

SCB_I2cCommSlave Example Project

Features

- Communication between I²C master and slave
- Simple packet protocol with command and status byte

General Description

This example project demonstrates the basic operation of the I²C slave (SCB mode) component. The I²C slave accepts a packet with a command from the I²C master to control the RGB LED color. The I²C slave updates its buffer with a status packet in response to the accepted command.

The I²C slave in this project is designed to communicate with an I²C master in either of the following configurations:

- The I²C master already present on the development kit. The master can be controlled using the provided Bridge Control Panel software.
- The SCB_I2cCommMaster Example project, programmed onto another device to serve as the master.

Development Kit Configuration

This example project is designed to run on the CY8CKIT-042 kit from Cypress Semiconductor. A description of the kit, along with more example programs and ordering information, can be found at http://www.cypress.com/go/cy8ckit-042.

The project requires configuration settings changes to run on other kits from Cypress Semiconductor. Table 1 is the list of the supported kits. To switch from CY8CKIT-042 to any other kit, change the project's device with the help of Device Selector called from the project's context menu.

Table 1. Development Kits vs Parts

Development Kit	Device
CY8CKIT-040	CY8C4014LQI-422
CY8CKIT-041	CY8C4045AZI-S413 /
	CY8C4146AZI-S433
CY8CKIT-042	CY8C4245AXI-483
CY8CKIT-042-BLE	CY8C4247LQI-BL483
CY8CKIT-044	CY8C4247AZI-M485

CY8CKIT-046	CY8C4248BZI-L489
CY8CKIT-048	CY8C4A45LQI-483

The pin assignments for the supported kits are in Table 2.

Table 2. Pin Assignment

Dovolonment Kit	Pin Name					
Development Kit	\I2CS:scl\	\I2CS:sda\	LED_RED	LED_GREEN	LED_BLUE	
CY8CKIT-040	P1[2]	P1[3]	P3[2]	P1[1]	P0[2]	
CY8CKIT-041	P3[0]	P3[1]	P3[4]	P2[6]	P3[6]	
CY8CKIT-042	P3[0]	P3[1]	P1[6]	P0[2]	P0[3]	
CY8CKIT-042 BLE	P3[5]	P3[4]	P2[6]	P3[6]	P3[7]	
CY8CKIT-044	P4[0]	P4[1]	P0[6]	P2[6]	P6[5]	
CY8CKIT-046	P4[0]	P4[1]	P5[2]	P5[3]	P5[4]	
CY8CKIT-048	P4[0]	P4[1]	P1[4]	P2[6]	P1[6]	

Note The project control files handle the pins placement automatically according to a selected PSoC.

Project Configuration

The example project consists of the I²C slave (SCB mode) and pin components. The design schematic is shown in Figure 1. The blue annotation components are used to represent the RGB LED installed on the kit. The three pin components are used to control the LED color. The kit provides connection between the I²C slave (PSoC 4) and I²C master (PSoC 5LP) as well as a pull-up resistor required for the I²C bus operation. The Bridge Control Panel software is provided to control the I²C master.



Vdd

Packet structure Start of packet (0x01) Command/Status End of Packet (0x17) **Command Table** Command Value Description CMD_SET_OFF 0x00 Turns off RGB LED CMD_SET_RED 0x01 Turns on Red color of RGB LED CMD_SET_GREEN 0x02 Turns on Green color of RGB LED CMD_SET_BLUE 0x03 Turns on Blue color of RGB LED Status Table Command Value Description STS_CMD_DONE 0x00 Command was executed Incorrect format of packet or STS_CMD_FAIL 0xFF unknown command 12CS Data rate: 100 kbps I2C

0x08 (7-bits). The component configuration window is shown below.

Figure 1. Example Project Design Schematic

RGB LED Control

LED_RED





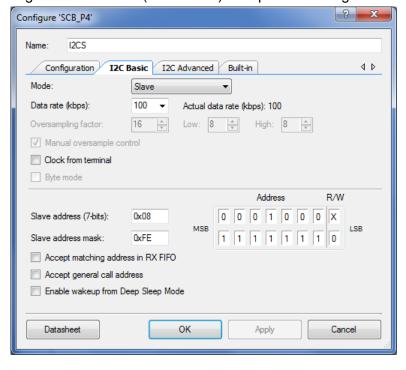


Figure 2. I2C Slave (SCB mode) Component Configuration

Project Description

In the main firmware routine, the I²C slave read and write buffers are configured when a component is started. The write buffer is exposed to the master to write a packet with a command and reads back the packet with a status. Interrupts are enabled to the CPU core as required by the I2C slave component for operation.

The I²C slave waits for communication from the I²C master. The main loop polls I2CS_I2CSlaveStatus() API continuously for a write or read completion event.

When a write completion event is reported, the write buffer content is checked against the valid packet. The packet structure and table with commands are shown below. The basic checks of the packet structure are done: the length of the packet, the start and end of the packet byte. If packet considered as valid the command is retrieved and passed to be executed. The result of a command execution is a change of the LED color. Initially the LED is turned off. The status is updated with a successful command execution or failure in the case when a command is unknown or the packet is considered as invalid. The table with return statuses is shown below. The packet with a status is exposed to the master in the slave read buffer.

When a read completion event is reported, the slave just exposes the read buffer to the master again. The master may not read the packet with a status at all and then it just sends a next packet with a command.

Packet structure

Start of packet (0x01) | Command/Status | End of Packet (0x17) |



Table 3. Command constants

Command	Value	Description
CMD_SET_OFF	0	Turns off RGB LED
CMD_SET_RED	1	Turns on Red color of RGB LED
CMD_SET_GREEN	2	Turns on Green color of RGB LED
CMD_SET_BLUE	3	Turns on Blue color of RGB LED

Table 4. Status constants

Status	Value	Description
STS_CMD_DONE	0x00	Command was executed
STS_CMD_FAIL	0xFF	Incorrect format of packet or unknown
		command

The packets with a command and status are converted into the following I²C master transfers. The packet with a command has a write direction set in the address byte and the packet with a status has a read direction set appropriately.

Packet with command S ADDR = 0x08 W A SOP = 0x01 A Command A EOP = 0x17 A P Packet with status S ADDR = 0x08 R A SOP = 0x01 A Status A EOP = 0x17 Ā P - Master drives the bus - Slave drives the bus

Expected Results

Build example project and program into the device.

Run the Bridge Control Panel software which is shipped with the PSoC Creator. It is used to control the I²C master implemented on the PSoC 5LP which is available on the kit. Follow the steps below to setup communication between the master and slave:

- 1. Select the KitProg device into the list of the Connected Ports.
- 2. Make sure that the selected Protocol is I²C.
- 3. Go to Tools->Protocol Configuration and select I2C Speed 100kHz.
- 4. Press the List button to make sure that the I²C slave device with address 0x08 (7-bits) is available for communication¹.

¹ Other I²C devices can be connected to the I²C bus. The addresses of these devices are shown after list operation completion. Refer to the development kit documentation for more information about other I²C devices available on the kit.



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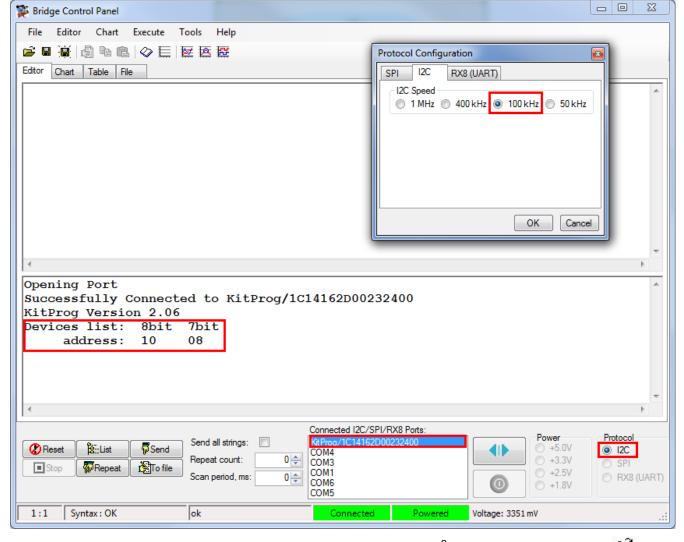


Figure 3. Bridge Control Panel I2C Master Setup

- 5. To load master commands for communication with the I²C slave use Open icon Avigate to BCP_Master_I2cCmd.iic file which is attached to the workspace and open it. The commands should appear in the Edit window.
- 6. There are two options of a master transfer execution.
 - A single command execution: set the cursor to the line with the command into the Edit window and press Enter. The RGB LED should change its color accordingly to the executed command.
 - Repeat the command execution: select a number of commands and press the Repeat button. The RGB LED should change its color accordingly to the executed commands.

The delays are added between commands to notice a LED color change.



_ D X Bridge Control Panel Editor Chart Execute Tools Editor Chart Table File Send CMD SET RED and read back status w 08 01 01 17 p r 08 x x [DELAY=500] ; Send CMD SET GREEN and read back status w 08 01 02 17 p r 08 x x [DELAY=500] ; Send CMD SET BLUE and read back status w 08 01 03 17 p r 08 х х хр [DELAY=500] [DELAY=500] w 08+ 01+ 02+ 17+ p r 08+ 01+ 00+ 17+ p [DELAY=500] w 08+ 01+ 03+ 17+ p r 08+ 01+ 00+ 17+ p [DELAY=500] w 08+ 01+ 01+ 17+ p r 08+ 01+ 00+ 17+ p Connected I2C/SPI/RX8 Ports: Protocol Send all strings: (2) Reset e:-List ₩ Send **4**I▶ @ I2C :OM4 0 ÷ +3.3V Repeat count: COM3 Stop To file COM1 +2.5V Scan period, ms: RX8 (UART) COM6 +1.8V COM5 10:16 Syntax: OK Ct=155 Rate=6 smp/s Voltage: 3351 mV Connected

Figure 4. Repeat Command Execution Result

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