



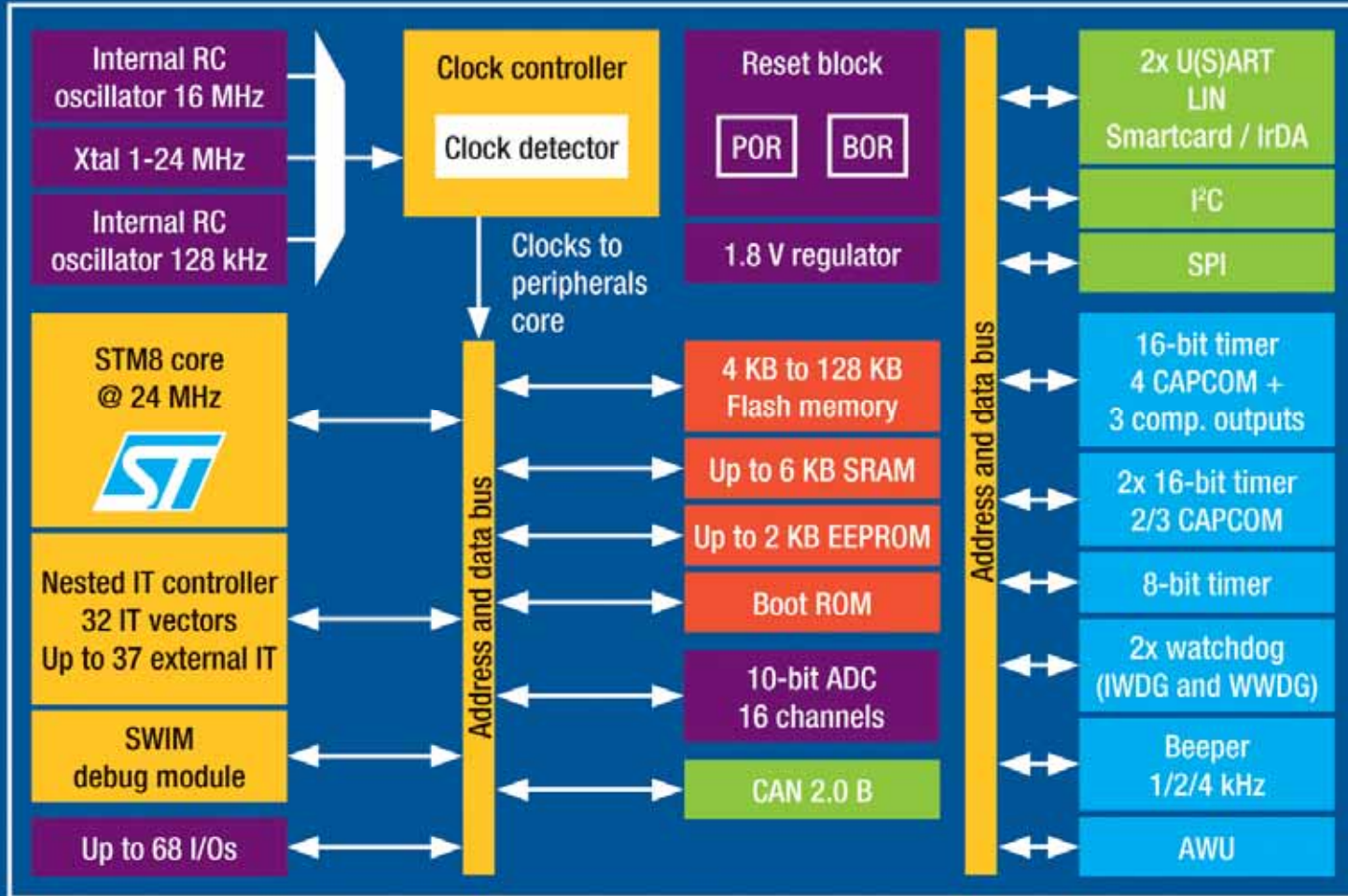
如何开始STM8S 系列单片机的开发

2009年ST MCU巡回演讲

北京、深圳、上海、台北、
青岛、重庆、南京、哈尔滨、
武汉、福州、西安

- ❖ STM8S系列单片机简介
- ❖ 一步一步开始STM8S系列单片机的开发
- ❖ 基于STM8S的电容触摸式按键方案介绍

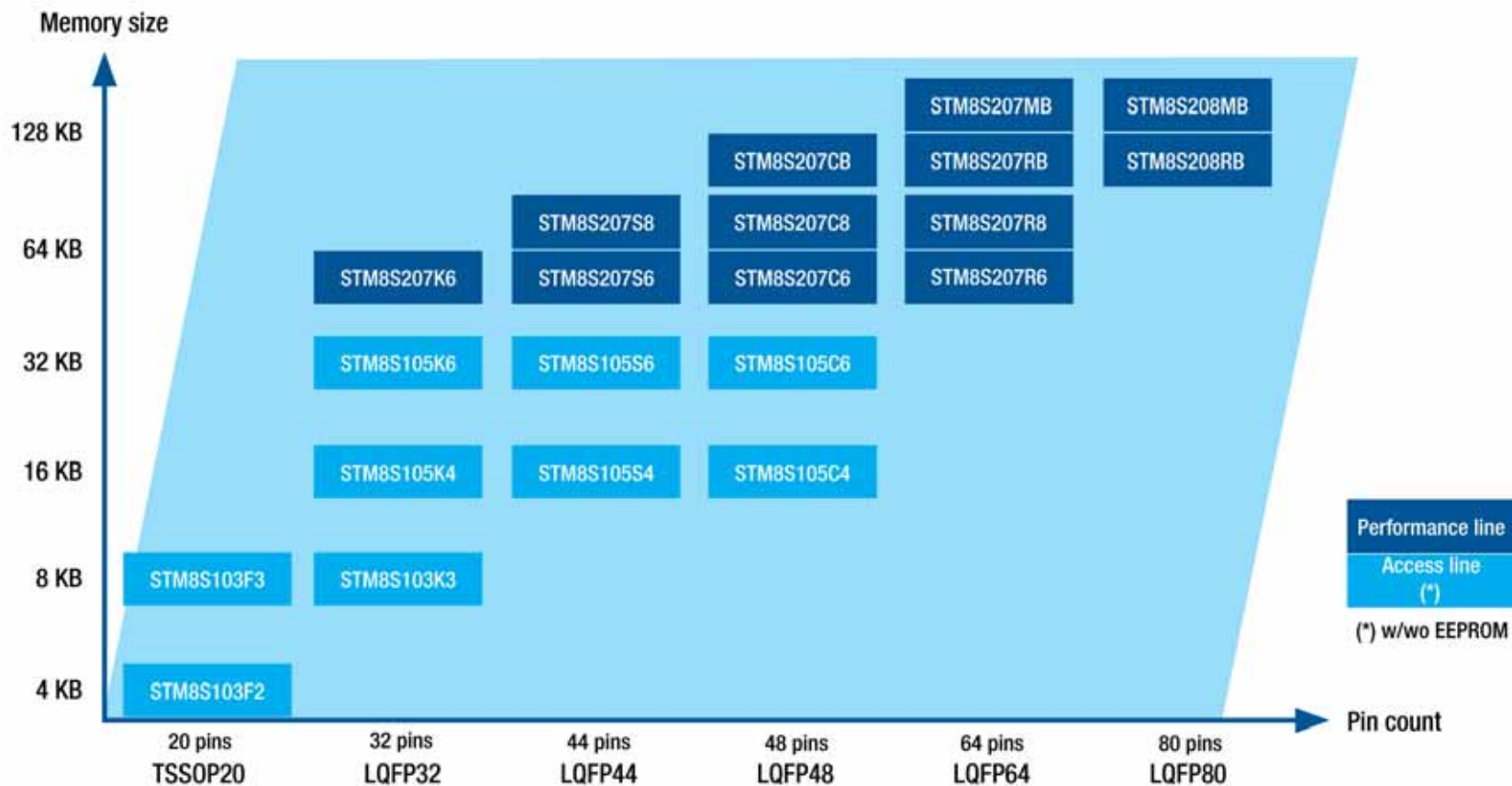
STM8S block diagram



STM8S产品线介绍



STM8S portfolio



*VQFN20, VQFN32 and VQFN48 packages are under qualification



一步一步开始STM8S系列单片机的开发

集成开发环境STVD(1) → 下载



<http://mcu.st.com>

<http://www.st.com/mcu>

Microcontroller Families

- 8-bit Microcontrollers**
 - STM8S
 - ST6
 - ST7
 - μPSD
- 16-bit Microcontrollers**
 - ST10
- 32-bit ARM Microcontrollers**
 - STM32 (Cortex™-M3 core)
 - STR7 (ARM7TDMI® core)
 - STR9 (ARM966E-S® core)

Related Families

- Touch sensing MCUs
- ZigBee®

Microcontrollers for automotive

- 8-bit Microcontrollers for automotive
- 16-bit Microcontrollers for automotive
- 32-bit Microcontrollers for automotive

STM8S - 8-bit Microcontrollers

STMicroelectronics' STM8S family of general-purpose 8-bit Flash microcontrollers offers ideal solutions for industrial and appliance market requirements. An advanced core version combined with a 3-stage pipeline ranks the STM8S microcontroller in the top position for performance. The true embedded EEPROM and the calibrated RC oscillator bring a significant cost effectiveness to the majority of applications. An easy-to-use and intuitive development environment contributes to improving time to market.

Documents and Files for STM8S family

Documents and files for family STM8 - 8-bit Microcontrollers

Available Documents

- Advertising | Application Note | Brochure | Flyer | Certification | Package | Errata Sheet | Firmware | Presentation - Marketing | Press Release | Programming Manual | Reference Manual | Release Note | Software for Tools

Development Tools Section

- Data Briefing | Reference Schematics | Release Note | Software for Tools | Software Patches | User Manual

Reference	Description	Version	Date	Size	File	File
	STM8S PRODUCT PRESENTATION USED DURING PRESS CONFERENCES		Mar-2009	1213 KB		

Application Note

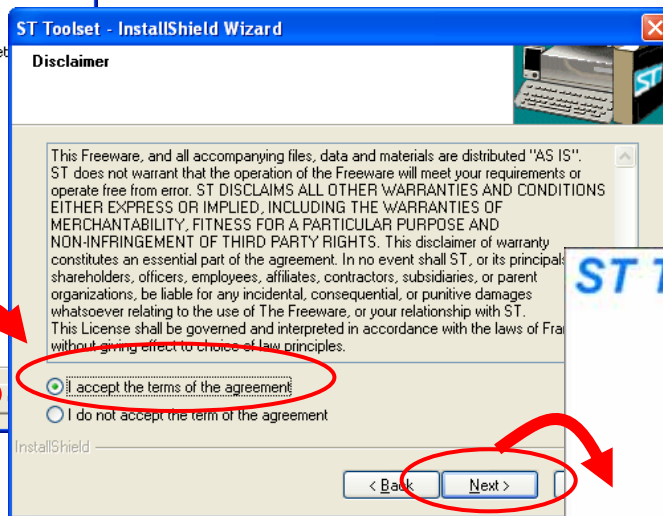
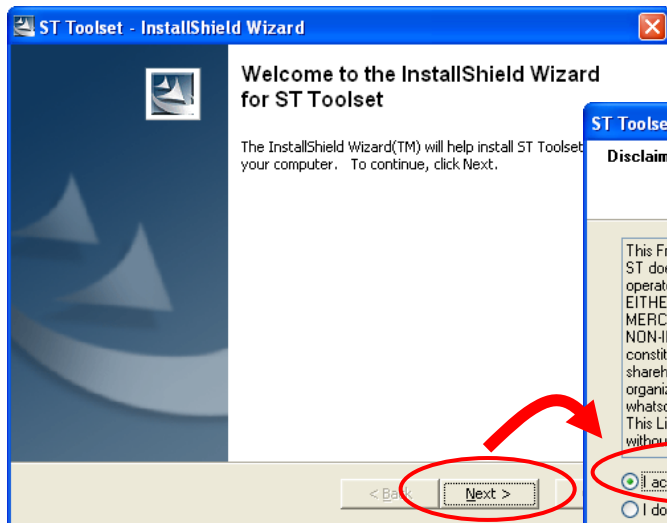
Reference	Description	Version	Date	Size	File	File
AN2887	STM8S family power management	2	Jul-2009			
AN2888	Using the analog to digital converter of the STM8S microcontroller	2	Jul-2009			
AN2887	STM8S20xxx LCD software driver	1	Apr-2009			

Software for Tools

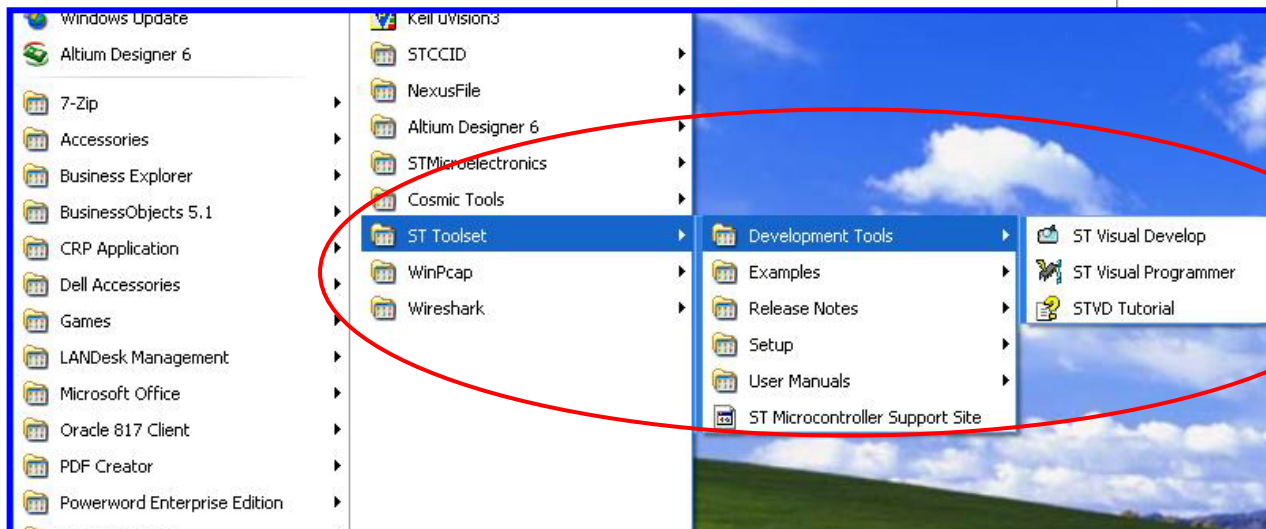
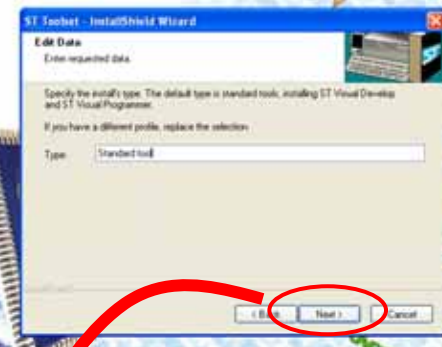
Reference	Description	Version	Date	Size	File	File
ST toolset	ST Visual Develop (STVD) 4.1.2 and ST Visual Programmer (STVP) 3.1.1 software releases – Software package includes IDE with advanced editor, project builder (supports Cosmic, and Raisonance C toolchains, and included ST assembler/linker), debugger with simulator, plus programming interface. Supports ST emulators, in-circuit debugger, Raisonance RLink and ST MCU programming tools	Pack 18	May-2009			

STM8S系列相关的资料和软件都可以在这个页面找到

集成开发环境STVD(2) → 安装



ST Toolset



<http://www.cosmicsoftware.com/download.php>

Available downloads for STMicroelectronics targets:

- **STMicroelectronics Power Architecture** evaluation tools
Cosmic tools for the Power Architecture family, evaluation version limited to 4k.
 Download
- **STMicroelectronics ST7** evaluation tools
Cosmic tools for the ST7 family, evaluation version limited to 4k.
 Download
- **STMicroelectronics ST10** evaluation tools
Cosmic tools for the ST10/Super10 family, evaluation version limited to 4k.
 Download



Home / Download / stm8 FREE 16k

Download of the FREE stm8 16k version

Fill and submit the form below to download the free stm8 compiler 16K version. To use this product you must register with Cosmic Software. The installation procedure will instruct you to send a message to Cosmic Software at stm8_16k@cosmic.fr to perform this registration. As a result you will receive the appropriate free license for this product.

* Name

* Company

Address

ZIP Code

City

* Country -- Select --

Phone

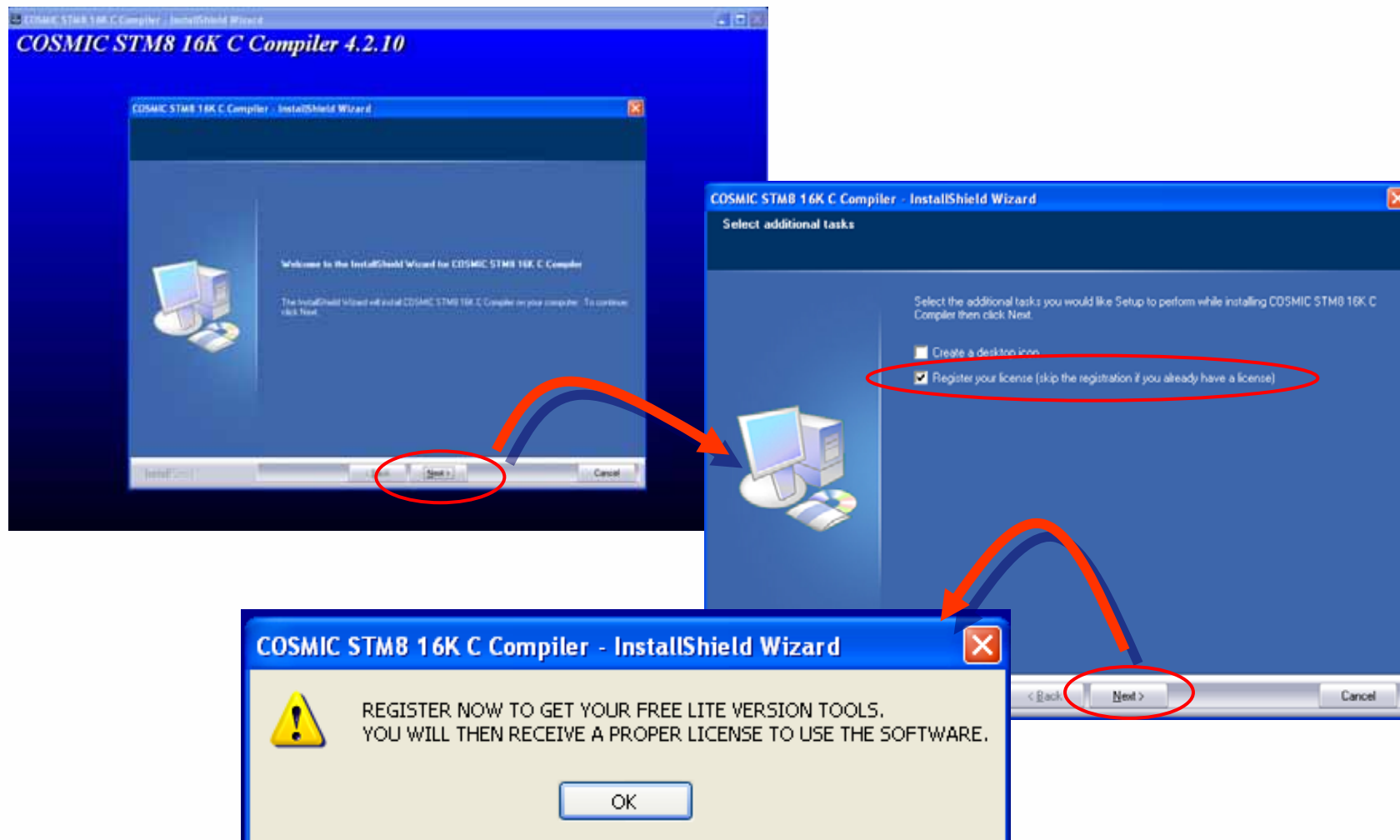
Fax

* E-mail

请仔细填写注册信息

Submit Clear

选择提交信息后，会弹出软件下载链接



Cosmic 16K Compiler Registration

REGISTER NOW TO GET YOUR FREE LITE VERSION TOOLS

```
PRODUCT=LXSTM816K
HOSTID="001641575fda 444553544200 00166f8de535"
USER=jacky xu
DISPLAY=SHZ10290
HOSTNAME=SHZ10290
DISK_SERIAL_NUM=c05b3ad6
```

User Name:

Company:

Address *:

88 Zihai Road
Zizhu Science Park
Minhang District
Shanghai 200241

Country * :

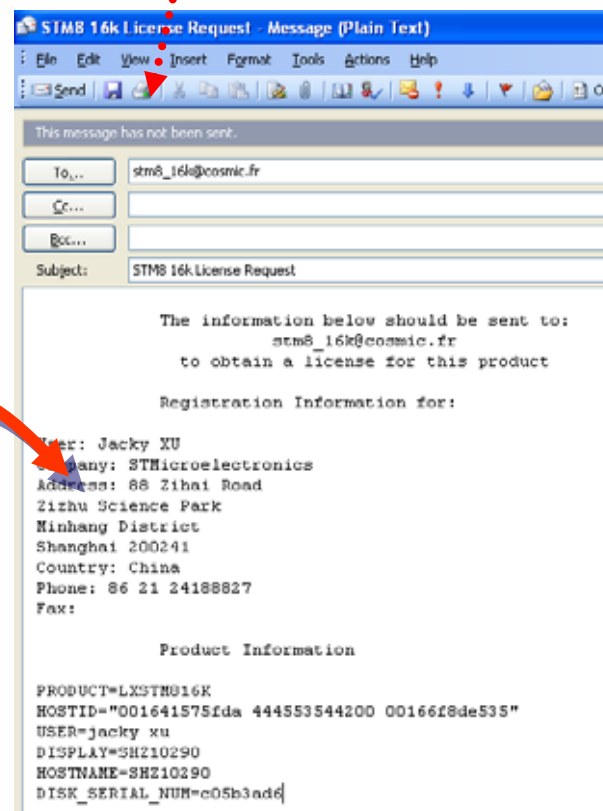
Phone * :

Fax: (Optional)

*: required.

详细填写注册信息以便获得免费的16K以下版本的License.

发送此邮件后，可以收到COSMIC公司发出的license.lic文件。将收到的License.lic文件复制到COSMIC安装路径下的License文件夹下即可。



安装在线调试工具



Altium Designer 6

7-Zip

Accessories

Business Explorer

BusinessObjects 5.1

ERP Application

Dell Accessories

Games

.ANDesk Management

Microsoft Office

Oracle 817 Client

PDF Creator

STCCID

NexusFile

Altium Designer 6

STMicroelectronics

Cosmic Tools

ST Toolset

WinPcap

Wireshark

Development Tools

Examples

Release Notes

Setup

User Manuals

ST Microcontroller Support Site

Install RLink driver

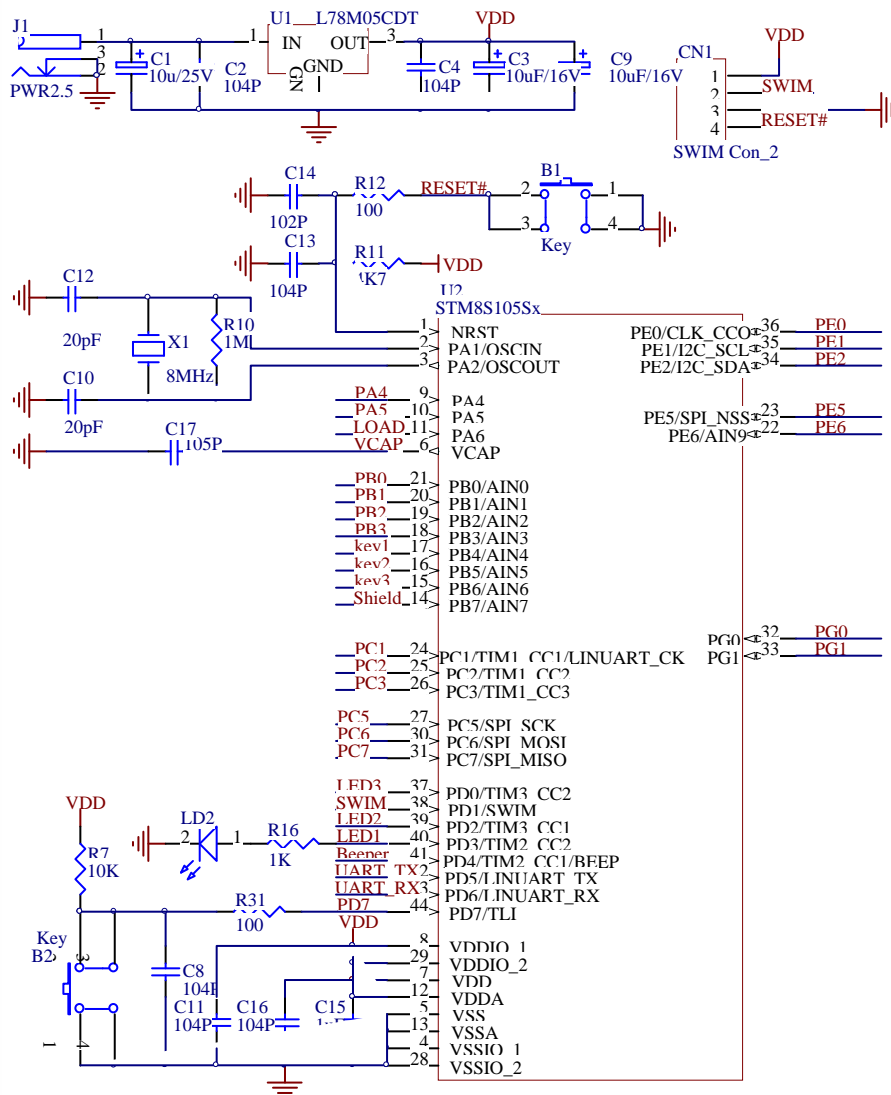
Uninstall ST Toolset

注：由于STVD自带ST-Link的驱动，所以无须另行安装。
如果要使用Rlink，则需要手动安装Rlink的驱动。



STM8S项目开发举例

STM8S硬件设计 → 以STM8S105S4-PKT评估板为例



❖ 电源

STM8S系列单片机的工作电压约为2.95V ~ 5.5V (具体的电压以Datasheet提供的数据为准)。因此在设计时要注意保证MCU的供电电源在这个范围之内。

对于不同封装的STM8S MCU，最多会有下面这些电源引脚：

VDD/VSS，VDDIO/VSSIO，VDDA/VSSA，VREF+/VREF-:

要保证MCU的正常工作，必须将芯片所有的电源引脚都连接到相应的供电电源上。

❖ Vcap

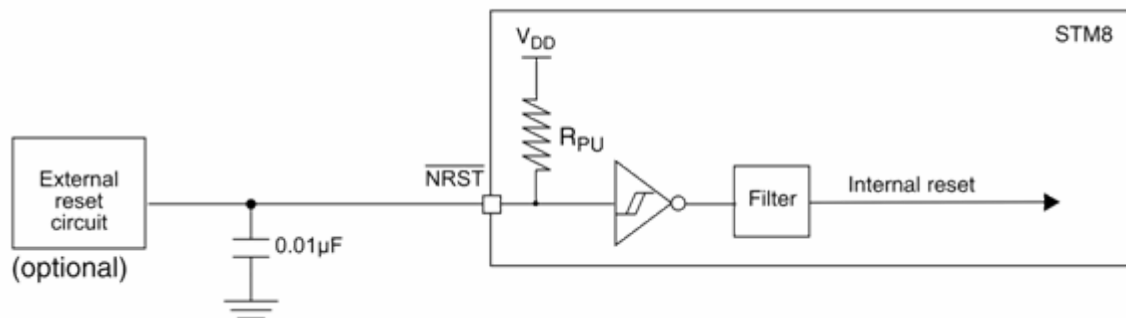
Vcap引脚是STM8S系列MCU内核供电电源的引出脚。为了保证内核能够正常运行，必须在Vcap引脚加去耦电容，并且要求距离MCU越近越好。建议这个引脚上的电容取680nf~1uF比较合适。注意不能使用电解电容，其较差的高频特性不适合用于此处。

❖ 时钟

STM8可使用外时钟或内时钟，当使用外时钟时，如果MCU主频超过16MHz，要在选项字节中配置等待周期为1。STM8的内时钟为16MHz，可根据需要进一步分频。其内部有3或4位的频率微调器，经过校正后其频率误差理论上可不大于0.5%(频率微调器为3位)或0.25%(频率微调器为4位)。

❖ 复位电路

复位电路可采用传统的外部RC方式，如上面的原理图所示。另外，由于MCU本身有内部弱上拉，因此外部的上拉电阻也可以不加。下图是数据手册提供的推荐电路。



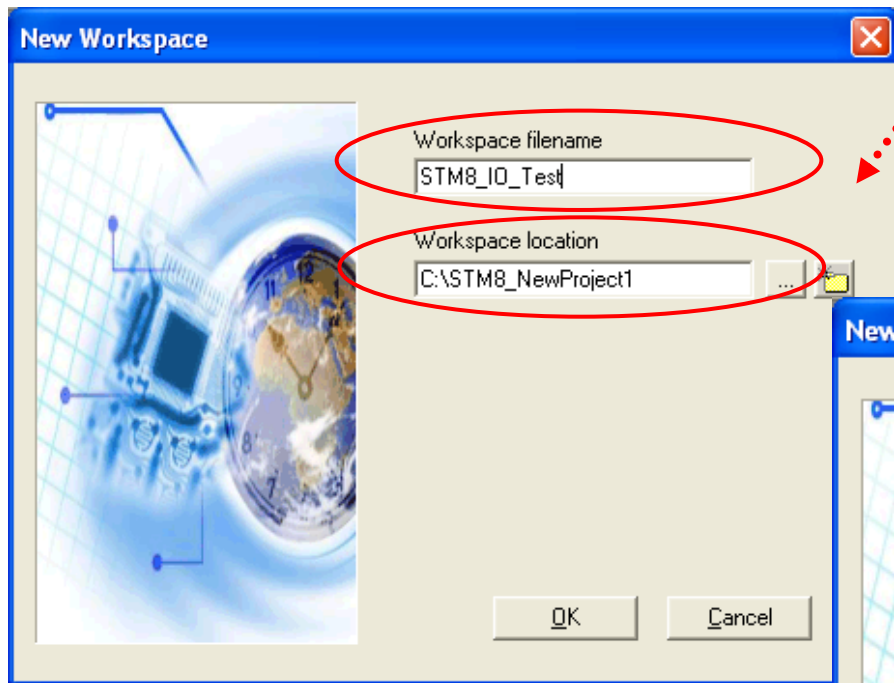
❖ I/O口的分配

- 要注意选项字节的配置，尤其注意I/O重映射功能状态是否与实际项目相符合
- STM8的I2C接口为真正的开漏接口，意味着其没有内部上拉电阻和对电源的保护二极管。
- 并非所有的I/O口都是大电流口，当需要I/O有很强驱动能力时要检查其是否需要外加驱动。
- SWIM接口要保证上电时为稳定电平以防止MCU误进入调试模式。

STM8S软件设计 → 创建工作区



The image shows the ST Visual Develop software interface. The 'File' menu is open, and 'New Workspace...' is selected. A 'New Workspace' dialog box is displayed, showing options to 'Create workspace and project', 'Create empty Workspace', 'Create from Project', and 'Wrap Executable'. The 'Create workspace and project' option is selected. A second 'New Workspace' dialog box is shown, with the 'Workspace filename' field containing 'Workspace名称' and the 'Workspace location' field containing 'Workspace存储路径'. The 'OK' button is highlighted.



本例对Workspace filename 起名为
STM8_IO_Test。
存储路径为：
C:\STM8_NewProject1

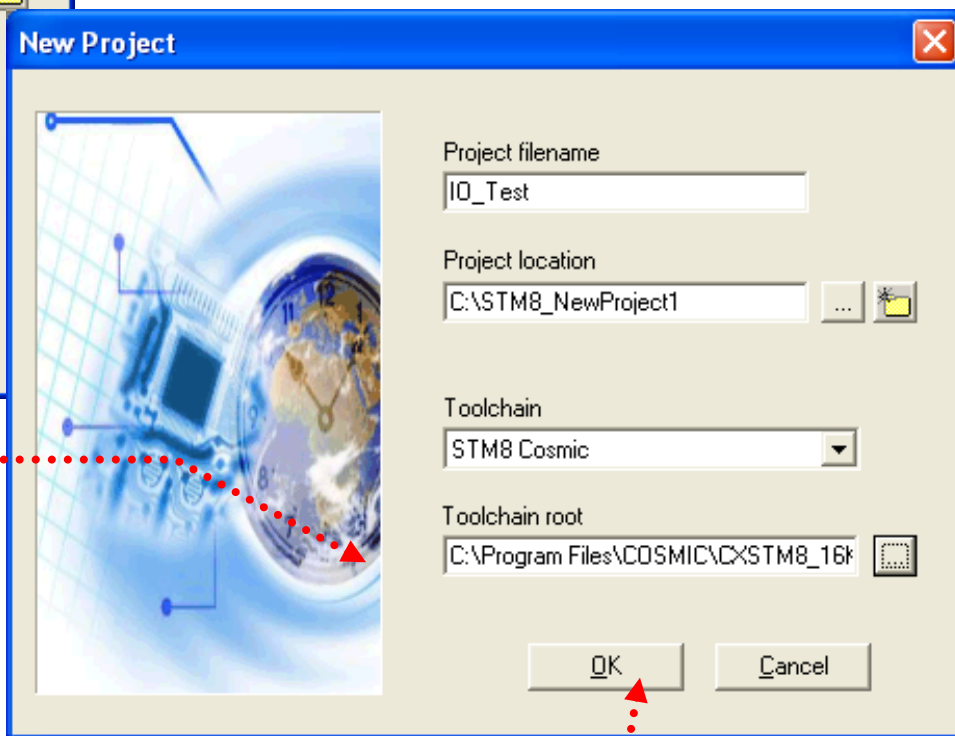
按照下面描述分别填入相关项：

Project filename：IO_Test。

Project location：无需改变，保留（默认与Workspace同路径）。

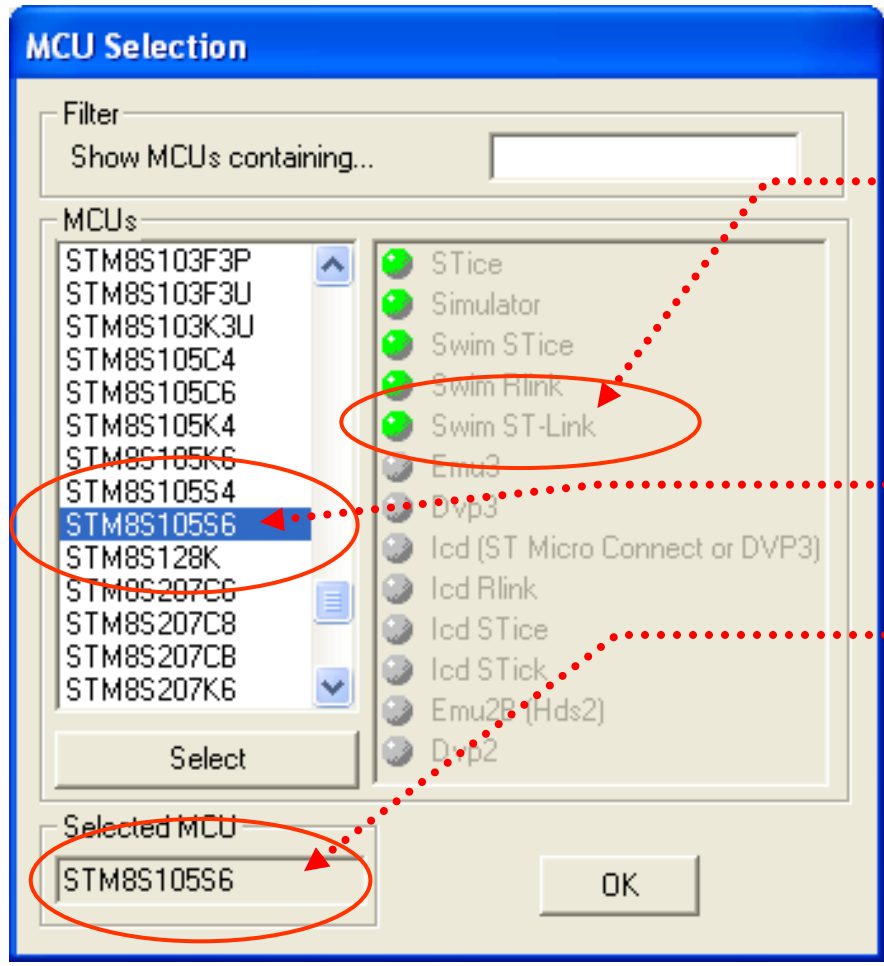
Toolchain：默认编译器为Raisonance，使用下拉菜单，将之选为STM8 Cosmic。

Toolchain root：选择STM8 COSMIC编译器的安装地址。



配置完成后的窗口如图所示，确认后进入MCU 选择窗口

STM8S软件设计 → MCU选择

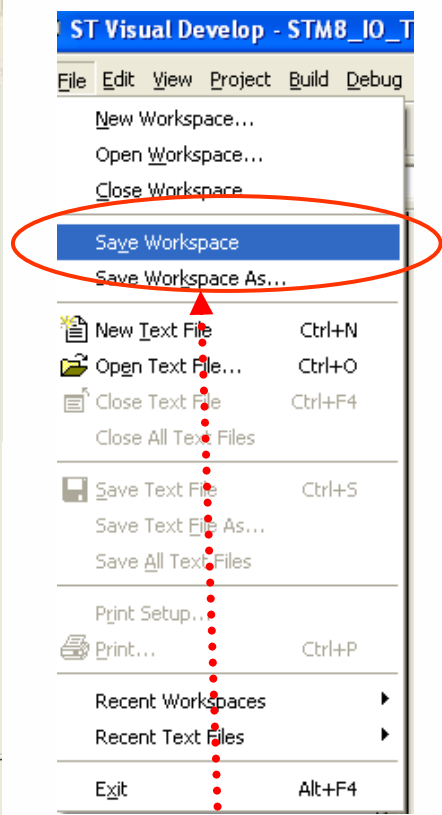
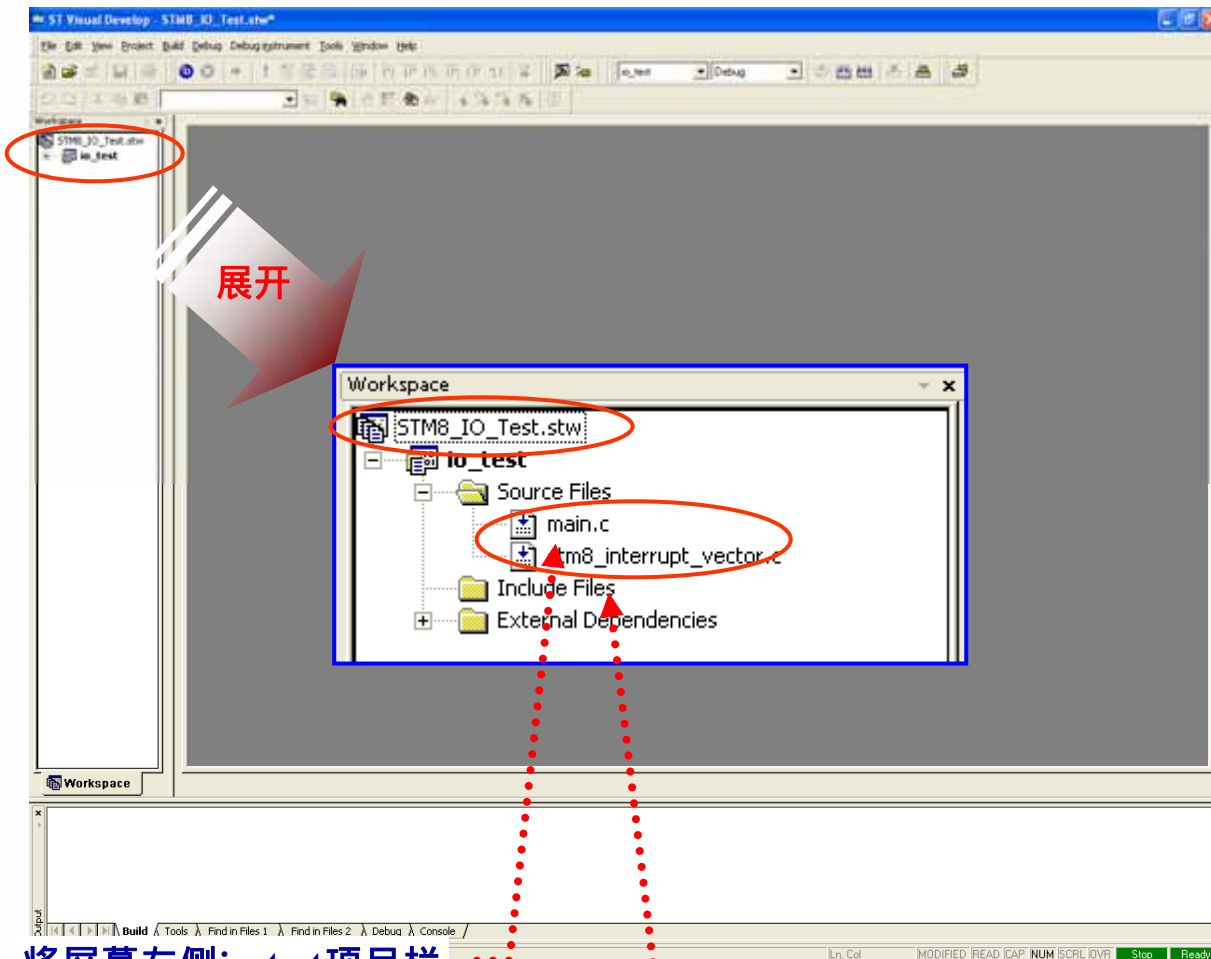


显示支持当前选中的MCU的所有工具。

选择目标MCU,并双击。

已选择的MCU会出现在此栏中
本例使用STM8 mini kit2做为目标板，因此选中STM8S105S4并双击之，使之出现在Selected MCU栏中。

STM8S软件设计 → 项目保存



将屏幕左侧io_test项目栏展开，可以看见系统已自动生成了两个C文件：
main.c
stm8_interrupt_vector.c

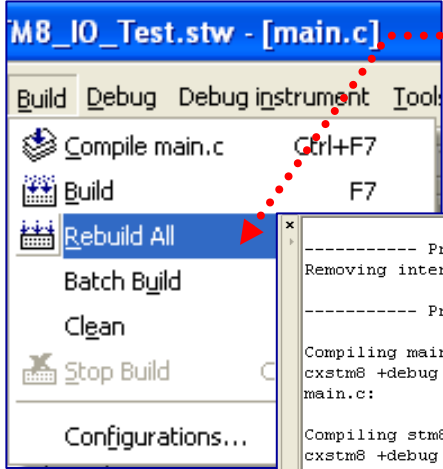
将需要使用的头文件添加到Include Files 文件夹下

所有的源文件和头文件添加完成后，选择保存。

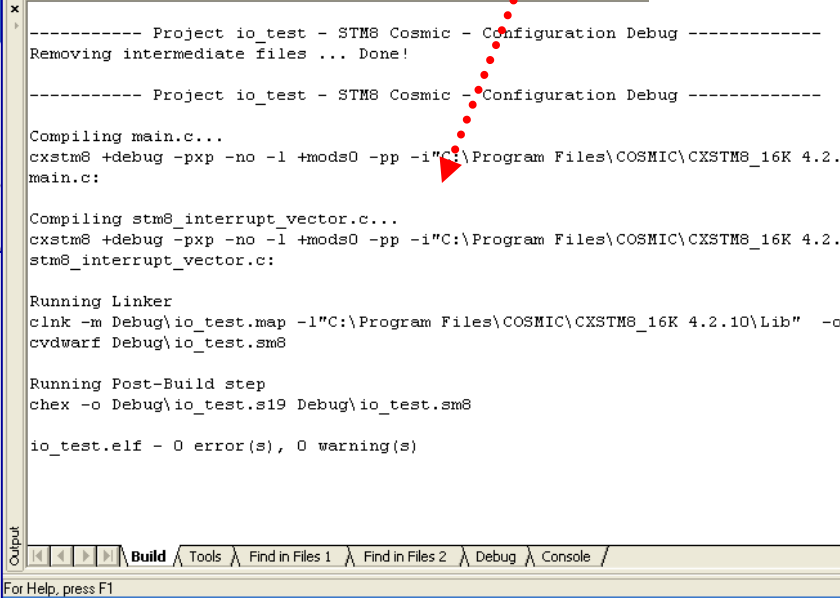
STM8S软件设计 → 编译



M8_IO_Test.stw - [main.c] **选择Build→ Rebuild**

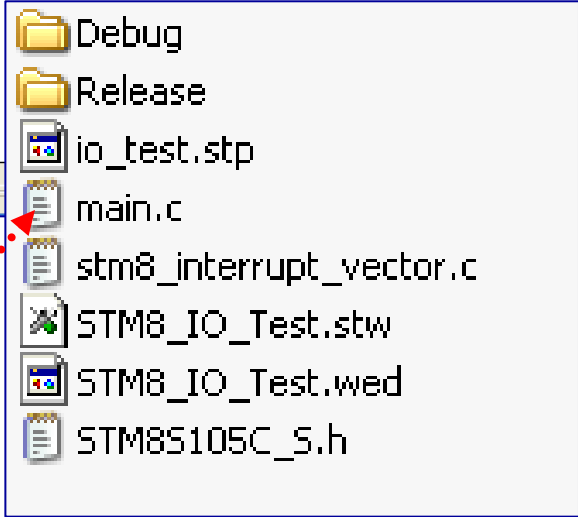


编译成功



```
----- Project io_test - STM8 Cosmic - Configuration Debug -----  
Removing intermediate files ... Done!  
  
----- Project io_test - STM8 Cosmic - Configuration Debug -----  
  
Compiling main.c...  
cxstm8 +debug -pxp -no -l +mods0 -pp -i"C:\Program Files\COSMIC\CXSTM8_16K_4.2.10\Hstm8" -c1Debug\ -coDebug\ main.c  
main.c:  
  
Compiling stm8_interrupt_vector.c...  
cxstm8 +debug -pxp -no -l +mods0 -pp -i"C:\Program Files\COSMIC\CXSTM8_16K_4.2.10\Hstm8" -c1Debug\ -coDebug\ stm8_interrupt_vector.c  
stm8_interrupt_vector.c:  
  
Running Linker  
clnk -m Debug\io_test.map -l"C:\Program Files\COSMIC\CXSTM8_16K_4.2.10\Lib" -o Debug\io_test.sm8 Debug\io_test.lkf  
cvsdwarf Debug\io_test.sm8  
  
Running Post-Build step  
chex -o Debug\io_test.s19 Debug\io_test.sm8  
  
io_test.elf - 0 error(s), 0 warning(s)
```

编译并且保存后，项目文件夹的内容



- Debug
- Release
- io_test.stp
- main.c
- stm8_interrupt_vector.c
- STM8_IO_Test.stw
- STM8_IO_Test.wed
- STM8S105C_s.h

❖ 时钟分配

- 主时钟是否正常起振并稳定，各个外设时钟是否开启

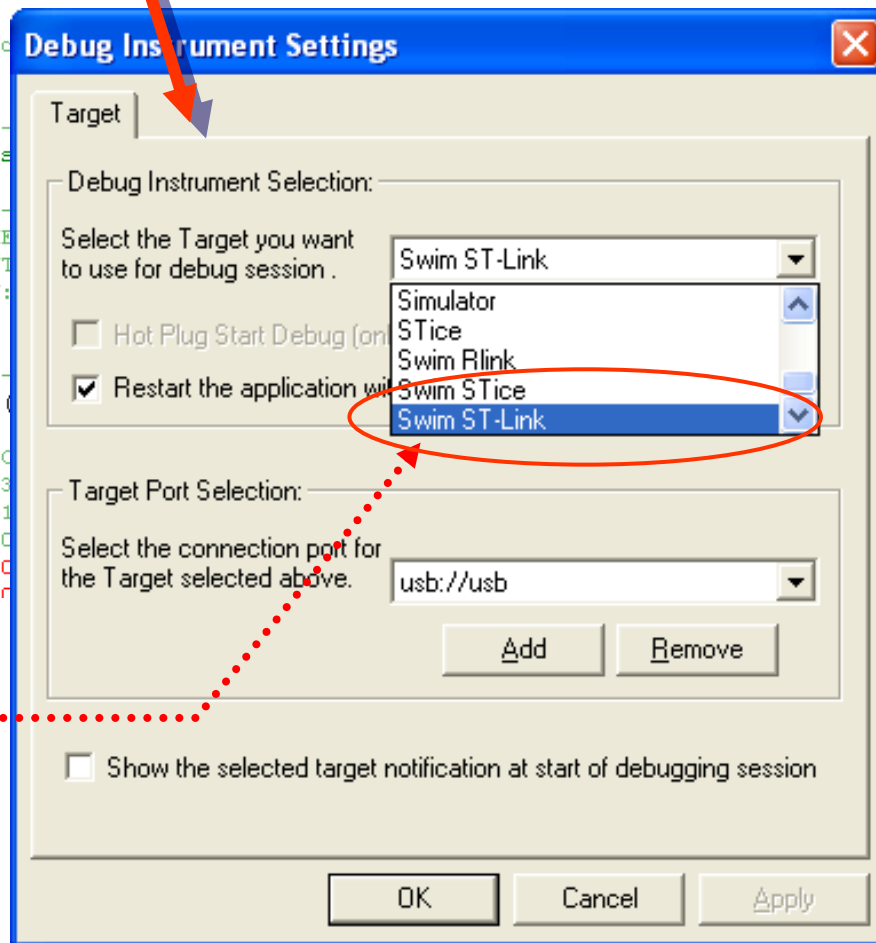
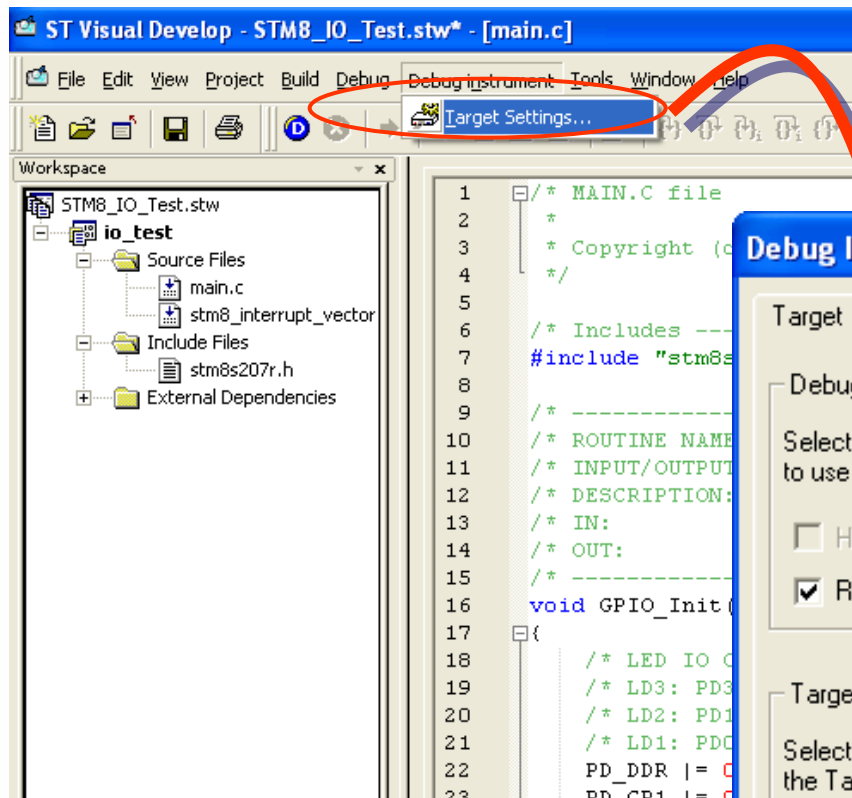
❖ 选项字节配置(option bytes)

- I/O重映射功能状态是否与实际项目相符合
- 如果看门狗使用硬件方法使能，则看门狗在复位后立即有效，主程序必须喂狗。
- 如果MCU主频高于16MHz，则需要配置选项字节的MCU等待周期为1

❖ 有一些状态寄存器的位的清零是通过读该寄存器来实现的，所以对这样的寄存器操作要清楚其后果。

❖ 建议将常用的变量分配在Zero page中，这样可以提高这些变量的访问速度。对于不常用的变量可以用@near定义在0xFF以外区域（相对来说，访问速度略慢）。用户可以根据实际情况决定。

在线调试 → 选择在线调试工具



根据需要使用合适的调试工具
本例使用ST-Link

在线调试 → 进入在线调试模式



The image shows the ST Visual Develop IDE interface. The top window displays the project workspace for 'STM8_IO_Test.stw' with a menu open over the 'Debug' tab, highlighting 'Start Debugging'. A red arrow points from this menu item to a second window titled 'STM8S207R8 STM SWIM - STM8_IO_Test.stw* - [Debug] - io_test.elf - [main.c]'. This window shows the source code for 'main.c' and a disassembly view on the right. The disassembly view shows memory addresses from 0x6000 to 0x6035. At the bottom, the 'Output' window displays the following text:

```
Application closed.
Debug session closed.
Starting debug session...
-> Emulator reset (usb://usb)...
done.
Opening application c:\STM8_NewProject\Debug\io_test.elf...
done.
-> Chip-reset...
** Application stopped:
```

在线调试 → 各个调试窗口介绍



The screenshot displays the STM8 IDE interface with several windows and their corresponding labels:

- Workspace:** Shows the project structure for `STM8_IO_Test.stw`, including source files and include files.
- Instruction Breakpoints:** A table with columns for Location, Count, and Condition. It is currently empty, with the label **指令断点** (Instruction Breakpoints).
- Source Code:** Displays the C source code for `main.c`, including comments and the `GPIO_Init` function. Labeled **源程序** (Source Code).
- Disassembly:** Shows the assembly code corresponding to the source code, with the instruction at `0x6000` highlighted. Labeled **反汇编** (Disassembly).
- Memory #1:** Shows a memory dump starting at `0x80`. Labeled **存储器** (Memory).
- Peripheral Registers:** A table listing registers for Port A through Port G. Labeled **外设寄存器** (Peripheral Registers).
- Core Registers:** Shows the state of the Program Counter (PC: `0x006000`), Stack Pointer (SP: `0x17ff`), Accumulator (A: `0x00`), and Condition Flags. Labeled **内核寄存器** (Core Registers).
- Call Stack:** Shows the current call stack with the entry `#0 0x6000 in ?? ()`. Labeled **堆栈** (Call Stack).
- Local Variables:** A table for local variables, currently empty. Labeled **局部变量** (Local Variables).
- Watch:** A table for watching variables, currently empty. Labeled **观察窗口** (Watch Window).
- Output:** Shows the output of the application, including the message "Application closed. Debug session closed." Labeled **输出窗口** (Output Window).

在线调试 → 断点设置



- ❖ STM8软件断点无数量限制，但是不能将中断设在中断向量表内。

The screenshot shows the STM8 IDE interface. The workspace on the left contains a project named 'io_test' with source files 'main.c' and 'stm8_interrupt_ve', include files 'stm8s207r.h', and external dependencies. The main editor displays the source code for 'main.c'. A red dot indicates a breakpoint is set at line 60, which is the call to 'GPIO_Init()'. The 'Instruction Breakpoints' table at the bottom left shows the location 'main.c:60, in <ma...' with a count of 1.

```
47
48 /* -----
49 /* ROUTINE: main
50 /*      main entry
51 /* -----
52 void main ( void )
53 {
54     unsigned int j;
55
56     _asm("sim");          /* Disable interrupts */
57
58     CLK_Init();
59     GPIO_Init();
60
61
62     _asm("rim");
63
64     while ( 1 )
65 {
```

This screenshot is similar to the one above, but the breakpoint is now set at line 60, which is the call to 'GPIO_Init()'. The 'Instruction Breakpoints' table shows the location 'main.c:60, in <ma...' with a count of 1. The code editor shows the same source code, but the line 'GPIO_Init();' is highlighted in yellow.

```
47
48 /* -----
49 /* ROUTINE: main
50 /*      main entry
51 /* -----
52 void main ( void )
53 {
54     unsigned int j;
55
56     _asm("sim");          /* Disable interrupts */
57
58     CLK_Init();
59     GPIO_Init();
60
61
62     _asm("rim");
63
64     while ( 1 )
```


- ❖ STM8S在调试时支持RD/WR on fly功能，用户可以在程序运行时，直接观察变量的变化。也可以在不中断程序运行的条件下直接修改寄存器或者变量的值。
- ❖ 支持hot plug功能。当程序在运行时，可以通过SWIM接口在不影响程序连续运行的条件下，通过STVD窗口观测存储器内各个值的变化。（前提是不设读保护）。

在线调试 → 使能On fly功能

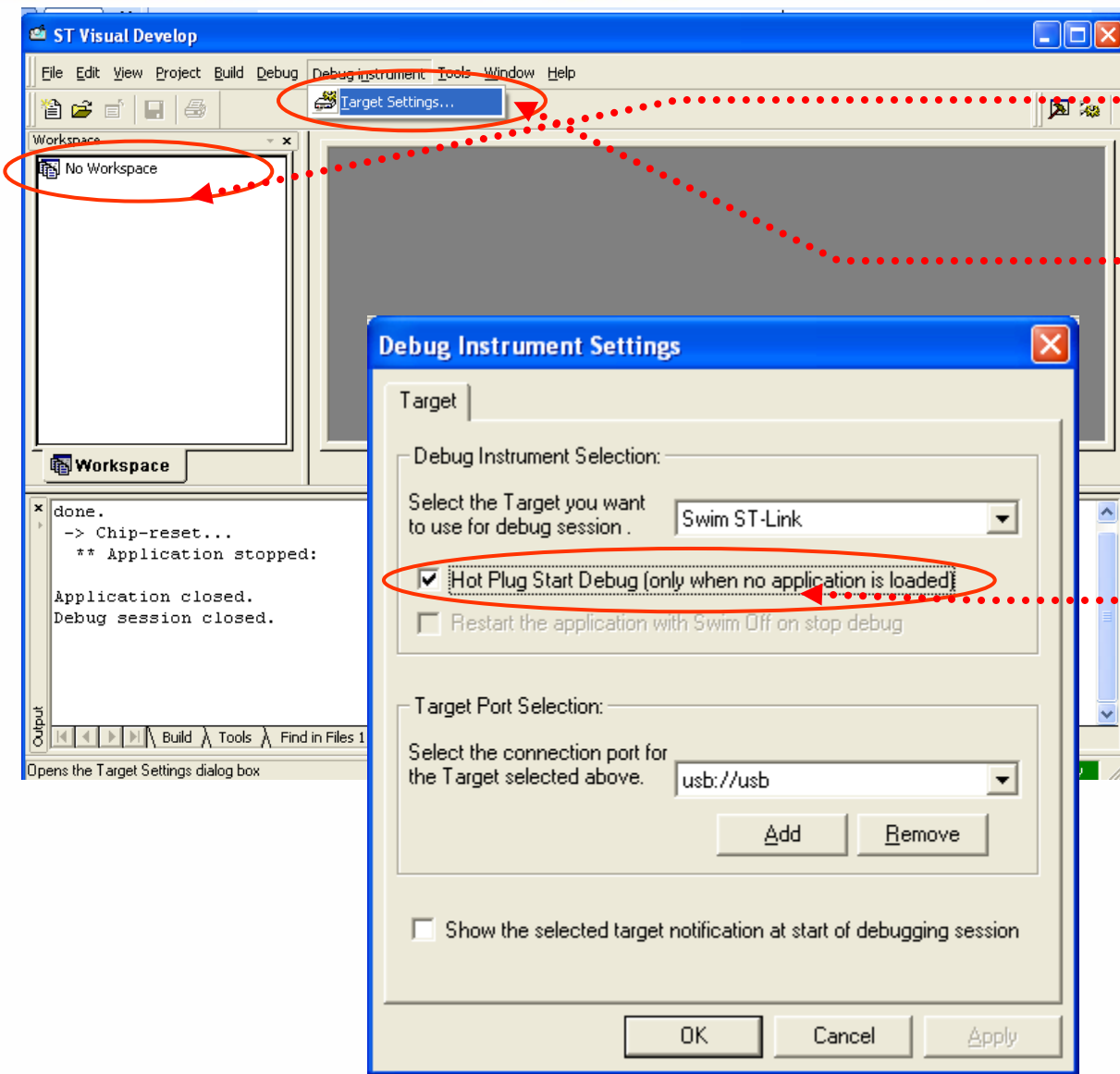


The screenshot shows the STM32 IDE interface. The main window displays C code for `CLK_Init` and `main`. A context menu is open over the code, with `Read/Write On Fly` highlighted. A red dotted arrow points from this menu item to the Watch window at the bottom right, which has a yellow background. Another red dotted arrow points from the menu item to the Memory window at the bottom left, which also has a yellow background. The Watch window contains a table with columns for Variable, Value, Type, and Address. The Memory window shows a hex dump of memory addresses from 000080 to 000130.

在 Watch 窗口或者 Memory 窗口
右击，选择“Read/Write on fly”

Watch 窗口或者 Memory 窗口的
背景色变成黄色，表示已经处于
on fly 状态

在线调试 → Hot Plug功能



1. 关闭所有的Workspace.

2. 通过Debug instrument → Target Settings 打开调试工具配置界面

3. 使能Hot Plug功能

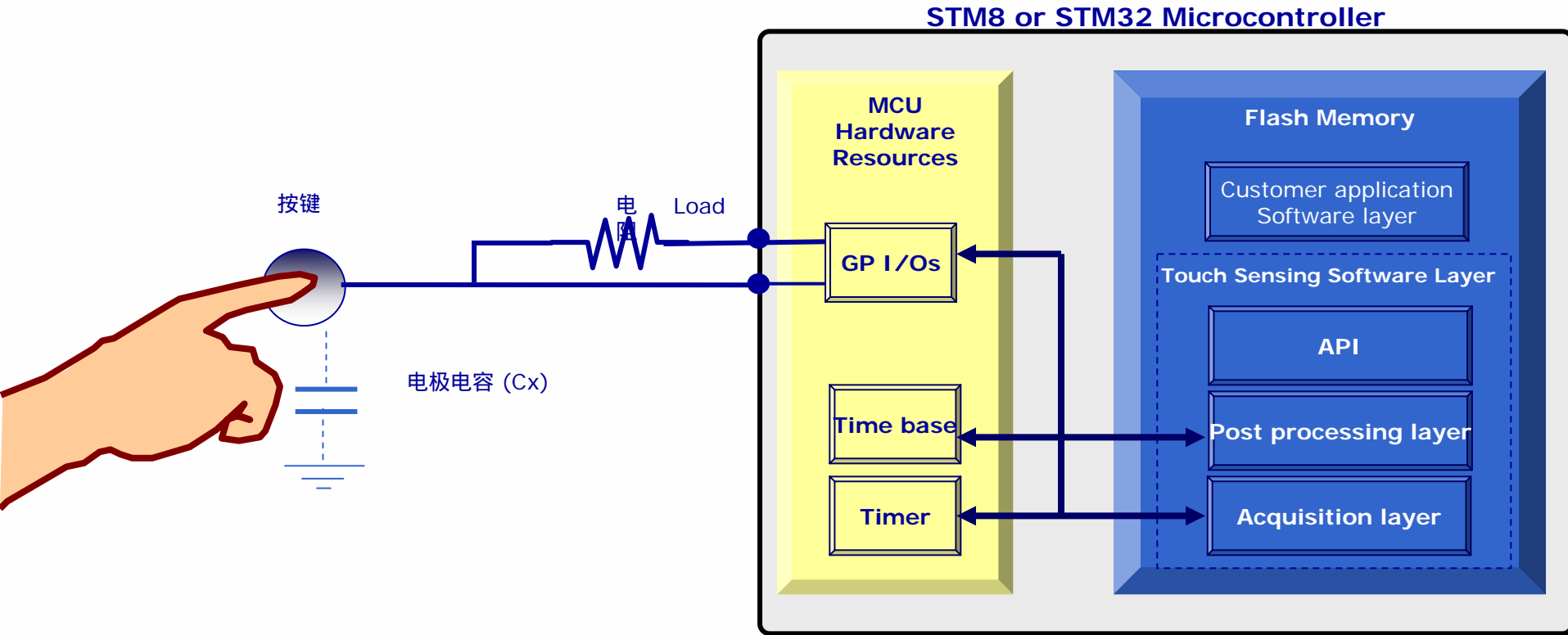
4. 重新进入在线调试界面，即可看到存储器内的值随着程序的变量发生变化。

基于STM8S的电容触摸式按键方案介绍

电容式触摸感应软件库的可提供如下功能：

- ❖ 软件库模块可以方便的应用于绝大部分微控制器中，直接内嵌在主控制器中。
- ❖ 软件库适用于大部分的用户接口需求: 最多24个按键，以及2个滑动条/滚轮。
- ❖ 经济的解决方案：少量的硬件和软件开销
- ❖ 采用各种必须的软件滤波处理以获得高可靠性
- ❖ 优化的固件源代码
- ❖ 完全免费的源代码（但仅限于应用在ST的微控制器上）

如何工作?



...容性的人体接触可以通过对RC网络的充放电时间的检测来测得。RC网络由一个电阻和电极的电容 (C_x) 组成。

- ❖ 每个触摸通道需要2个电阻和一个MCU 通用IO口。
- ❖ 可将MCU的任意通用IO口配置为触摸通道
- ❖ 触摸按键可分布在最多3个不同的GPIO 端口上（目前如此，以后可能会扩展）
- ❖ 软件库使用2个定时器：一个作为时基，一个用于采集

■ MCU 硬件

- ✓ 1*16位定时器 (采集: 测量RC充放电时间)
- ✓ 1*8位定时器 (后处理: 时基)
- ✓ 每个通道1个通用IO
- ✓ 1 I/O 作为LOAD输出 (common to all channels)

■ MCU 存储器使用

(库 + 常量)

- ✓ 只有按键 : ~ 1900 bytes
- ✓ 按键 + 1滚轮/滑动条 : ~ 3800 bytes
- ✓ 按键 + 2 滚轮/滑动条 : ~ 3900 bytes

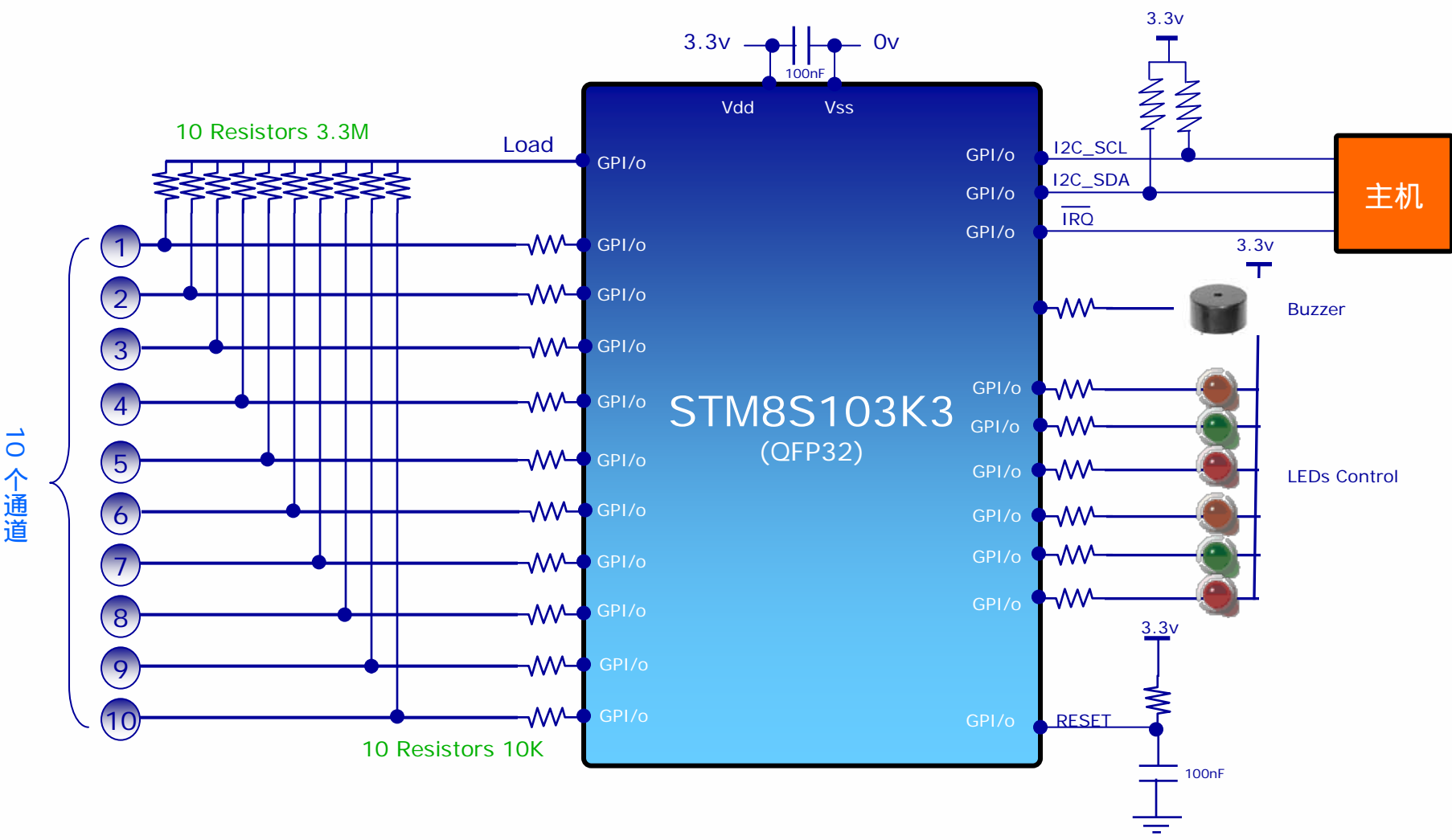
■ RAM

- ✓ 只有按键 : ~ 57 + (13*(Nb_keys - 1))
- ✓ 按键 + 1滚轮/滑动条 : ~ 112 + (13*(Nb_keys - 1))
- ✓ 按键 + 2 滚轮/滑动条 : ~ 154 + (13*(Nb_keys - 1))

- 例1 : 10 个按键占用174 bytes的RAM空间

- 例2 : 5 按键 + 1 滚轮占用174 bytes的RAM空间

例：采用LQFP32封装的 STM8S103K3 (10 按键 – I2C – LEDs – 蜂鸣器)



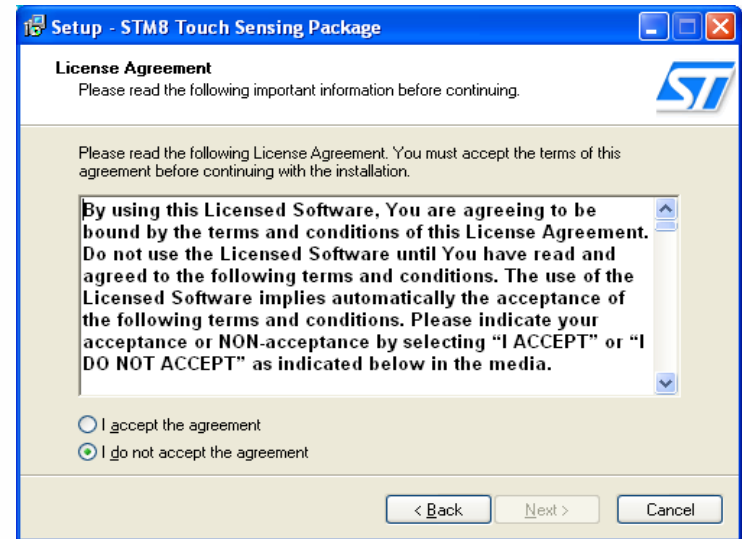
10个通道

- ❖ 软件库可配置为支持如下范围内的操作：
 - 所有按键分布在3个独立IO端口
 - 另外2个IO端口用来配置滚轮/滑动条
 - ➔ 因此最多可支持24个按键和2个滚轮/滑动条
- ❖ 可使用任意的IO端口，除了：
 - 避免使用晶振所在的IO引脚，因为这些引脚的电容过大
- ❖ 屏蔽信号 (Driven shield)需要占用每个端口的一个IO引脚
 - ➔ 因此最多只可支持21个按键和2个滚轮/滑动条
- ❖ 硬件配置通过软件库中的配置文件 (Configuration)完成。

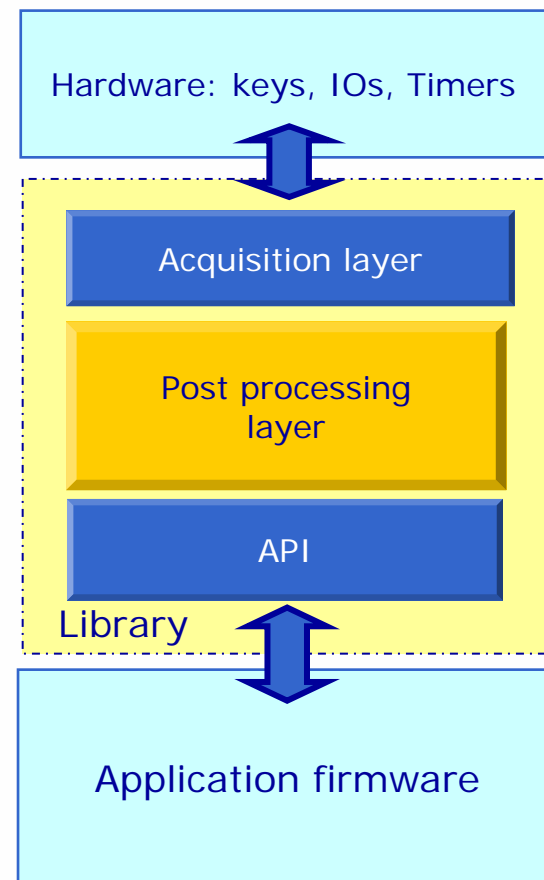
The license agreement



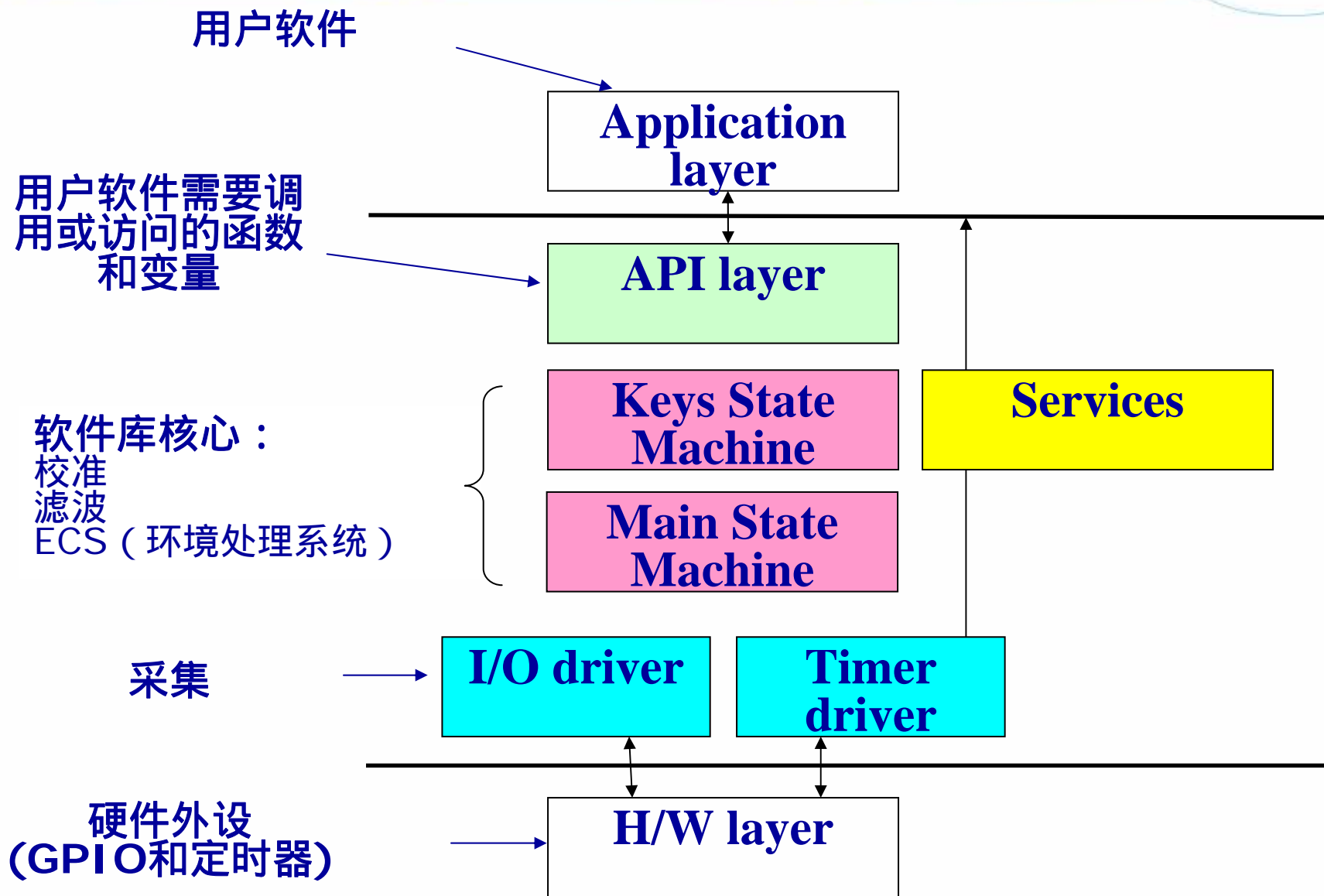
- The touch sensing library provides a complete ***NRE/Royalty-free*** Capacitive Touch Sensing software solution for ST Microcontrollers.
- Anyone who install the touch sensing library will be required to acknowledge and agree to be bound under the license agreement
- the license agreement requires the software library to be used only with ST microcontrollers
- The library must be distributed to customer with the package to make sure they agree with the license



- 采集层 Acquisition layer :
 - ✓ I/O端口配置
 - ✓ RC 采集
- 后处理层 Post processing layer :
 - ✓ 数据处理
 - ✓ 状态机
- 应用程序接口 API :
 - ✓ 与用户应用程序接口
 - ✓ 函数
 - ✓ 变量



软件库架构



基于STVD的软件开发界面



ST Visual Develop - example.stw - [STM8_TSL_RC_Configuration.h]

File Edit View Project Build Debug Debug Instrument Tools Window Help

Workspace

- example.stw
 - example
 - Source Files
 - main.c
 - stm8_interrupt_vector.c
 - STM8S_STANDARD_PERIPHERALS_LIB
 - STM8_TS_LIB
 - stm8_tsl_rc_api.c
 - stm8_tsl_rc_jodriver.c
 - stm8_tsl_rc_multichannelkey.c
 - stm8_tsl_rc_services.c
 - stm8_tsl_rc_singlechannelkey.c
 - stm8_tsl_rc_timerdriver.c
 - Include Files
 - stm8_tsl_rc_configuration.h
 - stm8s_conf.h
 - STM8S_STANDARD_PERIPHERALS_LIB
 - STM8_TS_LIB
 - External Dependencies

```
280 //
281 // 12) TSL PARAMETERS CONFIGURATION
282 //
283 //=====
284
285 /** @addtogroup TSL_parameters
286  * @ ( */
287
288 // IO acquisition
289 #define SCKEY_ACQ_NUM (3) /**< Single channel key acquisit
290 #define SCKEY_ADJUST_LEVEL (2) /**< Single channel key adjustme
291 #define MCKEY_ACQ_NUM (6) /**< Multi channel key acquisit:
292 #define MCKEY_ADJUST_LEVEL (2) /**< Multi channel key adjustme
293
294 // IO acquisition number of rejected values and measure guardbands
295 #define MAX_REJECTED_MEASUREMENTS (20) /**< Max number of rejected meas
296 #define MAX_MEAS_COEFF (0x011A) /**< Max measure guardband (MSB=
297 #define MIN_MEAS_COEFF (0x00E6) /**< Min measure guardband (MSB=
298
299 // Thresholds
300 #define SCKEY_DETECTTHRESHOLD_DEFAULT (15) /**< Single channel key
301 #define SCKEY_ENDDETECTTHRESHOLD_DEFAULT (6) /**< Single channel key
302 #define SCKEY_RECALIBRATIONTHRESHOLD_DEFAULT (-6) /**< Single channel key
303 #define MCKEY_DETECTTHRESHOLD_DEFAULT (30) /**< Multi channel key c
304 #define MCKEY_ENDDETECTTHRESHOLD_DEFAULT (20) /**< Multi channel key e
305 #define MCKEY_RECALIBRATIONTHRESHOLD_DEFAULT (-20) /**< Multi channel key c
306
307 // MCKey resolution
308 #define MCKEY_RESOLUTION_DEFAULT (4) /**< Multi channel key
```

main.c STM8_TSL_RC... STM8_TSL_R...

Output

Build Tools Find in Files 1 Find in Files 2 Debug Console

Ln 18, Col 4 MODIFIED READ CAP NUM SCRL OVR Stop Ready

谢谢 !

