearOC1Ref

*Table 519* describes the TIM_ClearOC1Ref function.

**Table 519. TIM_ClearOC1Ref function**

| | |
|---|---|
| Function name | TIM_ClearOC1Ref |
| Function prototype | `void TIM_ClearOC1Ref(TIM_TypeDef* TIMx, u16 TIM_OCClear)` |
| Behavior description | Clears or safeguards the OCREF1 signal on an external event. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_OCClear

The values of the Output Compare Reference Clear bit that can be used are listed in *Table 520*:

**Table 520. TIM_OCClear**

| TIM_OCClear | Description |
|---|---|
| TIM_OCClear_Enable | TIMx Output Compare Clear enable. |
| TIM_OCClear_Disable | TIMx Output Compare Clear disable. |

**Example:**

```
/* Enable the TIM2 Channel1 Ouput Compare Refence clear bit */
TIM_ClearOC1Ref(TIM2, TIM_OCClear_Enable);
```

### 19.2.36 TIM_ClearOC2Ref

*Table 521* describes the TIM_ClearOC2Ref function.

**Table 521. TIM_ClearOC2Ref function**

| | |
|---|---|
| Function name | TIM_ClearOC2Ref |
| Function prototype | `void TIM_ClearOC2Ref(TIM_TypeDef* TIMx, u16 TIM_OCClear)` |
| Behavior description | Clears or safeguards the OCREF2 signal on an external event. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM2 Channel2 Ouput Compare Refence clear bit */
TIM_ClearOC2Ref(TIM2, TIM_OCClear_Enable);
```

### 19.2.37 TIM_ClearOC3Ref

*Table 522* describes the TIM_ClearOC3Ref function.

**Table 522. TIM_ClearOC3Ref function**

| | |
|---|---|
| Function name | TIM_ClearOC3Ref |
| Function prototype | `void TIM_ClearOC3Ref(TIM_TypeDef* TIMx, u16 TIM_OCClear)` |
| Behavior description | Clears or safeguards the OCREF3signal on an external event. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM2 Channel3 Ouput Compare Refence clear bit */
TIM_ClearOC3Ref(TIM2, TIM_OCClear_Enable);
```

### 19.2.38 TIM_ClearOC4Ref

*Table 523* describes the TIM_ClearOC4Ref function.

**Table 523. TIM_ClearOC4Ref function**

| | |
|---|---|
| Function name | TIM_ClearOC4Ref |
| Function prototype | `void TIM_ClearOC4Ref(TIM_TypeDef* TIMx, u16 TIM_OCClear)` |
| Behavior description | Clears or safeguards the OCREF4 signal on an external event. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM2 Channel4 Ouput Compare Refence clear bit */
TIM_ClearOC4Ref(TIM2, TIM_OCClear_Enable);
```

### 19.2.39 TIM_UpdateDisableConfig function

*Table 524* describes the TIM_UpdateDisableConfig function.

**Table 524. TIM_UpdateDisableConfig function**

| | |
|---|---|
| Function name | TIM_UpdateDisableConfig |
| Function prototype | `void TIM_UpdateDisableConfig(TIM_TypeDef* TIMx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIMx Update event. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | NewState: new state of the UDIS bit in TIMx_CR1 register.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the Update event for TIM2 */
TIM_UpdateDisableConfig(TIM2, DISABLE);
```

### 19.2.40 TIM_EncoderInterfaceConfig function

*Table 525* describes the TIM_EncoderInterfaceConfig function.

**Table 525. TIM_EncoderInterfaceConfig function**

| | |
|---|---|
| Function name | TIM_EncoderInterfaceConfig |
| Function prototype | `void TIM_EncoderInterfaceConfig(TIM_TypeDef* TIMx, u8 TIM_EncoderMode, u8 TIM_IC1Polarity, u8 TIM_IC2Polarity)` |
| Behavior description | Configures the TIMx Encoder Interface. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_EncoderMode: TIM encoder Mode.<br>Refer to *Section : TIM_EncoderMode* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM_IC1Polarity: TI1 Polarity.<br>Refer to *Section : TIM_ICPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | TIM_IC2Polarity: TI2 Polarity.<br>Refer to *Section : TIM_ICPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_EncoderMode

TIM_EncoderMode selects the TIMx encoder mode. This parameter can be set to one of the following values:

**Table 526. TIM_EncoderMode definition**

| TIM_EncoderMode | Description |
|---|---|
| TIM_EncoderMode_TI1 | TIM encoder Mode 1 is used. |
| TIM_EncoderMode_TI2 | TIM encoder Mode 2 is used. |
| TIM_EncoderMode_TI12 | TIM encoder Mode 3 is used. |

**Example:**

```
/* Configures the encoder mode TI1 for TIM2 */
TIM_EncoderInterfaceConfig(TIM2, TIM_EncoderMode_TI1,
TIM_ICPolarity_Rising, TIM_ICPolarity_Rising);
```

### 19.2.41 TIM_GenerateEvent function

*Table 527* describes the TIM_GenerateEvent function.

**Table 527. TIM_GenerateEvent function**

| | |
|---|---|
| Function name | TIM_GenerateEvent |
| Function prototype | `void TIM_GenerateEvent(TIM_TypeDef* TIMx, u16 TIM_EventSource)` |
| Behavior description | Configures the TIMx event to be generated by software. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_EventSource: TIM software event sources.<br>Refer to *Section : TIM_EventSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_EventSource

TIM_EventSource selects the TIMx event software source. This parameter can be set to one of the following values:

**Table 528. TIM_EventSource values**

| TIM_EventSource | Description |
|---|---|
| TIM_EventSource_Update | TIM Update Event source |
| TIM_EventSource_CC1 | TIM Capture/Compare 1 Event source |
| TIM_EventSource_CC2 | TIM Capture/Compare 2 Event source |
| TIM_EventSource_CC3 | TIM Capture/Compare 3 Event source |
| TIM_EventSource_CC4 | TIM Capture/Compare 4 Event source |
| TIM_EventSource_Trigger | TIM Trigger Event source |

**Example:**

```
/* Selects the Trigger software Event generation for TIM2 */
TIM_GenerateEvent(TIM2, TIM_EventSource_Trigger);
```

### 19.2.42 TIM_OC1PolarityConfig function

*Table 529* describes the TIM_OC1PolarityConfig function.

**Table 529. TIM_OC1PolarityConfig function**

| | |
|---|---|
| Function name | TIM_OC1PolarityConfig |
| Function prototype | `void TIM_OC1PolarityConfig(TIM_TypeDef* TIMx, u16 TIM_Polarity)` |
| Behavior description | Configures the TIMx channel 1 Polarity. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPolarity: Output compare Polarity.<br>Refer to *Section : TIM_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM2 channel 1 output compare */
TIM_OC1PolarityConfig(TIM2, TIM_OCPolarity_High);
```

### 19.2.43 TIM_OC2PolarityConfig function

*Table 530* describes the TIM_OC2PolarityConfig function.

**Table 530. TIM_OC2PolarityConfig function**

| | |
|---|---|
| Function name | TIM_OC2PolarityConfig |
| Function prototype | `void TIM_OC2PolarityConfig(TIM_TypeDef* TIMx, u16 TIM_OCPolarity)` |
| Behavior description | Configures the TIMx channel 2 Polarity. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPolarity: Output compare Polarity.<br>Refer to *Section : TIM_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM2 channel 2 output compare */
TIM_OC2PolarityConfig(TIM2, TIM_OCPolarity_High);
```

### 19.2.44 TIM_OC3PolarityConfig function

*Table 531* describes the TIM_OC3PolarityConfig function.

**Table 531. TIM_OC3PolarityConfig function**

| | |
|---|---|
| Function name | TIM_OC3PolarityConfig |
| Function prototype | `void TIM_OC3PolarityConfig(TIM_TypeDef* TIMx, u16 TIM_OCPolarity)` |
| Behavior description | Configures the TIMx channel 3 Polarity. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPolarity: Output compare Polarity.<br>Refer to *Section : TIM_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM2 channel 3 output compare */
TIM_OC3PolarityConfig(TIM2, TIM_OCPolarity_High);
```

### 19.2.45 TIM_OC4PolarityConfig function

*Table 532* describes the TIM_OC4PolarityConfig function.

**Table 532. TIM_OC4PolarityConfig function**

| | |
|---|---|
| Function name | TIM_OC4PolarityConfig |
| Function prototype | `void TIM_OC4PolarityConfig(TIM_TypeDef* TIMx, u16 TIM_OCPolarity)` |
| Behavior description | Configures the TIMx channel 4 Polarity. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_OCPolarity: Output compare Polarity.<br>Refer to *Section : TIM_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM2 channel 4 output compare */
TIM_OC4PolarityConfig(TIM2, TIM_OCPolarity_High);
```

### 19.2.46 TIM_UpdateRequestConfig function

*Table 533* describes the TIM_UpdateRequestConfig function.

**Table 533. TIM_UpdateRequestConfig function**

| | |
|---|---|
| Function name | TIM_UpdateRequestConfig |
| Function prototype | `void TIM_UpdateRequestConfig(TIM_TypeDef* TIMx, u16 TIM_UpdateSource)` |
| Behavior description | Configures the TIMx Update Request source. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_UpdateSource: Update Request sources.<br>Refer to *Section : TIM_UpdateSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM_UpdateSource

TIM_UpdateSource selects the TIMx Update source. This parameter can be set to one of the following values:

**Table 534. TIM_UpdateSource**

| TIM_UpdateSource | Description |
|---|---|
| TIM_UpdateSource_Global | Source of update is the counter overflow/underflow or a set of UG bit, or update generation through the slave mode controller. |
| TIM_UpdateSource_Regular | Source of update is the counter overflow/underflow. |

**Example:**

```
/* Selects the regular update source for TIM2 */
TIM_UpdateRequestConfig(TIM2, TIM_UpdateSource_Regular);
```

### 19.2.47 TIM_SelectHallSensor function

*Table 535* describes the TIM_SelectHallSensor function.

**Table 535. TIM_SelectHallSensor function**

| | |
|---|---|
| Function name | TIM_SelectHallSensor |
| Function prototype | `void TIM_SelectHallSensor(TIM_TypeDef* TIMx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIMx Hall sensor interface. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | NewState: new state of the TIMx Hall sensor interface.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Hall Sensor Interface for TIM2 */
TIM_SelectHallSensor(TIM2, ENABLE);
```

### 19.2.48 TIM_SelectOnePulseMode function

*Table 536* describes the TIM_SelectOnePulseMode function.

**Table 536. TIM_SelectOnePulseMode function**

| | |
|---|---|
| Function name | TIM_SelectOnePulseMode |
| Function prototype | `void TIM_SelectOnePulseMode(TIM_TypeDef* TIMx, u16 TIM_OPMode)` |
| Behavior description | Selects the TIMx One Pulse Mode. |
| Input parameter1 | TIMx: where x can be 1, 2 or 3 to select the TIM peripheral. |
| Input parameter2 | TIM_OPMode: OPM mode.<br>Refer to *Section : TIM_OPMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_OPMode

TIM_OPMode selects the TIMx Update source. This parameter can be set to one of the following values:

**Table 537. TIM_OPMode definition**

| TIM_OPMode | Description |
|---|---|
| TIM_OPMode_Repetitive | Repetitive pulses are generated: counter is not stopped at update event. |
| TIM_OPMode_Single | A single pulse is generated: counter stops counting at the next update event. |

**Example:**

```
/* Selects the Single One Pulse Mode for TIM2 */
TIM_SelectOnePulseMode(TIM2, TIM_OPMode_Single);
```

## 19.2.49 TIM_SelectOutputTrigger function

*Table 538* describes the TIM_SelectOutputTrigger function.

**Table 538. TIM_SelectOutputTrigger function**

| | |
|---|---|
| Function name | TIM_SelectOutputTrigger |
| Function prototype | `void TIM_SelectOutputTrigger(TIM_TypeDef* TIMx, u16 TIM_TRGOSource)` |
| Behavior description | Selects the TIMx Trigger Output Mode. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_TRGOSource: Trigger Output source.<br>Refer to *Section : TIM_TRGOSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_TRGOSource

TIM_TRGOSource selects the TIMx Trigger Output source. This parameter can be set to one of the following values:

**Table 539. TIM8TRGOSource values**

| TIM_TRGOSource | Description |
|---|---|
| TIM_TRGOSource_Reset | The UG bit from the TIM_EGR register is used as trigger output (TRGO). |
| TIM_TRGOSource_Enable | The Counter Enable CEN is used as trigger output (TRGO). |
| TIM_TRGOSource_Update | The update event is selected as trigger output (TRGO). |
| TIM_TRGOSource_OC1 | The trigger output sends a positive pulse when the CC1IF flag is to be set, as soon as a capture or a compare match occurred (TRGO). |
| TIM_TRGOSource_OC1Ref | OC1REF signal is used as trigger output (TRGO). |
| TIM_TRGOSource_OC2Ref | OC2REF signal is used as trigger output (TRGO). |
| TIM_TRGOSource_OC3Ref | OC3REF signal is used as trigger output (TRGO). |
| TIM_TRGOSource_OC4Ref | OC4REF signal is used as trigger output (TRGO). |

**Example:**

```
/* Selects the update event as Trigger Output for TIM2 */
TIM_SelectOutputTrigger(TIM2, TIM_TRGOSource_Update);
```

## 19.2.50 TIM_SelectSlaveMode function

*Table 540* describes the TIM_SelectSlaveMode function.

**Table 540. TIM_SelectSlaveMode function**

| | |
|---|---|
| Function name | TIM_SelectSlaveMode |
| Function prototype | `void TIM_SelectSlaveMode(TIM_TypeDef* TIMx, u16 TIM_SlaveMode)` |
| Behavior description | Selects the TIMx slave mode. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_SlaveMode: TIM slave mode.<br>Refer to *Section : TIM_SlaveMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_SlaveMode

TIM_SlaveMode selects the TIMx slave mode. This parameter can be set to one of the following values:

**Table 541. TIM_SlaveMode definition**

| TIM_SlaveMode | Description |
|---|---|
| TIM_SlaveMode_Reset | Rising edge of the selected trigger signal (TRGI) reinitializes the counter and triggers an update of the registers. |
| TIM_SlaveMode_Gated | The counter clock is enabled when the trigger signal (TRGI) is high. |
| TIM_SlaveMode_Trigger | The counter starts at a rising edge of the trigger TRGI. |
| TIM_SlaveMode_External1 | Rising edges of the selected trigger (TRGI) clock the counter. |

**Example:**

```
/* Selects the Gated Mode as Slave Mode for TIM2 */
TIM_SelectSlaveMode(TIM2, TIM_SlaveMode_Gated);
```

## 19.2.51 TIM_SelectMasterSlaveMode function

*Table 542* describes the TIM_SelectMasterSlaveMode function.

**Table 542. TIM_SelectMasterSlaveMode function**

| | |
|---|---|
| Function name | TIM_SelectMasterSlaveMode |
| Function prototype | `void TIM_SelectMasterSlaveMode(TIM_TypeDef* TIMx, u16 TIM_MasterSlaveMode)` |
| Behavior description | Sets or Resets the TIMx Master/Slave Mode. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_MasterSlaveMode: Timer master slave mode.<br>Refer to *Section : TIM_MasterSlaveMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM_MasterSlaveMode

TIM_MasterSlaveMode select the TIMx Master Slave mode. See *Table 543* for the values of this parameter.

**Table 543. TIM_MasterSlaveMode definition**

| TIM_MasterSlaveMode | Description |
|---|---|
| TIM_MasterSlaveMode_Enable | Enable the Master Slave Mode. |
| TIM_MasterSlaveMode_Disable | Disable the Master Slave Mode. |

**Example:**

```
/* Enables the Master Slave Mode for TIM2 */
TIM_SelectMasterSlaveMode(TIM2, TIM_MasterSlaveMode_Enable);
```

### 19.2.52 TIM_SetCounter function

Table 544 describes the TIM_SetCounter function.

**Table 544. TIM_SetCounter function**

| | |
|---|---|
| Function name | TIM_SetCounter |
| Function prototype | `void TIM_SetCounter(TIM_TypeDef* TIMx, u16 Counter)` |
| Behavior description | Sets the TIMx Counter Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Counter: Counter register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Counter value */
u16 TIMCounter = 0xFFFF;
TIM_SetCounter(TIM2, TIMCounter);
```

### 19.2.53 TIM_SetAutoreload function

Table 545 describes the TIM_SetAutoreload function.

**Table 545. TIM_SetAutoreload function**

| | |
|---|---|
| Function name | TIM_SetAutoreload |
| Function prototype | `void TIM_SetAutoreload(TIM_TypeDef* TIMx, u16 Autoreload)` |
| Behavior description | Sets the TIMx Autoreload Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Autoreload: Autoreload register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Autoreload value */
u16 TIMAutoreload = 0xFFFF;
TIM_SetAutoreload(TIM2, TIMAutoreload);
```

## 19.2.54 TIM_SetCompare1 function

*Table 546* describes the TIM_SetCompare1 function.

**Table 546. TIM_SetCompare1 function**

| | |
|---|---|
| Function name | TIM_SetCompare1 |
| Function prototype | `void TIM_SetCompare1(TIM_TypeDef* TIMx, u16 Compare1)` |
| Behavior description | Sets the TIMx Capture Compare 1 Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Compare1: TIMx Capture Compare 1 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Output Compare 1 value */
u16 TIMCompare1 = 0x7FFF;
TIM_SetCompare1(TIM2, TIMCompare1);
```

## 19.2.55 TIM_SetCompare2 function

*Table 547* describes the TIM_SetCompare2 function.

**Table 547. TIM_SetCompare2 function**

| | |
|---|---|
| Function name | TIM_SetCompare2 |
| Function prototype | `void TIM_SetCompare2(TIM_TypeDef* TIMx, u16 Compare2)` |
| Behavior description | Sets the TIMx Capture Compare 2 Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Compare2: TIMx Capture Compare 2 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Output Compare 2 value */
u16 TIMCompare2 = 0x7FFF;
TIM_SetCompare2(TIM2, TIMCompare2);
```

### 19.2.56 TIM_SetCompare3 function

Table 548 describes the TIM_SetCompare3 function.

**Table 548. TIM_SetCompare3 function**

| | |
|---|---|
| Function name | TIM_SetCompare3 |
| Function prototype | `void TIM_SetCompare3(TIM_TypeDef* TIMx, u16 Compare3)` |
| Behavior description | Sets the TIMx Capture Compare 3 Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Compare3: TIMx Capture Compare 3 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Output Compare 3 value */
u16 TIMCompare3 = 0x7FFF;
TIM_SetCompare3(TIM1, TIMCompare3);
```

### 19.2.57 TIM_SetCompare4 function

Table 549 describes the TIM_SetCompare4 function.

**Table 549. TIM_SetCompare4 function**

| | |
|---|---|
| Function name | TIM_SetCompare4 |
| Function prototype | `void TIM_SetCompare4(TIM_TypeDef* TIMx, u16 Compare4)` |
| Behavior description | Sets the TIMx Capture Compare 4 Register value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | Compare4: TIMx Capture Compare 4 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 new Output Compare 4 value */
u16 TIMCompare4 = 0x7FFF;
TIM_SetCompare4(TIM2, TIMCompare4);
```

### 19.2.58 TIM_SetIC1Prescaler function

*Table 550* describes the TIM_SetIC1Prescaler function.

**Table 550. TIM_SetIC1Prescaler function**

| | |
|---|---|
| Function name | TIM_SetIC1Prescaler |
| Function prototype | `void TIM_SetIC1Prescaler(TIM_TypeDef* TIMx, u16 TIM_IC1Prescaler)` |
| Behavior description | Sets the TIMx Input Capture 1 Prescaler. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IC1Prescaler: Input Capture 1 Prescaler.<br>Refer to *Section : TIM_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 Input Capture 1 Prescaler */
TIM_SetIC1Prescaler(TIM2, TIM_ICPSC_Div2);
```

### 19.2.59 TIM_SetIC2Prescaler function

*Table 551* describes the TIM_SetIC2Prescaler function.

**Table 551. TIM_SetIC2Prescaler function**

| | |
|---|---|
| Function name | TIM_SetIC2Prescaler |
| Function prototype | `void TIM_SetIC2Prescaler(TIM_TypeDef* TIMx, u16 TIM_IC2Prescaler)` |
| Behavior description | Sets the TIMx Input Capture 2 Prescaler. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IC2Prescaler: Input Capture 2 Prescaler.<br>Refer to *Section : TIM_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 Input Capture 2 Prescaler */
TIM_SetIC2Prescaler(TIM2, TIM_ICPSC_Div2);
```

### 19.2.60 TIM_SetIC3Prescaler function

Table 552 describes the TIM_SetIC3Prescaler function.

**Table 552. TIM_SetIC3Prescaler function**

| | |
|---|---|
| Function name | TIM_SetIC3Prescaler |
| Function prototype | `void TIM_SetIC3Prescaler(TIM_TypeDef* TIMx, u16 TIM_IC3Prescaler)` |
| Behavior description | Sets the TIMx Input Capture 3 Prescaler. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IC3Prescaler: Input Capture 3 Prescaler.<br>Refer to *Section : TIM_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 Input Capture 3 Prescaler */
TIM_SetIC3Prescaler(TIM2, TIM_ICPSC_Div2);
```

### 19.2.61 TIM_SetIC4Prescaler function

Table 553 describes the TIM_SetIC4Prescaler function.

**Table 553. TIM_SetIC4Prescaler function**

| | |
|---|---|
| Function name | TIM_SetIC4Prescaler |
| Function prototype | `void TIM_SetIC4Prescaler(TIM_TypeDef* TIMx, u16 TIM_IC4Prescaler)` |
| Behavior description | Sets the TIMx Input Capture 4 Prescaler. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IC4Prescaler: Input Capture 4 Prescaler.<br>Refer to *Section : TIM_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 Input Capture 4 Prescaler */
TIM_SetIC4Prescaler(TIM2, TIM_ICPSC_Div2);
```

### 19.2.62 TIM_SetClockDivision function

*Table 554* describes the TIM_SetClockDivision function.

**Table 554. TIM_SetClockDivision function**

| | |
|---|---|
| Function name | TIM_SetClockDivision |
| Function prototype | `void TIM_SetClockDivision(TIM_TypeDef* TIMx, u16 TIM_CKD)` |
| Behavior description | Sets the TIMx Clock Division value. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_CKD: clock division value.<br>Refer to *Section : TIM_ClockDivision* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM2 CKD value */
TIM_SetClockDivision(TIM2, TIM_CKD_DIV4);
```

### 19.2.63 TIM_GetCapture1 function

*Table 555* describes the TIM_GetCapture1 function.

**Table 555. TIM_GetCapture1 function**

| | |
|---|---|
| Function name | TIM_GetCapture1 |
| Function prototype | `u16 TIM_GetCapture1(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIMx Input Capture 1 value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 1 value of the TIM2 */
u16 ICAP1value = TIM_GetCapture1(TIM2);
```

### 19.2.64 TIM_GetCapture2 function

Table 556 describes the TIM_GetCapture2 function.

**Table 556. TIM_GetCapture2 function**

| | |
|---|---|
| Function name | TIM_GetCapture2 |
| Function prototype | `u16 TIM_GetCapture2(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIMx Input Capture 2 value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 2 value of the TIM2 */
u16 ICAP2value = TIM_GetCapture2(TIM2);
```

### 19.2.65 TIM_GetCapture3 function

Table 557 describes the TIM_GetCapture3 function.

**Table 557. TIM_GetCapture3 function**

| | |
|---|---|
| Function name | TIM_GetCapture3 |
| Function prototype | `u16 TIM_GetCapture3(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIMx Input Capture 3 value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 3 value of the TIM2 */
u16 ICAP3value = TIM_GetCapture3(TIM2);
```

### 19.2.66 TIM_GetCapture4 function

*Table 558* describes the TIM_GetCapture4 function.

**Table 558. TIM_GetCapture4 function**

| | |
|---|---|
| Function name | TIM_GetCapture4 |
| Function prototype | `u16 TIM_GetCapture4(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIMx Input Capture 4 value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 4 value of the TIM2 */
u16 ICAP4value = TIM_GetCapture4(TIM2);
```

### 19.2.67 TIM_GetCounter function

*Table 559* describes the TIM_GetCounter function.

**Table 559. TIM_GetCounter function**

| | |
|---|---|
| Function name | TIM_GetCounter |
| Function prototype | `void TIM_GetCounter(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIMx counter value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets TIM2 counter value */
u16 TIMCounter = TIM_GetCounter(TIM2);
```

### 19.2.68 TIM_GetPrescaler function

*Table 560* describes the TIM_GetPrescaler function.

**Table 560. TIM_GetPrescaler function**

| | |
|---|---|
| Function name | TIM_GetPrescaler |
| Function prototype | `void TIM_GetPrescaler(TIM_TypeDef* TIMx)` |
| Behavior description | Gets the TIM x Prescaler value. |
| Input parameter | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets TIM2 prescaler value */
u16 TIMPrescaler = TIM_GetPrescaler(TIM2);
```

### 19.2.69 TIM_GetFlagStatus function

*Table 561* describes the TIM_GetFlagStatus function.

**Table 561. TIM_GetFlagStatus function**

| | |
|---|---|
| Function name | TIM_GetFlagStatus |
| Function prototype | `FlagStatus TIM_GetFlagStatus(TIM_TypeDef* TIMx, u16 TIM_FLAG)` |
| Behavior description | Checks whether the specified TIMx flag is set or not. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_FLAG: flag to check.<br>Refer to *Section : TIM_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of TIM_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### TIM_FLAG

The TIMx flags that can be checked by issuing a TIM_GetFlagStatus function are listed in the following table:

**Table 562. TIM_FLAG definition**

| TIM_FLAG | Description |
|---|---|
| TIM_FLAG_Update | TIM Update flag |
| TIM_FLAG_CC1 | TIM Capture/Compare 1 flag |
| TIM_FLAG_CC2 | TIM Capture/Compare 2 flag |
| TIM_FLAG_CC3 | TIM Capture/Compare 3 flag |
| TIM_FLAG_CC4 | TIM Capture/Compare 4 flag |
| TIM_FLAG_Trigger | TIM Trigger flag |
| TIM_FLAG_CC1OF | TIM Capture/Compare 1 OverFlow flag |
| TIM_FLAG_CC2OF | TIM Capture/Compare 2 OverFlow flag |
| TIM_FLAG_CC3OF | TIM Capture/Compare 3 OverFlow flag |
| TIM_FLAG_CC4OF | TIM Capture/Compare 4 OverFlow flag |

**Example**:

```
/* Check if the TIM2 Capture Compare 1 flag is set or reset */
if(TIM_GetFlagStatus(TIM2, TIM_FLAG_CC1) == SET)
{
}
```

## 19.2.70 TIM_ClearFlag function

*Table 563* describes the TIM_ClearFlag function.

**Table 563. TIM_ClearFlag function**

| | |
|---|---|
| Function name | TIM_ClearFlag |
| Function prototype | `void TIM_ClearFlag(TIM_TypeDef* TIMx, u16 TIM_Flag)` |
| Behavior description | Clears the TIMx's pending flags. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_FLAG: flag to clear.<br>Refer to *Section : TIM_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the TIM2 Capture Compare 1 flag */
TIM_ClearFlag(TIM2, TIM_FLAG_CC1);
```

### 19.2.71 TIM_GetITStatus function

*Table 564* describes the TIM_GetITStatus function.

**Table 564. TIM_GetITStatus function**

| | |
|---|---|
| Function name | TIM_GetITStatus |
| Function prototype | `ITStatus TIM_GetITStatus(TIM_TypeDef* TIMx, u16 TIM_IT)` |
| Behavior description | Checks whether the specified TIM interrupt has occurred or not. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IT: specifies the TIM interrupt source to check.<br>Refer to *Section : TIM_IT*" for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of TIM_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Check if the TIM2 Capture Compare 1 interrupt has occured or not
*/
if(TIM_GetITStatus(TIM2, TIM_IT_CC1) == SET)
{
}
```

### 19.2.72 TIM_ClearITPendingBit function

*Table 565* describes the TIM_ClearITPendingBit function.

**Table 565. TIM_ClearITPendingBit function**

| | |
|---|---|
| Function name | TIM_ClearITPending Bit |
| Function prototype | `void TIM_ClearITPendingBit(TIM_TypeDef* TIMx, u16 TIM_IT)` |
| Behavior description | Clears the TIMx's interrupt pending bits. |
| Input parameter1 | TIMx: where x can be 2, 3 or 4 to select the TIM peripheral. |
| Input parameter2 | TIM_IT: specifies the interrupt pending bit to clear.<br>Refer to *Section : TIM_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the TIM2 Capture Compare 1 interrupt pending bit */
TIM_ClearITPendingBit(TIM2, TIM_IT_CC1);
```

# 20 Advanced control timer (TIM1)

TIM1 consists of 16-bit auto-reload counter driven by a programmable prescaler.

This timer can be used for a variety of purposes, including measurement of input signal pulse length (input capture) or generation of output waveforms (output compare, PWM, complementary PWM with dead-time insertion...).

Pulse lengths and waveform periods can be modulated from a few microseconds to several milliseconds using the timer prescaler and the CPU clock prescaler.

*Section 20.1: TIM1 register structure* describes the data structures used in the TIM1 Firmware Library. *Section 20.2: Firmware library functions* presents the Firmware Library functions.

## 20.1 TIM1 register structure

The TIM1 register structure, TIM1_*TypeDef,* is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 CR1;
  u16 RESERVED0;
  vu16 CR2;
  u16 RESERVED1;
  vu16 SMCR;
  u16 RESERVED2;
  vu16 DIER;
  u16 RESERVED3;
  vu16 SR;
  u16 RESERVED4;
  vu16 EGR;
  u16 RESERVED5;
  vu16 CCMR1;
  u16 RESERVED6;
  vu16 CCMR2;
  u16 RESERVED7;
  vu16 CCER;
  u16 RESERVED8;
  vu16 CNT;
  u16 RESERVED9;
  vu16 PSC;
  u16 RESERVED10;
  vu16 ARR;
  u16 RESERVED11;
  vu16 RCR;
  u16 RESERVED12;
  vu16 CCR1;
  u16 RESERVED13;
  vu16 CCR2;
  u16 RESERVED14;
```

```
  vu16 CCR3;
  u16 RESERVED15;
  vu16 CCR4;
  u16 RESERVED16;
  vu16 BDTR;
  u16 RESERVED17;
  vu16 DCR;
  u16 RESERVED18;
  vu16 DMAR;
  u16 RESERVED19;
} TIM1_TypeDef;
```

*Table 566* gives the list of TIM1 registers.

**Table 566. TIM1 registers**

| Register | Description |
|---|---|
| CR1 | Control Register1 |
| CR2 | Control Register2 |
| SMCR | Slave Mode Control Register |
| DIER | DMA and Interrupt Enable Register |
| SR | Status Register |
| EGR | Event Generation Register |
| CCMR1 | Capture/Compare Mode Register 1 |
| CCMR2 | Capture/Compare Mode Register 2 |
| CCER | Capture/Compare Enable Register |
| CNT | Counter Register |
| PSC | Prescaler Register |
| ARR | Auto-Reload Register |
| RCR | Repetition Counter Register |
| CCR1 | Capture/Compare Register 1 |
| CCR2 | Capture/Compare Register 2 |
| CCR3 | Capture/Compare Register 3 |
| CCR4 | Capture/Compare Register 4 |
| BDTR | Break and Dead Time Register |
| DCR | DMA Control Register |
| DMAR | DMA Address for Burst mode Register |

The TIM1 peripheral is declared in *stm32f10x_map*:

```
...
#define PERIPH_BASE          ((u32)0x40000000)
#define APB1PERIPH_BASE      PERIPH_BASE
#define APB2PERIPH_BASE      (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE       (PERIPH_BASE + 0x20000)
....
```

```
#define TIM1_BASE              (APB2PERIPH_BASE + 0x2C00)
....
#ifndef DEBUG
...
#ifdef _TIM1
  #define TIM1                 ((TIM1_TypeDef *) TIM1_BASE)
#endif /*_TIM1 */
...
#else   /* DEBUG */
...
#ifdef _TIM1
  EXT TIM1_TypeDef             *TIM1;
#endif /*_TIM1 */
..
#endif
```

When using the Debug mode, _TIM1 pointer is initialized in *stm32f10x_lib.c* file:

```
...
#ifdef _TIM1
  TIM1 = (TIM1_TypeDef *)  TIM1_BASE;
#endif /*_TIM1 *//
...
```

To access TIM1 registers, _TIM1 must be defined in *stm32f10x_conf.h* as follows:

```
...
#define _TIM1
...
```

## 20.2 Firmware library functions

Table 567 gives the list of the various functions of the TIM1 library.

**Table 567. TIM1 firmware library functions**

| Function name | Description |
|---|---|
| TIM1_DeInit | Resets the TIM1 peripheral registers to their default reset values. |
| TIM1_TimeBaseInit | Initializes the TIM1 Time Base Unit according to the specified parameters in the TIM1_TimeBaseInitStruct. |
| TIM1_OC1Init | Initializes the TIM1 Channel1 according to the specified parameters in the TIM1_OCInitStruct. |
| TIM1_OC2Init | Initializes the TIM1 Channel2 according to the specified parameters in the TIM1_OCInitStruct. |
| TIM1_OC3Init | Initializes the TIM1 Channel3 according to the specified parameters in the TIM1_OCInitStruct. |
| TIM1_OC4Init | Initializes the TIM1 Channel4 according to the specified parameters in the TIM1_OCInitStruct. |
| TIM1_BDTRConfig | Configures the: Break feature, dead time, Lock level, the OSSI, the OSSR State and the AOE (automatic output enable). |
| TIM1_ICInit | Initializes the TIM1 peripheral according to the specified parameters in the TIM1_ICInitStruct. |
| TIM1_PWMIConfig | Configures the TIM1 peripheral in PWM Input Mode according to the specified parameters in the TIM1_ICInitStruct. |
| TIM1_TimeBaseStructInit | Fills each TIM1_TimeBaseInitStruct member with its default value. |
| TIM1_OCStructInit | Fills each TIM1_OCInitStruct member with its default value. |
| TIM1_ICStructInit | Fills each TIM1_ICInitStruct member with its default value. |
| TIM1_BDTRStructInit | Fills each TIM1_BDTRInitStruct member with its default value. |
| TIM1_Cmd | Enables or disables the specified TIM1 peripheral. |
| TIM1_CtrlPWMOutputs | Enables or disables the TIM1 peripheral Main Outputs. |
| TIM1_ITConfig | Enables or disables the specified TIM1 interrupts. |
| TIM1_DMAConfig | Configures the TIM1's DMA interface. |
| TIM1_DMACmd | Enables or disables the TIM1's DMA Requests. |
| TIM1_InternalClockConfig | Configures the TIM1 internal Clock. |
| TIM1_ETRClockMode1Config | Configures the TIM1 External clock Mode1. |
| TIM1_ETRClockMode2Config | Configures the TIM1 External clock Mode2. |
| TIM1_ETRConfig | Configures the TIM1 External Trigger (ETR). |
| TIM1_ITRxExternalClockConfig | Configures the TIM1 Internal Trigger as External Clock. |
| TIM1_TIxExternalClockConfig | Configures the TIM1 Trigger as External Clock. |
| TIM1_SelectInputTrigger | Selects theTIM1 Input Trigger source. |
| TIM1_UpdateDisableConfig | Enables or Disables the TIM1 Update event. |
| TIM1_UpdateRequestConfig | Selects the TIM1 Update Request Interrupt source. |

**Table 567. TIM1 firmware library functions (continued)**

| Function name | Description |
|---|---|
| TIM1_SelectHallSensor | Enables or disables the TIM1’s Hall sensor interface. |
| TIM1_SelectOnePulseMode | Enables or disables the TIM1’s One Pulse Mode. |
| TIM1_SelectOutputTrigger | Selects the TIM1 Trigger Output Mode. |
| TIM1_SelectSlaveMode | Selects the TIM1 Slave Mode. |
| TIM1_SelectMasterSlaveMode | Sets or Resets the TIM1 Master/Slave Mode. |
| TIM1_EncoderInterfaceConfig | Configures the TIM1 Encoder Interface. |
| TIM1_PrescalerConfig | Configures the TIM1 Prescaler. |
| TIM1_CounterModeConfig | Specifies the TIM1 Counter Mode to be used. |
| TIM1_ForcedOC1Config | Forces the TIM1 Channel1 output waveform to active or inactive level. |
| TIM1_ForcedOC2Config | Forces the TIM1 Channel2 output waveform to active or inactive level. |
| TIM1_ForcedOC3Config | Forces the TIM1 Channel3 output waveform to active or inactive level. |
| TIM1_ForcedOC4Config | Forces the TIM1 Channel4 output waveform to active or inactive level. |
| TIM1_ARRPreloadConfig | Enables or disables the TIM1 peripheral Preload register on ARR. |
| TIM1_SelectCOM | Selects the TIM1 peripheral Commutation event. |
| TIM1_SelectCCDMA | Selects the TIM1 peripheral Capture Compare DMA source. |
| TIM1_CCPreloadControl | Sets or Resets the TIM1 peripheral Capture Compare Preload Control bit. |
| TIM1_OC1PreloadConfig | Enables or disables the TIM1 peripheral Preload Register on CCR1. |
| TIM1_OC2PreloadConfig | Enables or disables the TIM1 peripheral Preload Register on CCR2. |
| TIM1_OC3PreloadConfig | Enables or disables the TIM1 peripheral Preload Register on CCR3. |
| TIM1_OC4PreloadConfig | Enables or disables the TIM1 peripheral Preload Register on CCR4. |
| TIM1_OC1FastConfig | Configures the TIM1 Capture Compare 1 Fast feature. |
| TIM1_OC2FastConfig | Configures the TIM1 Capture Compare 2 Fast feature. |
| TIM1_OC3FastConfig | Configures the TIM1 Capture Compare 3 Fast feature. |
| TIM1_OC4FastConfig | Configures the TIM1 Capture Compare 4 Fast feature. |
| TIM1_ClearOC1Ref | Clears or safeguards the OCREF1 signal on an external event |
| TIM1_ClearOC2Ref | Clears or safeguards the OCREF2 signal on an external event |
| TIM1_ClearOC3Ref | Clears or safeguards the OCREF3 signal on an external event |
| TIM1_ClearOC4Ref | Clears or safeguards the OCREF4 signal on an external event |

Table 567. TIM1 firmware library functions (continued)

| Function name | Description |
|---|---|
| TIM1_GenerateEvent | Configures the TIM1 event to be generate by software. |
| TIM1_OC1PolarityConfig | Configures the TIM1 Channel 1 polarity. |
| TIM1_OC1NPolarityConfig | Configures the TIM1 Channel 1N polarity. |
| TIM1_OC2PolarityConfig | Configures the TIM1 Channel 2 polarity. |
| TIM1_OC2NPolarityConfig | Configures the TIM1 Channel 2N polarity. |
| TIM1_OC3PolarityConfig | Configures the TIM1 Channel 3 polarity. |
| TIM1_OC3NPolarityConfig | Configures the TIM1 Channel 3N polarity. |
| TIM1_OC4PolarityConfig | Configures the TIM1 Channel 4 polarity. |
| TIM1_CCxCmd | Enables or disables the TIM1 Capture Compare Channel x. |
| TIM1_CCxNCmd | Enables or disables the TIM1 Capture Compare Channel xN. |
| TIM1_SelectOCxM | Selects the TIM1 Output Compare Mode.<br>This function disables the selected channel before changing the Output Compare Mode. User has to enable this channel using TIM1_CCxCmd and TIM1_CCxNCmd functions. |
| TIM1_SetCounter | Sets the TIM1 Counter Register value. |
| TIM1_SetAutoreload | Sets the TIM1 Autoreload Register value. |
| TIM1_SetCompare1 | Sets the TIM1 Capture Compare1 Register value. |
| TIM1_SetCompare2 | Sets the TIM1 Capture Compare2 Register value. |
| TIM1_SetCompare3 | Sets the TIM1 Capture Compare3 Register value. |
| TIM1_SetCompare4 | Sets the TIM1 Capture Compare4 Register value. |
| TIM1_SetIC1Prescaler | Sets the TIM1 Input Capture 1 prescaler. |
| TIM1_SetIC2Prescaler | Sets the TIM1 Input Capture 2 prescaler. |
| TIM1_SetIC3Prescaler | Sets the TIM1 Input Capture 3 prescaler. |
| TIM1_SetIC4Prescaler | Sets the TIM1 Input Capture 4 prescaler. |
| TIM1_SetClockDivision | Sets the TIM1 Clock Division value. |
| TIM1_GetCapture1 | Gets the TIM1 Input Capture 1 value. |
| TIM1_GetCapture2 | Gets the TIM1 Input Capture 2 value. |
| TIM1_GetCapture3 | Gets the Input Capture 3 value. |
| TIM1_GetCapture4 | Gets the TIM1 Input Capture 4 value. |
| TIM1_GetCounter | Gets the TIM1 counter value. |
| TIM1_GetPrescaler | Gets the Prescaler value. |
| TIM1_GetFlagStatus | Checks whether the specified TIM1 flag is set or not. |
| TIM1_ClearFlag | Clears the TIM1's pending flags. |
| TIM1_GetITStatus | Checks whether the specified TIM1 interrupt has occurred or not. |
| TIM1_ClearITPendingBit | Clears the TIM1's interrupt pending bits. |

## 20.2.1 TIM1_DeInit function

*Table 568* describes the TIM1_DeInit function.

**Table 568. TIM1_DeInit function**

| | |
|---|---|
| Function name | TIM1_DeInit |
| Function prototype | `void TIM1_DeInit(void)` |
| Behavior description | Resets the TIM1 peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphResetCmd |

**Example:**

```
/* Resets the TIM1 */
TIM1_DeInit();
```

## 20.2.2 TIM1_TimeBaseInit function

*Table 568* describes the TIM1_TimeBaseInit function.

**Table 569. TIM1_TimeBaseInit function**

| | |
|---|---|
| Function name | TIM1_TimeBaseInit |
| Function prototype | `void TIM1_TimeBaseInit(TIM1_TimeBaseInitTypeDef* TIM1_BaseInitStruct)` |
| Behavior description | Initializes the TIM1 Time Base Unit according to the parameters specified in the TIM1_TimeBaseInitStruct. |
| Input parameter | TIM1_BaseInitStruct: pointer to a TIM1_BaseInitTypeDef structure that contains the configuration information for the specified TIM1 Time Base Unit.<br>Refer to *Section : TIM1_TimeBaseInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## TIM1_TimeBaseInitTypeDef structure

The TIM1_BaseInitTypeDef structure is defined in the *stm32f10x_tim1.h* file:

```
typedef struct
{
u16 TIM1_Period;
  u16 TIM1_Prescaler;
u16 TIM1_ClockDivision;
  u16 TIM1_CounterMode;
  u8 TIM1_RepetitionCounter;
} TIM1_BaseInitTypeDef;
```

### TIM1_Period

TIM1_Period configures the period value to be loaded at the next update event in the active Auto-Reload register. This member must be a number between 0x0000 and 0xFFFF.

### TIM1_Prescaler

TIM1_Prescaler configures the Prescaler value that is used to divide the TIM1 clock. This member must be a number between 0x0000 and 0xFFFF.

### TIM1_ClockDivision

TIM1_ClockDivision configures the Clock Division. This member can be set to one of the following values:

**Table 570. TIM1_ClockDivision**

| TIM1_ClockDivision | Description |
|---|---|
| TIM1_CKD_DIV1 | $T_{DTS} = T_{ck\_tim}$ |
| TIM1_CKD_DIV2 | $T_{DTS} = 2*T_{ck\_tim}$ |
| TIM1_CKD_DIV4 | $T_{DTS} = 4*T_{ck\_tim}$ |

### TIM1_CounterMode

TIM1_CounterMode selects the Counter mode. This member can be one of the following values:

**Table 571. TIM1_CounterMode definition**

| TIM1_CounterMode | Description |
|---|---|
| TIM1_Counter_Up | TIM1 Up Counting mode. |
| TIM1_Counter_Down | TIM1 Down Counting mode. |
| TIM1_Counter_CenterAligned1 | TIM1 CenterAligned Mode1 Counting mode. |
| TIM1_Counter_CenterAligned2 | TIM1 CenterAligned Mode2 Counting mode. |
| TIM1_Counter_CenterAligned3 | TIM1 CenterAligned Mode3 Counting mode. |

### TIM1_RepetitionCounter

TIM1_RepetitionCounter configures the repetition counter value. Each time the RCR down-counter reaches zero, an update event is generated and counting restarts from RCR value (N).

This means in PWM mode (N+1) corresponds to:

- The number of PWM periods in edge-aligned mode
- The number of half PWM period in center-aligned mode

This member must be a number between 0x00 and 0xFF.

## 20.2.3 TIM1_OC1Init function

*Table 572* describes the TIM1_OC1Init function.

**Table 572. TIM1_OC1Init function**

| | |
|---|---|
| Function name | TIM1_OC1Init |
| Function prototype | `void TIM1_OC1Init(TIM1_OCInitTypeDef* TIM1_OCInitStruct)` |
| Behavior description | Initializes the TIM1 Channel 1 according to the parameters specified in the TIM1_OCInitStruct. |
| Input parameter | TIM1_OCInitStruct: pointer to a TIM1_OCInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_OCInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## TIM1_OCInitTypeDef structure

The TIM1_OCInitTypeDef structure is defined in the *stm32f10x_tim1.h* file:

```
typedef struct
{
  u16 TIM1_OCMode;
  u16 TIM1_OutputState;
  u16 TIM1_OutputNState;
  u16 TIM1_Pulse;
  u16 TIM1_OCPolarity;
  u16 TIM1_OCNPolarity;
  u16 TIM1_OCIdleState;
  u16 TIM1_OCNIdleState;
} TIM1_OCInitTypeDef;
```

### TIM1_OCMode

TIM1_OCMode selects the TIM1 mode. This member can be set to one of the following values:

**Table 573. TIM1_OCMode definition**

| TIM1_OCMode | Description |
|---|---|
| TIM1_OCMode_Timing | TIM1 Output Compare Timing Mode. |
| TIM1_OCMode_Active | TIM1 Output Compare Active Mode. |
| TIM1_OCMode_Inactive | TIM1 Output Compare Inactive Mode. |
| TIM1_OCMode_Toggle | TIM1 Output Compare Toggle Mode. |
| TIM1_OCMode_PWM1 | TIM1 Pulse Width Modulation Mode1. |
| TIM1_OCMode_PWM2 | TIM1 Pulse Width Modulation Mode2. |

### TIM1_OutputState

TIM1_OutputState selects the TIM1 Output Compare state. This member can be set to one of the following values:

**Table 574. TIM1_OutputState definition**

| TIM1_OutputState | Description |
|---|---|
| TIM1_OutputState_Disable | TIM1 Output Compare State Disable. |
| TIM1_OutputState_Enable | TIM1 Output Compare State Enable. |

### TIM1_OutputNState

TIM1_OutputNState selects the TIM1 complementary Output Compare state. This member can be set to one of the following values:

**Table 575. TIM1_OutputNState definition**

| TIM1_OutputNState | Description |
|---|---|
| TIM1_OutputNState_Disable | TIM1 Output N Compare State Disable. |
| TIM1_OutputNState_Enable | TIM1 Output N Compare State Enable. |

### TIM1_Pulse

TIM1_Pulse configures the pulse value to be loaded in the Capture Compare register. This member must be a number between 0x0000 and 0xFFFF.

### TIM1_OCPolarity

TIM1_OCPolarity configures the output polarity. This member can be set to one of the following values:

**Table 576. TIM1_OCPolarity definition**

| TIM1_OCPolarity | Description |
|---|---|
| TIM1_OCPolarity_High | Output Compare Polarity High. |
| TIM1_OCPolarity_Low | Output Compare Polarity Low. |

### TIM1_OCNPolarity

TIM1_OCNPolarity configures the complementary output polarity. This member can be SET TO one of the following values:

**Table 577. TIM1_OCNPolarity definition**

| TIM1_OCNPolarity | Description |
|---|---|
| TIM1_OCNPolarity_High | Output Compare N Polarity High. |
| TIM1_OCNPolarity_Low | Output Compare N Polarity Low. |

### TIM1_OCIdleState

TIM1_OCIdleState selects the Off-State for Idle state. This member can be set to one of the following values:

**Table 578. TIM1_OCIdleState definition**

| TIM1_OCIdleState | Description |
|---|---|
| TIM1_OCIdleState_Set | TIM1 Output OC Idle state set when MOE = 0 |
| TIM1_OCIdleState_Reset | TIM1 Output OC Idle state reset when MOE = 0 |

### TIM1_OCNIdleState

TIM1_OCNIdleState selects the Off-State for Idle state. This member can be one of the following values:

**Table 579. TIM1_OCNIdleState definition**

| TIM1_OCNIdleState | Description |
|---|---|
| TIM1_OCNIdleState_Set | TIM1 Output OCN Idle state set when MOE = 0 |
| TIM1_OCNIdleState_Reset | TIM1 Output OCN Idle state reset when MOE = 0 |

**Example:**

```
/* Configures the TIM1 Channel1 in PWM Mode */
TIM1_OCInitTypeDef TIM1_OCInitStructure;
TIM1_OCInitStructure.TIM1_OCMode = TIM1_OCMode_PWM1;
TIM1_OCInitStructure.TIM1_OutputState = TIM1_OutputState_Enable;
TIM1_OCInitStructure.TIM1_OutputNState=TIM1_OutputNState_Enable;
TIM1_OCInitStructure.TIM1_Pulse = 0x7FF;
TIM1_OCInitStructure.TIM1_OCPolarity = TIM1_OCPolarity_Low;
TIM1_OCInitStructure.TIM1_OCNPolarity = TIM1_OCNPolarity_Low;
TIM1_OCInitStructure.TIM1_OCIdleState = TIM1_OCIdleState_Set;
TIM1_OCInitStructure.TIM1_OCNIdleState = TIM1_OCIdleState_Reset;
TIM1_OC1Init(&TIM1_OCInitStructure);
```

### 20.2.4 TIM1_OC2Init function

*Table 580* describes the TIM1_OC2Init function.

**Table 580. TIM1_OC2Init function**

| | |
|---|---|
| Function name | TIM1_OC2Init |
| Function prototype | `void TIM1_OC2Init(TIM1_OCInitTypeDef* TIM1_OCInitStruct)` |
| Behavior description | Initializes the TIM1 Channel 2 according to the parameters specified in the TIM1_OCInitStruct. |
| Input parameter | TIM1_OCInitStruct: pointer to a TIM1_OCInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_OCInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Configures the TIM1 Channel2 in PWM Mode */
TIM1_OCInitTypeDef TIM1_OCInitStructure;

TIM1_OCInitStructure.TIM1_OCMode = TIM1_OCMode_PWM1;
TIM1_OCInitStructure.TIM1_OutputState = TIM1_OutputState_Enable;
TIM1_OCInitStructure.TIM1_OutputNState=TIM1_OutputNState_Enable;
TIM1_OCInitStructure.TIM1_Pulse = 0x7FF;
TIM1_OCInitStructure.TIM1_OCPolarity = TIM1_OCPolarity_Low;
TIM1_OCInitStructure.TIM1_OCNPolarity = TIM1_OCNPolarity_Low;
TIM1_OCInitStructure.TIM1_OCIdleState = TIM1_OCIdleState_Set;
TIM1_OCInitStructure.TIM1_OCNIdleState = TIM1_OCIdleState_Reset;

TIM1_OC2Init(&TIM1_OCInitStructure);
```

### 20.2.5 TIM1_OC3Init function

*Table 581* describes the TIM1_OC3Init function.

**Table 581. TIM1_OC3Init function**

| | |
|---|---|
| Function name | TIM1_OC3Init |
| Function prototype | `void TIM1_OC3Init(TIM1_OCInitTypeDef* TIM1_OCInitStruct)` |
| Behavior description | Initializes the TIM1 Channel 3 according to the parameters specified in the TIM1_OCInitStruct. |
| Input parameter | TIM1_OCInitStruct: pointer to a TIM1_OCInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_OCInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Configures the TIM1 Channel3 in PWM Mode */
TIM1_OCInitTypeDef TIM1_OCInitStructure;

TIM1_OCInitStructure.TIM1_OCMode = TIM1_OCMode_PWM1;
TIM1_OCInitStructure.TIM1_OutputState = TIM1_OutputState_Enable;
TIM1_OCInitStructure.TIM1_OutputNState=TIM1_OutputNState_Enable;
TIM1_OCInitStructure.TIM1_Pulse = 0x7FF;
TIM1_OCInitStructure.TIM1_OCPolarity = TIM1_OCPolarity_Low;
TIM1_OCInitStructure.TIM1_OCNPolarity = TIM1_OCNPolarity_Low;
TIM1_OCInitStructure.TIM1_OCIdleState = TIM1_OCIdleState_Set;
TIM1_OCInitStructure.TIM1_OCNIdleState = TIM1_OCIdleState_Reset;

TIM1_OC3Init(&TIM1_OCInitStructure);
```

### 20.2.6 TIM1_OC4Init function

*Table 582* describes the TIM1_OC4Init function.

**Table 582. TIM1_OC14nit function**

| | |
|---|---|
| Function name | TIM1_OC4Init |
| Function prototype | `void TIM1_OC4Init(TIM1_OCInitTypeDef* TIM1_OCInitStruct)` |
| Behavior description | Initializes the TIM1 Channel 4 according to the specified parameters in the TIM1_OCInitStruct. |
| Input parameter | TIM1_OCInitStruct: pointer to a TIM1_OCInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_OCInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Configures the TIM1 Channel4 in PWM Mode */
TIM1_OCInitTypeDef TIM1_OCInitStructure;

TIM1_OCInitStructure.TIM1_OCMode = TIM1_OCMode_PWM1;
TIM1_OCInitStructure.TIM1_OutputState = TIM1_OutputState_Enable;
TIM1_OCInitStructure.TIM1_Pulse = 0x7FF;
TIM1_OCInitStructure.TIM1_OCPolarity = TIM1_OCPolarity_Low;
TIM1_OCInitStructure.TIM1_OCIdleState = TIM1_OCIdleState_Set;

TIM1_OC4Init(&TIM1_OCInitStructure);
```

### 20.2.7 TIM1_BDTRConfig function

*Table 583* describes the TIM1_BDTRConfig function.

**Table 583. TIM1_BDTRConfig function**

| | |
|---|---|
| Function name | TIM1_BDTRConfig |
| Function prototype | `void TIM1_BDTRConfig(TIM1_BDTRInitTypeDef *TIM1_BDTRInitStruct)` |
| Behavior description | Configure the break feature, dead time, Lock level, OSSI, OSSR State and AOE (automatic output enable). |
| Input parameter | TIM1_BDTRInitStruct: pointer to a TIM1_BDTRInitTypeDef structure that contains the BDTR Register configuration information for the TIM1 peripheral.<br>Refer to *Section : TIM1_BDTRInitStruct structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_BDTRInitStruct structure

The TIM1_BDTRInitStruct structure is defined in the *stm32f10x_tim1.h* file:

```
typedef struct
{
  u16 TIM1_OSSRState;
  u16 TIM1_OSSIState;
  u16 TIM1_LOCKLevel;
  u16 TIM1_DeadTime;
  u16 TIM1_Break;
  u16 TIM1_BreakPolarity;
  u16 TIM1_AutomaticOutput;
} TIM1_BDTRInitTypeDef;
```

#### TIM1_OSSRState

TIM1_OSSRState configures the Off-State Selection used in Run mode. This member can be set to one of the following values:

**Table 584. TIM1_OSSRState definition**

| TIM1_OSSRState | Description |
|---|---|
| TIM1_OSSRState_Enable | TIM1 OSSR State is enabled |
| TIM1_OSSRState_Disable | TIM1 OSSR State is disabled |

### TIM1_OSSIState

TIM1_OSSIState selects the Off-State used in Idle state. This member can be set to one of the following values:

**Table 585. TIM1_OSSIState definition**

| TIM1_OSSIState | Description |
|---|---|
| TIM1_OSSIState_Enable | TIM1 OSSI State is enabled |
| TIM1_OSSIState_Disable | TIM1 OSSI State is disabled |

### TIM1_LOCKLevel

TIM1_LOCKLevel configures the LOCK level parameters. This member can be set to one of the following values:

**Table 586. TIM1_LOCKLevel definition**

| TIM1_LOCKLevel | Description |
|---|---|
| TIM1_LOCKLevel_OFF | No bits are locked. |
| TIM1_LOCKLevel_1 | LOCK level 1 is used. |
| TIM1_LOCKLevel_2 | LOCK level 2 is used. |
| TIM1_LOCKLevel_3 | LOCK level 3 is used. |

### TIM1_DeadTime

TIM1_DeadTime specifies the delay time between the switching-off and the switching-on of the outputs.

### TIM1_Break

TIM1_Break enables or disables the TIM1 Break input. This member can be set to one of the following values:

**Table 587. TIM1_Break definition**

| TIM1_Break | Description |
|---|---|
| TIM1_Break_Enable | TIM1 Break Input is enabled |
| TIM1_Break_Disable | TIM1 Break Input is disabled |

### TIM1_BreakPolarity

TIM1_BreakPolaritiy configures the TIM1 Break Input pin polarity. This member can be set to one of the following values:

**Table 588. TIM1_BreakPolarity definition**

| TIM1_BreakPolarity | Description |
|---|---|
| TIM1_BreakPolarity_Low | TIM1 Break Input pin polarity Low. |
| TIM1_BreakPolarity_High | TIM1 Break Input pin polarity High. |

### TIM1_AutomaticOutput

TIM1_AutomaticOutput enables or disables the Automatic Output feature. This member can be set to one of the following values:

**Table 589. TIM1_AutomaticOutput definition**

| TIM1_AutomaticOutput | Description |
|---|---|
| TIM1_AutomaticOutput_Enable | TIM1 Automatic Output enable. |
| TIM1_AutomaticOutput_Disable | TIM1 Automatic Output disable. |

**Example:**

```
/* OSSR, OSSI, Automatic Output enable, Break, dead time and Lock
Level configuration*/
TIM1_BDTRInitTypeDef TIM1_BDTRInitStructure;

TIM1_BDTRInitStructure.TIM1_OSSRState = TIM1_OSSRState_Enable;
TIM1_BDTRInitStructure.TIM1_OSSIState = TIM1_OSSIState_Enable;
TIM1_BDTRInitStructure.TIM1_LOCKLevel = TIM1_LOCKLevel_1;
TIM1_BDTRInitStructure.TIM1_DeadTime = 0x05;
TIM1_BDTRInitStructure.TIM1_Break = TIM1_Break_Enable;
TIM1_BDTRInitStructure.TIM1_BreakPolarity =
TIM1_BreakPolarity_High;
TIM1_BDTRInitStructure.TIM1_AutomaticOutput =
TIM1_AutomaticOutput_Enable;
TIM1_BDTRConfig(&TIM1_BDTRInitStructure);
```

### 20.2.8 TIM1_ICInit function

*Table 590* describes the TIM1_ICInit function.

**Table 590. TIM1_ICInit function**

| | |
|---|---|
| Function name | TIM1_ICInit |
| Function prototype | `void TIM1_ICInit(TIM1_ICInitTypeDef* TIM1_ICInitStruct)` |
| Behavior description | Initializes the TIM1 according to the parameters specified in the TIM1_ICInitStruct. |
| Input parameter | TIM1_ICInitStruct: pointer to a TIM1_ICInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_ICInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_ICInitTypeDef structure

The TIM1_ICInitTypeDef structure is defined in the *stm32f10x_tim1.h* file:

```
typedef struct
{
  u16 TIM1_Channel;
  u16 TIM1_ICPolarity;
  u16 TIM1_ICSelection;
  u16 TIM1_ICPrescaler;
  u8 TIM1_ICFilter;
} TIM1_ICInitTypeDef;
```

#### TIM1_Channel

TIM1_Channel selects the TIM1Channel. This member can be set to one of the following values:

**Table 591. TIM1_Channel definition**

| TIM1_Channel | Description |
|---|---|
| TIM1_Channel_1 | TIM1 Channel 1 is used. |
| TIM1_Channel_2 | TIM1 Channel 2 is used. |
| TIM1_Channel_3 | TIM1 Channel 3 is used. |
| TIM1_Channel_4 | TIM1 Channel 4 is used. |

### TIM1_ICPolarity

TIM1_ICPolarity selects the Input signal active edge. This member can be set to one of the following values:

**Table 592. TIM1_ICPolarity definition**

| TIM1_ICPolarity | Description |
|---|---|
| TIM1_ICPolarity_Rising | TIM1 Input Capture Rising Edge. |
| TIM1_ICPolarity_Falling | TIM1 Input Capture Falling Edge. |

### TIM1_ICSelection

TIM1_ICSelection selects the used Input. This member can be set to one of the following values:

**Table 593. TIM1_ICSelection definition**

| TIM1_ICSelection | Description |
|---|---|
| TIM1_ICSelection_DirectTI | TIM1 Input 1, 2 or 3 or 4 are selected to be connected respectively to IC1 or IC2 or IC3 or IC4. |
| TIM1_ICSelection_IndirectTI | TIM1 Input 1, 2 or 3 or 4 are selected to be connected respectively to IC2 or IC1 or IC4 or IC3. |
| TIM1_ICSelection_TRC | TIM1 Input 1, 2 or 3 or 4 are selected to be connected to TRC. |

### TIM1_ICPrescaler

TIM1_ICPrescaler configures the Input Capture Prescaler. This member can be set to one of the following values:

**Table 594. TIM1_ICPrescaler definition**

| TIM1_ICPrescaler | Description |
|---|---|
| TIM1_ICPSC_DIV1 | Capture performed each time an edge is detected on the capture input. |
| TIM1_ICPSC_DIV2 | Capture performed once every 2 events. |
| TIM1_ICPSC_DIV4 | Capture performed once every 4 events. |
| TIM1_ICPSC_DIV8 | Capture performed once every 8 events. |

### TIM1_ICFilter

TIM1_ICFilter specifies the Input Capture Filter. This member must be a value between 0x0 and 0xF.

**Example:**

```
/* TIM1 Input Capture Channel 1 mode Configuration */

TIM1_ICInitTypeDef TIM1_ICInitStructure;

TIM1_ICInitStructure.TIM1_Channel = TIM1_Channel_1;
TIM1_ICInitStructure.TIM1_ICPolarity = TIM1_ICPolarity_Falling;
TIM1_ICInitStructure.TIM1_ICSelection = TIM1_ICSelection_DirectTI;
TIM1_ICInitStructure.TIM1_ICPrescaler = TIM1_ICPSC_DIV2;
TIM1_ICInitStructure.TIM1_ICFilter = 0x0;

TIM1_ICInit(&TIM1_ICInitStructure);
```

### 20.2.9 TIM1_PWMIConfig function

*Table 595* describes the TIM1_PWMIConfig function.

**Table 595. TIM1_PWMIConfig function**

| | |
|---|---|
| Function name | TIM1_PWMIConfig |
| Function prototype | `TIM1_PWMIConfig(TIM1_ICInitTypeDef* TIM1_ICInitStruct)` |
| Behavior description | Configures the TIM1 peripheral in PWM Input mode according to the parameters specified in the TIM1_ICInitStruct. |
| Input parameter | TIM1_ICInitStruct: pointer to a TIM1_ICInitTypeDef structure that contains the configuration information for the specified TIM1 peripheral.<br>Refer to *Section : TIM1_ICInitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* TIM1 PWM Input Channel 1 mode Configuration */

TIM1_ICInitTypeDef TIM1_ICInitStructure;

TIM1_ICInitStructure.TIM1_Channel = TIM1_Channel_1;
TIM1_ICInitStructure.TIM1_ICPolarity = TIM1_ICPolarity_Rising;
TIM1_ICInitStructure.TIM1_ICSelection = TIM1_ICSelection_DirectTI;
TIM1_ICInitStructure.TIM1_ICPrescaler = TIM1_ICPSC_DIV1;
TIM1_ICInitStructure.TIM1_ICFilter = 0x0;

TIM1_PWMIConfig(&TIM1_ICInitStructure);
```

### 20.2.10 TIM1_TimeBaseStructInit function

Table 596 describes the TIM1_TimeBaseStructInit function.

**Table 596. TIM1_TimeBaseStructInit function**

| | |
|---|---|
| Function name | TIM1_TimeBaseStructInit |
| Function prototype | `void TIM1_TimeBaseStructInit(TIM1_TimeBaseInitTypeDef* TIM1_TimeBaseInitStruct)` |
| Behavior description | Fills each TIM1_TimeBaseInitStruct member with its default value. |
| Input parameter | TIM1_TimeBaseInitStruct: pointer to a TIM1_TimeBaseInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM1_TimeBaseInitStruct members have the following default values:

**Table 597. TIM1_TimeBaseInitStruct default values**

| Member | Default value |
|---|---|
| TIM1_Period | TIM1_Period_Reset_Mask |
| TIM1_Prescaler | TIM1_Prescaler_Reset_Mask |
| TIM1_CKD | TIM1_CKD_DIV1 |
| TIM1_CounterMode | TIM1_CounterMode_Up |
| TIM1_RepetitionCounter | TIM1_RepetitionCounter_Reset_Mask |

**Example:**

```
/* The following example illustrates how to initialize a
TIM1_BaseInitTypeDef structure */
TIM1_TimeBaseInitTypeDef TIM1_TimeBaseInitStructure;
TIM1_TimeBaseStructInit(& TIM1_TimeBaseInitStructure);
```

### 20.2.11 TIM1_OCStructInit function

Table 598 describes the TIM1_OCStructInit function.

**Table 598. TIM1_OCStructInit function**

| | |
|---|---|
| Function name | TIM1_OCStructInit |
| Function prototype | `void TIM1_OCStructInit(TIM1_OCInitTypeDef* TIM1_OCInitStruct)` |
| Behavior description | Fills each TIM1_OCInitStruct member with its default value. |
| Input parameter | TIM1_OCInitStruct: pointer to a TIM1_OCInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM1_OCInitStruct members have the following default values:

**Table 599. TIM1_OCInitStruct default values**

| Member | Default value |
|---|---|
| TIM1_OCMode | TIM1_OCMode_Timing |
| TIM1_OutputState | TIM1_OutputState_Disable |
| TIM1_OutputNState | TIM1_OutputNState_Disable |
| TIM1_Pulse | TIM1_Pulse_Reset_Mask |
| TIM1_OCPolarity | TIM1_OCPolarity_High |
| TIM1_OCNPolarity | TIM1_OCPolarity_High |
| TIM1_OCIdleState | TIM1_OCIdleState_Reset |
| TIM1_OCNIdleState | TIM1_OCNIdleState_Reset |

**Example:**

```
/* The following example illustrates how to initialize a
TIM1_OCInitTypeDef structure */
TIM1_OCInitTypeDef TIM1_OCInitStructure;
TIM1_OCStructInit(& TIM1_OCInitStructure);
```

### 20.2.12 TIM1_ICStructInit function

*Table 600* describes the TIM1_ICStructInit function.

**Table 600. TIM1_ICStructInit function**

| | |
|---|---|
| Function name | TIM1_ICStructInit |
| Function prototype | `void TIM1_ICStructInit(TIM1_ICInitTypeDef* TIM1_ICInitStruct)` |
| Behavior description | Fills each TIM1_ICInitStruct member with its default value. |
| Input parameter | TIM1_ICInitStruct: pointer to a TIM1_ICInitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM1_ICInitStruct members have the following default values:

**Table 601. TIM1_ICInitStruct default values**

| Member | Default value |
|---|---|
| TIM1_Channel | TIM1_Channel_1 |
| TIM1_ICSelection | TIM1_ICSelection_DirectTI |
| TIM1_ICPolarity | TIM1_ICPolarity_Rising |
| TIM1_ICPrescaler | TIM1_ICPSC_DIV1 |
| TIM1_ICFilter | TIM1_ICFilter_Mask |

**Example:**

```
/* The following example illustrates how to initialize a
TIM1_ICInitTypeDef structure */
TIM1_ICInitTypeDef TIM1_ICInitStructure;
TIM1_ICStructInit(& TIM1_ICInitStructure);
```

### 20.2.13 TIM1_BDTRStructInit function

*Table 602* describes the TIM1_BDTRStructInit function.

**Table 602. TIM1_BDTRStructInit function**

| | |
|---|---|
| Function name | TIM1_BDTRStructInit |
| Function prototype | `void TIM1_BDTRStructInit(TIM1_BDTRInitTypeDef* TIM1_BDTRInitStruct)` |
| Behavior description | Fills each TIM1_BDTRInitStruct member with its default value. |
| Input parameter | TIM1_BDTRInitStruct: pointer to a TIM1_BDTRInitStruct structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The TIM1_BDTRInitStruct members have the following default values:

**Table 603. TIM1_BDTRInitStruct default values**

| Member | Default value |
|---|---|
| TIM1_OSSRState | TIM1_OSSRState_Disable |
| TIM1_OSSIState | TIM1_OSSIState_Disable |
| TIM1_LOCKLevel | TIM1_LOCKLevel_OFF |
| TIM1_DeadTime | TIM1_DeadTime_Reset_Mask |
| TIM1_Break | TIM1_Break_Disable |
| TIM1_BreakPolarity | TIM1_BreakPolarity_Low |
| TIM1_AutomaticOutput | TIM1_AutomaticOutput_Disable |

**Example:**

```
/* The following example illustrates how to initialize a
TIM1_BDTRInitTypeDef structure */
TIM1_BDTRInitTypeDef TIM1_BDTRInitStructure;
TIM1_BDTRStructInit(& TIM1_BDTRInitStructure);
```

### 20.2.14 TIM1_Cmd function

*Table 604* describes the TIM1_Cmd function.

**Table 604. TIM1_Cmd function**

| | |
|---|---|
| Function name | TIM1_Cmd |
| Function prototype | `void TIM1_Cmd(FunctionalState NewState)` |
| Behavior description | Enables or disables the specified TIM1 peripheral. |
| Input parameter | NewState: new state of the TIM1 peripheral.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 counter */
TIM1_Cmd(ENABLE);
```

### 20.2.15 TIM1_CtrlPWMOutputs function

*Table 605* describes the TIM1_CtrlPWMOutputs function.

**Table 605. TIM1_CtrlPWMOutputs function**

| | |
|---|---|
| Function name | TIM1_CtrlPWMOutputs |
| Function prototype | `void TIM1_CtrlPWMOutputs(FunctionalState Newstate)` |
| Behavior description | Enables or disables TIM1 peripheral main outputs. |
| Input parameter | NewState: new state of the TIM1 peripheral main outputs.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 peripheral Main Outputs. */
TIM1_CtrlPWMOutputs(ENABLE);
```

### 20.2.16 TIM1_ITConfig function

Table 606 describes the TIM1_ITConfig function.

**Table 606. TIM1_ITConfig function**

| | |
|---|---|
| Function name | TIM1_ITConfig |
| Function prototype | `void TIM1_ITConfig(u16 TIM1_IT, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified TIM1 interrupts. |
| Input parameter1 | TIM1_IT: TIM1 interrupt sources to be enabled or disabled.<br>Refer to Section : TIM1_IT for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the specified TIM1 interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_IT

TIM1_IT enables or disables TIM1 interrupts. One or a combination of the following values can be used:

**Table 607. TIM1_IT values**

| TIM1_IT | Description |
|---|---|
| TIM1_IT_Update | TIM1 Update Interrupt source |
| TIM1_IT_CC1 | TIM1 Capture/Compare 1 Interrupt source |
| TIM1_IT_CC2 | TIM1 Capture/Compare 2 Interrupt source |
| TIM1_IT_CC3 | TIM1 Capture/Compare 3 Interrupt source |
| TIM1_IT_CC4 | TIM1 Capture/Compare 4 Interrupt source |
| TIM1_IT_COM | TIM1 COM Interrupt source |
| TIM1_IT_Trigger | TIM1 Trigger Interrupt source |
| TIM1_IT_BRK | TIM1 Break Interrupt source |

**Example:**

```
/* Enables the TIM1 Capture Compare channel 1 Interrupt source */
TIM1_ITConfig(TIM1_IT_CC1, ENABLE );
```

### 20.2.17 TIM1_DMAConfig function

*Table 608* describes the TIM1_DMAConfig function.

**Table 608. TIM1_DMAConfig function**

| | |
|---|---|
| Function name | TIM1_DMAConfig |
| Function prototype | `void TIM1_DMAConfig(u8 TIM1_DMABase, u16 TIM1_DMABurstLength)` |
| Behavior description | Configures the TIM1 DMA interface. |
| Input parameter1 | TIM1_DMABase: DMA base address.<br>Refer to *Section : TIM1_DMABase* for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_DMABurstLength: DMA Burst length.<br>Refer to *Section : TIM1_DMABurstLength* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_DMABase

TIM1_DMABase selects TIM1 DMA base address (see *Table 609*).

**Table 609. TIM1_DMABase values**

| TIM1_DMABase | Description |
|---|---|
| TIM1_DMABase_CR1 | CR1 register used as DMA Base |
| TIM1_DMABase_CR2 | CR2 register used as DMA Base |
| TIM1_DMABase_SMCR | SMCR register used as DMA Base |
| TIM1_DMABase_DIER | DIER register used as DMA Base |
| TIM1_DMABase_SR | SR register used as DMA Base |
| TIM1_DMABase_EGR | EGR register used as DMA Base |
| TIM1_DMABase_CCMR1 | CCMR1 register used as DMA Base |
| TIM1_DMABase_CCMR2 | CCMR2 register used as DMA Base |
| TIM1_DMABase_CCER | CCER register used as DMA Base |
| TIM1_DMABase_CNT | CNT register used as DMA Base |
| TIM1_DMABase_PSC | PSC register used as DMA Base |
| TIM1_DMABase_ARR | ARR register used as DMA Base |
| TIM1_DMABase_RCR | RCR register used as DMA Base |
| TIM1_DMABase_CCR1 | CCR1 register used as DMA Base |
| TIM1_DMABase_CCR2 | CCR2 register used as DMA Base |
| TIM1_DMABase_CCR3 | CCR3 register used as DMA Base |

Table 609. TIM1_DMABase values (continued)

| TIM1_DMABase | Description |
|---|---|
| TIM1_DMABase_CCR4 | CCR4 register used as DMA Base |
| TIM1_DMABase_BDTR | BDTR register used as DMA Base |
| TIM1_DMABase_DCR | DCR register used as DMA Base |

### TIM1_DMABurstLength

This parameter configures the TIM1 DMA Burst length (see *Table 610*).

Table 610. TIM1_DMABurstLength values

| TIM1_DMABurstLength | Description |
|---|---|
| TIM1_DMABurstLength_1Byte | DMA Burst length 1 byte |
| TIM1_DMABurstLength_2Bytes | DMA Burst length 2 bytes |
| TIM1_DMABurstLength_3Bytes | DMA Burst length 3 bytes |
| TIM1_DMABurstLength_4Bytes | DMA Burst length 4 bytes |
| TIM1_DMABurstLength_5Bytes | DMA Burst length 5 bytes |
| TIM1_DMABurstLength_6Bytes | DMA Burst length 6 bytes |
| TIM1_DMABurstLength_7Bytes | DMA Burst length 7 bytes |
| TIM1_DMABurstLength_8Bytes | DMA Burst length 8 bytes |
| TIM1_DMABurstLength_9Bytes | DMA Burst length 9 bytes |
| TIM1_DMABurstLength_10Bytes | DMA Burst length 10 bytes |
| TIM1_DMABurstLength_11Bytes | DMA Burst length 11 bytes |
| TIM1_DMABurstLength_12Bytes | DMA Burst length 12 bytes |
| TIM1_DMABurstLength_13Bytes | DMA Burst length 13 bytes |
| TIM1_DMABurstLength_14Bytes | DMA Burst length 14 bytes |
| TIM1_DMABurstLength_15Bytes | DMA Burst length 15 bytes |
| TIM1_DMABurstLength_16Bytes | DMA Burst length 16 bytes |
| TIM1_DMABurstLength_17Bytes | DMA Burst length 17 bytes |
| TIM1_DMABurstLength_18Bytes | DMA Burst length 18 bytes |

**Example:**

```
/* Configures the TIM1 DMA Interface to transfer 1 byte and to use
the CCR1 as base address */
TIM1_DMAConfig(TIM1_DMABase_CCR1, TIM1_DMABurstLength_1Byte)
```

### 20.2.18 TIM1_DMACmd function

*Table 611* describes the TIM1_DMACmd function.

**Table 611. TIM1_DMACmd function**

| | |
|---|---|
| Function name | TIM1_DMACmd |
| Function prototype | `void TIM1_DMACmd(u16 TIM1_DMASource, FunctionalState Newstate)` |
| Behavior description | Enables or disables TIM1 DMA requests. |
| Input parameter1 | TIM1_DMASource: DMA Request sources.<br>Refer to *Section : TIM1_DMASource* for more details on the allowed values of this parameter. |
| Input parameter2 | NewState: new state of the DMA Request sources.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_DMASource

TIM1_DMASource selects the TIM1 DMA request source. One or a combination of the following values can be used:

**Table 612. TIM1_DMASource values**

| TIM1_DMASource | Description |
|---|---|
| TIM1_DMA_Update | TIM1 Update DMA source |
| TIM1_DMA_CC1 | TIM1 Capture/Compare 1 DMA source |
| TIM1_DMA_CC2 | TIM1 Capture/Compare 2 DMA source |
| TIM1_DMA_CC3 | TIM1 Capture/Compare 3 DMAsource |
| TIM1_DMA_CC4 | TIM1 Capture/Compare 4 DMA source |
| TIM1_DMA_COM | TIM1 COM DMA source |
| TIM1_DMA_Trigger | TIM1 Trigger DMA source |

**Example:**

```
/* TIM1 Capture Compare 1 DMA Request Configuration */
TIM1_DMACmd(TIM1_DMA_CC1, ENABLE);
```

### 20.2.19 TIM1_InternalClockConfig function

*Table 613* describes the TIM1_InternalClockConfig function.

**Table 613. TIM1_InternalClockConfig function**

| | |
|---|---|
| Function name | TIM1_InternalClockConfig |
| Function prototype | `void TIM1_InternalClockConfig(void)` |
| Behavior description | Configures the TIM1 internal Clock. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the internal clock for TIM1 */
TIM1_InternalClockConfig();
```

### 20.2.20 TIM1_ETRClockMode1Config function

*Table 614* describes the TIM1_ETRClockMode1Config function.

**Table 614. TIM1_ETRClockMode1Config function**

| | |
|---|---|
| Function name | TIM1_ETRClockMode1Config |
| Function prototype | `void TIM1_ETRClockMode1Config(u16 TIM1_ExtTRGPrescaler, u16 TIM1_ExtTRGPolarity, u16 ExtTRGFilter)` |
| Behavior description | Configures the TIM1 External clock Mode1. |
| Input parameter1 | TIM1_ExtTRGPrescaler: external trigger prescaler.<br>Refer to *Section : TIM1_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_ExtTRGPolarity: external clock polarity.<br>Refer to *Section : TIM1_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter3 | ExtTRGFilter: Specifies the external trigger Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_ExtTRGPrescaler

TIM1_ExtTRGPrescaler selects the External Trigger Prescaler. This member can be set to one of the following values:

**Table 615. TIM1_ExtTRGPrescaler values**

| TIM1_ExtTRGPrescaler | Description |
|---|---|
| TIM1_ExtTRGPSC_OFF | Prescaler OFF. |
| TIM1_ExtTRGPSC_DIV2 | ETRP frequency divided by 2. |
| TIM1_ExtTRGPSC_DIV4 | ETRP frequency divided by 4. |
| TIM1_ExtTRGPSC_DIV8 | ETRP frequency divided by 8. |

### TIM1_ExtTRGPolarity

TIM1_ExtTRGPolarity configures the external trigger polarity. This member can be set to one of the following values:

**Table 616. TIM1_ExtTRGPolarity values**

| TIM1_ExtTRGPolarity | Description |
|---|---|
| TIM1_ExtTRGPolarity_Inverted | External Trigger Polarity Inverted: active Low or falling edge active. |
| TIM1_ExtTRGPolarity_NonInverted | External Trigger Polarity non Inverted: active High or rising edge active. |

**Example:**

```
/* Selects the external clock Mode 1 for TIM1: the external clock is
connected to ETR input pin, the rising edge is the active edge, no
filter sampling is done (ExtTRGFilter = 0) and the prescaler is
fixed to TIM1_ExtTRGPSC_DIV2 */
TIM1_ExternalCLK1Config(TIM1_ExtTRGPSC_DIV2,
TIM1_ExtTRGPolarity_NonInverted, 0x0);
```

### 20.2.21 TIM1_ETRClockMode2Config function

*Table 617* describes the TIM1_ETRClockMode2Config function.

**Table 617. TIM1_ETRClockMode2Config function**

| | |
|---|---|
| Function name | TIM1_ETRClockMode2Config |
| Function prototype | `void TIM1_ETRClockMode2Config(u16 TIM1_ExtTRGPrescaler, u16 TIM1_ExtTRGPolarity, u16 ExtTRGFilter)` |
| Behavior description | Configures the TIM1 External clock Mode2. |
| Input parameter2 | TIM1_ExtTRGPrescaler: specifies the external trigger prescaler.<br>Refer to *Section : TIM1_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter3 | TIM1_ExtTRGPolarity: specifies the external clock polarity.<br>Refer to *Section : TIM1_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter4 | ExtTRGFilter: Specifies the external trigger Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the external clock Mode 2 for TIM1: the external clock is
connected to ETR input pin, the rising edge is the active edge, no
filter sampling is done (ExtTRGFilter = 0) and the prescaler is
fixed to TIM1_ExtTRGPSC_DIV2 */
TIM1_ExternalCLK2Config(TIM1_ExtTRGPSC_DIV2,
TIM1_ExtTRGPolarity_NonInverted, 0x0);
```

### 20.2.22 TIM1_ETRConfig

*Table 618* describes the TIM1_ETRConfig function.

**Table 618. TMI1_ETRConfig function**

| | |
|---|---|
| Function name | TIM1_ETRConfig |
| Function prototype | `void TIM1_ETRConfig( u16 TIM1_ExtTRGPrescaler, u16 TIM1_ExtTRGPolarity, u8 ExtTRGFilter)` |
| Behavior description | Configures the TIM1 External Trigger (ETR). |
| Input parameter1 | TIM1_ExtTRGPrescaler: external trigger prescaler.<br>Refer to *Section : TIM1_ExtTRGPrescaler* for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_ExtTRGPolarity: external clock polarity.<br>Refer to *Section : TIM1_ExtTRGPolarity* for more details on the allowed values of this parameter. |
| Input parameter3 | ExtTRGFilter: external trigger Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Configure the External Trigger (ETR) for TIM1: the rising edge is
the active edge, no filter sampling is done (ExtTRGFilter = 0) and
the prescaler is fixed to TIM1_ExtTRGPSC_DIV2 */
TIM1_ExternalCLK2Config(TIM1_ExtTRGPSC_DIV2,
TIM1_ExtTRGPolarity_NonInverted, 0x0);
```

### 20.2.23 TIM1_ITRxExternalClockConfig function

*Table 619* describes the TIM1_ITRxExternalClockConfig function.

**Table 619. TIM1_ITRxExternalClockConfig function**

| | |
|---|---|
| Function name | TIM1_ITRxExternalClockConfig |
| Function prototype | `void TIM1_ITRxExternalClockConfig(u16 TIM1_InputTriggerSource)` |
| Behavior description | Configures the TIM1 internal Trigger as External clock. |
| Input parameter2 | TIM1_InputTriggerSource: Input Trigger source.<br>Refer to *Section : TIM1_InputTriggerSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_InputTriggerSource

TIM1_InputTriggerSource selectS the TIM1 Input trigger (see *Table 620*).

**Table 620. TIM1_InputTriggerSource values**

| TIM1_InputTriggerSource | Description |
|---|---|
| TIM1_TS_ITR0 | TIM1 Internal Trigger 0 |
| TIM1_TS_ITR1 | TIM1 Internal Trigger 1 |
| TIM1_TS_ITR2 | TIM1 Internal Trigger 2 |
| TIM1_TS_ITR3 | TIM1 Internal Trigger 3 |

**Example:**

```
/* TIM1 internal trigger 3 used as clock source */
TIM1_ITRxExternalClockConfig(TIM1_TS_ITR3);
```

### 20.2.24 TIM1_TIxExternalClockConfig function

*Table 621* describes the TIM1_TIxExternalClockConfig function.

**Table 621. TIM1_TIxExternalClockConfig function**

| | |
|---|---|
| Function name | TIM1_TIxExternalClockConfig |
| Function prototype | `void TIM1_TIxExternalClockConfig(u16 TIM1_TIxExternalCLKSource, u16 TIM1_ICPolarity, u16 ICFilter)` |
| Behavior description | Configures the TIM1 input Trigger as External Clock. |
| Input parameter1 | TIM1_TIxExternalCLKSource: Trigger source.<br>Refer to *Section : TIM1_TIxExternalCLKSource* for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_ICPolarity: TI polarity.<br>Refer to *Section : TIM1_ICPolarity* for more details on the allowed values of this parameter. |
| Input parameter3 | ICFilter: Specifies the Input Capture Filter. This member can be a value between 0x0 and 0xF. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_TIxExternalCLKSource

TIM1_TIxExternalCLKSource selects the TIM1 TIx external clock source. One or a combination of the following values can be used:

**Table 622. TIM1_TIxExternalCLKSource values**

| TIM1_TIxExternalCLKSource | Description |
|---|---|
| TIM1_TS_TI1FP1 | IC1 is mapped on TI1. |
| TIM1_TS_TI2FP2 | IC2 is mapped on TI2. |
| TIM1_TS_TI1F_ED | IC1 is mapped on TI1: edge detector is used |

**Example:**

```
/* Selects the TI1 as clock for TIM1: the external clock is
connected to TI1 input pin, the rising edge is the active edge and
no filter sampling is done (ICFilter = 0) */
TIM1_TIxExternalClockConfig(TIM1_TS_TI1FP1, TIM1_ICPolarity_Rising,
0);
```

### 20.2.25 TIM1_SelectInputTrigger function

*Table 623* describes the TIM1_SelectInputTrigger function.

**Table 623. TIM1_SelectInputTrigger function**

| | |
|---|---|
| Function name | TIM1_SelectInputTrigger |
| Function prototype | `void TIM1_SelectInputTrigger(u16 TIM1_InputTriggerSource)` |
| Behavior description | Selects the TIM1 input trigger source. |
| Input parameter | TIM1_InputTriggerSource: the Input Trigger source.<br>Refer to *Section : TIM_InputTriggerSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_InputTriggerSource

TIM1_InputTriggerSource selects the TIM1 Input Trigger Source. This member can beset to one of the following values:

**Table 624. TIM1_InputTriggerSource values**

| TIM1_InputTriggerSource | Description |
|---|---|
| TIM1_TS_ITR0 | TIM1 Internal Trigger 0. |
| TIM1_TS_ITR1 | TIM1 Internal Trigger 1. |
| TIM1_TS_ITR2 | TIM1 Internal Trigger 2. |
| TIM1_TS_ITR3 | TIM1 Internal Trigger 3. |
| TIM1_TS_TI1F_ED | TIM1 TI1 Edge Detector. |
| TIM1_TS_TI1FP1 | TIM1 Filtered Timer Input 1. |
| TIM1_TS_TI2FP2 | TIM1 Filtered Timer Input 2. |
| TIM1_TS_ETRF | TIM1 External Trigger input. |

**Example:**

```
/* Selects the Internal Trigger 3 as input trigger fot TIM1 */
void TIM1_SelectInputTrigger(TIM1_TS_ITR3);
```

### 20.2.26 TIM1_UpdateDisableConfig function

*Table 625* describes the TIM1_UpdateDisableConfig function.

**Table 625. TIM1_UpdateDisableConfig function**

| | |
|---|---|
| Function name | TIM1_UpdateDisableConfig |
| Function prototype | `void TIM1_UpdateDisableConfig(FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIM1 Update event. |
| Input parameter | NewState: new state of the UDIS bit in TIM1_CR1 register.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the Update event for TIM1 */
TIM1_UpdateDisableConfig(DISABLE);
```

### 20.2.27 TIM1_UpdateRequestConfig function

*Table 626* describes the TIM1_UpdateRequestConfig function.

**Table 626. TIM1_UpdateRequestConfig function**

| | |
|---|---|
| Function name | TIM1_UpdateRequestConfig |
| Function prototype | `void TIM1_UpdateRequestConfig(u8 TIM1_UpdateSource)` |
| Behavior description | Selects the TIM1 Update Request source Interrupt source. |
| Input parameter | TIM1_UpdateSource: Update Request sources.<br>Refer to *Section : TIM1_UpdateSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_UpdateSource

TIM1_UpdateSource selects the TIM1 Update source (see *Table 627*).

**Table 627. TIM1_UpdateSource values**

| TIM1_UpdateSource | Description |
|---|---|
| TIM1_UpdateSource_Global | Source of update is counter overflow / underflow or set of UG bit or update generation through the slave mode controller. |
| TIM1_UpdateSource_Regular | Source of update is counter overflow / underflow. |

**Example:**

```
/* Selects the regular update source for TIM1 */
TIM1_UpdateRequestConfig(TIM1_UpdateSource_Regular);
```

### 20.2.28 TIM1_SelectHallSensor function

Table 628 describes the TIM1_SelectHallSensor function.

**Table 628. TIM1_SelectHallSensor function**

| | |
|---|---|
| Function name | TIM1_SelectHallSensor |
| Function prototype | `void TIM1_SelectHallSensor(FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIM1 Hall sensor interface. |
| Input parameter2 | NewState: new state of the TI1S bit in TIM1_CR2 register.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Hall Sensor Interface for TIM1 */
TIM1_SelectHallSensor(ENABLE);
```

### 20.2.29 TIM1_SelectOnePulseMode function

Table 629 describes the TIM1_SelectOnePulseMode function.

**Table 629. TIM1_SelectOnePulseMode function**

| | |
|---|---|
| Function name | TIM1_SelectOnePulseMode |
| Function prototype | `void TIM1_SelectOnePulseMode(u16 TIM1_OPMode)` |
| Behavior description | Selects the TIM1 One Pulse mode. |
| Input parameter | TIM1_OPMode: specifies the One Pulse Mode to be used.<br>Refer to *Section : TIM1_OPMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_OPMode

TIM1_OPMode selects the TIM1 Update source (see *Table 630*).

**Table 630. TIM1_OPMode definition**

| TIM1_OPMode | Description |
|---|---|
| TIM1_OPMode_Single | TIM1 Single One Pulse Mode. |
| TIM1_OPMode_Repetitive | TIM1 Repetitive One Pulse Mode. |

**Example:**

```
/* Selects the Single One Pulse Mode for TIM1 */
TIM1_SelectOnePulseMode(TIM1_OPMode_Single);
```

## 20.2.30 TIM1_SelectOutputTrigger function

*Table 631* describes the TIM1_SelectOutputTrigger function.

**Table 631. TIM1_SelectOutputTrigger function**

| | |
|---|---|
| Function name | TIM1_SelectOutputTrigger |
| Function prototype | `void TIM1_SelectOutputTrigger(u16 TIM1_TRGOSource)` |
| Behavior description | Selects the TIM1 Trigger Output mode. |
| Input parameter | TIM1_TRGOSource: TRGO sources.<br>Refer to *Section : TIM1_TRGOSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_TRGOSource

TIM1_TRGOSource selects the TIM1 TRGO source (see *Table 632*).

**Table 632. TIM1_TRGOSource values**

| TIM1_TRGOSource | Description |
|---|---|
| TIM1_TRGOSource_Reset | The UG bit from the TIM1_EGR register is used as trigger output (TRGO). |
| TIM1_TRGOSource_Enable | The Counter Enable CEN is used as trigger output (TRGO). |
| TIM1_TRGOSource_Update | The update event is selected as trigger output (TRGO). |
| TIM1_TRGOSource_OC1 | The trigger output send a positive pulse when the CC1IF flag is to be set, as soon as a capture or a compare match occurred. (TRGO). |
| TIM1_TRGOSource_OC1Ref | OC1REF signal is used as trigger output (TRGO). |
| TIM1_TRGOSource_OC2Ref | OC2REF signal is used as trigger output (TRGO). |

**Table 632. TIM1_TRGOSource values (continued)**

| TIM1_TRGOSource | Description |
|---|---|
| TIM1_TRGOSource_OC3Ref | OC3REF signal is used as trigger output (TRGO). |
| TIM1_TRGOSource_OC4Ref | OC4REF signal is used as trigger output (TRGO). |

**Example:**

```
/* Selects the update event as TRGO for TIM1 */
TIM1_SelectOutputTrigger(TIM1_TRGOSource_Update);
```

## 20.2.31 TIM1_SelectSlaveMode function

*Table 633* describes the TIM1_SelectSlaveMode function.

**Table 633. TIM1_SelectSlaveMode function**

| | |
|---|---|
| Function name | TIM1_SelectSlaveMode |
| Function prototype | `void TIM1_SelectSlaveMode(u16 TIM1_SlaveMode)` |
| Behavior description | Selects the TIM1 Slave Mode. |
| Input parameter2 | TIM1_SlaveMode: TIM1 slave mode.<br>Refer to *Section : TIM1_SlaveMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_SlaveMode

TIM1_SlaveMode selects the TIM1 slave mode (see *Table 634*).

**Table 634. TIM1_SlaveMode definition**

| TIM1_SlaveMode | Description |
|---|---|
| TIM1_SlaveMode_Reset | Rising edge of the selected trigger signal (TRGI) reinitializes the counter and triggers an update of the registers. |
| TIM1_SlaveMode_Gated | The counter clock is enabled when the trigger signal (TRGI) is high. |
| TIM1_SlaveMode_Trigger | The counter starts at a rising edge of the trigger TRGI. |
| TIM1_SlaveMode_External1 | Rising edges of the selected trigger (TRGI) clock the counter. |

**Example:**

```
/* Selects the Gated Mode as Slave Mode for TIM1 */
TIM1_SelectSlaveMode(TIM1_SlaveMode_Gated);
```

### 20.2.32 TIM1_SelectMasterSlaveMode function

*Table 635* describes the TIM1_SelectMasterSlaveMode function.

**Table 635. TIM1_SelectMasterSlaveMode function**

| | |
|---|---|
| Function name | TIM1_SelectMasterSlaveMode |
| Function prototype | `void TIM1_SelectMasterSlaveMode(u16 TIM1_MasterSlaveMode)` |
| Behavior description | Sets or Resets the TIM1 master/slave mode. |
| Input parameter | TIM1_MasterSlaveMode: Timer Master Slave Mode.<br>Refer to *Section : TIM_MasterSlaveMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_MasterSlaveMode

TIM1_MasterSlaveMode selects the TIMx master slave mode (see *Table 636*).

**Table 636. TIM1_MasterSlaveMode definition**

| TIM1_MasterSlaveMode | Description |
|---|---|
| TIM1_MasterSlaveMode_Enable | Enable the Master Slave Mode. |
| TIM1_MasterSlaveMode_Disable | Disable the Master Slave Mode. |

**Example:**

```
/* Enables the Master Slave Mode for TIM2 */
TIM1_SelectMasterSlaveMode(TIM2, TIM1_MasterSlaveMode_Enable);
```

## 20.2.33 TIM1_EncoderInterfaceConfig function

Table 637 describes the TIM1_EncoderInterfaceConfig function.

**Table 637. TIM1_EncoderInterfaceConfig function**

| | |
|---|---|
| Function name | TIM1_EncoderInterfaceConfig |
| Function prototype | `void TIM1_EncoderInterfaceConfig(u16 TIM1_EncoderMode, u16 TIM1_IC1Polarity, u16 TIM1_IC2Polarity)` |
| Behavior description | Configures the TIM1 Encoder Interface. |
| Input parameter1 | TIM1_EncoderMode: TIM1 encoder mode.<br>Refer to Section : TIM1_EncoderMode for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_IC1Polarity: TI1 Polarity.<br>Refer to Section : TIM1_ICPolarity for more details on the allowed values of this parameter. |
| Input parameter3 | TIM1_IC2Polarity: TI2 Polarity.<br>Refer to section TIM1_ICPolarity on page 405 for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_EncoderMode

TIM1_EncoderMode selects the TIM1 Encoder mode (see Table 638).

**Table 638. TIM1_EncoderMode definition**

| TIM1_EncoderMode | Description |
|---|---|
| TIM1_EncoderMode_TI1 | TIM1 encoder Mode 1 is used. |
| TIM1_EncoderMode_TI2 | TIM1 encoder Mode 2 is used. |
| TIM1_EncoderMode_TI12 | TIM1 encoder Mode 3 is used. |

**Example:**

```
/* uses of the TIM1 Encoder interface */
TIM1_EncoderInterfaceConfig(TIM1_EncoderMode_1,
TIM1_ICPolarity_Rising,
TIM1_ICPolarity_Rising);
```

### 20.2.34 TIM1_PrescalerConfig function

*Table 639* describes the TIM1_PrescalerConfig function.

**Table 639. TIM1_PrescalerConfig function**

| | |
|---|---|
| Function name | TIM1_PrescalerConfig |
| Function prototype | `void TIM1_PrescalerConfig(u16 Prescaler, u16 TIM1_PSCReloadMode)` |
| Behavior description | Configures the TIM1 Prescaler. |
| Input parameter1 | Prescaler: TIM1 new prescaler value. |
| Input parameter2 | TIM1_PSCReloadMode: TIM1 prescaler reload mode.<br>Refer to *Section : TIM1_PSCReloadMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_PSCReloadMode

To select the TIM1 Prescaler Reload mode use one of the following values:

**Table 640. TIM1_PSCReloadMode values**

| TIM1_PSCReloadMode | Description |
|---|---|
| TIM1_PSCReloadMode_Update | The Prescaler is loaded at the update event. |
| TIM1_PSCReloadMode_Immediate | The Prescaler is loaded immediately. |

**Example:**

```
/* Sets the TIM1 new Prescaler value */
u16 TIM1Prescaler = 0xFF00;
TIM1_SetPrescaler(TIM1Prescaler, TIM1_PSCReloadMode_Update);
```

### 20.2.35 TIM1_CounterModeConfig function

*Table 641* describes the TIM1_CounterModeConfig function.

**Table 641. TIM1_CounterModeConfig function**

| | |
|---|---|
| Function name | TIM1_CounterModeConfig |
| Function prototype | `void TIM1_CounterModeConfig(u16 TIM1_CounterMode)` |
| Behavior description | Specifies the TIM1 counter mode to be used. |
| Input parameter | TIM1_CounterMode: counter mode to be used.<br>Refer to *Section : TIM1_CounterMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Center Aligned counter Mode 1 for the TIM1 */
TIM1_CounterModeConfig(TIM1_Counter_CenterAligned1);
```

### 20.2.36 TIM1_ForcedOC1Config function

*Table 642* describes the TIM1_ForcedOC1Config function.

**Table 642. TIM1_ForcedOC1Config function**

| | |
|---|---|
| Function name | TIM1_ForcedOC1Config |
| Function prototype | `void TIM1_ForcedOC1Config(u16 TIM1_ForcedAction)` |
| Behavior description | Forces the TIM1 Channel1 output waveform to active or inactive level. |
| Input parameter | TIM1_ForcedAction: specifies the forced Action to be set to the output waveform.<br>Refer to *Section : TIM1_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_ForcedAction

The forced actions that can be used are listed in *Table 643*.

**Table 643. TIM1_ForcedAction values**

| TIM1_ForcedAction | Description |
|---|---|
| TIM1_ForcedAction_Active | Force active level on OCxREF. |
| TIM1_ForcedAction_InActive | Force inactive level on OCxREF. |

**Example:**

```
/* Forces the TIM1 Channel1 Output to the active level */
TIM1_ForcedOC1Config(TIM1_ForcedAction_Active);
```

### 20.2.37 TIM1_ForcedOC2Config function

*Table 644* describes the TIM1_ForcedOC2Config function.

**Table 644. TIM1_ForcedOC2Config function**

| | |
|---|---|
| Function name | TIM1_ForcedOC2Config |
| Function prototype | `void TIM1_ForcedOC2Config(u16 TIM1_ForcedAction)` |
| Behavior description | Forces the TIM1 Channel2 output to active or inactive level. |
| Input parameter | TIM1_ForcedAction: specifies the forced Action to be set to the output waveform.<br>Refer to *Section : TIM1_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM1 Channel2 Output to the active level */
TIM1_ForcedOC2Config(TIM1_ForcedAction_Active);
```

### 20.2.38 TIM1_ForcedOC3Config function

*Table 645* describes the TIM1_ForcedOC3Config function.

**Table 645. TIM1_ForcedOC3Config function**

| | |
|---|---|
| Function name | TIM1_ForcedOC3Config |
| Function prototype | `void TIM1_ForcedOC3Config(u16 TIM1_ForcedAction)` |
| Behavior description | Forces the TIM1 Channel3 output waveform to active or inactive level. |
| Input parameter | TIM1_ForcedAction: specifies the forced Action to be set to the output waveform.<br>Refer to *Section : TIM1_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM1 Channel3 Output to the active level */
TIM1_ForcedOC3Config(TIM1_ForcedAction_Active);
```

## 20.2.39 TIM1_ForcedOC4Config function

*Table 646* describes the TIM1_ForcedOC4Config function.

**Table 646. TIM1_ForcedOC4Config function**

| | |
|---|---|
| Function name | TIM1_ForcedOC4Config |
| Function prototype | `void TIM1_ForcedOC4Config(u16 TIM1_ForcedAction)` |
| Behavior description | Forces the TIM1 Channel4 output waveform to active or inactive level. |
| Input parameter | TIM1_ForcedAction: specifies the forced Action to be set to the output waveform.<br>Refer to *Section : TIM1_ForcedAction* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Forces the TIM1 Channel4 Output to the active level */
TIM1_ForcedOC4Config(TIM1_ForcedAction_Active);
```

## 20.2.40 TIM1_ARRPreloadConfig function

*Table 647* describes the TIM1_ARRPreloadConfig function.

**Table 647. TIM1_ARRPreloadConfig function**

| | |
|---|---|
| Function name | TIM1_ARRPreloadConfig |
| Function prototype | `void TIM1_ARRPreloadConfig(FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIM1 peripheral Preload register on ARR. |
| Input parameter | NewState: new state of the ARPE bit in the TIM1_CR1 Register.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 Preload on ARR Register */
TIM1_ARRPreloadConfig(ENABLE);
```

### 20.2.41 TIM1_SelectCOM function

*Table 648* describes the TIM1_SelectCOM function.

**Table 648. TIM1_SelectCOM function**

| | |
|---|---|
| Function name | TIM1_SelectCOM |
| Function prototype | `void TIM1_SelectCOM(FunctionalState Newstate)` |
| Behavior description | Selects the TIM1 peripheral Commutation event. |
| Input parameter | Newstate: new state of the Commutation event.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the TIM1 Commutation event */
TIM1_SelectCOM(ENABLE);
```

### 20.2.42 TIM1_SelectCCDMA function

*Table 649* describes the TIM1_SelectCCDMA function.

**Table 649. TIM1_SelectCCDMA function**

| | |
|---|---|
| Function name | TIM1_SelectCCDMA |
| Function prototype | `void TIM1_SelectCCDMA(FunctionalState Newstate)` |
| Behavior description | Selects the TIM1 peripheral Capture Compare DMA source. |
| Input parameter | Newstate: new state of the Capture Compare DMA source.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the TIM1 Capture Compare DMA source */
TIM1_SelectCCDMA(ENABLE);
```

### 20.2.43 TIM1_CCPreloadControl function

*Table 650* describes the TIM1_CCPreloadControl function.

**Table 650. TIM1_CCPreloadControl function**

| | |
|---|---|
| Function name | TIM1_CCPreloadControl |
| Function prototype | `void TIM1_CCPreloadControl(FunctionalState Newstate)` |
| Behavior description | Sets or Resets the TIM1 peripheral Capture Compare Preload Control bit. |
| Input parameter | Newstate: new state of the Capture Compare Preload Control bit.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the TIM1 Capture Compare Preload Control */
TIM1_CCPreloadControl(ENABLE);
```

### 20.2.44 TIM1_OC1PreloadConfig function

*Table 651* describes the TIM1_OC1PreloadConfig function.

**Table 651. TIM1_OC1PreloadConfig function**

| | |
|---|---|
| Function name | TIM1_OC1PreloadConfig |
| Function prototype | `void TIM1_OC1PreloadConfig(u16 TIM1_OCPreload)` |
| Behavior description | Enables or Disables the TIM1 Preload register on CCR1. |
| Input parameter | TIM1_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM1_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_OCPreload

The Output Compare Preload states are listed in *Table 652*.

**Table 652. TIM1_OCPreload states**

| TIM1_OCPreload | Description |
|---|---|
| TIM1_OCPreload_Enable | TIM1 Preload register on CCR1 enable. |
| TIM1_OCPreload_Disable | TIM1 Preload register on CCR1 disable. |

**Example:**

```
/* Enables the TIM1 Preload on CC1 Register */
TIM1_OC1PreloadConfig(TIM1_OCPreload_Enable);
```

### 20.2.45 TIM1_OC2PreloadConfig function

*Table 653* describes the TIM1_OC2PreloadConfig function.

**Table 653. TIM1_OC2PreloadConfig function**

| | |
|---|---|
| Function name | TIM1_OC2PreloadConfig |
| Function prototype | `void TIM1_OC2PreloadConfig(u16 TIM1_OCPreload)` |
| Behavior description | Enables or Disables the TIM1 Preload register on CCR2. |
| Input parameter | TIM1_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM1_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 Preload on CC2 Register */
TIM1_OC2PreloadConfig(TIM1_OCPreload_Enable);
```

### 20.2.46 TIM1_OC3PreloadConfig function

*Table 654* describes the TIM1_OC3PreloadConfig function.

**Table 654. TIM1_OC3PreloadConfig function**

| | |
|---|---|
| Function name | TIM1_OC3PreloadConfig |
| Function prototype | `void TIM1_OC3PreloadConfig(u16 TIM1_OCPreload)` |
| Behavior description | Enables or Disables the TIM1 Preload register on CCR3. |
| Input parameter | TIM1_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM1_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 Preload on CC3 Register */
TIM1_OC3PreloadConfig(TIM1_OCPreload_Enable);
```

## 20.2.47 TIM1_OC4PreloadConfig function

*Table 655* describes the TIM1_OC4PreloadConfig function.

**Table 655. TIM1_OC4PreloadConfig function**

| | |
|---|---|
| Function name | TIM1_OC4PreloadConfig |
| Function prototype | `void TIM1_OC4PreloadConfig(u16 TIM1_OCPreload)` |
| Behavior description | Enables or Disables the TIM1 Preload register on CCR4. |
| Input parameter | TIM1_OCPreload: Output Compare Preload state.<br>Refer to *Section : TIM1_OCPreload* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 Preload on CC4 Register */
TIM1_OC4PreloadConfig(TIM1_OCPreload_Enable);
```

## 20.2.48 TIM1_OC1FastConfig function

*Table 656* describes the TIM1_OC1FastConfig function.

**Table 656. TIM1_OC1FastConfig function**

| | |
|---|---|
| Function name | TIM1_OC1FastConfig |
| Function prototype | `void TIM1_OC1FastConfig(u16 TIM1_OCFast)` |
| Behavior description | Configures the TIM1 Output Compare 1 Fast feature. |
| Input parameter | TIM1_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM1_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_OCFast

The Output Compare Preload states are listed in *Table 657*.

**Table 657. TIM1_OCFast states**

| TIM1_OCFast | Description |
|---|---|
| TIM1_OCFast_Enable | TIM1 Output Compare Fast capability enable. |
| TIM1_OCFast_Disable | TIM1 Output Compare Fast capability disable. |

**Example:**

```
/* Use the TIM1 OC1 in fast Mode */
TIM1_OC1FastConfig(TIM1_OCFast_Enable);
```

### 20.2.49 TIM1_OC2FastConfig function

*Table 658* describes the TIM1_OC2FastConfig function.

**Table 658. TIM1_OC2FastConfig function**

| | |
|---|---|
| Function name | TIM1_OC2FastConfig |
| Function prototype | `void TIM1_OC2FastConfig(u16 TIM1_OCFast)` |
| Behavior description | Configures the TIM1 Output Compare 2 Fast feature. |
| Input parameter | TIM1_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM1_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM1 OC2 in fast Mode */
TIM1_OC2FastConfig(TIM1_OCFast_Enable);
```

### 20.2.50 TIM1_OC3FastConfig function

*Table 659* describes the TIM1_OC3FastConfig function.

**Table 659. TIM1_OC3FastConfig function**

| | |
|---|---|
| Function name | TIM1_OC3FastConfig |
| Function prototype | `void TIM1_OC3FastConfig(u16 TIM1_OCFast)` |
| Behavior description | Configures the TIM1 Output Compare 3 Fast feature. |
| Input parameter | TIM1_OCFast: Output Compare fast feature state.<br>Refer to *Section : TIM1_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM1 OC3 in fast Mode */
TIM1_OC3FastConfig(TIM1_OCFast_Enable);
```

### 20.2.51 TIM1_OC4FastConfig function

*Table 660* describes the TIM1_OC4FastConfig function.

**Table 660. TIM1_OC4FastConfig function**

| | |
|---|---|
| Function name | TIM1_OC4FastConfig |
| Function prototype | `void TIM1_OC4FastConfig(u16 TIM1_OCFast)` |
| Behavior description | Configures the TIM1 Output Compare 4 Fast feature. |
| Input parameter2 | TIM1_OCFast: specifies the Output Compare fast feature state.<br>Refer to *Section : TIM1_OCFast* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Use the TIM1 OC4 in fast Mode */
TIM1_OC4FastConfig(TIM1_OCFast_Enable);
```

### 20.2.52 TIM1_ClearOC1Ref

*Table 661* describes the TIM1_ClearOC1Ref function.

**Table 661. TIM1_ClearOC1Ref function**

| | |
|---|---|
| Function name | TIM1_ClearOC1Ref |
| Function prototype | `void TIM1_ClearOC1Ref(u16 TIM1_OCClear)` |
| Behavior description | Clears or safeguards the OCREF1 signal on an external event. |
| Input parameter | TIM1_OCClear: new state of the Output Compare Clear Enable Bit.<br>Refer to *Section : TIM1_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_OCClear

The values of the Output Compare Reference Clear bit that can be used are listed in *Table 662*:

**Table 662. TIM1_OCClear**

| TIM1_OCClear | Description |
|---|---|
| TIM1_OCClear_Enable | TIM1 Output Compare Clear enable. |
| TIM1_OCClear_Disable | TIM1 Output Compare Clear disable. |

**Example:**

```
/* Enable the TIM1 Channel1 Ouput Compare Refence clear bit */
TIM1_ClearOC1Ref(TIM1_OCClear_Enable);
```

### 20.2.53 TIM1_ClearOC2Ref

*Table 663* describes the TIM1_ClearOC1Ref function.

**Table 663. TIM1_ClearOC2Ref function**

| | |
|---|---|
| Function name | TIM1_ClearOC2Ref |
| Function prototype | `void TIM1_ClearOC2Ref(u16 TIM1_OCClear)` |
| Behavior description | Clears or safeguards the OCREF2 signal on an external event. |
| Input parameter | TIM1_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM1_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM1 Channel2 Ouput Compare Refence clear bit */
TIM1_ClearOC2Ref(TIM1_OCClear_Enable);
```

### 20.2.54 TIM1_ClearOC3Ref

*Table 664* describes the TIM1_ClearOC3Ref function.

**Table 664. TIM1_ClearOC3Ref function**

| | |
|---|---|
| Function name | TIM1_ClearOC3Ref |
| Function prototype | `void TIM1_ClearOC3Ref(u16 TIM1_OCClear)` |
| Behavior description | Clears or safeguards the OCREF3signal on an external event. |
| Input parameter | TIM1_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *Section : TIM1_OCClear* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM1 Channel3 Ouput Compare Refence clear bit */
TIM1_ClearOC3Ref(TIM1_OCClear_Enable);
```

### 20.2.55 TIM1_ClearOC4Ref

*Table 665* describes the TIM1_ClearOC4Ref function.

**Table 665. TIM1_ClearOC4Ref function**

| | |
|---|---|
| Function name | TIM1_ClearOC4Ref |
| Function prototype | `void TIM1_ClearOC4Ref(u16 TIM1_OCClear)` |
| Behavior description | Clears or safeguards the OCREF4 signal on an external event. |
| Input parameter | TIM1_OCClear: new state of the Output Compare Clear Enable Bit. Refer to *TIM_OCClear on page 364* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the TIM1 Channel4 Ouput Compare Refence clear bit */
TIM1_ClearOC4Ref(TIM1_OCClear_Enable);
```

### 20.2.56 TIM1_GenerateEvent function

*Table 666* describes the TIM1_GenerateEvent function.

**Table 666. TIM1_GenerateEvent function**

| | |
|---|---|
| Function name | TIM1_GenerateEvent |
| Function prototype | `void TIM1_GenerateEvent(u16 TIM1_EventSource)` |
| Behavior description | Configures the TIM1 event to be generated by software. |
| Input parameter | TIM1_EventSource: specifies the TIM1 software event sources.<br>Refer to *Section : TIM1_EventSource* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_EventSource

The TIM1 event software source can be selected by using one or a combination of the following values:

**Table 667. TIM1_EventSource values**

| TIM1_EventSource | Description |
|---|---|
| TIM1_EventSource_Update | TIM1 Update Event source |
| TIM1_EventSource_CC1 | TIM1 Capture/Compare 1 Event source |
| TIM1_EventSource_CC2 | TIM1 Capture/Compare 2 Event source |
| TIM1_EventSource_CC3 | TIM1 Capture/Compare 3 Event source |
| TIM1_EventSource_CC4 | TIM1 Capture/Compare 4 Event source |
| TIM1_EventSource_COM | TIM1 COM Event source |
| TIM1_EventSource_Trigger | TIM1 Trigger Event source |
| TIM1_EventSource_Break | TIM1 Break Event source |

**Example:**

```
/* Selects the Trigger software Event generation for TIM1 */
TIM1_GenerateEvent(TIM1_EventSource_Trigger);
```

## 20.2.57 TIM1_OC1PolarityConfig function

*Table 668* describes the TIM1_OC1PolarityConfig function.

**Table 668. TIM1_OC1PolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC1PolarityConfig |
| Function prototype | `void TIM1_OC1PolarityConfig(u16 TIM1_OCPolarity)` |
| Behavior description | Configures the TIM1 Channel 1 polarity. |
| Input parameter | TIM1_OCPolarity: Output compare polarity.<br>Refer to *Section : TIM1_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_OCPolarity

TIM1_OCPolarity selects the TIM1 polarity (see *Table 669*).

**Table 669. TIM1_OCPolarity values**

| TIM1_OCPolarity | Description |
|---|---|
| TIM1_OCPolarity_High | TIM1 Output Polarity High. |
| TIM1_OCPolarity_Low | TIM1 Output Polarity Low. |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 1 output compare */
TIM1_OC1PolarityConfig(TIM1_OCPolarity_High);
```

### 20.2.58 TIM1_OC1NPolarityConfig function

*Table 670* describes the TIM1_OC1NPolarityConfig function.

**Table 670. TIM1_OC1NPolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC1NPolarityConfig |
| Function prototype | `void TIM1_OC1NPolarityConfig(u16 TIM1_OCNPolarity)` |
| Behavior description | Configures the TIM1 Channel 1N polarity. |
| Input parameter | TIM1_OCNPolarity: Output compare N polarity.<br>Refer to *Section : TIM1_OCNPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 1N output compare */
TIM1_OC1NPolarityConfig(TIM1_OCNPolarity_High);
```

### 20.2.59 TIM1_OC2PolarityConfig function

*Table 671* describes the TIM1_OC2PolarityConfig function.

**Table 671. TIM1_OC2PolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC2PolarityConfig |
| Function prototype | `void TIM1_OC2PolarityConfig(u16 TIM1_OCPolarity)` |
| Behavior description | Configures the TIM1 Channel 2 polarity. |
| Input parameter | TIM1_OCPolarity: Output compare polarity.<br>Refer to *Section : TIM1_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 2 output compare */
TIM1_OC2PolarityConfig(TIM1_OCPolarity_High);
```

### 20.2.60 TIM1_OC2NPolarityConfig function

*Table 672* describes the TIM1_OC2NPolarityConfig function.

**Table 672. TIM1_OC2NPolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC2NPolarityConfig |
| Function prototype | `void TIM1_OC2NPolarityConfig(u16 TIM1_OCNPolarity)` |
| Behavior description | Configures the TIM1 Channel 2N polarity. |
| Input parameter | TIM1_OCNPolarity: Output compare N polarity.<br>Refer to *Section : TIM1_OCNPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 2N output compare */
TIM1_OC2NPolarityConfig(TIM1_OCNPolarity_High);
```

### 20.2.61 TIM1_OC3PolarityConfig function

*Table 673* describes the TIM1_OC3PolarityConfig function.

**Table 673. TIM1_OC3PolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC3PolarityConfig |
| Function prototype | `void TIM1_OC3PolarityConfig(u16 TIM1_OCPolarity)` |
| Behavior description | Configures the TIM1 Channel 3 polarity. |
| Input parameter2 | TIM1_OCPolarity: Output compare polarity.<br>Refer to *Section : TIM1_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 3 output compare */
TIM1_OC3PolarityConfig(TIM1_OCPolarity_High);
```

## 20.2.62 TIM1_OC3NPolarityConfig function

*Table 674* describes the TIM1_OC3NPolarityConfig function.

**Table 674. TIM1_OC3NPolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC3NPolarityConfig |
| Function prototype | `void TIM1_OC3NPolarityConfig(u16 TIM1_OCNPolarity)` |
| Behavior description | Configures the TIM1 Channel 3 N polarity. |
| Input parameter2 | TIM1_OCNPolarity: Output compare N polarity.<br>Refer to *Section : TIM1_OCNPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 3N output compare */
TIM1_OC3NPolarityConfig(TIM1_OCNPolarity_High);
```

## 20.2.63 TIM1_OC4PolarityConfig function

*Table 675* describes the TIM1_OC4PolarityConfig function.

**Table 675. TIM1_OC4PolarityConfig function**

| | |
|---|---|
| Function name | TIM1_OC4PolarityConfig |
| Function prototype | `void TIM1_OC4PolarityConfig(u16 TIM1_OCPolarity)` |
| Behavior description | Configures the TIM1 Channel 4 polarity. |
| Input parameter | TIM1_OCPolarity: Output compare polarity.<br>Refer to *Section : TIM1_OCPolarity* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Selects the Polarity high for TIM1 channel 4 output compare */
TIM1_OC4PolarityConfig(TIM1_OCPolarity_High);
```

### 20.2.64 TIM1_CCxCmd function

*Table 676* describes the TIM1_CCxCmd function.

**Table 676. TIM1_CCxCmd function**

| | |
|---|---|
| Function name | TIM1_CCxCmd |
| Function prototype | `void TIM1_CCxCmd(u16 TIM1_Channel, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIM1 Capture Compare Channel x. |
| Input parameter1 | TIM1_Channel: TIM1 Channel.<br>Refer to *Section : TIM1_Channel* for more details on the allowed values of this parameter. |
| Input parameter2 | Newstate: specifies the TIM1 Channel CCxE bit new state.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 channel 4 */
TIM1_CCxCmd(TIM1_Channel_4, ENABLE);
```

### 20.2.65 TIM1_CCxNCmd function

*Table 677* describes the TIM1_CCxNCmd function.

**Table 677. TIM1_CCxNCmd function**

| | |
|---|---|
| Function name | TIM1_CCxCmd |
| Function prototype | `void TIM1_CCxNCmd(u16 TIM1_Channel, FunctionalState Newstate)` |
| Behavior description | Enables or disables the TIM1 Capture Compare Channel xN. |
| Input parameter1 | TIM1_Channel: TIM1 Channel.<br>Refer to *Section : TIM1_Channel* for more details on the allowed values of this parameter. |
| Input parameter2 | Newstate: specifies the TIM1 Channel CCxNE bit new state.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enables the TIM1 channel 3N */
TIM1_CCxNCmd(TIM1_Channel_3, ENABLE);
```

## 20.2.66 TIM1_SelectOCxM function

*Table 678* describes the TIM1_SelectOCxM function.

**Table 678. TIM1_SelectOCxM function**

| | |
|---|---|
| Function name | TIM1_SelectOCxM |
| Function prototype | `void TIM1_SelectOCxM(u16 TIM1_Channel, u16 TIM1_OCMode)` |
| Behavior description | Selects the TIM1 Output Compare Mode. |
| Input parameter1 | TIM1_Channel: TIM1 Channel.<br>Refer to *Section : TIM1_Channel* for more details on the allowed values of this parameter. |
| Input parameter2 | TIM1_OCMode: TIM1 Output Compare mode.<br>Refer to *Section : TIM1_OCMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | This function disables the selected channel before changing the Output Compare mode. The user has to enable this channel using TIM1_CCxCmd and TIM1_CCxNCmd functions. |
| Called functions | None |

### TIM1_OCMode

TIM1_OCMode selects the TIM1 Output Compare mode (see *Table 678*).

**Table 679. TIM1_OCMode definition**

| TIM1_OCMode | Description |
|---|---|
| TIM1_OCMode_Timing | TIM1 Output Compare Timing Mode. |
| TIM1_OCMode_Active | TIM1 Output Compare Active Mode. |
| TIM1_OCMode_Inactive | TIM1 Output Compare Inactive Mode. |
| TIM1_OCMode_Toggle | TIM1 Output Compare Toggle Mode. |
| TIM1_OCMode_PWM1 | TIM1 Pulse Width Modulation Mode1. |
| TIM1_OCMode_PWM2 | TIM1 Pulse Width Modulation Mode2. |
| TIM1_ForcedAction_Active | Force active level on OCxREF. |
| TIM1_ForcedAction_InActive | Force inactive level on OCxREF. |

**Example:**

```
/* Selects the TIM1 Channel 1 PWM2 Mode */
TIM1_SelectOCxM(TIM1_Channel_1, TIM1_OCMode_PWM2);
```

### 20.2.67 TIM1_SetCounter function

*Table 680* describes the TIM1_SetCounter function.

**Table 680. TIM1_SetCounter function**

| | |
|---|---|
| Function name | TIM1_SetCounter |
| Function prototype | `void TIM1_SetCounter(u16 Counter)` |
| Behavior description | Sets the TIM1 Counter Register value. |
| Input parameter2 | Counter: specifies the Counter register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Counter value */
u16 TIM1Counter = 0xFFFF;
TIM1_SetCounter(TIM1Counter);
```

### 20.2.68 TIM1_SetAutoreload function

*Table 681* describes the TIM1_SetAutoReload function.

**Table 681. IM1_SetCounter function**

| | |
|---|---|
| Function name | TIM1_SetAutoreload |
| Function prototype | `void TIM1_SetAutoreload(u16 Autoreload)` |
| Behavior description | Sets the TIM1 Autoreload Register value. |
| Input parameter | Autoreload: TIM1 period new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Autoreload value */
u16 TIM1Autoreload = 0xFFFF;
TIM1_SetAutoreload(TIM1Autoreload);
```

### 20.2.69 TIM1_SetCompare1 function

*Table 682* describes the TIM1_SetCompare1 function.

**Table 682. TIM1_SetCompare1 function**

| | |
|---|---|
| Function name | TIM1_SetCompare1 |
| Function prototype | `void TIM1_SetCompare1(u16 Compare1)` |
| Behavior description | Sets the TIM1 Capture Compare 1 value. |
| Input parameter | Compare1: TIM1 Capture Compare 1 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Output Compare 1 value */
u16 TIM1Compare1 = 0x7FFF;
TIM1_SetCompare1(TIM1Compare1);
```

### 20.2.70 TIM1_SetCompare2 function

*Table 683* describes the TIM1_SetCompare2 function.

**Table 683. TIM1_SetCompare2 function**

| | |
|---|---|
| Function name | TIM1_SetCompare2 |
| Function prototype | `void TIM1_SetCompare2(u16 Compare2)` |
| Behavior description | Sets the TIM1 Capture Compare 2 value. |
| Input parameter | Compare2: TIM1 Capture Compare 2 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Output Compare 2 value */
u16 TIM1Compare2 = 0x7FFF;
TIM1_SetCompare2(TIM1Compare2);
```

### 20.2.71 TIM1_SetCompare3 function

*Table 684* describes the TIM1_SetCompare3 function.

**Table 684. TIM1_SetCompare3 function**

| | |
|---|---|
| Function name | TIM1_SetCompare3 |
| Function prototype | `void TIM1_SetCompare3(u16 Compare3)` |
| Behavior description | Sets the TIM1 Capture Compare 3 value. |
| Input parameter | Compare3: TIM1 Capture Compare 3 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Output Compare 3 value */
u16 TIM1Compare3 = 0x7FFF;
TIM1_SetCompare1(TIM1Compare3);
```

### 20.2.72 TIM1_SetCompare4 function

*Table 685* describes the TIM1_SetCompare4 function.

**Table 685. TIM1_SetCompare4 function**

| | |
|---|---|
| Function name | TIM1_SetCompare4 |
| Function prototype | `void TIM1_SetCompare4(u16 Compare4)` |
| Behavior description | Sets the TIM1 Capture Compare 4 value. |
| Input parameter | Compare4: TIM1 Capture Compare 4 Register new value. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 new Output Compare 4 value */
u16 TIM1Compare4 = 0x7FFF;
TIM1_SetCompare1(TIM1Compare4);
```

### 20.2.73 TIM1_SetIC1Prescaler function

*Table 686* describes the TIM1_SetIC1Prescaler function.

**Table 686. TIM1_SetIC1Prescaler function**

| | |
|---|---|
| Function name | TIM1_SetIC1Prescaler |
| Function prototype | `void TIM1_SetIC1Prescaler(u16 TIM1_IC1Prescaler)` |
| Behavior description | Sets the TIM1 Input Capture 1 Prescaler. |
| Input parameter | TIM1_IC1Prescaler: Input Capture 1 Prescaler.<br>Refer to *Section : TIM1_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### TIM1_ICPrescaler

TIM1_ICPrescaler selects the TIM1 Input Capture Prescaler (see *Table 687*).

**Table 687. TIM1_ICPrescaler values**

| TIM1_ICPrescaler | Description |
|---|---|
| TIM1_ICPSC_DIV1 | Capture is done each time an edge is detected on the capture input. |
| TIM1_ICPSC_DIV2 | Capture is done once every 2 events. |
| TIM1_ICPSC_DIV4 | Capture is done once every 4 events. |
| TIM1_ICPSC_DIV8 | Capture is done once every 8 events. |

**Example:**

```
/* Sets the TIM1 Input Capture 1 Prescaler */
TIM1_SetIC1Prescaler(TIM1_ICPSC_Div2);
```

### 20.2.74 TIM1_SetIC2Prescaler function

*Table 688* describes the TIM1_SetIC2Prescaler function.

**Table 688. TIM1_SetIC2Prescaler function**

| | |
|---|---|
| Function name | TIM1_SetIC2Prescaler |
| Function prototype | `void TIM1_SetIC2Prescaler(u16 TIM1_IC2Prescaler)` |
| Behavior description | Sets the TIM1 Input Capture 2 Prescaler. |
| Input parameter | TIM1_IC2Prescaler: Input Capture 2 Prescaler.<br>Refer to *Section : TIM1_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 Input Capture 2 Prescaler */
TIM1_SetIC2Prescaler(TIM1_ICPSC_Div2);
```

### 20.2.75 TIM1_SetIC3Prescaler function

*Table 689* describes the TIM1_SetIC3Prescaler function.

**Table 689. TIM1_SetIC3Prescaler function**

| | |
|---|---|
| Function name | TIM1_SetIC3Prescaler |
| Function prototype | `void TIM1_SetIC3Prescaler(u16 TIM1_IC3Prescaler)` |
| Behavior description | Sets the TIM1 Input Capture 3 Prescaler. |
| Input parameter | TIM1_IC3Prescaler: Input Capture 3 Prescaler.<br>Refer to *Section : TIM1_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 Input Capture 3 Prescaler */
TIM1_SetIC3Prescaler(TIM1_ICPSC_Div2);
```

### 20.2.76 TIM1_SetIC4Prescaler function

*Table 690* describes the TIM1_SetIC4Prescaler function.

**Table 690. TIM1_SetIC4Prescaler function**

| | |
|---|---|
| Function name | TIM1_SetIC4Prescaler |
| Function prototype | `void TIM1_SetIC4Prescaler(u16 TIM1_IC4Prescaler)` |
| Behavior description | Sets the TIM1 Input Capture 4 Prescaler. |
| Input parameter | TIM1_IC4Prescaler: Input Capture 4 Prescaler.<br>Refer to *Section : TIM1_ICPrescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the TIM1 Input Capture 4 Prescaler */
TIM1_SetIC4Prescaler(TIM1_ICPSC_Div2);
```

### 20.2.77 TIM1_SetClockDivision function

*Table 691* describes the TIM1_SetClockDivision function.

**Table 691. TIM1_SetClockDivision function**

| | |
|---|---|
| Function name | TIM1_SetClockDivision |
| Function prototype | `void TIM1_SetClockDivision(u16 TIM1_CKD)` |
| Behavior description | Sets the TIM1 Clock Division value. |
| Input parameter2 | TIM1_CKD: clock division value.<br>Refer to *Section : TIM1_CKD* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### TIM1_CKD

TIM1_CKD selects the TIM1 Clock Division (see *Table 692*).

**Table 692. TIM1_CKD values**

| TIM1_CKD | Description |
|---|---|
| TIM1_CKD_DIV1 | $T_{DTS} = T_{ck\_tim}$ |
| TIM1_CKD_DIV2 | $T_{DTS} = 2*T_{ck\_tim}$ |
| TIM1_CKD_DIV4 | $T_{DTS} = 4*T_{ck\_tim}$ |

**Example:**

```
/* Sets the TIM1 CKD value */
TIM1_SetClockDivision(TIM1_CKD_DIV4);
```

## 20.2.78 TIM1_GetCapture1 function

*Table 693* describes the TIM1_GetCapture1 function.

**Table 693. TIM1_GetCapture1 function**

| | |
|---|---|
| Function name | TIM1_GetCapture1 |
| Function prototype | `u16 TIM1_GetCapture1(void)` |
| Behavior description | Gets the TIM1 Input Capture 1 value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 1 value of the TIM1 */
u16 IC1value = TIM1_GetCapture1();
```

## 20.2.79 TIM1_GetCapture2 function

*Table 694* describes the TIM1_GetCapture2 function.

**Table 694. TIM1_GetCapture2 function**

| | |
|---|---|
| Function name | TIM1_GetCapture2 |
| Function prototype | `u16 TIM1_GetCapture2(void)` |
| Behavior description | Gets the TIM1 Input Capture 2 value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 2 value of the TIM1 */
u16 IC2value = TIM1_GetCapture2();
```

## 20.2.80 TIM1_GetCapture3 function

*Table 695* describes the TIM1_GetCapture3 function.

**Table 695. TIM1_GetCapture3 function**

| | |
|---|---|
| Function name | TIM1_GetCapture3 |
| Function prototype | `u16 TIM1_GetCapture3(void)` |
| Behavior description | Gets the TIM1 Input Capture 3 value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 3 value of the TIM1 */
u16 IC3value = TIM1_GetCapture3();
```

### 20.2.81 TIM1_GetCapture4 function

*Table 696* describes the TIM1_GetCapture4 function.

**Table 696. TIM1_GetCapture4 function**

| | |
|---|---|
| Function name | TIM1_GetCapture4 |
| Function prototype | `u16 TIM1_GetCapture4(void)` |
| Behavior description | Gets the TIM1 Input Capture 4 value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets the Input Capture 4 value of the TIM1 */
u16 IC4value = TIM1_GetIC4();
```

### 20.2.82 TIM1_GetCounter function

*Table 697* describes the TIM1_GetCounter function.

**Table 697. TIM1_GetCounter function**

| | |
|---|---|
| Function name | TIM1_GetCounter |
| Function prototype | `void TIM1_GetCounter(void)` |
| Behavior description | Gets the TIM1 counter value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets TIM1 counter value */
u16 TIM1Counter = TIM1_GetCounter();
```

## 20.2.83 TIM1_GetPrescaler function

*Table 698* describes the TIM1_GetPrescaler function.

**Table 698. TIM1_GetPrescaler function**

| | |
|---|---|
| Function name | TIM1_GetPrescaler |
| Function prototype | `void TIM1_GetPrescaler(void)` |
| Behavior description | Gets the TIM1 prescaler value. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Gets TIM1 prescaler value */
u16 TIM1Prescaler = TIM1_GetPrescaler();
```

## 20.2.84 TIM1_GetFlagStatus function

*Table 699* describes the TIM1_GetFlagStatus function.

**Table 699. TIM1_GetFlagStatus function**

| | |
|---|---|
| Function name | TIM1_GetFlagStatus |
| Function prototype | `FlagStatus TIM1_GetFlagStatus(u16 TIM1_FLAG)` |
| Behavior description | Checks whether the specified TIM1 flag is set or not. |
| Input parameter | TIM1_FLAG: specifies the flag to check.<br>Refer to *Section : TIM1_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of TIM1_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### TIM1_FLAG

The TIM1 flags that can be checked are listed in *Table 700*:

**Table 700. TIM1_FLAG definition**

| TIM1_FLAG | Description |
|---|---|
| TIM1_FLAG_Update | TIM1 Update flag |
| TIM1_FLAG_CC1 | TIM1 Capture/Compare 1 flag |
| TIM1_FLAG_CC2 | TIM1 Capture/Compare 2 flag |
| TIM1_FLAG_CC3 | TIM1 Capture/Compare 3 flag |

**Table 700. TIM1_FLAG definition (continued)**

| TIM1_FLAG | Description |
|---|---|
| TIM1_FLAG_CC4 | TIM1 Capture/Compare 4 flag |
| TIM1_FLAG_COM | TIM1 COM flag |
| TIM1_FLAG_Trigger | TIM1 Trigger flag |
| TIM1_FLAG_BRK | TIM1 Break flag |
| TIM1_FLAG_CC1OF | TIM1 Capture/Compare 1 OverFlow flag |
| TIM1_FLAG_CC2OF | TIM1 Capture/Compare 2 OverFlow flag |
| TIM1_FLAG_CC3OF | TIM1 Capture/Compare 3 OverFlow flag |
| TIM1_FLAG_CC4OF | TIM1 Capture/Compare 4 OverFlow flag |

**Example**:

```
/* Check if the TIM1 Capture Compare 1 flag is set or reset */
if(TIM1_GetFlagStatus(TIM1_FLAG_CC1) == SET)
{
}
```

### 20.2.85 TIM1_ClearFlag function

*Table 701* describes the TIM1_ClearFlag function.

**Table 701. TIM1_ClearFlag function**

| | |
|---|---|
| Function name | TIM1_ClearFlag |
| Function prototype | `void TIM1_ClearFlag(u16 TIM1_Flag)` |
| Behavior description | Clears the TIM1 pending flags. |
| Input parameter | TIM1_FLAG: flag to clear.<br>Refer to *Section : TIM1_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the TIM1 Capture Compare 1 flag */
TIM1_ClearFlag(TIM1_FLAG_CC1);
```

### 20.2.86 TIM1_GetITStatus function

*Table 702* describes the TIM1_GetITStatus function.

**Table 702. TIM1_GetITStatus function**

| | |
|---|---|
| Function name | TIM1_GetITStatus |
| Function prototype | `ITStatus TIM1_GetITStatus(u16 TIM1_IT)` |
| Behavior description | Checks whether the specified TIM1 interrupt has occurred or not. |
| Input parameter | TIM1_IT: TIM1 interrupt source to check.<br>Refer to *Section : TIM1_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of TIM1_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/*Check if the TIM1 Capture Compare 1 interrupt has occured or not*/
if(TIM1_GetITStatus(TIM1_IT_CC1) == SET)
{
}
```

### 20.2.87 TIM1_ClearITPendingBit function

*Table 703* describes the TIM1_ClearITPendingBit function.

**Table 703. TIM1_ClearITPendingBit function**

| | |
|---|---|
| Function name | TIM1_ClearITPending Bit |
| Function prototype | `void TIM1_ClearITPendingBit(u16 TIM1_IT)` |
| Behavior description | Clears the TIM1's interrupt pending bits. |
| Input parameter | TIM1_IT: interrupt pending bit to be cleared.<br>Refer to *Section : TIM1_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the TIM1 Capture Compare 1 interrupt pending bit */
TIM1_ClearITPendingBit(TIM1_IT_CC1);
```

# 21 Universal synchronous asynchronous receiver transmitter (USART)

The Universal synchronous/asynchronous receiver transmitter (USART) performs flexible full-duplex data exchange with external equipment requiring industry-standard NRZ asynchronous serial data format. The SCI offers a very wide range of baud rates based on fractional baud rate generator systems. The USART interface also supports the Smart Card Protocol compliant with IrDA SIR ENDEC specifications. It can perform single-wire half-duplex communications, synchronous transmissions and modem operations (CTS/RTS).

*Section 21.1: USART register structure* describes the data structures used in the USART Firmware Library. *Section 21.2: Firmware library functions* presents the Firmware Library functions.

## 21.1 USART register structure

The USART register structure, USART_*TypeDef*, is defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu16 SR;
  u16 RESERVED1;
  vu16 DR;
  u16 RESERVED2;
  vu16 BRR;
  u16 RESERVED3;
  vu16 CR1;
  u16 RESERVED4;
  vu16 CR2;
  u16 RESERVED5;
  vu16 CR3;
  u16 RESERVED6;
  vu16 GTPR;
  u16 RESERVED7;
} USART_TypeDef;
```

*Table 704* gives the list of USART registers.

**Table 704. USART registers**

| Register | Description |
|---|---|
| SR | USART Status Register |
| DR | USART Data Register |
| BRR | USART BaudRate Register |
| CR1 | USART Control Register 1 |
| CR2 | USART Control Register 2 |

Table 704. USART registers

| Register | Description |
|---|---|
| CR3 | USART Control Register 3 |
| GTPR | USART Guard-Time and Prescaler Register |

The three USART peripherals are declared in *stm32f10x_map.h*:

```
...
#define PERIPH_BASE           ((u32)0x40000000)
#define APB1PERIPH_BASE       PERIPH_BASE
#define APB2PERIPH_BASE       (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE        (PERIPH_BASE + 0x20000)

#define USART1_BASE           (APB2PERIPH_BASE + 0x3800)
#define USART2_BASE           (APB1PERIPH_BASE + 0x4400)
#define USART3_BASE           (APB1PERIPH_BASE + 0x4800)

#ifndef DEBUG
...
#ifdef _USART1
  #define USART1              ((USART_TypeDef *) USART1_BASE)
#endif /*_USART1 */

#ifdef _USART2
  #define USART2              ((USART_TypeDef *) USART2_BASE)
#endif /*_USART2 */

#ifdef _USART3
  #define USART3              ((USART_TypeDef *) USART3_BASE)
#endif /*_USART3 */
...
#else   /* DEBUG */
...
#ifdef _USART1
  EXT USART_TypeDef           *USART1;
#endif /*_USART1 */

#ifdef _USART2
  EXT USART_TypeDef           *USART2;
#endif /*_USART2 */

#ifdef _USART3
  EXT USART_TypeDef           *USART3;
#endif /*_USART3 */
...
#endif
```

When using the Debug mode, _USART1, _USART2 and _USART3 pointers are initialized in *stm32f10x_lib.c* file:

```
...
#ifdef _USART1
  USART1 = (USART_TypeDef *) USART1_BASE;
#endif /*_USART1 */

#ifdef _USART2
  USART2 = (USART_TypeDef *) USART2_BASE;
#endif /*_USART2 */

#ifdef _USART3
  USART3 = (USART_TypeDef *) USART3_BASE;
#endif /*_USART3 */
...
```

To access the USART registers _USART, _USART1, _USART2 and _USART3 must be defined in *stm32f10x_conf.h*,as follows:

```
...
#define _USART
#define _USART1
#define _USART2
#define _USART3
```

## 21.2 Firmware library functions

*Table 705* lists the various functions of the USART library.

**Table 705. USART firmware library functions**

| Function name | Description |
|---|---|
| USART_DeInit | Resets the USARTx peripheral registers to their default reset values. |
| USART_Init | Initializes the USARTx peripheral according to the specified parameters in the USART_InitStruct. |
| USART_StructInit | Fills each USART_InitStruct member with its default value. |
| USART_Cmd | Enables or disables the specified USART peripheral. |
| USART_ITConfig | Enables or disables the specified USART interrupts. |
| USART_DMACmd | Enables or disables the USART DMA interface. |
| USART_SetAddress | Sets the address of the USART node. |
| USART_WakeUpConfig | Selects the USART WakeUp method. |
| USART_ReceiverWakeUpCmd | Determines if the USART is in mute mode or not. |
| USART_LINBreakDetectionConfig | Sets the USART LIN Break detection length. |
| USART_LINCmd | Enables or disables the USARTx LIN mode. |
| USART_SendData | Transmits single data through the USARTx peripheral. |
| USART_ReceiveData | Returns the most recent received data by the USARTx peripheral. |
| USART_SendBreak | Transmits break characters. |
| USART_SetGuardTime | Sets the specified USART guard time. |
| USART_SetPrescaler | Sets the USART clock prescaler. |
| USART_SmartCardCmd | Enables or disables the USART Smart Card mode. |
| USART_SmartCardNackCmd | Enables or disables NACK transmission. |
| USART_HalfDuplexCmd | Enables or disables the USART Half Duplex mode. |
| USART_IrDAConfig | Configures the USART IrDA mode. |
| USART_IrDACmd | Enables or disables the USART IrDA mode. |
| USART_GetFlagStatus | Checks whether the specified USART flag is set or not. |
| USART_ClearFlag | Clears the USARTx pending flags. |
| USART_GetITStatus | Checks whether the specified USART interrupt has occurred or not. |
| USART_ClearITPendingBit | Clears the USARTx interrupt pending bits. |

### 21.2.1 USART_DeInit function

*Table 706* describes the USART_DeInit function.

**Table 706. USART_DeInit function**

| | |
|---|---|
| Function name | USART_DeInit |
| Function prototype | `void USART_DeInit(USART_TypeDef* USARTx)` |
| Behavior description | Resets the USARTx peripheral registers to their default reset values. |
| Input parameter | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB2PeriphResetCmd()<br>RCC_APB1PeriphResetCmd() |

**Example:**

```
/* Resets the USART1 registers to their default reset value */
USART_DeInit(USART1);
```

### 21.2.2 USART_Init function

*Table 707* describes the USART_Init function.

**Table 707. USART_Init function**

| | |
|---|---|
| Function name | USART_Init |
| Function prototype | `void USART_Init(USART_TypeDef* USARTx, USART_InitTypeDef* USART_InitStruct)` |
| Behavior description | Initializes the USARTx peripheral according to the parameters specified in the USART_InitStruct. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_InitStruct: pointer to a USART_InitTypeDef structure that contains the configuration information for the specified USART peripheral.<br>Refer to *Section : USART_InitTypeDef structure* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

## USART_InitTypeDef structure

The USART_InitTypeDef structure is defined in the *stm32f10x_usart.h* file:

```
typedef struct
{
  u32 USART_BaudRate;
  u16 USART_WordLength;
  u16 USART_StopBits;
  u16 USART_Parity;
  u16 USART_HardwareFlowControl;
  u16 USART_Mode;
  u16 USART_Clock;
  u16 USART_CPOL;
  u16 USART_CPHA;
  u16 USART_LastBit;
} USART_InitTypeDef;
```

*Table 708* describes the USART_InitTypeDef structure members which are used in asynchronous and in synchronous mode.

**Table 708. USART_InitTypeDef members versus USART mode**

| Members | Asynchronous mode | Synchronous mode |
|---|---|---|
| USART_BaudRate | X | X |
| USART_WordLength | X | X |
| USART_StopBits | X | X |
| USART_Parity | X | X |
| USART_HardwareFlowControl | X | X |
| USART_Mode | X | X |
| USART_Clock | | X |
| USART_CPOL | | X |
| USART_CPHA | | X |
| USART_LastBit | | X |

### USART_BaudRate

This member configures the USART communication baud rate. The baud rate is computed using the following formula:

IntegerDivider = ((APBClock) / (16 * (USART_InitStruct->USART_BaudRate)))

FractionalDivider = ((IntegerDivider - ((u32) IntegerDivider)) * 16) + 0.5

### USART_WordLength

USART_WordLength indicates the number of data bits transmitted or received in a frame. See *Table 709* for the values of this member.

**Table 709. USART_WordLength definition**

| USART_WordLength | Description |
|---|---|
| USART_WordLength_8b | 8 bits Data |
| USART_WordLength_9b | 9 bits Data |

### USART_StopBits

USART_StopBits defines the number of stop bits transmitted. See *Table 710* for the values of this member.

**Table 710. USART_StopBits definition**

| USART_StopBits | Description |
|---|---|
| USART_StopBits_1 | 1 stop bit is transmitted at the end of frame |
| USART_StopBits_0_5 | 0.5 stop bit is transmitted at the end of frame |
| USART_StopBits_2 | 2 stop bits are transmitted at the end of frame |
| USART_StopBits_1_5 | 1.5 stop bit is transmitted at the end of frame |

### USART_Parity

USART_Parity defines the parity mode. See *Table 711* for the values of this member.

**Table 711. USART_Parity definition**

| USART_Parity | Description |
|---|---|
| USART_Parity_No | Parity Disable |
| USART_Parity_Even | Even Parity |
| USART_Parity_Odd | Odd Parity |

*Note: When parity is enabled, the computed parity is inserted at the MSB position of the transmitted data ($9^{th}$ bit when the word length is set to 9 data bits; $8^{th}$ bit when the word length is set to 8 data bits).*

### USART_HardwareFlowControl

USART_HardwareFlowControl specifies wether the hardware flow control mode is enabled or disabled. See *Table 712* for the values of this member.

**Table 712. USART_HardwareFlowControl definition**

| USART_HardwareFlowControl | Description |
|---|---|
| USART_HardwareFlowControl_None | HFC Disabled |
| USART_HardwareFlowControl_RTS | RTS enabled |

**Table 712. USART_HardwareFlowControl definition**

| USART_HardwareFlowControl | Description |
|---|---|
| USART_HardwareFlowControl_CTS | CTS enabled |
| USART_HardwareFlowControl_RTS_CTS | RTS and CTS enabled |

### USART_Mode

USART_Mode specifies wether the Receive or Transmit mode is enabled or disabled. See *Table 713* for the values of this member.

**Table 713. USART_Mode definition**

| USART_Mode | Description |
|---|---|
| USART_Mode_Tx | Transmit enabled |
| USART_Mode_Rx | Receive enabled |

### USART_Clock

USART_Clock indicates wether the USART clock specified in the USART_Clock member is enabled or disabled. See *Table 714* for the values of this member.

**Table 714. USART_Clock definition**

| USART_Clock | Description |
|---|---|
| USART_Clock_Enable | USART Clock enabled |
| USART_Clock_Disable | USART Clock disabled |

### USART_CPOL

USART_CPOL specifies the steady state value of the serial clock. See *Table 715* for the values of this member.

**Table 715. USART_CPOL definition**

| USART_CPOL | Description |
|---|---|
| USART_CPOL_High | Clock is active High |
| USART_CPOL_Low | Clock is active Low |

### USART_CPHA

USART_CPHA defines the clock transition on which the bit capture is made. See *Table 716* for the values of this member.

**Table 716. USART_CPHA definition**

| USART_CPHA | Description |
|---|---|
| USART_CPHA_1Edge | Data is captured on the first clock edge |
| USART_CPHA_2Edge | Data is captured on the second clock edge |

### USART_LastBit

USART_LastBit defines whether the clock pulse corresponding to the last data bit transmitted (MSB) has to be output on the SCLK pin in synchronous mode. See *Table 717* for the values of this member.

**Table 717. USART_LastBit definition**

| USART_LastBit | Description |
|---|---|
| USART_LastBit_Disable | The clock pulse of the last data bit is not output to the SCLK pin. |
| USART_LastBit_Enable | The clock pulse of the last data bit is output to the SCLK pin. |

**Example:**

```
/* The following example illustrates how to configure the USART1 */
USART_InitTypeDef USART_InitStructure;

USART_InitStructure.USART_BaudRate = 9600;
USART_InitStructure.USART_WordLength = USART_WordLength_8b;
USART_InitStructure.USART_StopBits = USART_StopBits_1;
USART_InitStructure.USART_Parity = USART_Parity_Odd;
USART_InitStructure.USART_HardwareFlowControl =
USART_HardwareFlowControl_RTS_CTS;
USART_InitStructure.USART_Mode = USART_Mode_Tx | USART_Mode_Rx;
USART_InitStructure.USART_Clock = USART_Clock_Disable;
USART_InitStructure.USART_CPOL = USART_CPOL_High;
USART_InitStructure.USART_CPHA = USART_CPHA_1Edge;
USART_InitStructure.USART_LastBit = USART_LastBit_Enable;
USART_Init(USART1, &USART_InitStructure);
```

### 21.2.3 USART_StructInit function

*Table 718* describes the USART_StructInit function.

**Table 718. USART_StructInit function**

| | |
|---|---|
| Function name | USART_StructInit |
| Function prototype | `void USART_StructInit(USART_InitTypeDef* USART_InitStruct)` |
| Behavior description | Fills each USART_InitStruct member with its default value. |
| Input parameter | USART_InitStruct: pointer to the USART_InitTypeDef structure which will be initialized. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

The USART_InitStruct members have the following default values:

**Table 719. USART_InitStruct default values**

| Member | Default value |
|---|---|
| USART_BaudRate | 9600 |
| USART_WordLength | USART_WordLength_8b |
| USART_StopBits | USART_StopBits_1 |
| USART_Parity | USART_Parity_No |
| USART_HardwareFlowControl | USART_HardwareFlowControl_None |
| USART_Mode | USART_Mode_Rx \| USART_Mode_Tx |
| USART_Clock | USART_Clock_Disable |
| USART_CPOL | USART_CPOL_Low |
| USART_CPHA | USART_CPHA_1Edge |
| USART_LastBit | USART_LastBit_Disable |

**Example:**

```
/* The following example illustrates how to initialize a
USART_InitTypeDef structure */
USART_InitTypeDef USART_InitStructure;
USART_StructInit(&USART_InitStructure);
```

### 21.2.4 USART_Cmd function

*Table 720* describes the USART_Cmd function.

**Table 720. USART_Cmd function**

| | |
|---|---|
| Function name | USART_Cmd |
| Function prototype | `void USART_Cmd(USART_TypeDef* USARTx, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified USART peripheral. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the USARTx peripheral.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the USART1 */
USART_Cmd(USART1, ENABLE);
```

### 21.2.5 USART_ITConfig function

*Table 721* describes the USART_ITConfig function.

**Table 721. USART_ITConfig function**

| | |
|---|---|
| Function name | USART_ITConfig |
| Function prototype | `void USART_ITConfig(USART_TypeDef* USARTx, u16 USART_IT, FunctionalState NewState)` |
| Behavior description | Enables or disables the specified USART interrupts. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_IT: specifies the USART interrupt sources to be enabled or disabled.<br>Refer to *Section : USART_IT* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the specified USARTx interrupts.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### USART_IT

USART_IT is used to enable or disable USART interrupts. Refer to *Table 722* for the values taken by this parameter.

**Table 722. USART_IT values**

| USART_IT | Description |
|---|---|
| USART_IT_PE | Parity Error interrupt |
| USART_IT_TXE | Transmit interrupt |
| USART_IT_TC | Transmission Complete interrupt |
| USART_IT_RXNE | Receive interrupt |
| USART_IT_IDLE | IDLE line interrupt |
| USART_IT_LBD | LIN break detection interrupt |
| USART_IT_CTS | CTS interrupt |
| USART_IT_ERR | Error interrupt |

**Example:**

```
/* Enables the USART1 transmit interrupt */
USART_ITConfig(USART1, USART_IT_Transmit ENABLE);
```

## 21.2.6 USART_DMACmd function

*Table 723* describes the USART_DMACmd function.

**Table 723. USART_DMACmd function**

| | |
|---|---|
| Function name | USART_DMACmd |
| Function prototype | `void USART_DMACmd(USART_TypeDef* USARTx, u16 USART_DMAReq, FunctionalState Newstate)` |
| Behavior description | Enables or disables the USART DMA interface. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_DMAReq: specifies the DMA request.<br>Refer to *Section : USART_DMAReq* for more details on the allowed values of this parameter. |
| Input parameter3 | NewState: new state of the DMA Request sources.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### USART_DMAReq

USART_DMAReq selects the DMA request to be enabled or disabled. Refer to *Table 724* for the values taken by this parameter.

**Table 724. USART_DMAReq values**

| ***USART_DMAReq*** | **Description** |
|---|---|
| USART_DMAReq_Tx | Transmit DMA request |
| USART_DMAReq_Rx | Receive DMA request |

**Example:**

```
/* Enable the DMA transfer on Rx and Tx action for USART2 */
USART_DMACmd(USART2, USART_DMAReq_Rx | USART_DMAReq_Tx, ENABLE);
```

## 21.2.7 USART_SetAddress function

*Table 725* describes the USART_SetAddress function.

**Table 725. USART_SetAddress function**

| | |
|---|---|
| Function name | USART_SetAddress |
| Function prototype | `void USART_SetAddress(USART_TypeDef* USARTx, u8 USART_Address)` |
| Behavior description | Sets the address of the USART node. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_Address indicates the address of the USART node. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Sets the USART2 address node to 0x5 */
USART_SetAddress(USART2, 0x5);
```

### 21.2.8 USART_WakeUpConfig function

Table 726 describes the USART_WakeUpConfig function.

**Table 726. USART_WakeUpConfig function**

| | |
|---|---|
| Function name | USART_WakeUpConfig |
| Function prototype | `void USART_WakeUpConfig(USART_TypeDef* USARTx, u16 USART_WakeUp)` |
| Behavior description | Selects the USART WakeUp method. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_WakeUp: specifies the USART wake-up method.<br>Refer to Section : USART_WakeUp for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### USART_WakeUp

USART_WakeUp selects the wake-up method. Refer to Table 727 for the values taken by this parameter.

**Table 727. USART_WakeUp values**

| *USART_WakeUp* | Description |
|---|---|
| USART_WakeUp_IdleLine | IDLE line wake-up |
| USART_WakeUp_AddressMark | Address Mark wake-up |

**Example:**

```
/* Selects the IDLE Line as USART1 WakeUp */
USART_WakeUpConfig(USART1, USART_WakeUpIdleLine);
```

### 21.2.9 USART_ReceiverWakeUpCmd function

*Table 728* describes the USART_ReceiverWakeUpCmd function.

**Table 728. USART_ReceiverWakeUpCmd function**

| | |
|---|---|
| Function name | USART_ReceiverWakeUpCmd |
| Function prototype | `void USART_ReceiverWakeUpCmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Determines if the USART is in mute mode or not. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the USART mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* USART3 in normal mode */
USART_ReceiverWakeUpCmd(USART3, DISABLE);
```

### 21.2.10 USART_LINBreakDetectLengthConfig function

*Table 729* describes the USART_LINBreakDetectLengthConfig function.

**Table 729. USART_LINBreakDetectLengthConfig function**

| | |
|---|---|
| Function name | USART_LINBreakDetectLengthConfig |
| Function prototype | `void USART_LINBreakDetectLengthConfig(USART_TypeDef* USARTx, u16 USART_LINBreakDetectLength)` |
| Behavior description | Sets the USART LIN Break detection length. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_LINBreakDetectLength specifies the LIN break detection length.<br>Refer to *Section : USART_LINBreakDetectLength* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

### USART_LINBreakDetectLength

USART_LINBreakDetectLength selects the LIN break detection length. Refer to *Table 730* for the values taken by this parameter.

**Table 730. USART_LINBreakDetectionLength values**

| USART_LINBreakDetectionLength | Description |
|---|---|
| USART_LINBreakDetectLength_10b | 10 bit break detection |
| USART_LINBreakDetectLength_11b | 11 bit break detection |

**Example:**

```
/* Selects 10 bit break detection for USART1 */
USART_LINBreakDetectLengthConfig(USART1,
USART_LINDetectLength_10b);
```

## 21.2.11 USART_LINCmd function

*Table 731* describes the USART_LINCmd function.

**Table 731. USART_LINCmd function**

| | |
|---|---|
| Function name | USART_LINCmd |
| Function prototype | `void USART_LINCmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the USART LIN mode. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the USART LIN mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the USART2 LIN mode */
USART_LINCmd(USART2, ENABLE);
```

### 21.2.12 USART_SendData function

Table 732 describes the USART_SendData function.

**Table 732. USART_SendData function**

| | |
|---|---|
| Function name | USART_SendData |
| Function prototype | `void USART_SendData(USART_TypeDef* USARTx, u16 Data)` |
| Behavior description | Transmits single data through the USARTx peripheral. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | Data: the data to transmit. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Send one HalfWord on USART3 */
USART_SendData(USART3, 0x26);
```

### 21.2.13 USART_ReceiveData function

Table 733 describes the USART_ReceiveData function.

**Table 733. USART_ReceiveData function**

| | |
|---|---|
| Function name | USART_ReceiveData |
| Function prototype | `u16 USART_ReceiveData(USART_TypeDef* USARTx)` |
| Behavior description | Returns the most recent data received through the USARTx peripheral. |
| Input parameter | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Output parameter | None |
| Return parameter | The received data. |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Receive one halfword on USART2 */
u16 RxData;
RxData = USART_ReceiveData(USART2);
```

### 21.2.14 USART_SendBreak function

*Table 734* describes the USART_SendBreak function.

**Table 734. USART_SendBreak function**

| | |
|---|---|
| Function name | USART_SendBreak |
| Function prototype | `void USART_SendBreak(USART_TypeDef* USARTx)` |
| Behavior description | Transmits a break character |
| Input parameter | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Send break character on USART1 */
USART_SendBreak(USART1);
```

### 21.2.15 USART_SetGuardTime function

*Table 735* describes the USART_SetGuardTime function.

**Table 735. USART_SetGuardTime function**

| | |
|---|---|
| Function name | USART_SetGuardTime |
| Function prototype | `void USART_SetGuardTime(USART_TypeDef* USARTx, u8 USART_GuardTime)` |
| Behavior description | Sets the specified USART guard time. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_GuardTime: specifies the guard time. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set the guard time to 0x78 */
USART_SetGuardTime(0x78);
```

### 21.2.16 USART_SetPrescaler function

*Table 736* describes the USART_SetPrescaler function.

**Table 736. USART_SetPrescaler function**

| | |
|---|---|
| Function name | USART_SetPrescaler |
| Function prototype | `void USART_SetPrescaler(USART_TypeDef* USARTx, u8 USART_Prescaler)` |
| Behavior description | Sets the USART clock prescaler. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_Prescaler: specifies the prescaler. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set the system clock prescaler to 0x56 */
USART_SetPrescaler(0x56);
```

### 21.2.17 USART_SmartCardCmd function

*Table 737* describes the USART_SmartCardCmd function.

**Table 737. USART_SmartCardCmd function**

| | |
|---|---|
| Function name | USART_SmartCardCmd |
| Function prototype | `void USART_SmartCardCmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the USART Smart Card mode. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the Smart Card mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the USART1 Smart Card mode */
USART_SmartCardCmd(USART1, ENABLE);
```

### 21.2.18 USART_SmartCardNACKCmd function

*Table 738* describes the USART_SmartCardNACKCmd function.

**Table 738. USART_SmartCardNACKCmd function**

| | |
|---|---|
| Function name | USART_SmartCardNACKCmd |
| Function prototype | `void USART_SmartCardNACKCmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Enables or disables NACK transmission. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter3 | NewState: new state of the NACK transmission.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the USART1 NACK transmission during parity error */
USART_SmartCardNACKCmd(USART1, ENABLE);
```

### 21.2.19 USART_HalfDuplexCmd function

*Table 739* describes the USART_HalfDuplexCmd function.

**Table 739. USART_HalfDuplexCmd function**

| | |
|---|---|
| Function name | USART_HalfDuplexCmd |
| Function prototype | `void USART_HalfDuplexCmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the USART’s Half Duplex mode. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the Half Duplex mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enabe HalfDuplex mode for USART2 */
USART_HalfDuplexCmd(USART2, ENABLE);
```

### 21.2.20 USART_IrDAConfig function

*Table 740* describes the USART_IrDAConfig function.

**Table 740. USART_IrDAConfig function**

| | |
|---|---|
| Function name | USART_IrDAConfig |
| Function prototype | `void USART_IrDAConfig(USART_TypeDef* USARTx, u16 USART_IrDAMode)` |
| Behavior description | Configures the USART IrDA mode. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_IrDAMode: specifies the IrDA mode.<br>Refer to *Section : USART_IrDAMode* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### USART_IrDAMode

USART_IrDAMode select the IrDA mode. Refer to *Table 741* for the values taken by this parameter.

**Table 741. USART_IrDAMode values**

| *USART_IrDAMode* | Description |
|---|---|
| USART_IrDAMode_LowPower | IrDA low Power mode |
| USART_IrDAMode_Normal | IrDA normal mode |

**Example:**

```
/* USART2 IrDA Low Power Selection */
USART_IrDAConfig(USART2,USART_IrDAMode_LowPower);
```

### 21.2.21 USART_IrDACmd function

*Table 742* describes the USART_IrDACmd function.

**Table 742. USART_IrDACmd function**

| | |
|---|---|
| Function name | USART_IrDACmd |
| Function prototype | `void USART_IrDACmd(USART_TypeDef* USARTx, FunctionalState Newstate)` |
| Behavior description | Enables or disables the USART IrDA mode. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | NewState: new state of the IrDA mode.<br>This parameter can be: ENABLE or DISABLE. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable the USART1 IrDA Mode */
USART_IrDACmd(USART1, ENABLE);
```

### 21.2.22 USART_GetFlagStatus function

*Table 743* describes the USART_GetFlagStatus function.

**Table 743. USART_GetFlagStatus function**

| | |
|---|---|
| Function name | USART_GetFlagStatus |
| Function prototype | `FlagStatus USART_GetFlagStatus(USART_TypeDef* USARTx, u16 USART_FLAG)` |
| Behavior description | Checks whether the specified USART flag is set or not. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_FLAG: specifies the flag to check.<br>Refer to *Section : USART_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of USART_FLAG (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

### USART_FLAG

The USART flags that can be checked are listed in the following table:

**Table 744. USART_FLAG definition**

| USART_FLAG | Description |
|---|---|
| USART_FLAG_CTS | CTS flag |
| USART_FLAG_LBD | LIN Break detection flag |
| USART_FLAG_TXE | Transmit data register empty flag |
| USART_FLAG_TC | Transmission complete flag |
| USART_FLAG_RXNE | Read data register Not empty flag |
| USART_FLAG_IDLE | Idle line detected |
| USART_FLAG_ORE | Overrun Error |
| USART_FLAG_NE | Noise Error |
| USART_FLAG_FE | Framing Error |
| USART_FLAG_PE | Parity Error |

**Example:**

```
/* Check if the transmit data register is full or not */
FlagStatus Status;
Status = USART_GetFlagStatus(USART1, USART_FLAG_TXE);
```

## 21.2.23 USART_ClearFlag function

*Table 745* describes the USART_ClearFlag function.

**Table 745. USART_ClearFlag function**

| | |
|---|---|
| Function name | USART_ClearFlag |
| Function prototype | `void USART_ClearFlag(USART_TypeDef* USARTx, u16 USART_FLAG)` |
| Behavior description | Clears the USARTx pending flags. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_FLAG: specifies the flag to clear.<br>Refer to *Section : USART_FLAG* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear Overrun error flag */
USART_ClearFlag(USART1,USART_FLAG_OR);
```

### 21.2.24 USART_GetITStatus function

*Table 746* describes the USART_GetITStatus function.

**Table 746. USART_GetITStatus function**

| | |
|---|---|
| Function name | USART_GetITStatus |
| Function prototype | `ITStatus USART_GetITStatus(USART_TypeDef* USARTx, u16 USART_IT)` |
| Behavior description | Checks whether the specified USART interrupt has occurred or not. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_IT: specifies the USART interrupt source to check.<br>Refer to *Section : USART_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | The new state of USART_IT (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

#### USART_IT

USART_IT is used to read the status of USART interrupt pending bits. Refer to *Table 747* for the values taken by this parameter.

**Table 747. USART_IT definition**

| USART_IT | Description |
|---|---|
| USART_IT_PE | Parity Error interrupt |
| USART_IT_TXE | Transmit interrupt |
| USART_IT_TC | Transmission Complete interrupt |
| USART_IT_RXNE | Receive interrupt |
| USART_IT_IDLE | IDLE line interrupt |
| USART_IT_LBD | LIN break detection interrupt |
| USART_IT_CTS | CTS interrupt |
| USART_IT_ORE | Overrun Error interrupt |
| USART_IT_NE | Noise Error interrupt |
| USART_IT_FE | Frame Error interrupt |

**Example:**

```
/* Get the USART1 Overrun Error interrupt status */
ITStatus ErrorITStatus;
ErrorITStatus = USART_GetITStatus(USART1, USART_IT_OverrunError);
```

### 21.2.25 USART_ClearITPendingBit function

Table 748 describes the USART_ClearITPendingBit function.

**Table 748. USART_ClearITPendingBit function**

| | |
|---|---|
| Function name | USART_ClearITPending Bit |
| Function prototype | `void USART_ClearITPendingBit(USART_TypeDef* USARTx, u16 USART_IT)` |
| Behavior description | Clears the USARTx interrupt pending bits. |
| Input parameter1 | USARTx: where x can be 1, 2 or 3 to select the USART peripheral. |
| Input parameter2 | USART_IT: specifies the interrupt pending bit to clear.<br>Refer to *Section : USART_IT* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear the Overrun Error interrupt pending bit */
USART_ClearITPendingBit(USART1,USART_IT_OverrunError);
```

# 22 Window watchdog (WWDG)

The window watchdog (WWDG) is used to detect if a software fault has occurred. A software fault is usually generated by external interference or by unforeseen logical conditions which cause the application program to abandon its normal sequence.

*Section 22.1: WWDG registers* describes the data structures used in the WWDG Firmware Library. *Section 22.2: Firmware library functions* presents the Firmware Library functions.

## 22.1 WWDG registers

The WWDG register structure, *WWDG_TypeDef, is* defined in the *stm32f10x_map.h* file as follows:

```
typedef struct
{
  vu32 CR;
  vu32 CFR;
  vu32 SR;
} WWDG_TypeDef;
```

*Table 749* gives the list of WWDG registers.

**Table 749. WWDG registers**

| Register | Description |
|---|---|
| CR | Window Watchdog Control register |
| CFR | Window Watchdog Configuration Register |
| SR | Window Watchdog Status Register |

The WWDG peripheral is declared in *stm32f10x_map.h*, as following:

```
#define PERIPH_BASE            ((u32)0x40000000)
#define APB1PERIPH_BASE        PERIPH_BASE
#define APB2PERIPH_BASE        (PERIPH_BASE + 0x10000)
#define AHBPERIPH_BASE         (PERIPH_BASE + 0x20000)

#define WWDG_BASE              (APB1PERIPH_BASE + 0x2C00)

#ifndef DEBUG
...
#ifdef _WWDG
  #define WWDG                 ((WWDG_TypeDef *) WWDG_BASE)
#endif /*_WWDG */
...
#else   /* DEBUG */
...
#ifdef _WWDG
  EXT WWDG_TypeDef             *WWDG;
#endif /*_WWDG */
...
```

```
#endif
```

When using the Debug mode, WWDG pointer is initialized in *stm32f10x_lib.c*:

```
#ifdef _WWDG
  WWDG = (WWDG_TypeDef *)  WWDG_BASE;
#endif /*_WWDG */
```

To access the window watchdog registers, _WWDG must be defined in *stm32f10x_conf.h*, as follows:

```
#define _WWDG
```

## 22.2 Firmware library functions

*Table 750* gives the list of the various functions of the WWDG library.

**Table 750. WWGD firmware library functions**

| Function name | Description |
|---|---|
| WWDG_DeInit | Resets the WWDG peripheral registers to their default reset values. |
| WWDG_SetPrescaler | Sets the WWDG Prescaler. |
| WWDG_SetWindowValue | Sets the WWDG window value. |
| WWDG_EnableIT | Enables the WWDG Early Wake-up interrupt (EWI). |
| WWDG_SetCounter | Sets the WWDG counter value. |
| WWDG_Enable | Enables WWDG and load the counter value. |
| WWDG_GetFlagStatus | Checks whether the Early Wake-up interrupt flag is set or not. |
| WWDG_ClearFlag | Clears Early Wake-up interrupt flag. |

### 22.2.1 WWDG_DeInit function

*Table 751* describes the WWDG_DeInit function.

**Table 751. WWDG_DeInit function**

| | |
|---|---|
| Function name | WWDG_DeInit |
| Function prototype | `void WWDG_DeInit(void)` |
| Behavior description | Resets the WWDG peripheral registers to their default reset values. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | RCC_APB1PeriphResetCmd |

**Example:**

```
/* Deinitialize the WWDG registers */
WWDG_DeInit();
```

### 22.2.2 WWDG_SetPrescaler function

*Table 752* describes the WWDG_SetPrescaler function.

**Table 752. WWDG_SetPrescaler function**

| | |
|---|---|
| Function name | WWDG_SetPrescaler |
| Function prototype | `void WWDG_SetPrescaler(u32 WWDG_Prescaler)` |
| Behavior description | Sets the WWDG Prescaler. |
| Input parameter | WWDG_Prescaler: specifies the WWDG Prescaler.<br>Refer to *Section : WWDG_Prescaler* for more details on the allowed values of this parameter. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

#### WWDG_Prescaler

WWDG_Prescaler selects the WWDG Prescaler. Refer to *Table 753* for the values taken by this parameter.

**Table 753. WWGD_Prescaler values**

| WWDG_Prescaler | Description |
|---|---|
| WWDG_Prescaler_1 | WWDG counter clock = (PCLK1 / 4096) / 1 |
| WWDG_Prescaler_2 | WWDG counter clock = (PCLK1 / 4096) / 2 |
| WWDG_Prescaler_4 | WWDG counter clock = (PCLK1 / 4096) / 4 |
| WWDG_Prescaler_8 | WWDG counter clock = (PCLK1 / 4096) / 8 |

**Example:**

```
/* Set WWDG prescaler to 8 */
WWDG_SetPrescaler(WWDG_Prescaler_8);
```

### 22.2.3 WWDG_SetWindowValue function

*Table 754* describes WWDG_SetWindowValue function.

**Table 754. WWDG_SetWindowValue function**

| | |
|---|---|
| Function name | WWDG_SetWindowValue |
| Function prototype | `void WWDG_SetWindowValue(u8 WindowValue)` |
| Behavior description | Sets the WWDG window value. |
| Input parameter | WindowValue: specifies the window value to be compared to the downcounter.<br>This parameter value must be lower than 0x80. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set WWDG window value to 0x50 */
WWDG_SetWindowValue(0x50);
```

### 22.2.4 WWDG_EnableIT function

*Table 755* describes WWDG_EnableIT function.

**Table 755. WWDG_EnableIT function**

| | |
|---|---|
| Function name | WWDG_EnableIT |
| Function prototype | `void WWDG_EnableIT(void)` |
| Behavior description | Enables the WWDG Early Wake-up interrupt(EWI). |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Enable WWDG Early wakeup interrupt */
WWDG_EnableIT();
```

### 22.2.5 WWDG_SetCounter function

*Table 756* describes WWDG_SetCounter function.

**Table 756. WWDG_SetCounter function**

| | |
|---|---|
| Function name | WWDG_SetCounter |
| Function prototype | `void WWDG_SetCounter(u8 Counter)` |
| Behavior description | Sets the WWDG counter value. |
| Input parameter | Counter: specifies the watchdog counter value. This parameter must be a number between 0x40 and 0x7F. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Set WWDG counter value to 0x70 */
WWDG_SetCounter(0x70);
```

### 22.2.6 WWDG_Enable function

*Table 757* describes WWDG_Enable function.

**Table 757. WWDG_Enable function**

| | |
|---|---|
| Function name | WWDG_Enable |
| Function prototype | `void WWDG_Enable(u8 Counter)` |
| Behavior description | Enables WWDG and load the counter value[(1)] |
| Input parameter | Counter: specifies the watchdog counter value. This parameter must be a number between 0x40 and 0x7F. |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

1. Once enabled the WWDG can not be disabled any more.

**Example:**

```
/* Enable WWDG and set counter value to 0x7F */
WWDG_Enable(0x7F);
```

### 22.2.7 WWDG_GetFlagStatus function

*Table 758* describes WWDG_GetFlagStatus function.

**Table 758. WWDG_GetFlagStatus function**

| | |
|---|---|
| Function name | WWDG_GetFlagStatus |
| Function prototype | `FlagStatus WWDG_GetFlagStatus(void)` |
| Behavior description | Checks whether the Early Wake-up interrupt flag is set or not. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | The new state of the Early Wake-up interrupt flag (SET or RESET). |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Test if the counter has reached the value 0x40 */
FlagStatus Status;
Status = WWDG_GetFlagStatus();
if(Status == RESET)
{
...
}
else
{
...
}
```

### 22.2.8 WWDG_ClearFlag function

*Table 759* describes WWDG_ClearFlag function.

**Table 759. WWDG_ClearFlag function**

| | |
|---|---|
| Function name | WWDG_ClearFlag |
| Function prototype | `void WWDG_ClearFlag(void)` |
| Behavior description | Clears Early Wake-up interrupt flag. |
| Input parameter | None |
| Output parameter | None |
| Return parameter | None |
| Required preconditions | None |
| Called functions | None |

**Example:**

```
/* Clear EWI flag */
WWDG_ClearFlag();
```

# 23 Revision history

**Table 760. Revision history**

| Date | Revision | Changes |
|---|---|---|
| 28-May-2007 | 1 | Initial release. |
| 05-Oct-2007 | 2 | *Section 1.3.1: Variables on page 36* updated.<br>In *Peripheral declaration on page 38*, `#define DEBUG` replaced by `#define DEBUG 1`.<br>*assert* replaced by *assert_param* and *#undef assert* removed from document.<br>*Figure 1: Firmware library folder structure* updated.<br>RIDE added in *Section 2.1.3: Project folder on page 41*.<br>Targeted bit position modified in *Section 2.4.1: Mapping formula on page 45*. BKP_RTCOutputConfig modified in *Table 54: BKP library functions*.<br>In *Section 5.2: Firmware library functions on page 82*, BKP_RTCCalibrationClockOutputCmd() function replaced by BKP_RTCOutputConfig().<br>*Table 75: CAN_SJW values* modified.<br>Required preconditions updated in *Table 161: FLASH_ReadOutProtection function* and note added in *Section 9.2.13: FLASH_ReadOutProtection function*.<br>RTC_GetPrescaler function removed (see *Section 16.2: Firmware library functions*).<br>Descriptions changed in *Table 414: SPI_CPOL definition*.<br>*Section 19.2.2: TIM_TimeBaseInit function* modified.<br>TIM_InitTypeDef replaced by TIM_OCInitTypeDef and example updated in *Section 19.2.3: TIM_OCInit function*.<br>*Table 471: TIM_ICSelection definition* and *Table 493: TIM_ExtTRGPrescaler values* modified.<br>*Section 20.2.58: TIM1_OC1NPolarityConfig function*, *Section 20.2.60: TIM1_OC2NPolarityConfig function* and *Section 20.2.62: TIM1_OC3NPolarityConfig function* modified.<br>Note added in *USART_Parity on page 465*.<br>*Section 5.2.5: BKP_RTCOutputConfig function* modified.<br>Examples modified in *Section 16.2.10: RTC_WaitForSynchro function* and *Section 20.2.60: TIM1_OC2NPolarityConfig function*. |

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