

# 5.2 BLE Module Board

### 5.2.1 PSoC 4 BLE or PRoC BLE

The PRoC BLE or PSoC 4 BLE is the main component on the BLE Module. It provides the RF interface and analog and digital capability. The PRoC BLE or PSoC 4 BLE pins are mapped to the Bluetooth module headers (see Figure 5-20). For more information, refer to the BLE web page.

Figure 5-20. Schematics and Board Highlight of Bluetooth Module Headers for BLE Pins





The PSoC 4 BLE and PRoC BLE Modules connect to the Pioneer board using the two (20-pin and 24-pin) Bluetooth module headers (Figure 5-21). All GPIOs and power domains are brought out to these headers. These headers are the counterparts of the connectors in section 5.1.4.

Figure 5-21. Schematics and Board Highlight of Headers



DD



# 5.2.3 Wiggle Antenna

Both the modules use the wiggle antenna. Refer to the Antenna Design Guide (AN91445) for details. Figure 5-22. Board Highlight of Wiggle Antenna







### 5.2.4 Antenna Matching Network

An Antenna Matching Network is required between the BLE device and the antenna to achieve optimum performance (Figure 5-23). The matching network has four main tasks:

- Transform the balanced output of the radio to an unbalanced connection to the antenna (balun).
- Transform the output impedance of the radio to a 50-ohm antenna.
- Suppress harmonics to a level below the regulations level in TX mode.
- Suppress the local oscillator (LO) leakage in RX mode.

Figure 5-23. Schematics and Board Highlight of Antenna Matching Network and Antenna









### 5.2.5 BLE Passives

Module boards include a 24-MHz crystal and a 32-kHz crystal, the CMOD and shield (CTANK) circuit for CapSense, a SAR bypass capacitor, and adequate decoupling capacitors for all the power domains, as shown in Figure 5-24.

Figure 5-24. Schematics and Board Highlight of External Crystal, CMOD, CTANK, Decaps, Jumpers











### 5.2.6 Test Points

All power domains are brought out as test points for easy probing.

# 5.3 BLE Dongle Board

See PSoC 4 BLE or PRoC BLE on page 106. See Wiggle Antenna on page 108. See Antenna Matching Network on page 109. See Pioneer Board LEDs on page 101. See Push Buttons on page 102. Figure 5-25. Board Highlight





## 5.3.1 Power System

The board is powered directly using 5 V from the USB port, as shown in Figure 5-26.

Figure 5-26. Power Supply Block Diagram With Protection Circuits



### 5.3.1.1 Protection Circuits

The PTC resettable fuse is connected to protect the computer's USB ports from shorts and overcurrent.



### 5.3.2 USB Type A Plug

The PSoC 5LP connects to the USB port of a PC through a USB type A plug (Figure 5-27). This plug can also be used to power the board. A resettable polyfuse is used to protect the computer's USB ports from shorts and overcurrent. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed. The VBUS, D+, and D– lines from the USB connector are also protected against ESD events using TVS diodes.

Figure 5-27. Schematics and Board Highlight of USB Type A Plug







# 5.3.3 User LED

A user LED is provided to indicate status from the PRoC BLE device (Figure 5-28). It is also used to show the bind status.

Figure 5-28. Schematics and Board Highlight of User LED

R7 LED1 BLE\_STATUS 2 1 820 ohm Status LED Blue





This chapter describes advanced features of the BLE Pioneer kit as well as the corresponding projects. It can be used as reference to exploit these features for other applications, according to project requirements.

# 6.1 Using PSoC 5LP as USB-UART Bridge

6. Advanced Topics

The PSoC 5LP serves as a USB-UART bridge, which can communicate with the COM terminal software. This section explains how to create a PSoC 4 BLE code example to communicate with the COM terminal software.

Users who have a Windows operating system that does not have HyperTerminal can use an alternative terminal software such as PuTTY.

1. Create a new PSoC 4 BLE project in PSoC Creator, as shown in Figure 6-1. Select an appropriate location for your project and rename the project as required.

New Project			? 🗙
Design Other	r		4 ۵
<ul> <li>Default Template</li> </ul>	25		<u>^</u>
PSoC 3 D	Design	Creates a PSoC 3, 8-bit 8051, design project.	
PSoC 400	00 Design	Creates a PSoC 4000, 32-bit ARM Cortex-M0, design project.	=
PSoC 410	00/4200 Design	Creates a PSoC 4100/4200, 32-bit ARM Cortex-M0, design project.	
PSoC 410	00/4200-BL Design	Creates a PSoC 4100/4200-BL, 32-bit ARM Cortex-M0, design project.	
PRoC BLE	E Design	Creates a PRoC BLE, 32-bit ARM Cortex-M0, design project.	
PSoC 5LP	<sup>p</sup> Design	Creates a PSoC 5LP, 32-bit ARM Cortex-M3, design project.	
PSoC 3 Starter De	esigns		
ADC_DM	A_VDAC	Shows how to transfer data from an ADC to a DAC using DMA with no CPU intervention.	
Pa DelSig_16	6Channel	Shows a 16-channel, 12-bit Delta Sigma ADC in PSoC 3 sequenced in hardware; samples are transferred from ADC to SRAM using DMA - without processor intervention.	
Pa DelSig_I2	2CM	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.	
DelSig_I2	cs	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.	-
Name: Des	sign01		
Location: C:\\	Users\BLE\Project		
Device: CYS	8C4247LQI-BL483		•
Advanced			_
Workspace:	Create New Workspace		-
Workspace Name:	Design01		
Sheet Template:	Empty (11" x 8.5")		•
Application Type	Normal		•
		ОК	iancel

Figure 6-1. Create New Project in PSoC Creator



2. Drag and drop a UART (SCB) component (Figure 6-2) to the TopDesign.

Figure 6-2. UART Component in Component Catalog



3. To configure the UART, double-click or right-click the UART component and select **Configure**, as shown in Figure 6-3.







4. Change the instance name to **UART**. Configure the UART as shown in Figure 6-4, Figure 6-5, and Figure 6-6. Click **OK**.

Figure 6-4. UART Configuration Tab Window

Configure 'SCB_P4'	? <mark>×</mark>
Name: UART	
Configuration UART Basic UART Advanced Built-in	4 ۵
Unconfigured SCB	
© 12C	
© EZI2C	
SPI	
O UART	
Datasheet OK Apply	Cancel

Figure 6-5. UART Basic Tab Window

Configure "	SCB_P4'		? <mark>×</mark>
Name:	UART		
Confi	guration	UART Basic UART Advanced Built-in	4 ۵
Mode:		Standard 👻	<u> </u>
Direction:		TX+RX -	
Baud rate	(bps):	9600 <ul> <li>Actual baud rate (bps): 9592</li> </ul>	
Data bits:		8 bits 🔹	
Parity:		None	E
Stop bits:		1 bit 🔹	
Oversamp	ling:	12	
Clock	from termina	al	
Media	in filter		
Retry	on NACK		
Inverti	ing RX		-
Datas	heet	OK Apply	Cancel



Configure 'SCB_P4'	? ×
Name: UART	
Configuration UART Basic UART Adv	anced Built-in 4 b
Buffers size	
RX buffer size: B 😜 💿 None	
TX buffer size: 8	al
Byte mode 🔘 Exten	hal
Interrupt sources	_
UART done	RX FIFO not empty
TX FIFO not full	RX FIFO full
TX FIFO empty	RX FIFO overflow
TX FIFO overflow	RX FIFO underflow
TX FIFO underflow	RX frame error
TX lost arbitration	RX parity error
TX NACK	RX FIFO level: 7
TX FIFO level: 0	
Multiprocessor mode	RX FIFO drop
Address (hex): 2	On parity error
Mask (hex): FF 🚖	On frame error
Accept matching address in RX FIFO	
Flow control	
RTS Polarity: Active Low	RTS FIFO level: 4
CTS Polarity: Active Low	
E oro rolany. Active Low	
Datasheet	K Apply Cancel

#### Figure 6-6. UART Advanced Tab Window

5. Select P1[4] for UART RX and P1[5] for UART TX in the **Pins** tab of *<Project\_Name>.cydwr*, as shown in Figure 6-7.

Figure 6-7. Pin Selection

Alias	Name 🗠	Port		Pin Lo		Lock
	\UART_1:rx\	P1[4] OA3:vminus, TCPWM2:line_out, SCB0:uart_rx, SCB0:i2c_sda, SCB0:spi mosi	Ŧ	32	•	<b>V</b>
	\UART_1:tx\	P1[5] OA3:vplus, TCPWM2:line_out_compl, SCB0:uart_tx, SCB0:i2c_scl, SCB0:spi miso	Ŧ	33	•	<b>V</b>



6. Place the following code in your *main.c* project file. The code will echo any UART data received.

```
int main()
{
    uint8 ch;
    /* Start SCB UART TX+RX operation */
    UART_Start();
/* Transmit String through UART TX Line */
UART_UartPutString("CY8CKIT-042-BLE USB-UART");
    for(;;)
    {
        /* Get received character or zero if nothing has been received yet
* /
         ch = UART_UartGetChar();
         if(0u != ch)
         {
 /* Send the data through UART. This function is blocking and waits until
there is an entry into the TX FIFO. */
             UART UartPutChar(ch);
         }
    }
}
7. Build the project by clicking Build > Build {Project Name} or [Shift][F6]. After the project is built
  without errors and warnings, program (by choosing Debug > Program) the project to PSoC 4
  BLE/PRoC BLE through the PSoC 5LP USB programmer or MiniProg3.
```

**Note:** UART RX and UART TX can be routed to any digital pin on PSoC 4 BLE/PRoC BLE based on the configuration of the UART component. An SCB implementation of UART will route the RX and TX pins to one of the following subsets: (P0[0], P0[1] or P0[4], P0[5] or P1[4], P1[5] or P3[0], P3[1] or P3[4], P3[5] or P5[0], P5[1]).



To communicate with the PSoC 4 from the terminal software, follow this procedure:

 Connect USB mini-B to J13. The kit enumerates as a KitProg USB-UART and is available in the Device Manager, Ports (COM & LPT). A communication port is assigned to the KitProg USB-UART, as shown in Figure 6-8.

Figure 6-8. KitProg USB-UART in Device Manager

🛃 Device Manager	_ 0	x
Eile Action View Help		
(= -) 🖬 📓 🖬 🕺		
> 🐙 Computer		*
Disk drives		
Display adapters		
DVD/CD-ROM drives		
Wai Human Interface Devices		
Generation in the sector of the sector is the sector		
Figure 1994 Bus host controllers		
Keyboards     Mise and other pointing devices		
Manitors		
A Network adapters		
Cisco Systems VPN Adapter for 64-bit Windows		
<ul> <li>Intel(R) 82579I M Gigabit Network Connection</li> </ul>		
Intel(R) Centrino(R) Advanced-N 6205		
Microsoft Virtual WiFi Miniport Adapter		=
Other devices		
- In Unknown device		
Ports (COM & LPT)		
- The Intel (R) Active Management Technology - SOL (CC	OM3)	
KitProg USB-UART (COM12)		
Processors		
- P Security Devices		
SM Driver		
Sound, video and game controllers		
Storage controllers		
System devices		
Universal Serial Bus controllers		-



2. Open HyperTerminal and choose **File > New Connection** and enter a name for the new connection and click **OK**, as shown in Figure 6-9. For PuTTY, double-click the PuTTY icon and select **Serial** under **Connection**.

Figure 6-9. Open New Connection

#### HyperTerminal

Connection Description	2 ×
New Connection	
Enter a name and choose an icon for the connection:	
Name:	
USB-UART communication	
jcon:	
4 III	
ОК	Cancel

#### PuTTY

R PuTTY Configuration		X	
Category:			
⊟-Session	Basic options for your PuTTY session		
E- Terminal	Specify the destination you want to con-	nect to	
- Keyboard	Host Name (or IP address)	Port	
- Features	Connection type: Raw I elnet Rlogin	SSH Serial	
- Appendice     - Behaviour     - Translation     - Selection     - Colours     - Connection     - Data     - Proxy     - Telnet     - Rlogin     - SSH	Load, save or delete a stored session Saved Sessions		
	Default Settings	Load Sa <u>v</u> e Delete	
Serial	Close window on exit Always Never Only	on clean exit	
About	Open	Cancel	



3. A new window opens, where the communication port can be selected.

In HyperTerminal, select COMx (or the specific communication port that is assigned to the Kit-Prog USB-UART) in **Connect using** and click **OK**, as shown in Figure 6-10. In PuTTY enter the COMx in **Serial line to connect to**. This code example uses **COM12**.

Figure 6-10. Select Communication Port

#### HyperTerminal

Connect To	? ×	
USB-UART communication		
Enter details for the	he phone number that you want to dial:	
Country/region:	India (91) 👻	
Ar <u>e</u> a code:	080	
Phone number:		
Connect using:	COM12 -	
	OK Cancel	

#### PuTTY

Category:		
Category: Session Logging Terminal Keyboard Bell Features Window Appearance Behaviour Translation Selection Colours Connection Data Proxy Telnet Placin	Options controlling Select a serial line Serial line to connect to Configure the serial line Speed (baud) Data bits Stop bits Parity Elow control	g local serial lines COM12 9600 8 1 1 None • XON/XOFF •
SSH Serial		Ormal



4. In HyperTerminal, select **Bits per second**, **Data bits**, **Parity**, **Stop bits**, and **Flow control** under **Port Settings** and click **OK**, as shown in Figure 6-11. Make sure that the settings are identical to the UART settings configured for the BLE device.

In PuTTY select **Speed (baud)**, **Data bits**, **Stop bits**, **Parity** and **Flow control** under **Configure the serial line**. Click **Session** and select **Serial** under **Connection type**. **Serial line** shows the communication port (COM12) and **Speed** shows the baud rate selected. Click **Open** to start the communication.

Figure 6-11. Configure the Communication Port

#### HyperTerminal

COM12 Properties	2 ×
Port Settings	
Bits per second:	9600 💌
Data bits:	8
Parity:	None
Stop bits:	1 •
Elow control:	None
	<u>R</u> estore Defaults
0	K Cancel Apply

PuTTY

Real PuTTY Configuration		<b>X</b>
Category: Session Logging Terminal Ferminal Features Window Appearance Behaviour Translation Selection Colours Connection Data Proxy Telnet Rlogin SSH Sensi	Options controlling Select a serial line Serial line to connect to Configure the serial line Speed (baud) Data bits Stop bits Parity Elow control	g local serial lines COM12 9600 8 1 1 None None V
About		Open Cancel



 Enable Echo typed characters locally in File > Properties > Settings > ASCII Setup, to display the typed characters on HyperTerminal, as shown in Figure 6-12. In PuTTY, select Force on in Terminal > Line discipline options to display the typed characters on PuTTY, as shown in Figure 6-13.

Figure 6-12. Enable Echo of Typed Characters in HyperTerminal

ASCII Setup
ASCII Sending
Send line ends with line feeds
Echo typed characters locally
Line delay: 0 milliseconds.
Character delay: 0 milliseconds.
ASCII Receiving           Append line feeds to incoming line ends           Eorce incoming data to 7-bit ASCII           Wrap lines that exceed terminal width
OK Cancel

Figure 6-13.	Enabling Echo of	<b>Typed Characters</b>	in PuTTY
--------------	------------------	-------------------------	----------

Category:					
Session	Options controlling the terminal emulation				
	Set various terminal options				
Keyboard	Auto wrap mode initially on				
-Bell	DEC Origin Mode initially on				
Features	Implicit CB in every LF				
Window	Implicit LE in every CR				
Behaviour	Use background colour to erase screen				
- Translation	Enable blinking text				
-Selection	Angwerback to "E:				
Colours	PuTTY				
<ul> <li>Connection</li> <li>Data</li> <li>Proxy</li> <li>Telnet</li> <li>Rlogin</li> <li>BSH</li> <li>Serial</li> </ul>	Line discipline options Local echo: Auto Local line editing: Auto Force on Force of Force off				
	Remote-controlled printing				
	Printer to send ANSI printer output to:				
	None (printing disabled)				



6. The COM terminal software displays both the typed data and the echoed data from the PSoC 4 BLE or PRoC BLE UART, as shown in Figure 6-14 and Figure 6-15.

Figure 6-14. Data Displayed on HyperTerminal

USB-UART communicat	tion - HyperT (ransfer <u>H</u> el	'erminal p						
D ☞ ⊕ 3 = D 원 @	" E USB-UAR	T PPSSool	CC_					
Connected 0/0/35 A	uto detect	9600 8-N-1	SCROH	CAPS	NUBA	Canture	Diret orbit	

Figure 6-15. Data Displayed on PuTTY





# 6.2 Using PSoC 5LP as USB-I<sup>2</sup>C Bridge

The PSoC 5LP serves as a USB-I<sup>2</sup>C bridge that can be used to communicate with the USB-I<sup>2</sup>C software running on the PC. The following steps describe how to use the USB-I<sup>2</sup>C bridge, which can communicate between the BCP and the PSoC 4 BLE/PRoC BLE.

1. Create a new project targeting the PSoC 4 BLE/PRoC BLE device in PSoC Creator, as shown in Figure 6-16.

New Project			? 🗙	
Design Other			4 ۵	
<ul> <li>Default Templates</li> </ul>			<u> </u>	
PSoC 3 Design		Creates a PSoC 3, 8-bit 8051, design project.		
PSoC 4000 Design		Creates a PSoC 4000, 32-bit ARM Cortex-M0, design project.	E	
PSoC 4100/4200 De	sign	Creates a PSoC 4100/4200, 32-bit ARM Cortex-M0, design project.		
PSoC 4100/4200-BL Design		Creates a PSoC 4100/4200-BL, 32-bit ARM Cortex-M0, design project.		
PRoC BLE Design		Creates a PRoC BLE, 32-bit ARM Cortex-M0, design project.		
PSoC 5LP Design		Creates a PSoC 5LP, 32-bit ARM Cortex-M3, design project.		
■ PSoC 3 Starter Designs				
ADC_DMA_VDAC		Shows how to transfer data from an ADC to a DAC using DMA with no CPU intervention.		
▶ DelSig_16Channel		Shows a 16-channel, 12-bit Delta Sigma ADC in PSoC 3 sequenced in hardware; samples are transferred from ADC to SRAM using DMA - without processor intervention.		
▶ DelSig_I2CM		Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.		
DelSig_I2CS		Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.	-	
Name: Design01				
Location: C:\Users\BLE\P	roject			
Device: CY8C4247LQI-B	L483		•	
Advanced				
Workspace:	New Workspace			
	e New Wolkapace			
Workspace Name: Design	n01			
Sheet Template: Empty	r (11" x 8.5")		-	
Application Type Norma	al		•	
		ОК	ancel	

Figure 6-16. Create New Project in PSoC Creator



2. Drag and drop an  $I^2C$  component (Figure 6-17) to the TopDesign.

Figure 6-17. I<sup>2</sup>C Component in Component Catalog



3. To configure the I<sup>2</sup>C component, double-click or right-click the I<sup>2</sup>C component and select **Configure**, as shown in Figure 6-18.





4. Change the instance name to **I2C**. Configure the I<sup>2</sup>C component according to the settings in Figure 6-19 and Figure 6-20 and click **OK**.

Figure 6-19. Configuration Tab

Configure 'SCB_P4'	? <mark>- × -</mark>
Name: 12C	
Configuration I2C Basic I2C Advanced Built-in	4 ۵
Unconfigured SCB	
I2C     I2C	
© EZI2C	
© SPI	
O UART	
Datasheet OK Apply	Cancel

Figure 6-20. I<sup>2</sup>C Basic and Advanced Tabs

Configure 'SCB_P4'		? <mark>- X -</mark>
Name: I2C		
Configuration 12	C Basic I2C Advanced Built-in	4 ۵
Mode:	Slave 👻	
Data rate (kbps):	400 <ul> <li>Actual data rate (kbps): 400</li> </ul>	
Oversampling factor:	16 🚖 Low: 8 🚖 High: 8 束	
Clock from terminal		
Byte mode		
	Address R/W	
Slave address (7-bits):	0x08 0 0 0 1 0 0 X	
Slave address mask:	0xFE 1 1 1 1 1 1 1 0	
Accept matching add	Iress in RX FIFO	
Enable wakeup from	Deep Sleep Mode	
Datasheet	OK Apply C	Cancel



5. Select pin P3[5] for the I<sup>2</sup>C SCL and pin P3[4] for the I<sup>2</sup>C SDA in the **Pins** tab of *<Project\_Name>.cydwr*, as shown in Figure 6-21.

Figure 6-21. Pin Selection\_USBI2C

						•	4	⊳
			*	Alias	Name A	Port		
					\I2C_1:scl\	P3[5] SARMUX:pads[5], TCPWM2:line_out_compl, SCB1:uart tx, SCB1:i2c scl	•	5
P2[5]	42	OA1:vout_10:			\T2C 1:eda\	P3[4] SARMUX:pads[4], TCPWM2:line_out,	Л	5
P2[4]	41	OA1:vminus			(120_1.5ua)	SCB1:uart rx, SCB1:i2c sda		5
P2[3]	40	OA1typlus, 5/155:ext_ck_f						
P2[2]	39	OA0.voit_10x, 5455:vakeup, 5050:spl_select(3)						
P2[1]	38	OA0:vminus, SCS0:spl_select(2)						
P2[0]	37	OAC:vplus, SCSC:spl_select(1)						
VDDA	36	3.3v						
P1[7]	35	O A 3 vplus_ait, TCPWW3:line_out_ SC50:uart_cts, SC50:apl_ck	=					
P1[6]	34	OA2vplus_st, TOPWW3:line_out, SOS0:ust_rts, SOS0:ust_steed(0)	-					
P1[5]	33	O A 3:void_10x, TCPWW2:line_out, SC50:2c_ad, SC50:apl_misc						
P1[4]	32	OA3.vminus, TCPWW2:line_out, 5 SCS0:2c_ade, SCS0:api_mosi						
P1[3]	31	O A3:vplus, TCPWW1:line_out_com SCS0:spl_select(3)						
P1[2]	30	OA2.vo.t_10x, TCPWW11ine_out, SC50:spl_select(2)						
P1[1]	29	O A2:vminus, TCPVVV0:line_out_or UPCOVIP:comg(1), SCS0:spl_select						

 Place the following code in your *main.c* project file. The code will enable the PSoC 4 BLE/PRoC BLE device to transmit and receive I<sup>2</sup>C data to and from the BCP application.

```
int main()
{
uint8 wrBuf[10]; /* I<sup>2</sup>C write buffer */
uint8 rdBuf[10]; /* I<sup>2</sup>C read buffer */
uint8 indexCntr;
uint32 byteCnt;
/* Enable the Global Interrupt */
CyGlobalIntEnable;
/* Start I<sup>2</sup>C Slave operation */
I2C_Start();
/* Initialize write buffer */
I2C_I2CSlaveInitWriteBuf((uint8 *) wrBuf, 10);
/* Initialize read buffer */
I2C_I2CSlaveInitReadBuf((uint8 *) rdBuf, 10);
for(;;) /* Loop forever */
{
/* Wait for I<sup>2</sup>C master to complete a write */
```



```
if(Ou != (I2C_I2CSlaveStatus() & I2C_I2C_SSTAT_WR_CMPLT))
{
      /* Read the number of bytes transferred */
      byteCnt = I2C I2CSlaveGetWriteBufSize();
      /* Clear the write status bits*/
      I2C I2CSlaveClearWriteStatus();
/* Move the data written by the master to the read buffer so that the
      master can read back the data */
      for(indexCntr = 0; indexCntr < byteCnt; indexCntr++)</pre>
rdBuf [indexCntr] = wrBuf[indexCntr]; /* Loop back the data to the read
            buffer */
      }
/* Clear the write buffer pointer so that the next write operation will
      start from index 0 */
      I2C_I2CSlaveClearWriteBuf();
/* Clear the read buffer pointer so that the next read operations starts
      from index 0 */
      I2C_I2CSlaveClearReadBuf();
/* If the master has read the data , reset the read buffer pointer to 0
and clear the read status */
if(Ou != (I2C_I2CSlaveStatus() & I2C_I2C_SSTAT_RD_CMPLT))
{
/* Clear the read buffer pointer so that the next read operations starts
from index 0 */
      I2C I2CSlaveClearReadBuf();
      /* Clear the read status bits */
      I2C I2CSlaveClearReadStatus();
}
}
```

- Build the project by choosing Build > Build Project or [Shift] [F6]. After the project is built without errors and warnings, program ([Ctrl] [F5]) this code onto the PSoC 4 BLE/PRoC BLE through the PSoC 5LP programmer or MiniProg3.
- 8. Open the BCP from Start > All Programs > Cypress > Bridge Control Panel <version number>.
- 9. Connect to KitProg/ under Connected I2C/SPI/RX8 Ports, as shown in Figure 6-22.



Figure	6-22	Connecting	to	KitProg/	in	BCP
iguie	0-22.	Connecting	ιυ	KILF IOG/		DUF

🗱 Bridge Control Panel		
File Editor Chart Execute Tools	Help	
🖻 🛯 🗑 🍙 🛍 🖉 🧮 🗱 🖉	5 <b>1</b> 2	
Editor Chart Table File		
COM6 Serial Port		
Opening Port		
Successfully Connected 1 KitProg Version 2.08	to KitProg/051717FF011B3400	
		=
•		
P	Connected I2C/SPI/RX8 Ports:	
Reset         Send         Repet         Send         Rep         Send         Rep         Send         Rep         Scar         Scar	d all strings: KeProg/051717FF01183400 eat count: 0  CUM6 UUM6	Power         Protocol           +5.0V         © 12C           +3.3V         SPI           +2.5V         RX8 (UART)
1:1 Syntax: OK	Connected Powered V	/oltage: 4566 mV:



10.Open **Protocol Configuration** from the **Tools** menu and select the appropriate **I2C Speed**, as shown in Figure 6-23. Make sure the I<sup>2</sup>C speed is the same as the one configured in the I<sup>2</sup>C component. Click **OK** to close the window.

Figure 6-23. Opening Protocol Configuration Window in BCP

Tools Help Protocol Configuration						
Protocol Configuration						
· · · · · · · · · · · · · · · · · · ·	F7					
I2C Bootloader	F3					
Protocol Configuration SPI I2C RX8 (UART) I2C Speed 1 MHz  400 kHz  100 kHz  50 kHz						
● 1 MHz ● 400 kHz ● 100 kHz ● 50 kHz						
	12C Bootloader	12C Bootloader F3				

11. From the BCP, transfer five bytes of data to the I<sup>2</sup>C device with slave address 0x08. Type the command shown in Figure 6-24 and press **[Enter]** or click the **Send** button in the BCP. The log shows whether the transaction was successful. A '+' indication after each byte indicates that the transaction was successful and a '-' indicates that the transaction was a failure.

Figure 6-24. Entering Commands in BCP

Bridge Control Panel	
File Editor Chart Execute Tools Help	
Editor Chart Table File	
w 8 aa bb cc dd ee P	*
Generate STOP	
condition on I2C bus	
Data Bytes	
Slave Address	
<ul> <li>Martin J. Reserve</li> </ul>	
'Write data'	
Indicates Acknowledgement (ACK)	-
4	•
Opening Port	*
Successfully Connected to KitProg/051717FF011B3400	
w $08+$ AA+ BB+ CC+ DD+ EE+ p	
	-
Carported IOC (CDI (DV0 D-44)	,
Connected 12/3P1/HAS Points	Power Protocol
COM6	○ +3.3V ○ SPI
Scan period, ms: 0	



12. From the BCP, read five bytes of data from the I<sup>2</sup>C slave device with slave address 0x08. The log shows whether the transaction was successful, as shown in Figure 6-25.

Figure 6-25. Read Data Bytes from BCP

Fidge Control Panel		
File Editor Chart Execute Tools Help		
Editor Chart Table File		
r 8 x x x x P		*
Generate STOP condicti	on on I2C bus	
No. of data bytes to be read		
Slave Address		
'Read data'		
command		
Data bytes retur	ned after read operation	-
4		- F
Opening Port		<u>^</u>
Successfully Connected to Kit	Prog/051717FF011B3400	
w $08+$ AA+ BB+ CC+ DD+ EE+ p		E
r 08+ AA+ BB+ CC+ DD+ EE+ p		
		-
		,
Send all strings;	Connected I2C/SPI/RX8 Ports: Power Pr	rotocol
Repeat count:	0(≑) COM6 0 +3.3V	I2C
Scan period, ms	· · · · · · · · · · · · · · · · · · ·	RX8 (UART)
	• • • • • • • • • • • • • • • • • • •	
1:14 Syntax: OK ok	Connected Powered Voltage: 4575 mV	

Note: Refer to Help Contents under Help in BCP or press [F1] for details of I<sup>2</sup>C commands.



# 6.3 Developing Applications for PSoC 5LP

The BLE Pioneer kit has an onboard PSoC 5LP whose primary function is that of a programmer and a bridge. You can build either a normal project or a bootloadable project using the PSoC 5LP.

The PSoC 5LP connections in the Pioneer board are summarized in Figure 6-26. J8 is the I/O connector. The USB (J13) is connected and used as the PC interface. However, you can still use this USB connection to create customized USB designs.



Figure 6-26. PSoC 5LP Connections on BLE Pioneer Kit

The programming header (J7) is meant for standalone programming. This header needs to be populated. See the 'No Load Components' section in Bill of Materials (BOM) on page 184.

#### 6.3.1 Building a Bootloadable Project for PSoC 5LP

All bootloadable applications developed for the PSoC 5LP should be based on the bootloader hex file, which is programmed onto the kit.

The hex files are included in the following kit installer directory:

<Install\_Directory>\CY8CKIT-042-BLE Kit\<version>\Firmware\Programmer\
KitProg\_Bootloader

Figure 6-27.	KitProg	Bootloader	Hex	File	Location
			-	-	

G 🖉 🕨 « 1	0 • Firmware • Programmer • KitProg_Bo	otloader 👻	47 Search
Organize • In	lude in library • Share with • Burn	New folder	
Favorites	Name	Date modified	Туре
Desktop	KitProg_Bootloader.elf	3/18/2013 6:38 PM	ELF File
Downloads	KitProg_Bootloader.hex	3/18/2013 6:38 PM	HEX File



To build a bootloadable application for the PSoC 5LP, follow this procedure:

 In PSoC Creator, choose New > Project > PSoC 5LP, click the expand button adjacent to Advanced, select Launch Device Selector to bring up the Select Device Window and select the Device as CY8C5868LTI-LP039, as shown in Figure 6-28. Select the Application Type as Bootloadable from the drop-down list and click OK.

Figure 6-28. Create New Project in PSoC Creator\_PSoC 5LP

N	ew Project			? 💌			
	Design	Other		4 ۵			
	<ul> <li>Default Tem</li> </ul>	plates		<u>^</u>			
	PSo	C 3 Design	Creates a PSoC 3, 8-bit 8051, design project.				
	PSo	C 4000 Design	Creates a PSoC 4000, 32-bit ARM Cortex-M0, design project.	E			
	PSo	C 4100/4200 Design	Creates a PSoC 4100/4200, 32-bit ARM Cortex-M0, design project.				
	PSo	C 4100/4200-BL Design	Creates a PSoC 4100/4200-BL, 32-bit ARM Cortex-M0, design project.				
	PRo	C BLE Design	Creates a PRoC BLE, 32-bit ARM Cortex-M0, design project.				
	PSo	C 5LP Design	Creates a PSoC 5LP, 32-bit ARM Cortex-M3, design project.				
	PSoC 3 Start	ter Designs					
	Pa ADC	_DMA_VDAC	Shows how to transfer data from an ADC to a DAC using DMA with no CPU intervention.				
	▶ DelS	ig_16Channel	Shows a 16-channel, 12-bit Delta Sigma ADC in PSoC 3 sequenced in hardware; samples are transferred from ADC to SRAM using DMA - without processor intervention.				
	🔁 DelS	ig_I2CM	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.				
	🖪 DelS	ig_I2CS	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.				
	Name:	Design01					
	Location:	C:\Users\BLE\Project					
	Device:	CY8C5868LTI-LP039		•			
	Advanced						
	Workspace:	Create New Workspace		•			
	Workspace Na	me: Design01					
	Sheet Template:     Empty (11" x 8.5")       Application Type     Bootloadable			•			
				•			
-			ОК	Cancel			



<u> </u>															
Select Device - [Bootloadable - CY8C5868LTI-LP039]															
Devices Notices Log 4 >															
🖻 View Datasheet 🖽 Hide/Show Columns ⊃ Reset to Defaults 24 Columns Hidden															
Architecture Architecture Flash (KB) Flash (KB) SRAM (KB) SRAM (KB) Traos Bufter (KB) DMA Channels PLL LCD Dmve (max ratio) CapSense								ADC	8-bit DAC	SOUT Blocks	DFB	•			
Filters:															
CY8C5867LTI-LP025	PSoC 5LP (ARM CM3)	67	128	32	2048	-	24	1	x16	-	1x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5867LTI-LP028	PSoC 5LP (ARM CM3)	67	128	32	2048	-	24	1	x16	1	1x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868AXI-LP031	PSoC 5LP (ARM CM3)	67	256	64	2048	-	24	1	x16	1	2x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868AXI-LP032	PSoC 5LP (ARM CM3)	67	256	64	2048		24	1	x16	-	2x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868AXI-LP035	PSoC 5LP (ARM CM3)	67	256	64	2048	-	24	1	x16	1	2x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868LTI-LP036	PSoC 5LP (ARM CM3)	67	256	64	2048	-	24	1	x16	1	2x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868LTI-LP038	PSoC 5LP (ARM CM3)	67	256	64	2048		24	1	x16	-	2x 12-bit SAR 1x 20-bit Delta Sigma	4	4	1	
CY8C5868LTI-LP039 PSoC 5LP (ARM CM3) 67 256 64 2048 - 24 1 x16 🛷 2x 12-bit SAR 4 4									*						
4					m									÷.	
233 of 233 devices fou	nd Clear Filters														
Start Auto Select	]										ОК		Can	el	

#### Figure 6-29. Select Device in PSoC Creator

2. Navigate to the Schematic view and drag and drop a Bootloadable component (Figure 6-30) on the TopDesign.

Figure 6-30. Bootloadable Component in Component Catalog





To configure the Bootloadable, double-click or right-click the Bootloadable component and select **Configure**. In the **General** tab, enable the check box for **Manual application image placement** and set the **Placement address** to '0x00002800'.

Figure 6-31.	Configuration	Window of	Bootloadable	Component in	"General"	Tab Setting
	9					

Configure 'Bootloadable	1	? 💌
Name: Bootloadable	_1	
General Depen	dencies Built-in	4 ⊳
Application version:	0x0000	
Application ID:	0x0000	
Application custom ID:	0x0000000	
Manual application in Placement address:	nage placement 0x00002800	
Datasheet	ОК Арру	Cancel

Set the dependency of the Bootloadable component by selecting the **Dependencies** tab in the configuration window and clicking the **Browse** button, as shown in Figure 6-32. Select the *KitProg\_Bootloader.hex* (Figure 6-33) and *KitProg\_Bootloader.elf* files (Figure 6-34); click **Open**.

Figure 6-32. Configuration Window of Bootloadable Component in the Dependencies Tab

Configure 'Bootloadable'	? <mark>- x</mark>
Name: Bootloadable_1	
General Dependencies Built-in	٩ ۵
Bootloadable projects require a reference to the associated Bootloader project's HEX files. The HEX files extension is *.hex. The ELF files extension depends on IDE and ca *.elf, *.out, *.avf, or other.	and ELF an be
Bootloader HEX file:	
1	
Bro	wse
Bootloader ELF file:	
	_
Bro	wse
Datasheet OK Apply	Cancel



Select a Bootloader Hex File			×
🚱 💭 🔻 👢 « Firmware )	Programmer      KitProg_Bootloader	▼ 49 Searc	:h KitProg_Bootloa 🔎
Organize   New folder			iii • 🔟 📀
Desktop ^	Name	Date modified	Туре
Downloads	KitProg_Bootloader.hex	3/18/2013 6:38	HEX File
S Recent Places			
<ul> <li>Libraries</li> <li>Documents</li> <li>Music</li> <li>Pictures</li> <li>Videos</li> </ul>			
second the computer			
😻 Windows7_OS (C:			
🚱 Lenovo_Recovery 👻 🤞	( III		•
File <u>n</u> ame	: KitProg_Bootloader.hex	<ul> <li>Hex Files (</li> <li>Open</li> </ul>	*.hex)   Cancel

Figure 6-33. Select KitProg Bootloader Hex File

Figure 6-34. Select KitProg Bootloader Elf File

Select a Bootloader Hex File			x
G V Firmware > Pro	ogrammer 🕨 KitProg_Bootloader	✓ 4 Search KitProg_Bootloader	٩
Organize 👻 New folder		)II 🕶 🗍	0
🚖 Favorites	^ Name	Date modified Type	
Desktop	KitProg_Bootloader.elf	4/18/2013 1:07 AM ELF File	
Recent Places	E		
🥽 Libraries			
Documents			
Music     Pictures			
Videos			
11 Computer			
CY8C58 Family Processo	v (		Þ
File <u>n</u> ame:		<ul> <li>Elf Files (*.elf, .axf, .out)</li> </ul>	•
		<u>O</u> pen Cance	

3. Develop your custom project.



4. Make sure that the NVL setting of the Bootloadable project and the KitProg\_Bootloader project is the same. Figure 6-35 shows the *KitProg\_Bootloader.cydwr* system settings.

Figure 6-35. KitProg Bootloader System Settings

5	: Reset   ╠⊕ Expand   └── Collapse		
Op	stion	Value	
÷	Configuration		
	- Device Configuration Mode	Compressed	-
	- Enable Error Correcting Code (ECC)		
	Store Configuration Data in ECC Memory		
	- Instruction Cache Enabled		
	Enable Fast IMO During Startup		
	- Unused Bonded IO	Allow but warn	•
	Heap Size (bytes)	0x80	
	- Stack Size (bytes)	0x0800	
	Include CMSIS Core Peripheral Library Files		
Þ	Programming\Debugging		
	- Debug Select	SWD+SWV (serial wire debug an	nd viewer) 👘 🔻
	- Enable Device Protection		
	- Embedded Trace (ETM)		
	Use Optional XRES		
÷	Operating Conditions		
	- VDDA (V)	5.0	
	- Variable VDDA		
	- VDDD (V)	5.0	
	- VDDI00 (V)	5.0	
	- VDI01 (V)	5.0	
	- VDD02 (V)	5.0	
	- VDDIO3 (V)	5.0	
lf tr	ue, device configuration data will be stored in ECC memory to reduce main FLASH memory usage. Error correction may not be used when this option is enabled.		
_			
	🗤 Piris 🗤 Analog 👦 Gocks 💉 Interruptis 👝 🛛 UMA N 🌠 System 🕅 🔚 Directives 🔚 Hash Security 📑 EEPROM		4

- 5. Build the project in PSoC Creator by choosing Build > Build Project or [Shift] [F6].
- 6. To download the project onto the PSoC 5LP device, open the Bootloader Host tool, which is available in PSoC Creator. Choose **Tools > Bootloader Host**, as shown in Figure 6-36.

Eile Edit View Project Build Debug Tools Window Help Install drivers for µVision . . . 🔂 🎦 🔂 🚅 🗔 🕼 🖪 🚨 🛄 👗 🗠 🖄 💙 100% Datapath Config Tool... 四・古事の意義。 多見も むる hs Serif - 10 DMA Wizard\_ Workspace Explorer opDesign.cysch 3 3 Bootloader Host. 4 Workspace 'Bootloadable project' (1 Projects) Options... B Project 'Bootloadable' [CY8C5868LTI-LPC TopDesign cysch ource P Bootloadable.cydwr 0 🕀 🗀 Header Files device.h 8 E C Source Files

Figure 6-36. Open Bootloader Host Tool in PSoC Creator



 In the Bootloader Host tool, click Filters and add a filter to identify the USB device. Ensure that the check box for Show USB Devices is enabled. Set VID as 0x04B4, PID as 0xF13B, and click OK, as shown in Figure 6-37.

🛓 Bootloader Host		
File Actions Help		
🖆 🗼 BB 📎 🛛	3	
File: C:\Program Files (x86)\Cypres	CY8CKIT-042 PSoC 4 Pioneer Kit\1.0\Firmware\P	rogrammer\KitProg\KitProg.cyacc
Ports:	Filters Port Configuration  Port Filters  Show 12C Devices Show SPI Devices Show UART Devices Show USB Devices Show USB Devices	Port Information
Log: 05:46:31 PM - Selected device: USE	VID: 0x0484 PID: 0xF138 Cancel OK	
Ready		



8. In the Bootloader Host tool, click the **Open File** button (Figure 6-38) to browse to the location of the bootloadable file (\*.cyacd), as shown in Figure 6-38.

Figure 6-38. Open Bootloadable File in Bootloader Host Tool

🐒 Bootloader Host		_ <b>_</b> X
Eile Actions Help		
🖆 🔰 22 📎 🛞		
File: C:Users\ancy\Desktop\Bootloadable project	Bootloadable.cydsn/CortexM3\ARM_GCC_	441\Debug\Booffoadable.cyacd
Forts:     Filters       USB1: uman Interface Device (0484_F13B)       Program Button       Open File Button	Port Configuration USB  Violation necessary for this port.	Port Information VID: 0484 PID: F138
Log:		
12.35.02 PM - Selected device: USB Human Interface 12.35.02 PM - Selected device: USB Human Interface 12.35.08 PM - Selected device: USB Human Interface	e Device (0484_F138) a Device (0484_F138) a Device (0484_F138)	

Figure 6-39. Select Bootloadable .cyacd File in Bootloader Host

Droanize • New folder		#= •	0
Favorites	Name	Date modified	Туре
E Desktop	L .deps	4/18/2013 12:34 PM	File folder
👍 Downloads 🛛 🤇	Bootloadable.cyacd	4/18/2013 12:34 PM	CYACD Fil
💢 Libraries			
Uibraries Uibraries Uibraries Uibraries Uibraries Videos			
Ubranies Documents Music Pictures Videos Computer			
Ubranies Documents Music Pictures Videos Computer Mundows7 OS IC: * *	711		

 Keep the reset switch (SW1) pressed and plug in the USB mini-B connector. If the switch is pressed for more than 100 ms, the PSoC 5LP enters into bootloader. Click the Program button (Figure 6-38) in the Bootloader Host tool to program the device.


10.If bootload is successful, the log of the tool displays "Programming Finished Successfully"; otherwise, it displays "Failed" and a reason for the failure.

#### Notes:

- The PSoC 5LP pins are brought to the PSoC 5LP GPIO header (J8). These pins are selected to support high-performance analog and digital projects. See PSoC 5LP GPIO Header (J8) on page 97 for pin information.
- Take care when allocating the PSoC 5LP pins for custom applications. For example, P2[0]–P2[4] are dedicated for programming the PSoC 4 BLE/PRoC BLE. See Schematics on page 168 before allocating the pins.
- When a custom project is programmed onto the PSoC 5LP, the initial capability of the PSoC 5LP to act as a programmer, USB-UART bridge, or USB-I<sup>2</sup>C bridge in not available.
- The status LED does not function unless used by the custom project.

For additional information on bootloaders, refer to Cypress application note, AN73503 - USB HID Bootloader for PSoC 3 and PSoC 5LP.



## 6.3.2 Building a Normal Project for PSoC 5LP

A normal project is a completely new project created for the PSoC 5LP device on the CY8CKIT-042. Here the entire flash of the PSoC 5LP is programmed, overwriting all bootloader and programming code. To recover the programmer, reprogram the PSoC 5LP device with the factory-set *KitProg.hex* file, which is shipped with the kit installer.

The *KitProg.hex* file is available at the following location: <Install\_Directory>\CY8CKIT-042-BLE Kit\<version>\Firmware\ Programmer\KitProg

This advanced functionality requires a MiniProg3 programmer, which is not included with this kit. The MiniProg3 can be purchased from www.cypress.com/go/CY8CKIT-002.

To build a normal project for the PSoC 5LP, follow these steps:

 In PSoC Creator, choose New > Project > PSoC 5LP, click the expand button adjacent to Advanced, select Device as CY8C5868LTI-LP039, and select Application Type as Normal from the drop-down list, as shown in Figure 6-40.

New Project		? 🗙
Design Other		4 ۵
Default Templates		<b>^</b>
PSoC 3 Design	Creates a PSoC 3, 8-bit 8051, design project.	
PSoC 4000 Design	Creates a PSoC 4000, 32-bit ARM Cortex-M0, design project.	E
PSoC 4100/4200 Design	Creates a PSoC 4100/4200, 32-bit ARM Cortex-M0, design project.	
PSoC 4100/4200-BL Design	Creates a PSoC 4100/4200-BL, 32-bit ARM Cortex-M0, design project.	
PRoC BLE Design	Creates a PRoC BLE, 32-bit ARM Cortex-M0, design project.	
PSoC 5LP Design	Creates a PSoC 5LP, 32-bit ARM Cortex-M3, design project.	
PSoC 3 Starter Designs		
ADC_DMA_VDAC	Shows how to transfer data from an ADC to a DAC using DMA with no CPU intervention.	
DelSig_16Channel	Shows a 16-channel, 12-bit Delta Sigma ADC in PSoC 3 sequenced in hardware samples are transferred from ADC to SRAM using DMA - without processor intervention.	;
Pa DelSig_I2CM	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.	
DelSig_I2CS	Shows the 16-bit differential ADC, hardware multiplexed into 8 channels and transported over I2C.	-
Name: Design01		
Location: C:\Users\BLE\Project		
Device: CY8C5868LTI-LP039		•
Advanced		
Workspace: Create New Workspace		<b></b>
Workspace Name: Design01		
Sheet Template: Empty (11" x 8.5")		•
Application Type Bootloadable		•
	ОК	Cancel

Figure 6-40. Create New Project in PSoC Creator PSoC 5LP

- 2. Develop your custom project.
- 3. Build the project in PSoC Creator by choosing Build > Build Project or pressing [Shift] [F6].



- 4. Connect the 10-pin connector of MiniProg3 to the onboard 10-pin SWD debug and programming header J7 (which needs to be populated).
- To program the PSoC 5LP with PSoC Creator, choose Debug > Program or press [Ctrl] [F5]. If the Programming window appears and shows MiniProg3 and the selected device in the project under it (CY8C5868LTI-LP039); click on the device and click Connect to program.

#### Notes:

- The 10-pin SWD debug and programming header (J7) is not populated. See the 'No Load Components' section of A.3 Bill of Materials (BOM) for details.
- The PSoC 5LP pins are brought to the PSoC 5LP GPIO header (J8). These pins are selected to support high-performance analog and digital projects. See PSoC 5LP GPIO Header (J8) on page 97 for pin information.
- Take care when allocating the PSoC 5LP pins for custom applications. For example, P2[0]–P2[4] are dedicated for programming the PSoC 4. Refer to A.1 Schematics before allocating the pins.
- When a normal project is programmed onto the PSoC 5LP, the initial capability of the PSoC 5LP to act as a programmer, USB-UART bridge, or USB-1<sup>2</sup>C bridge is not available.
- The status LED does not function unless it is used by the custom project.

## 6.4 **PSoC 5LP Factory Program Restore Instructions**

The BLE Pioneer Kit features a PSoC 5LP device that comes factory-programmed as the onboard programmer and debugger for the PSoC 4 BLE/PRoC BLE device.

In addition to creating applications for the BLE device, you can also create custom applications for the PSoC 5LP device on this kit. For details, see section Developing Applications for PSoC 5LP on page 134. Reprogramming or bootloading the PSoC 5LP device with a new flash image will overwrite the factory program and forfeit the ability to use the PSoC 5LP device as a programmer/ debugger for the BLE device. Follow the instructions to restore the factory program on the PSoC 5LP and enable the programmer/debugger functionality.

#### 6.4.1 PSoC 5LP is Programmed with a Bootloadable Application

If the PSoC 5LP is programmed with a bootloadable application, restore the factory program by using one of the following two methods.

#### 6.4.1.1 Restore PSoC 5LP Factory Program Using PSoC Programmer

- 1. Launch **PSoC Programmer 3.21.1** or later from **Start > Cypress > PSoC Programmer**.
- Configure the BLE Pioneer Kit in service mode. To do this, while holding down the reset button (SW1 Reset), plug in the BLE Pioneer Kit to the computer using the included USB cable (USB A to mini-B). This puts the PSoC 5LP into service mode, which is indicated by the blinking green status LED.



3. The following message appears in the PSoC Programmer **Results** window, as shown in Figure 6-41: "KitProg Bootloader device is detected".

Figure 6-41. PSoC Programmer Results Window

PSoC Programmer	
File View Options H	lelp
🖆 · 🗼 🔘 BB	
Port Selection	Programmer Utilities JTAG
Device Family CY8C3ox Device CY8C30564XL040	Programming Parameters         File Path:       C:Program Files (x86)/Cypress/CY8CKIT-042-BLE Kit1.0/FirmwarelProgrammer/KitProg_Bootload
01000000000000	
Actions	Results
Actions Connected at 1:38:4	Results           6FM         KitErog bootLoader device is detected           Please close all ports, then navigate to the Utilities tab and click the Upgrade Firmware button to recover Bridge



4. Switch to the **Utilities** tab in PSoC Programmer and press the **Upgrade Firmware** button, as shown in Figure 6-42. Unplug all other PSoC programmers (such as MiniProg3 and DVKProg) from the PC before pressing the **Upgrade Firmware** button.

Figure 6-42. Upgrade Firmware





5. After programming has completed, the following message appears, as shown in Figure 6-43: "Firmware Update Finished at <time>".

Figure 6-43. Firmware Update Completed

🖗 PSoC Programmer	
File View Options Help	
📂 · 🔪 💿 BB 🕻 🖹 🗋 🕲	
Port Selection IVilities JTAG	
KitProg/051717FF011B340     Upgrade Rimware     Click to upgrade connected device's firmware     Erase Block     Click to erase user specific flash block	
Device Family       CYBC300x       Device       CYBC3866AX0-040	
Actions Results	*
Successfully Connected to KitProg/051717FF01B3400 KitProg Version 2.08 at 1:41:51 PM	
PM	
Connected at 1:41:49 PM KitProg/051717FF011B3400	=
Disconnected at 1:41:33 PM Bootloader device	_
Firmware Update Finished at 1:41:33 PM	
Succeeded	
Verifying	
Initializing	
Firmware Upgrade Started at 1:41:24 PM	
Firmware Upgrade	-
For Help, press F1 PASS Powered	Connected .::

6. The factory program is now successfully restored on the PSoC 5LP. It can be used as the programmer/debugger for the PSoC 4 BLE or PRoC BLE device.



#### 6.4.1.2 Restore PSoC 5LP Factory Program Using Bootloader Host Tool

- 1. Launch the Bootloader Host tool from Start > Cypress > PSoC Creator.
- 2. Using the **File > Open** menu, load the *KitProg.cyacd* file, which is installed with the kit software, as shown in Figure 6-44. The default location for this file is: <Install\_Directory>\ CY8CKIT-042-BLE Kit\<version>\Firmware\Programmer\KitProg\KitProg.cyacd

🛓 Bootloader Host			- • •
<u>File Actions H</u> elp			
🔁   🔪 BB 📎   (	8		
File: C:\Program Files (x86)\Cypres	ss\CY8CKIT-042-BLE Kit\1.0\Firmware\Program	mer\KitProg\KitProg.cyacd	
Ports:	Filters Port Configuration	Port Information	
Log:			
I			
Ready			.::
🔮 Open			<b>X</b>
Goo V 🖟 « Firmware 🕨	Programmer 🕨 KitProg 💌 🗲	Search KitProg	Q
Organize 🔻 New folder		:≡ ▼ □	0
🔆 Favorites	Name	Date modifi	
Downloads	KitProg.cyacd	6/2/2014 5:0	

Figure 6-44. Load KitProg.cyacd File

🛓 Open			×
✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	Programmer 🕨 KitProg 👻 🗲	Search KitProg	٩
Organize 🔻 New folder			
🚖 Favorites	Name	Date modifi	
〕 Downloads	KitProg.cyacd	6/2/2014 5:0	
Recent Places Desktop			
🔚 Libraries	E		No preview available.
🖳 Computer			
🏭 Windows7_OS (C:)			
🤯 Lenovo_Recovery (Q:)			
	<b>▼</b>	*	
File <u>n</u> am	e: KitProg.cyacd 🗸	Bootloader Files (*.cyacd)	-
		Open 🛛 C	ancel



- Configure the Pioneer Kit in service mode. To do this, while holding down the reset button (SW1 Reset), plug in the BLE Pioneer Kit to the computer using the included USB cable (USB A to mini-B). This puts the PSoC 5LP into service mode, which is indicated by the blinking green status LED.
- 4. In the Bootloader Host tool, set the filters for the USB devices with VID: 04B4 and PID: F13B. The USB Human Interface Device port appears in the Ports list. Click that port to select it, as shown in Figure 6-45.

Bootloader Host - • • <u>F</u>ile Actions Help File C:\Program Files (x86)\Cypress\CY8CKIT-042-BLE Kit\1.0\Firmware\Programmer\KitProg\KitProg.cyacd Port Filters. Port Configuration USB Port Information VID: 04B4 PID: F13B No configuration necessary for this USB Human Interface D port Log: 01:48:37 PM - Selected device: USB Human Interface Device (04B4\_F13B) Ready

Figure 6-45. Select USB Human Interface Device

 Click the Program button (or choose Actions > Program) to restore the factory-program by bootloading it onto the PSoC 5LP.



6. After programming has completed, the following message appears, as shown in Figure 6-46: "Programming Finished Successfully".

Figure 6-46. Programming Finished Successfully

🛓 Bootloader Host	
<u>F</u> ile <u>A</u> ctions <u>H</u> elp	
File: C:\Program Files (x86)\Cypress\CY8CKIT-042-BLE Kit\1.0\Fimware\Programmer\KitProg\KitProg.cyacd	
Ports: Filters Port Configuration Port Information Log:	
01:48:37 PM - Selected device: USB Human Interface Device (04B4_F13B) 02:02:04 PM - Programming Finished Successfully 20:20:20 PM - Programming Finished Successfully Programming completed in 4367ms.	
Ready	

7. The factory program is now successfully restored on the PSoC 5LP. It can be used as the programmer/debugger for the PSoC 4 BLE/PRoC BLE device.

## 6.5 Using FM24V10 F-RAM

The BLE Pioneer board has an onboard ferroelectric RAM chip that can hold up to 1 Mb of data. The chip provides an I<sup>2</sup>C communication interface for data access. It is hardwired to the I<sup>2</sup>C lines (P3\_4 and P3\_5); the same lines are also routed to the PSoC 5LP I<sup>2</sup>C lines. Because the F-RAM device is an I<sup>2</sup>C slave, it can be accessed or shared among various I<sup>2</sup>C masters on the same line. For more details on the F-RAM device, refer to the device datasheet.



#### 6.5.1 Address Selection

The slave address of the F-RAM device consists of three parts, as shown in Figure 6-47: slave ID, device select, and page select. Slave ID is an F-RAM family-specific ID located in the datasheet of the particular F-RAM device. For the device used in BLE Pioneer board (FM24V10), the slave ID is 1010b. Device select bits are set using the two physical pins A2 and A1 in the device. The setting of these two pins on the BLE Pioneer board is controlled by resistors R32/R36 (A1) and R33/R37 (A2). Because the memory location in F-RAM is divided into two pages of 64 KB each, the page select bit is used to refer to one of the two pages in which the read or write operations will take place.

Figure 6-47. F-RAM I<sup>2</sup>C Address Byte Structure



#### 6.5.2 Write/Read Operation

The device's datasheet includes details on how to perform a write/read operation with the F-RAM. Figure 6-48 and Figure 6-49 provide a snapshot of the write/read packet structure as a quick reference.

Figure 6-48. F-RAM Single-Byte and Multiple-Byte Write Packet Structure



Single-Byte Write





#### Figure 6-49. F-RAM Single-Byte and Multiple-Byte Read Packet Structure

As shown in the figures, all operations start with the slave address followed by the memory address. For write operations, the bus master sends each byte of data to the memory, and the memory generates an acknowledgement condition. For read operations, after receiving the complete slave address and memory address, the memory begins shifting data from the current address on the next clock.

## 6.6 CySmart iOS/Android Application

The CySmart mobile application is a powerful tool that allows the mobile device (iOS/Android) with BLE capability to connect to a BLE peripheral device and communicate with it. It supports various standard BLE services along with two custom services for CapSense and LED control. It also provides a common support for all profiles, standard or custom.

This app is free. You can download and install it for Apple iOS devices from the App Store and for Android Devices from Play Store. Make sure that the mobile device being used supports BLE.

To verify the example project using the CySmart mobile app, follow these steps.

- 1. Plug the BLE Pioneer Kit into the PC for power, using the J13 USB connector.
- 2. Program the kit with the desired BLE example project.
- 3. Open the app on the mobile device.



4. If Bluetooth is not enabled on the device, the app will ask to enable it, as shown in Figure 6-50. Figure 6-50. Turn on Bluetooth on Device

Turn On Bluetooth "CySmart" to Con Accessories	to Allow nect to
Settings	ок

5. After Bluetooth is enabled, the app will automatically search for available BLE peripherals and list them, as shown in Figure 6-51. Select the BLE Pioneer Kit peripheral in the list. The name displayed in the list will be the same as that set in the BLE Component.







6. When connected, the app will list the supported profiles by the peripherals, as shown in Figure 6-52. Tap on the desired profile.

Figure 6-52. Profiles Page

iPod	2:10 PM	@ 💲 💼 +
$\bigcirc$	Profile	
	Capsense	
	CapSense Button & Poemty	*

7. Depending on the type of profile chosen, the app will display options for the profile. Figure 6-53 shows an example for the CapSense slider custom profile, where swiping a finger on the CapSense slider of the BLE Pioneer Kit is reflected in the app. See Pioneer Baseboard on page 88.



Figure 6-53. CapSense Slider GUI

8. To go to a different service, go back to the service page in the GUI.



- 9. To connect to a new BLE peripheral, go back to home page and swipe the screen below to scan for devices.
- 10. To transfer data/notifications through any other profile that is not listed on the Profiles page after connecting to the peripheral, go to the **GATT DB** option on the Profiles page. The GATT DB allows you to access the services and characteristics of a profile directly, as shown in Figure 6-54, and to modify or receive values through BLE.

Figure 6-54. GATT DB GUI for Characteristics



The **Data Logger** option provides a textual form of all the events that has happened with a particular BLE peripheral device, including scanning and connection.

Figure 6-55. Data Logger





Two custom profiles are created for demonstrating the BLE Pioneer Kit features: the CapSense profile and the RGB LED profile. Both these profiles are integrated into the CySmart mobile app, as easy-to-use GUI.

The CapSense profile GUI supports three CapSense functionalities.

CapSense Buttons: After connecting to the BLE peripheral, the CapSense Buttons service page displays the number of CapSense buttons supported by the peripheral, as shown in Figure 6-56. Any touch on one of the CapSense buttons on the peripheral is reflected in the CySmart GUI.

Figure 6-56. CapSense Buttons GUI Page





 CapSense Slider: After connecting to the BLE peripheral, the CapSense Slider service page displays the CapSense slider as supported by the peripheral, as shown in Figure 6-57. Swiping a finger on the CapSense slider on the peripheral is reflected in the CySmart GUI.

For example, the CapSense\_Slider\_LED project (CapSense Slider and LED on page 47) will show this utility on the app.

Figure 6-57. CapSense Slider GUI Page





CapSense Proximity: After connecting to the BLE peripheral, the CapSense Proximity service page displays the CapSense proximity supported by the peripheral, as shown in Figure 6-58. A change in proximity on the proximity sensor (such as a wire) on the peripheral is reflected in the CySmart GUI.

For example, the CapSense\_Proximity project (CapSense Proximity on page 62) will show this utility on the app.

Figure 6-58. CapSense Proximity GUI Page





The RGB LED profile allows you to control the color and intensity of the BLE Pioneer Kit onboard RGB LED, as shown in Figure 6-59. Pressing any part of the color gamut on the GUI is reflected on the BLE peripheral device with the onboard RGB LED.

**Note:** The onboard RGB LED color range depends on the LED being used. It is possible that the complete color gamut is not reflected on the onboard RGB LED due to limitations on the LED itself.

For example, the CapSense\_Slider\_LED project (CapSense Slider and LED on page 47) will show this utility on the app.

Figure 6-59. RGB LED Profile





# 6.7 CySmart PC Tool

The CySmart PC tool is a BLE Central host emulation tool that, along with the dongle, allows you to connect to a BLE peripheral device and transfer data over BLE services. Also, it displays all the packets that are involved during the connection, which can be analyzed for details.

The CySmart PC tool is installed as part of the BLE Pioneer Kit installer. To launch the software, choose Start > All Programs > Cypress > CySmart <version> > CySmart <version>.

Follow these steps to connect to a BLE peripheral device using the dongle and CySmart PC tool and to transfer data.

1. Connect the dongle to one of the USB ports on the PC.

Figure 6-60. Connect Dongle to USB Port





2. Start the CySmart PC tool on the PC. You will see a list of dongles connected to it. Select the dongle you want to use and click **Connect**, as shown in Figure 6-61.

Figure 6-61. Selecting Dongle in CySmart PC Tool

CySmart 1.0				
Ele Help				
() <sup>*</sup> Select Dongle				
	Select BLE Dongle Target			
		Details Manufacturer: Product: Fernware version: Hardware version: Description: Cypress BLE dongle	Cypress Semiconductor Cypress BLE Dongle 1.0.0.35 1.0.0.0	
	· •			
	Show all	]		
	Refresh		Connect Close	
Log		_		
🍵 Clear Log 🔡 Save Log				
				-

3. The CySmart PC tool can be used to connect to any BLE peripheral device, including the BLE Pioneer kit. To connect to the BLE Pioneer kit, power the kit through the J13 USB connector and program the appropriate BLE peripheral project to it. Follow the steps according to the project description to start advertising.



4. When the dongle is selected and connected to, the main window shown in Figure 6-62 opens up.

Figure 6-62.	CySmart PC Tool Main Window
--------------	-----------------------------

CySmart 1.0	
Eile Help (1) Menu bar	
Select Dongle & Configure Master Settings Manage PSMs (2) Options for changing settings on BLE Do	ngle
Master acting as BLE Central Device	
Discovered devices	
(3) Actions that can be taken on a discovered det	Vice Advertisement data Scan response data
# Device Bluetooth Address Address Type RSSI Advertisement Type Connected	E C
(6) This Window displays the list of Devices that have been scanned and discovered by the BLE Dongle after 'Start Scan' is clicked	Decoptor Vale Index (4) This window displays the data received as part of advertisement packet and Scan Response packet
Whitelet	(7) Raw Data of the selected field
+ Add Remove 📋 Clear All 🚱 Refresh	
# Bluetooth Address Address Type	
	Flaw Data
<ul> <li>(6) Whitelist options allow a peripheral device to be added as peripheral device to be</li> </ul>	
added of removed from the tool is whitelist	
Classing Li Sevelop	
17.11.451 - Sart Long RD Aldress Resourced event received	
17.11.45]: BD Address Type: PUBLIC ADDRESS (8) Log Window (8) Log Window	
In the on energy of the second s	

The important parts of this window are as follows:

- **Menu bar:** This contains options to exit or find help about the CySmart PC tool.
- Dongle settings: These settings comprise of Select Dongle, Configure Master Settings, and Manage PSMs. Select the dongle allows to connect to a dongle that is listed by the system. If a different dongle needs to be connected, then this option can be used. Configure Master Settings option allows to modify the various settings that the dongle requires to act as a BLE Central device such as connection parameters, scan parameters, or security parameters. Manage PSMs allows to register for PSM or modify them.
- Discovered devices options: The Master tab provides three options by default: Start Scan, Connect, and Add to Whitelist. The Start Scan button allows the tool to start scanning for available BLE peripheral devices and list them in the Discovered Devices window. This option also allows to stop an ongoing scan. The Connect option allows to connect to a particular BLE peripheral device that is listed in the Discovered Device window. Add to Whitelist allows to add a selected device address to the whitelist.
- Advertisement Data/Scan response data tabs: These tabs provide the description of the data received in the advertisement packet and scan response packet from the selected device.
- Discovered Devices window: This window lists all the peripheral devices found after starting a scan. Selecting any device populates the information on advertisement data and scan response data on the right side window.
- Whitelist window: This window lists the devices that have been added as whitelist and provides options to add, remove, or clear devices from the whitelist.
- **Raw Data window:** This window displays the raw data (in hexadecimal) of the field selected.
- Log window: This window displays all the activities that occur on the dongle and the data communicated. This feature is also useful for debugging.



1. Click Start Scan to see the list of available BLE peripheral devices, as shown in Figure 6-63.

Figure 6-63. Scanned Devices Listed in CySmart PC Tool

👌 Select Dongle 🏿 🖉 Config	jure Master Settings	Manage PSN	/ls		Linter d	leviess found during DLE scen
Master						levices found during BLE scan
Discovered devices						
🚫 Stop Scan 👹 Connect	Add to Whitelist					Advertisement data Scan response data
# Device	Bluetooth Address	Address Type	RSSI	Advertisement Type	Connected	E# 1=
1 CapSense Slider and LED	22:43:65:56:34:12	Public	-67 dBm	Connectable undirected		Description Value Index

- 2. After the available devices are listed, choose the desired peripheral and double-click **Connect**, as shown in Figure 6-64.
- Figure 6-64. Start Connection with Selected Device

sster	Send connect request to selected device	e :	received from selected device					
scovered devices	-							
Start Scan 💝 Co	nnect Add to Whitelist		Adventisement data   Scan response data					
Device	Bluetooth Address Address Type RSSI Advertisement Type	Connected						
	LED 22.43.65.58.34.12 Public -71 dBm Connectable underected		Description	Value Index				
	Selected E	LE peripheral device	- AD Data 0: < <plags>&gt;</plags>	la an las				
			Length of this data	0.02 [0]				
			Disconagero	0.01 [1]				
			1 E Limited Discoverble Mode	0666 [6]				
			I E General Dermanske Mode	ON				
			- RR/FOR Net Surveyed	ON				
			Smutaneous LE and BR/EDB to Same Device Canable Controller	nable Controller) OFF				
			- Smultaneous LE and BR/EDR to Same Device Capable (Host)	OFF				
			Reserved	OFF				
			Reserved	OFF				
			Reserved	OFF				
			AD Data 1: < <complete local="" name="">&gt;</complete>					
Add PE Longer	Charles All Co Belevily		- Length of this data 0x18 [3]					
Hos Hemove	Cicer All • J Kerch		i≟⊢ < <complete local="" name="">&gt;</complete>	0x09 [4]				
Buetooth Address A	adress type			0x43 [5]				
			- 8	0x61 [6]				
			p	0x70 [7]				
			Raw Data					
			02:01:06:18:09:43:61:70:53:65:6E:73:65:20:53:6C:69:64:65:72:20:61:6E:64:20:4C	45:44				
ear Loo 💾 Save	Log							
1041 - 'Stop Scan's	ecuent sect							
Off - Sean Banne	wi Notification' event received							



3. If the connection is successful, you will see another tab opening besides the Master tab. This tab provides options with respect to the connected BLE device, as shown in Figure 6-65.

Figure 6-65. Connected Device Tab



4. On the device tab, click **Discover All Attributes** to find the supported attributes by the connected BLE device. This action populates the list of services and characteristics in the Attribute window along with their values, if any, as shown in Figure 6-66.

Figure 6-66. Discover All Attributes

Eile He Select D Master Ca thributes Stop	elp Pongle "Ø Cor apSense Slidera Enable All N	nfigure Maste nd LED [22:43	er Settings Manage PSMs 3:65:56:34:12]			
Select D Master Ca ttributes Stop	ongle 🥒 Cor apSense Slider a Enable All N	nfigure Maste nd LED [22:43	er Settings Manage PSMs 3:65:56:34:12]			
Master Ca ttributes Stop	apSense Slider a	nd LED [22:43	3:65:56:34:12]			
ttributes Stop	💶 Enable All N					Attributes read and listed
Stop	🕑 Enable All N					
bodle		Notifications	🔟 Read All Characteristics 💸 Bond	🔠 Export 🛛 💼 Clear	/	View: Category 👻 🖬
anue		UUID	UUID Description	Value	Properties	-
- Primary	Service Declarat	ion: Generic A	locess			
⊡- 0x00	001	0x2800	Primary Service Declaration	00:18 (Generic Access)		
<b>-</b>	Characteristic De	eclaration: Dev	vice Name		20	
	Ė- 0x0002	0x2803	Characteristic Declaration	02:03:00:00:2A		
	0x0003	0x2A00	Device Name		0x02	
	Characteristic De	eclaration: App	bearance			1
		0x2803	Characteristic Declaration	02:05:00:01:2A		
	0x0005	0x2A01	Appearance		0x02	
	Characteristic De	eclaration: Per	ipheral Preferred Connection Parameters			
	⊡- 0x0006	0x2803	Characteristic Declaration	02:07:00:04:2A		
	0x0007	0x2A04	Peripheral Preferred Connection Parameters		0x02	
Primary	Service Declarat	ion: Generic A	ttribute			
	008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)		
ė	Characteristic De	eclaration: Ser	vice Changed			
	⊡ 0x0009	0x2803	Characteristic Declaration	22:0A:00:05:2A		
	L 0x000A	0x2A05	Service Changed		0x22	
- Primary	Service Declarat	ion				
	00B	0x2800	Primary Service Declaration	B6:CA		
<u>_</u>	Characteristic De	eclaration	125		592.	
	Ė- 0x000C	0x2803	Characteristic Declaration	10:0D:00:A2:CA		
	0x000D	0xCAA2			0x10	
	0x000E	0x2902	Client Characteristic Configuration			



5. You can read the characteristics individually or you can use the **Read All Characteristics** option to update the values for all readable characteristics, as shown in Figure 6-67.

CySmart 1.0					
Eile Help					
🕃 Select Dongle 🤏 🕻	onfigure Ma	ster Settings 🛠 Manage PSMs 🍵 Di	sconnect		
Master CapSense Side	r and LED [00	A0 50 65 43 21]			Selected Attribute details
Atributes					Attribute Details Send Commands
😗 Discover All Attribu	les 🚺 Ena	ble All Notifications 🧰 Read All Chara	ecteristics 🦑 Pair 🛛 🔛 Export 🛛 👔	Clear View: Category 🔻 🚺	Handle: 0x0013
Handle	UUID	UUID Description	Value	Properties	* UUID: 0xCBB1
- Dx000	15 Dx2A01	Appearance	00.00	6-02	UUID Description:
Oharacteristic	Declaration: F	Peripheral Preferred Connection Parameters			Value:
⊡-0x0005	0x2803	Characteristic Declaration	02:07:00:04:2A		00.00.00
0x00	17 0x2A04	Peripheral Preferred Connection Parame	eters 06:00:50:00:00:00:90:01	0x02	
Primary Service Deck	ration: Genera	c Attribute			
B- 0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)		Read Value *
E-Characteristic	Declaration: 5	Service Changed			Providen Probled
i≘- 0x0009	0x2803	Characteristic Declaration	22:0A:00:05:2A	Characteristic Read	Properties Chapters
- 0x000	IA 0x2A05	Service Changed	00.00.00.00	0.22	proaccast
0x000	B 0x2902	Client Characteristic Configuration			Fead
Primary Service Deck	ration				Write without response
B 0x000C	0x2800	Primary Service Declaration	85CA		Wite
Characteristic	Declaration		- 60		Notfy
i⇒ 0×0000	0x2803	Characteristic Declaration	10:0E:00:A2:CA		Indicate
0x00	E DACAA2			0x10	Authenticated signed writes
0x000	F 0x2902	Client Characteristic Configuration			Extended properties
0x00	0 0x2901	Characteristic User Description			
Primary Service Deck	ration	14 - 14 - 14 - 14 - 14 - 14 - 14 - 14 -	1.		
E-0x0011	0x2800	Primary Service Declaration	88-C8		
Characteristic	Declaration				
i⊟ 0x0012	0x2803	Characteristic Declaration	1A:13:00:B1:CB		
0x00	3 0x0881		00-00-00-00	DelA.	
- 0x00	4 0x2902	Client Characteristic Configuration	An Lote Control of Lot		
0x00	5 0x2901	Characteristic User Description			

Figure 6-67. Read All Characteristics

6. To modify the value of a characteristic individually, select the particular characteristic from the attribute list. The Attribute Details window on the right will display the properties of the selected characteristics as well as the options to modify or read the values, as shown in Figure 6-68.

CySmart 1.0							
Eile Help							
🕃 Select Dongle 🎭 C	onfigure Ma	ster Settings 🛠 Manage PSMs  👸 Disco	onnect				
Master CopSense Side	and LED [00	A0 50 65 43 21]					
Attributes							Attribute Details Send Commands
C Discover All Attribut	es 🚺 Enal	ble All Notifications 🛄 Read All Characte	eristics 🤣 Pair 🛛 🔝 Export 🛛 🎽	Clear	View: Category 👻 🚺		Hander 0x0013
Handle	UUID	UUID Description	Value	Properties			UUID: 0xC881
- 0x000	5 0x2A01	Appearance	00:00	0x02			UUID Description:
- Characteristic	Declaration: P	enpheral Preferred Connection Parameters	101				Value: Data on the attribute
E−0x0006	0x2803	Characteristic Declaration	02:07:00:04:2A				00.FF-00.FF
- 0x000	7 0x2A04	Perpheral Preferred Connection Parameter	n 06:00:50:00:00:00:90:01	0x02			
Primary Service Decla	ration: Generic	Attribute					
B- 0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)			11	Actions allowed on the characteristic Read Value * Wite Value *
E Characteristic	Declaration: S	iervice Changed					Product A
É 0x0009	0x2803	Characteristic Declaration	22:0A:00:05:2A				Properse Proped
0x000	A 0x2A05	Service Changed	00.00.00.00	0x22			bradcast
- 0x000	6 0x2902	Client Characteristic Configuration					Read
Primary Service Decla	ration						Write without response
B-0x000C	0x2800	Primary Service Declaration	85CA				Wite S
E Characteristic	Declaration	and the second se					Notfy
E-0x000D	0x2803	Characteristic Declaration	10:0E:00:A2:CA				Indicate
- 0x000	E DACAA2			0x10		14	Authenticated signed writes
0x000	F 0x2902	Client Characteristic Configuration				-111	Etended properties
0x001	0 0x2901	Characteristic User Description				-111	Supported properties
Primary Service Decla	ration						
B-0x0011	0x2800	Primary Service Declaration	88:08	-		-11	
- Characteristic	Declaration	T.					
i⊟-0x0012	0x2803	Characteristic Declaration	1A:13:00:B1:CB	1	Selected Characteristic		
0x001	3 040881		00.FF 00.FF	De1A			
- 0x001	4 0x2902	Client Characteristic Configuration					
- 0x001	5 0x2901	Characteristic User Description					
Attributes L2CAP Chan	nels						

Figure 6-68. Modify a Characteristic

7. Similarly, notifications or indications can be enabled on the characteristics that support those properties.



8. The list of attributes of the connected BLE device can also be saved in *.csv* format for later use. For this, click the **Export** button on the device tab and select the location where you want the file to be saved, as shown in Figure 6-69.

	-					
S CySmart 1.0						
<u>File</u> <u>H</u> elp						
😝 Select Dongle 🥒 Cor	nfigure Mas	ster Settings Manage PSMs				
Master CapSense Proximit	y [21:43:65:	56:34:12]				
Attributes						Attribute Details Send Commands
S Discover All Attributes	Enak	ole All Notifications  🧧 Read All Character	istics 💸 Bond  🔛 E	xport	💼 Clear 🔰 🖬 🖬	Handle: 0x000D
Handle	UUID	UUID Description	Value	Proper	es	UUID: 0xCAA1
Primary Service Declarat	ion: Generic	Access				UUID Description:
⊡- 0x0001	0x2800	Primary Service Declaration	00:18 (Generic Access)		<b></b>	Value:
Characteristic De	eclaration: D	levice Name			Save As	<u>×</u>
⊡ • <b>0</b> ×0002	0x2803	Characteristic Declaration	02:03:00:00:2A		🚱 🔵 🗢 詞 🕨 Libraries 🕨	- 4 Search Libraries
0x0003	0x2A00	Device Name		0x02	Organize T	B* • 0
Characteristic De	eclaration: A	ppearance			Rei a constante	Mr
⊡ 0x0004	0x2803	Characteristic Declaration	02:05:00:01:2A		Libraries	
0x0005	0x2A01	Appearance		0x02	Open a library to see your files and arrang	ge them by folder, date, and other properties.
E- Characteristic De	eclaration: P	eripheral Preferred Connection Parameters			🔁 Libraries	N Maria
⊡- <b>0</b> ×0006	0x2803	Characteristic Declaration	02:07:00:04:2A		Documents	Library
0x0007	0x2A04	Peripheral Preferred Connection Parameters	1	<b>0</b> x02	J Music	~
Primary Service Declarat	ion: Generic	Attribute			Pictures Pictures	Subversion
Ė- 0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute	)	Subversion	Library
E Characteristic D	eclaration: S	ervice Changed			Videos Videos	
	0x2803	Characteristic Declaration	22:0A:00:05:2A		Library	
0x000A	0x2A05	Service Changed		0x22	r Computer	
B Primary Service Declarat	ion				File name: Peripheral Attribute list	÷
Ė⊢ 0x000B	0x2800	Primary Service Declaration	B5:CA		Save as type: CSV (*.CSV)	•
E Characteristic D	eclaration					
⊡- 0x000C	0x2803	Characteristic Declaration	10:0D:00:A1:CA		Hide Folders	Save Cancel
0x000D	0xCAA1			0x10		
0x000E	0x2902	Client Characteristic Configuration				

Figure 6-69. Save Attribute List to a File

9. The tool also allows sending specific commands to the BLE peripheral device. These commands are present in the **Send Commands** tab on the device window. Select the command to be sent from the list and click **Send**, as shown in Figure 6-70.

CySmart 1.0					
Eile Help					
Select Dongle 🥒 C	onfigure Mas	iter Settings Manage PSMs			
Master CopSense Side	and LED [22-	43:65:56:34:12]			
Abbutes					Attribute Details Send Commands
Discover All Attribut	es 🚺 Enab	ole All Notifications 🧰 Read All Character	istics 💸 Bond 🛛 🏭 Export 🛛 🍵 Clear	View: Category 💌 🖪 🕻	B _ Commands
lande	UUID	UUID Description	Value	Properties	GATT     GATT     Galactererererererererererererererererererer
Primary Service Decla	ration: Generic	Access			Decover Al Pringy Services
E- 0x0001	0x2800	Primary Service Declaration	00.18 (Generic Access)		- Discover Primary Services by UUID
B-Characteristic	Declaration: D	evice Name			Helatonship Discovery     Discovery
i⇒ 0x0002	0x2803	Characteristic Declaration	02:03:00:00:2A		Oharacteristic Descriptor Discovery
- 0x000	3 0x2A00	Device Name	43 61 70 53 65 6E 73 65 20 53 6C 69 64 65 72 20 61 6E 64 20 4C 45	0x02	Gir Characteristic Value Read     Gir Characteristic Value Wate
Characteristic	Declaration: A	ppearance			E) Characteristic Descriptor
E- 0x0004	Dx0004 0x2803 Characteristic Declaration 02:05:00:01:2A			G- GAP	
0x000	5 0x2A01	Appearance	00.00	0x02	- update Contrection Parameters
Characteristic	Declaration: P	enpheral Preferred Connection Parameters			E
B- 0x0006	0x2803	Characteristic Declaration	02-07:00:04:2A		
- 0x000	7 0x2A04	Peripheral Preferred Connection Parameters	06 00 80 0C 00 00 E8 03	0x02	
Primary Service Decla	ration. Generic	Atribute			E Discover All Primary Services Parameters
B-0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)		Parameters None
B- Characteristic	Declaration: Se	ervice Changed			
E-0x0009	0x2803	Characteristic Declaration	22-0A-00-05-2A		
0x000	A 0x2A05	Service Changed	00:00:00:00	0x22	
Primary Service Decla	ration		77		
B-0x0008	0x2800	Primary Service Declaration	BG:CA		
- Characteristic	Declaration				Parameters
- 0x000C	0x2803	Characteristic Declaration	10:00:00:A2:CA		The command does not have any parameters
- 0x000	D DICAA2		44	0x10	
- 0x000	E 0x2902	Client Characteristic Configuration			Şend
menter 112CAP Chan	outs I	1.	1	1	

Figure 6-70. Send Commands



10. To disconnect from the device, go to the **Master** tab, select the connected device, and click **Disconnect**, as shown in Figure 6-71.

Figure 6-71. Disconnect BLE Device

😏 CySmart 1.0					
<u>F</u> ile <u>H</u> elp					
🚯 Select Dongle 🥒 Configur	re Master Settings	Manage PSM	1s		
Master CapSense Slider and LE	D [22:43:65:56:34:1	2]			
Discovered devices	_				
🔯 Start Scan 🙀 Disconnect	R Add to White	list			
# Device	Bluetooth Address	Address Type	RSSI	Advertisement Type	Connected
1 CapSense Slider and LED	22:43:65:56:34:12	Public	-66 dBm	Connectable undirected	
<u></u>					

**Note:** Refer to the CySmart PC tool user guide for more information. To access the user guide from the tool, go to **Help > Help Topics**.

# A. Appendix



## A.1 Schematics

## A.1.1 BLE Pioneer Board









VDD P P UART RX P SPI_SSEL	J8 SLP0_0_3 SLP3_4_5 SLP3_4_5 SLP3_4_5 SLP3_5_7 SL	PI 2 PD 1 PI 2 PI 2 PI 2 PI 2 SPI_MOSI PI 2 Keader
	1 Bridge Connections	
USB-Seria		

























## A.1.2 BLE Module





## A.1.3 Dongle









# A.2 Board Layout

## A.2.1 BLE Pioneer Board

Figure A-1. Primary Side of BLE Pioneer Board



Figure A-2. Ground Layer of BLE Pioneer Board



Figure A-3. Power Layer of BLE Pioneer Board





Figure A-4. Secondary Side of BLE Pioneer Board

Figure A-5. Primary Silkscreen of BLE Pioneer Board



Figure A-6. Secondary Silkscreen of BLE Pioneer Board




# A.2.2 PRoC BLE Module

Figure A-7. Primary Side of PRoC BLE Module



#### Figure A-8. Ground Layer of PRoC BLE Module



Figure A-9. VCC Layer of PRoC BLE Module









Figure A-11. Primary Silkscreen of PRoC BLE Module



Figure A-12. Secondary Silkscreen of PRoC BLE Module





## A.2.3 PSoC 4 BLE Module

Figure A-13. Primary Side of PSoC 4 BLE Module



Figure A-14. Ground Layer of PSoC 4 BLE Module



Figure A-15. VCC Layer of PSoC 4 BLE Module









Figure A-17. Primary Silkscreen of PSoC 4 BLE Module



Figure A-18. Secondary Silkscreen of PSoC 4 BLE Module





# A.2.4 Dongle

Figure A-19. Primary Side of Dongle



Figure A-20. Ground Layer of Dongle



Figure A-21. Power Layer of Dongle



















# A.3 Bill of Materials (BOM)

#### A.3.1 BLE Pioneer Board

ltem	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
1			-	PCB, 106.22 mm x 53.34 mm, High Tg, ENIG finish, 4 layer, Color = RED, Silk = WHITE.	Cypress	
2	1	BT1	CR2032 Bat- tery Holder	HOLDER COIN CELL CR2032 EJECT	MPD	BA2032
3	1	C1	1.0 uF	CAP TANT 1UF 35V 10% 1210	AVX Corporation	TAJB105K035RNJ
4	1	C2	4.7 uF	CAP TANT 4.7UF 20V 10% 1210	AVX Corporation	TAJB475K020RNJ
5	1	С3	0.01 uFd	CAP 10000PF 16V CERAMIC 0402 SMD	TDK Corporation	C1005X7R1C103K050BA
6	1	C4	100 uFd	CAP CER 100UF 6.3V 20% X5R 1210	TDK Corporation	C3225X5R0J107M250AC
7	15	C5,C8,C9,C10,C1 2,C14,C17,C18,C 19,C21,C23,C25, C26,C27,C28	0.1 uFd	CAP .1UF 16V CERAMIC X5R 0402	TDK Corporation	C1005X5R1A104K050BA
8	7	C6,C7,C11,C13,C 15,C16,C20	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	TMK107BJ105KA-T
9	1	C29	33 uF	CAP CER 33UF 6.3V 20% X5R 0805	TDK Corporation	C2012X5R0J336M125AC
10	6	D1,D2,D3,D4,D5, D10	MBR0520L	DIODE SCHOTTKY 0.5A 20V SOD-123	Fairchild Semicon- ductor	MBR0520L
11	3	D6,D7,D8	ESD diode	SUPPRESSOR ESD 5VDC 0603 SMD	Bourns Inc.	CG0603MLC-05LE
12	1	D9	3.9V Zener	DIODE ZENER 3.9V 500MW SOD12	Diodes Inc	BZT52C3V9-7-F
13	1	D11	2.7V Zener	DIODE ZENER 2.7V 500MW SOD123	ON Semiconductor	MMSZ4682T1G
14	1	F1	FUSE	PTC RESETTABLE .50A 15V 1812	Bourns	MF-MSMF050-2
15	2	J1, J4	8x1 RECP	CONN HEADER FEMALE 8POS .1" GOLD	Protectron Electro- mech	P9401-08-21
16	1	J2	6x2 RECP	CONN HEADER FMAL 12PS.1" DL GOLD	Protectron Electro- mech	P9403-12-21
17	1	J3	10x1 RECP	CONN HEADER FMALE 10POS .1" GOLD	Protectron Electro- mech	P9401-10-21
18	1	J8	8X2 RECP	CONN HEADER FMAL 16PS.1" DL GOLD	Protectron Electro- mech	P9403-16-21
19	1	J10	12X2 RECP	CONN HEADER 2.54MM 24POS GOLD	Sullins Connector Solutions	SBH11-PBPC-D12-ST-BK
20	1	J11	10X2 RECP	CONN HEADER 2.54MM 20POS GOLD	Sullins Connector Solutions	SBH11-PBPC-D10-ST-BK
21	1	J13	USB MINI B	MINI USB RCPT R/A DIP	TE Connectivity	1734510-1



ltem	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
22	1	J14	1X1 RECP	CONN RCPT 1POS .100" SNGL HORZ	Samtec Inc	BCS-101-L-S-HE
23	1	J15	2p_jumper	CONN HEADR BRKWAY .100 2POS STR	Protectron Electro- mech	P9101-02-12-1
24	1	J16	3p_jumper	CONN HEADR BRKWAY .100 3POS STR	Protectron Electro- mech	P9101-03-12-1
25	1	LED1	Power LED Amber	LED 595NM AMB DIFF 0805 SMD	Avago Technolo- gies	HSMA-C170
26	1	LED2	Status LED Green	LED GREEN CLEAR 0805 SMD	Chicago Miniature	CMD17-21VGC/TR8
27	1	LED3	RGB LED	LED RED/GREEN/BLUE PLCC4 SMD	Cree, Inc.	CLV1A-FKB- CJ1M1F1BB7R4S3
28	3	L1,L2,L3	330 OHM @ 100MHz	FERRITE CHIP 330 OHM 0805	Murata	BLM21PG331SN1D
29	3	Q2,Q4,Q6	PMOS	MOSFET P-CH 30V 2.2A SOT23	ON Semiconductor	NTR4171PT1G
30	1	Q1,	PMOS	MOSFET P-CH 30V 3.8A SOT23-3	Diodes Inc	DMP3098L-7
31	2	Q3,Q5	PMOS	MOSFET P-CH 20V 3.5A SOT23	NXP Semiconduc- tors	PMV48XP,215
32	1	R1	11K 1%	RES 11K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1102V
33	1	R2	560 ohm	RES 560 OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ561V
34	1	R3	14.7K 1%	RES 14.7K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1472V
35	1	R4	10K 1%	RES 10K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1002V
36	1	R5	4.3K 1%	RES 4.3K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF4301V
37	1	R6	100K	RES 100K OHM 1/10W 5% 0402 SMD	Panasonic - ECG	ERJ-2GEJ104X
38	14	R19,R26,R27,R3 6,R37,R38,R45,R 46,R47,R52,R53, R54,R55,R56	ZERO	RES 0.0 OHM 1/10W 0603 SMD	Panasonic - ECG	ERJ-3GEY0R00V
39	2	R8,R58	15K	RES 15K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1502V
40	2	R9,R20	10K 1%	RES 10K OHM 1/8W 1% 0805 SMD	Stackpole Electron- ics Inc	RMCF0805FT10K0
41	1	R10	10K	RES 10K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ103V
42	1	R11	820 ohm	RES 820 OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ821V
43	2	R13,R14	ZERO	RES 0.0 OHM 1/8W 0805 SMD	Panasonic-ECG	ERJ-6GEY0R00V
44	2	R15,R16	22E	RES 22 OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF22R0V
45	2	R17,R18	15K	RES 15K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ153V



Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
46	5	R22,R23,R28,R3 1,R35	2.2K	RES 2.2K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ222V
47	2	R24,R25	30K	RES 30K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ303V
48	2	R29,R30	1.5K	RES 1.5K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ152V
49	5	R39,R40,R41,R4 2,R43	560 ohm	RES 560 OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ561V
50	2	SW1,SW2	SW PUSH- BUTTON	SWITCH TACTILE SPST- NO 0.05A 12V	Panasonic - ECG	EVQ-PE105K
51	1	TP5	BLACK	TEST POINT PC MINI .040"D Black	Keystone Electron- ics	5001
52	2	TVS1,TVS2	5V 350W	TVS UNIDIR 350W 5V SOD-323	Dioded Inc.	SD05-7
53	1	U1	LDO	IC REG LDO ADJ 1A TO252-5	Rohm Semiconduc- tor	BA00BC0WFP-E2
54	1	U2	PSoC 5LP	68QFN PSoC 5LP chip for USB debug channel and USB-Serial interface	Cypress Semicon- ductor	CY8C5868LTI-LP039
55	1	U3	F-RAM	F-RAM 1-Mbit (128K X 8) I2C interface	Cypress Semicon- ductor	FM24V10-G
56	1	U4	DUAL PMOS	MOSFET 2P-CH 20V 430MA SOT-563	ON Semiconductor	NTZD3152PT1G
Install	on B	ottom of PCB As p	per the Silk Scre	een in the Corners		
57	4	N/A	N/A	BUMPER CYLIN 0.375" DIA BLK	3M	SJ61A4
Specia	al Jun	per Installation In	structions			
58	2	J15,J16	Install jumper across pins 1 and 2	Rectangular Connectors MINI JUMPER GF 6.0MM CLOSE TYPE BLACK	Kobiconn	151-8010-E
Label						
59	1	N/A	N/A	LBL, PCA Label, Vendor Code, Datecode, Serial Number 121-60158-01 Rev 04 (YYWWVVXXXX)	Cypress Semicon- ductor	
60	1	N/A	N/A	LBL, QR code, 12mm X 12mm	Cypress Semicon- ductor	
No loa	d cor	nponents			-	
61	1	C22	0.1 uFd	CAP .1UF 16V CERAMIC Y5V 0402	TDK Corporation	C1005X5R1A104K050BA
62	1	C24	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	TMK107BJ105KA-T
63	9	R7,R59,R32,R33, R34,R48,R49,R5 0,R51	Zero Ohm	RES 0.0 OHM 1/10W JUMP 0603	TE Connectivity	1623094-1
64	1	R21	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
65	2	J7,J6	50MIL KEYED SMD	CONN HEADER 10 PIN 50MIL KEYED SMD	Samtec	FTSH-105-01-L-DV-K



ltem	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
66	1	<b>1</b> 8	2 PIN HDR	CONN HEADER FEMALE 2POS .1" GOLD	Sullins Connector Solutions	PPPC021LFBN-RC
67	2	TP4,TP5	BLACK	ACK TEST POINT 43 HOLE 65 Keyston PLATED BLACK ics		5001
68	3	TP1,TP2,TP3	RED	D TEST POINT 43 HOLE 65 Ke PLATED RED ics		5000
69	2	R44,R12	ZERO	RES 0.0 OHM 1/8W 0805 SMD	Panasonic-ECG	ERJ-6GEY0R00V
70	1	J12	3x2 RECPT	CONN HEADER FMAL 6PS .1" DL GOLD	Sullins Connector Solutions	PPPC032LFBN-RC
71	1	J5	6X1 RECP RA	CONN FEMALE 6POS .100" R/A GOLD	Sullins Connector Solutions	PPPC061LGBN-RC



## A.3.2 BLE Module

#### A.3.2.1 CY5671 PRoC BLE Module

Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
1	1	600-60196-01	-	PRoC BLE Module printed circuit board	Cypress qualified ven- dor	600-60196-01 Rev03
2	8	C1,C3,C5,C7,C9,C 11,C16,C18	0.1 uF	CAP .1UF 16V CERAMIC Y5V 0402	Samsung Electro- Mechanics America, Inc	CL05F104ZO5NNNC
3	10	C2,C4,C6,C8,C10, C12,C15,C17,C19, C20	1.0 uF	CAP CERAMIC 1.0UF 25V X5R 0603 10%	TDK Corporation	C1608X5R1E105K080AC
4	1	C21	2200 pF	CAP CER 2200PF 50V 5% NP0 0805	Murata Electronics	GRM2165C1H222JA01D
5	1	C22	10000 pF	CAP CER 10000PF 50V 5% NP0 0805	Murata Electronics	GRM2195C1H103JA01D
6	1	C23	36 pF	CAP CER 36PF 50V 5% NP0 0402	Murata Electronics	GRM1555C1H360JA01D
7	1	C24	18 pF	CAP CER 18PF 50V 1% NP0 0402	Murata Electronics	GRM1555C1H180FA01D
8	1	C14	1.5 pF	CAP CER 1.5PF 50V NP0 0402	Johanson Technology Inc	500R07S1R5BV4T
9	1	J1	HEADE R 24	CONN HEADR FMALE 24POS .1" DL AU	Sullins Connector	SFH11-PBPC-D12-ST-BK
10	1	J2	HEADE R 20	CONN HEADR FMALE 20POS .1" DL AU	Sullins Connector	SFH11-PBPC-D10-ST-BK
11	1	L1	6.8nH	CER INDUCTOR 6.8NH 0402	Johanson Technology Inc	L-07C6N8JV6T
12	3	L2,L3,L4	330 Ohm @100 MHz	FERRITE CHIP 330 OHM 0805	Murata Electronics	BLM21PG331SN1D
13	1	U1	PRoC BLE	56 QFN PRoC BLE	Cypress Semiconduc- tor	CYBL10563-56LQXI
14	1	Y1	32.768K Hz	CRYSTAL 32.768KHZ 12.5PF SMD	ECS Inc	ECS327-12.5-34B
15	1	Y2	24MHz	CRYSTAL 24.000 MHZ 8PF SMD	ECS Inc	ECS-240-8-36CKM
16	1	LBL	-	LBL, PCA Label, Vendor Code, Datecode, Serial Number 121-60160-01 Rev 04 (YYWWV- VXXXXX)	Cypress qualified ven- dor	-
No Lo	oad co	omponents				
17	1	C13	1.2 pF	CAP CER 1.2PF 50V NP0 0402	Johanson Technology Inc	500R07S1R2BV4T
18	1	C25	100pF	CAP CER 100PF 50V 10% X7R 0603	Kemet	C0603C101K5RACTU



Item	Qty	Reference	Value Description		Manufacturer	Mfr Part Number
19	1	R1	Zero Ohm	RES 0.0 OHM 1/8W 0605 SMD	TE Connectivity	1623094-1
20	1	R2	Rbleed	No Load	-	-
21	1	R3	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
22	1	J3	4 HEADE R	CONN HEADER 4POS .100 R/A 15AU	FCI	68016-204HLF
23	4	TP1,TP2,TP3,TP4	RED	TEST POINT 43 HOLE 65 PLATED RED	Keystone Electronics	5000
24	1	TP5	BLACK	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Electronics	5001



#### A.3.2.2 CY8CKIT-142 PSoC 4 BLE Module

Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
1	1	600-60195-01	-	PSoC 4 BLE Module printed circuit board	Cypress qualified vendor	600-60195-01 Rev03
2	8	C1,C3,C5,C7,C9, C11,C16,C18	0.1 uF	CAP .1UF 16V CERAMIC Y5V 0402	Samsung Electro- Mechanics Amer- ica, Inc	CL05F104ZO5NNNC
3	10	C2,C4,C6,C8,C10 ,C12,C15,C17,C1 9,C20	1.0 uF	CAP CERAMIC 1.0UF 25V X5R 0603 10%	TDK Corporation	C1608X5R1E105K080AC
4	1	C21	2200 pF	CAP CER 2200PF 50V 5% NP0 0805	Murata Electronics	GRM2165C1H222JA01D
5	1	C22	10000 pF	CAP CER 10000PF 50V 5% NP0 0805	Murata Electronics	GRM2195C1H103JA01D
6	1	C23	36 pF	CAP CER 36PF 50V 5% NP0 0402	Murata Electronics	GRM1555C1H360JA01D
7	1	C24	18 pF	CAP CER 18PF 50V 1% NP0 0402	Murata Electronics	GRM1555C1H180FA01D
8	1	C14	1.5 pF	CAP CER 1.5PF 50V NP0 0402	Johanson Technol- ogy Inc	500R07S1R5BV4T
9	1	J1	HEADER 24	CONN HEADR FMALE 24POS .1" DL AU	Sullins Connector	SFH11-PBPC-D12-ST-BK
10	1	J2	HEADER 20	CONN HEADR FMALE 20POS .1" DL AU	Sullins Connector	SFH11-PBPC-D10-ST-BK
11	1	L1	6.8nH	CER INDUCTOR 6.8NH 0402	Johanson Technol- ogy Inc	L-07C6N8JV6T
12	3	L2,L3,L4	330 Ohm @100 MHz	FERRITE CHIP 330 OHM 0805	Murata Electronics	BLM21PG331SN1D
13	1	U1	PSoC 4BLE	56 QFN PSoC 4 BLE	Cypress Semicon- ductor	CY8C4247LQI-BL483
14	1	Y1	32.768K Hz	CRYSTAL 32.768KHZ 12.5PF SMD	ECS Inc	ECS327-12.5-34B
15	1	Y2	24MHz	CRYSTAL 24.000 MHZ 8PF SMD	ECS Inc	ECS-240-8-36CKM
16	1	LBL	-	LBL, PCA Label, Vendor Code, Datecode, Serial Number 121-60159-01 Rev 04 (YYWWVVXXXX)	Cypress qualified vendor	-
No L	oad co	omponents		-	-	
17	1	C13	1.2 pF	CAP CER 1.2PF 50V NP0 0402	Johanson Technol- ogy Inc	500R07S1R2BV4T
18	1	C25	100pF	CAP CER 100PF 50V 10% X7R 0603	Kemet	C0603C101K5RACTU
19	1	R1	Zero Ohm	RES 0.0 OHM 1/10W JUMP 0603	TE Connectivity	1623094-1
20	1	R2	Rbleed	No Load	-	-



Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
21	1	R3	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
22	1	J3	4 HEADER	CONN HEADER 4POS .100 R/A 15AU	FCI	68016-204HLF
23	4	TP1,TP2,TP3,TP4	RED	TEST POINT 43 HOLE 65 PLATED RED	Keystone Electron- ics	5000
24	1	TP5	BLACK	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Electron- ics	5001



# A.3.3 Dongle

ltem	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
1	1	600-60197-01	-	PCB, 60 mm x 30 mm, High Tg, ENIG finish, 2 layer, Color = BLACK, Silk = WHITE.	Cypress qualified vendor	600-60197-01 Rev02
2	17	C1,C4,C6,C7,C9,C11 ,C14,C16,C25,C28,C 29,C32,C35,C36,C38 ,C41,C42	0.1 uFd	CAP .1UF 16V CERAMIC Y5V 0402	TDK Corporation	C1005X5R1A104K050BA
3	17	C2,C3,C5,C8,C10,C 12,C13,C15,C17,C18 ,C24,C26,C30,C31,C 33,C34,C40	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	ТМК107ВЈ105КА-Т
4	1	C19	1.2 pFd	CAP CER 1.2PF 50V NP0 0402	Johanson Technol- ogy Inc	500R07S1R2BV4T
5	1	C22	36 pF	CAP CER 36PF 50V 5% NP0 0402	Murata Electronics	GRM1555C1H360JA01D
6	1	C23	18 pF	CAP CER 18PF 50V 1% NP0 0402	Murata Electronics	GRM1555C1H180FA01D
7	1	C39	0.01 uFd	CAP 10000PF 16V CERAMIC 0402 SMD	TDK Corporation	C1005X7R1C103K050BA
8	3	D1,D2,D3	ESD diode	SUPPRESSOR ESD 5VDC 0603 SMD	Bourns Inc.	CG0603MLC-05LE
9	1	F1	FUSE	PTC RESETTABLE .50A 15V 1812	Bourns	MF-MSMF050-2
10	1	J1	USB A PLUG	CONN PLUG USB 4POS RT ANG PCB	Molex Inc	480370001
11	1	J2	50MIL KEYED SMD	CONN HEADER 10POS DUAL SHRD SMD	FCI	20021521-00010T1LF
12	1	LED1	Status LED Blue	LED BLUE CLEAR THIN 0805 SMD	LiteOn Inc	LTST-C171TBKT
13	1	LED2	Status LED Green	LED GREEN CLEAR 0805 SMD	Chicago Miniature	CMD17-21VGC/TR8
14	1	LED3	Power LED Red	LED SUPER RED CLEAR 0805 SMD	LiteOn Inc	LTST-C170KRKT
15	1	L1	5.1 nH	CER INDUCTOR 5.1NH 0402	Johanson Technol- ogy Inc	L-07C5N1SV6T
16	2	R8,R11	Zero Ohm	RES 0.0 OHM 1/8W 0805 SMD	Panasonic-ECG	ERJ-6GEY0R00V
17	1	R7	820 ohm	RES 820 OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ821V
18	2	R22,R25	820 ohm	RES 820 OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ821V
19	2	R9,R10	2.2K	RES 2.2K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ222V



Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
20	9	R1,R2,R3,R4,R12,R 13,R14,R15,R26	ZERO	RES 0.0 OHM 1/10W 0603 SMD	Panasonic - ECG	ERJ-3GEY0R00V
21	2	R17,R18	22E	RES 22 OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF22R0V
22	1	R21	100K	RES 100K OHM 1/10W 5% 0402 SMD	RES 100K OHM 1/10W 5% 0402 SMD Panasonic - ECG	
23	2	R19,R20	15K	RES 15K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ153V
24	2	R23,R24	30K	RES 30K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ303V
25	2	SW1,SW2	SW RA PUSH	SWITCH TACTILE SPST-NO 0.05A 12V	Panasonic - ECG	EVQ-P3401P
26	1	TVS1	5V 350W	TVS UNIDIR 350W 5V SOD-323	Diodes Inc.	SD05-7
27	1	U1	PRoC BLE	PRoC BLE, Programma- ble Radio on Chip, 56QFN	Cypress Semiconduc- tor	CYBL10162-56LQXI
28	1	U2	DUAL PMOS	MOSFET 2P-CH 20V 430MA SOT-563	ON Semiconductor	NTZD3152PT1G
29	1	U3	PSoC 5LP	PSoC 5LP Programma- ble System on Chip, 68QFN	Cypress Semiconduc- tor	CY8C5868LTI-LP039
30	1	Y1	32.768K Hz	CRYSTAL 32.768KHZ 12.5PF SMD	ECS Inc	ECS327-12.5-34B
31	1	Y2	24MHz	CRYSTAL 24.000 MHZ 8PF SMD	ECS Inc	ECS-240-8-36CKM
32	1	N/A	N/A	LBL, PCA Label, Ven- dor Code, Datecode, Serial Number 121- 60161-01 Rev 03 (YYW- WVVXXXXX); Only bar- code	Cypress qualified vendor	-
No lo	ad co	omponents				
33	1	C20	1.2 pF	CAP CER 1.2PF 50V NP0 0402	Johanson Technol- ogy Inc	500R07S1R2BV4T
34	1	C21	100pF	CAP CER 100PF 50V 10% X7R 0603	Kemet	C0603C101K5RACTU
35	1	C37	0.1 uFd	CAP .1UF 16V CERAMIC Y5V 0402	TDK Corporation	C1005X5R1A104K050BA
36	1	C27	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	ТМК107ВЈ105КА-Т
37	1	R5	Zero Ohm	RES 0.0 OHM 1/10W JUMP 0603	TE Connectivity	1623094-1
38	2	R6,R16	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
39	15	TP1,TP2,TP3,TP4,T P5,TP6,TP7,TP8,TP 9,TP10,TP11,TP12,T P13,TP14,TP15	No load	No load	-	-



# A.4 KitProg Status LED States

	User Indication	Scenario	Action Required by user
1	LED blinks fast: Time period = 0.25 s	LED starts blinking at power up, if bootloadable file is corrupt.	Bootload the <i>KitProg.cyacd</i> file: in PSoC Programmer, connect to the kit, open the <b>Utilities</b> tab and press <b>Upgrade Firmware</b> button.
2	LED blinks slow: Time period = 1.50 s	Entered Bootloader mode by holding the PSoC 4 Reset button during kit power-up.	Release the Reset button and re-plug power if you entered this mode by mistake. If the mode entry was intentional, bootload the new.cyacd file using the Bootloader Host tool shipped with PSoC Creator.
3	LED blinks very fast: Time period = 0.67 s	SWD operation is in progress. Any I2C traffic. Kit's COM port connect/discon- nect event (one blink).	In PSoC Programmer, watch the log window for status mes- sages for SWD operations. In the Bridge Control Panel, the LED blinks on I2C command requests. In BCP or any other serial port terminal program, distinguish the kit's COM port number by the blinking LED when the port is connected or disconnected.
4	LED is ON.	USB enumeration successful. Kit is in the idle state waiting for commands.	The kit functions can be used by PSoC Creator, PSoC Pro- grammer, Bridge Control Panel, and any serial port terminal program.
5	LED is OFF.	Power LED is ON.	This means that the USB enumeration was unsuccessful. This can happen if the kit is not powered from the USB host or the kit is not connected to the USB host through the USB cable. Verify the USB cable and check if PSoC Programmer is installed on the PC.



# A.5 Adding BLE module compatible headers on your own baseboard

The baseboard should have two headers, one 20-pin and another 24-pin. Dimension of these connects are detailed below.



You can get these at Digikey.

#	Description	Manufacturer	Mfr Part Number	Digikey part #
1	CONN HEADER 2.54MM 24POS GOLD	Sullins Connector Solutions	SBH11-PBPC-D12-ST-BK	SBH11-PBPC-D12-ST-BK-ND
2	CONN HEADER 2.54MM 20POS GOLD	Sullins Connector Solutions	SBH11-PBPC-D10-ST-BK	S9172-ND

# **Revision History**



#### CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit Guide Revision History

Revision	Issue Date	Origin of Change	Description of Change
**	11/10/2014	ROIT	New kit guide.
			Updated Safety Information chapter on page 6:
			Updated entire section.
			Updated Software Installation chapter on page 20:
			Updated "Before You Begin" on page 20:
			Updated description.
			Updated Example Projects chapter on page 42:
		ROIT	Updated "CapSense Slider and LED" on page 47:
			Updated "Flow Chart" on page 51:
			Updated Figure 4-11.
			Updated "Verify Output" on page 52:
			Updated "CySmart PC Tool" on page 52:
			Updated Figure 4-17.
			Updated Figure 4-24.
			Updated "CySmart iOS/Android App" on page 58:
<b></b>			Replaced "iOS" with "iOS/Android" in heading.
А			Updated "CapSense Proximity" on page 62:
			Updated "Project Description" on page 62:
			Updated Figure 4-33.
			Updated "Flow Chart" on page 66:
			Updated Figure 4-38.
			Updated "Verify Output" on page 67:
			Updated "CySmart PC Tool" on page 67:
			Updated Figure 4-45, Figure 4-48.
			Updated "CySmart iOS/Android App" on page 71:
			Replaced "iOS" with "iOS/Android" in heading and in all other instances.
			Updated "Direct Test Mode (DTM)" on page 84:
			Updated "Hardware Connection" on page 86:
			Updated description.
			Updated "Verify Output" on page 87:
			Updated description.

#### CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit Guide Revision History (continued)

Document Title: CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit Guide						
Revision	Issue Date	Origin of Change	Description of Change			
*A (cont.)	Issue Date	ROIT	Description of ChangeUpdated Hardware chapter on page 88:Updated "Pioneer Baseboard" on page 88:Updated "Power System" on page 88:Updated description.Updated Figure 5-1.Updated "Protection Circuits" on page 90:Updated "Current Measurement Jumper" on page 92:Updated description.Updated "Current Measurement Jumper" on page 92:Updated "Expansion Connectors" on page 95:Updated "Arduino Compatible Headers (J1, J2, J3, J4, and J12-unpopulated)" on page 95:Updated Figure 5-8.Removed figure "Schematics of Arduino Connectors".Updated Pioneer Board LEDs" on page 101:Updated description.Updated description.Updated description.Updated "Serial Interconnection Between PSoC 5LP and BLE Module" on page 104:Updated "Buetooth Module Headers" on page 105:Updated description.Updated description.Updated Bluetooth Module Board" on page 106:Updated "BLE Module Board" on page 106:Updated "BLE Module Board" on page 108:Updated "BLE Passives" on page 111:Updated "BLE Passives" on page 111:Updated description.Updated description.Updated "BLE Dongle Board" on page 111:Updated description.Updated description.Updated description.Updated description.Updated description.Updated description.Updated "BLE Dongle Board" on page 111:Updated description.Updated description.Updated description.Updated description. </td			
			Updated description.			



#### CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit Guide Revision History (continued)

Document Title: CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit Guide							
Document Number: 001-93731							
Revision	Issue Date	Origin of Change	Description of Change				
*A (cont.)			Updated Appendix chapter on page 168:				
			Updated "Schematics" on page 168:				
		Updated entire section.					
			Updated "Bill of Materials (BOM)" on page 184:				
		ROIT	Updated "BLE Pioneer Board" on page 184:				
			Updated entire section.				
			Updated "BLE Module" on page 188:				
			Updated "CY5671 PRoC BLE Module" on page 188:				
			Updated entire section.				
			Updated "CY8CKIT-142 PSoC 4 BLE Module" on page 190:				
			Updated entire section.				
			Updated "Dongle" on page 192:				
			Updated entire section.				
			Added "Adding BLE module compatible headers on your own baseboard" on page 195.				