Shadow Registers Data Sheet

ShadowRegs vX.Y

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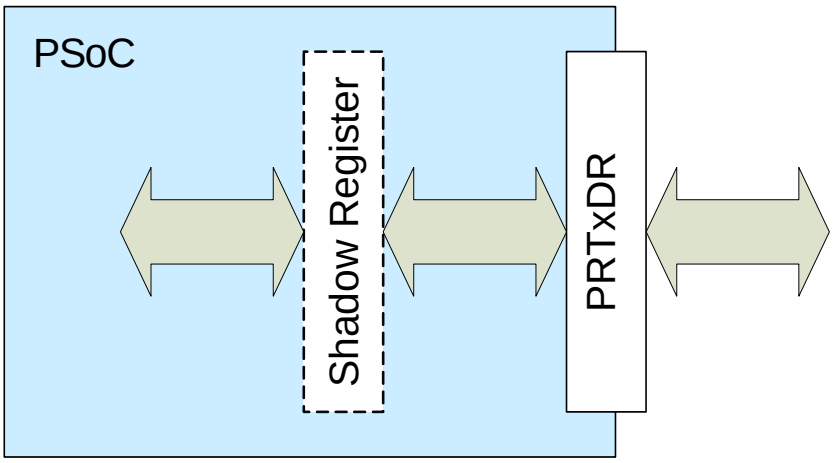
Resources	PSoC® Blocks			API Memory (Bytes)		Pins (per External I/O)
	Digital	Analog CT	Analog SC	Flash	RAM	
CY8C29/27/26/25/24/22/ 21xxx, CY7C64215, CY7C603xx, CY8CLED02/04/08/16	0	0	0	0	1	0

Features and Overview

- Provides a global shadow register for a selected port data register
- Generates a set of macros for port pin manipulation
- Prevents corruption of GPIO pin settings during CPU control of GPIO
- Cooperates with other user modules that allocate shadow registers.

The ShadowRegs user module creates a RAM variable (the shadow register) that caches values written to a port data register (PRTxDR). Usage of a shadow register enables CPU control of an individual GPIO output pin without the risk of corrupting the settings of other GPIO pins sharing the same port..



ShadowRegs Block Diagram

Functional Description

The ShadowRegs User module creates a shadow register for the selected port data register.

Note Some other user modules create shadow registers. If the selected port data register coincides with a port data register for which another user module created a shadow register, the user modules will cooperate so that there is only one shadow register that needs to be accessed by your code.

Theory of Operation

Data written to a port data register may differ from data read from the port data register because the read data represents actual pin voltages while the written data controls the pin output setting (transistor switching). This difference between the read and written data introduces the risk of inadvertently corrupting a pin's output setting when performing a logical operation directly on the port data register to affect the setting of a different pin sharing the same port. This situation commonly occurs with pins operating in resistively pulled-up/pulled-down, or open drain drive modes.

Example

An application uses P0[0] as a sourcing LED output, and P0[1] as a pulled-up input for a normally open switch connected to ground. After setting the drive mode registers for port 0, the firmware initializes the LED to off and enables the input with the following C statement.

```
PRT0DR = 0x02;
```

Without a shadow, register, the firmware toggles the LED by the following C statement.

```
PRT0DR ^= 0x01;
```

On the initial LED toggle operation, the value read from PRT0DR is 0x00 if the switch is closed, and 0x02 if the switch is open. Performing the XOR operation to toggle the LED results in 0x01 (0x00 XOR 0x01) if the switch is closed but 0x03 (0x02 XOR 0x01) if the switch is open when the initial toggle occurs. Toggling the LED when the switch is closed causes P0[1] to be driven to 0V internally. When the switch is opened, the value read from PRT0DR is still 0x01 because the voltage on P0[1] is still 0V. The switch input has been inadvertently disabled.

The solution is to always manipulate the shadow register first, then copy the shadow register value into the port data register. The following C statements initialize the LED output and the switch input.

```
Port0_Data_Shade = 0x02;
PRT0DR = Port0_Data_Shade;
```

The following code toggles the LED without affecting the switch input

```
Port0_Data_Shade ^= 0x01;
PRT0DR = Port0_Data_Shade;
```

Regardless of whether the switch is open or closed, 0x03 (0x02 XOR 0x01) is written to the port data register on the initial toggle operation because the logical operation was performed using the shadow register (0x02 regardless of whether button is open or closed) as input rather than the port data register (0x00 when the switch is closed, and 0x02 when the switch is open)

Parameters and Resources

ShadowPort

This parameter selects the PRTxDR register for which a shadow register is created. The ShadowPort parameter contains a list of all available ports.

Application Programming Interface

There is no API for this user module.

PSoC Designer generates pin manipulation macros for all named pins of the selected port. The pin manipulation macros are contained in the psocgpioint.inc file. It contains the following macros (*ShadowRegs* is replaced by the instance name of the user module):

- macro Get*ShadowRegs*Pin_Data;
- macro Set*ShadowRegs*Pin_Data;
- macro Clear*ShadowRegs*Pin_Data;

PSoC Designer automatically generates C language constants and masks in psocgpioint.h, but you will need to create

```
MyPin_DataShadow &= ~MyPin_MASK;
MyPin_Data_ADDR = MyPin_DataShadow;
```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