

Objective

This example project implements a BLE-controlled Segment LCD display with PSoC 4 BLE

Overview

In this example, PSoC 4 BLE is configured as a BLE **GAP Peripheral** with a **custom Profile** to communicate with a Segment LCD. The **custom Profile** contains a **Characteristic** that is used to send one byte of data to a **GAP Central** device that can Start/Stop a timer on the LCD. The timer on the LCD is displayed in seconds.

Segment LCDs are displays that can only show digits or alphanumeric characters. They are called segment displays because they are composed of several segments that switch On/Off to draw on the screen. These segments are usually single LEDs or liquid crystals, mostly used in digital watches, pocket calculators, multi-meters, etc. Typically, segment LCDs require an external driver IC, but with PSoC you have direct segment LCD drive capabilities, removing the need for any external driver ICs. The PSoC 4 Segment LCD Component employs a patent-pending digital correlation LCD drive mode, enabling very low power consumption (~3-μA at 30Hz refresh rate). The Component can support LCDs with up to four common and 32 segment electrodes. It can drive 14-segment and 16-segment alphanumeric, 7-segment numeric, and dot matrix displays.

Using this example, you can implement a true one-chip solution that includes a user interface, a BLE wireless connection and a microcontroller with just one PSoC 4 BLE device.

Requirements

Tool: [PSoC Creator 3.1 Service Pack 1](#)

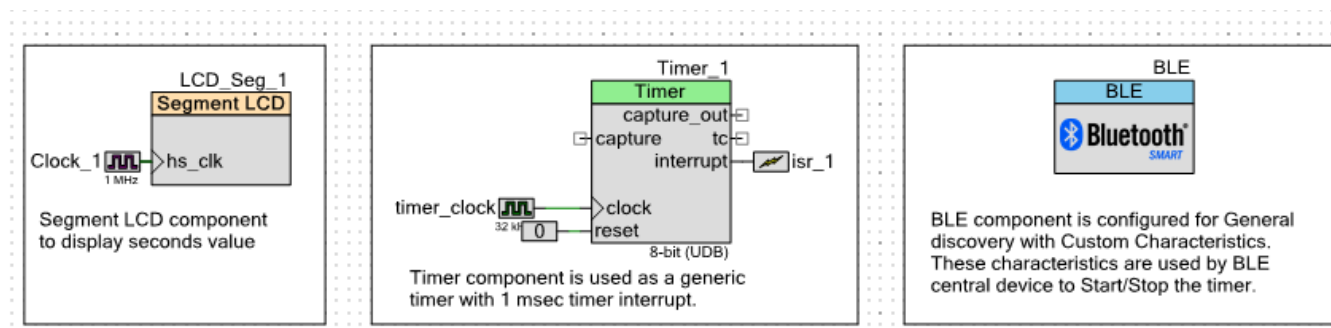
Programming Language: C (GCC 4.8.4), Cortex-M0 assembler (included in PSoC Creator)

Associated Parts: CY8C4274LQI-BL483

Related Hardware: [CY8CKIT-042-BLE Pioneer Kit](#)

PSoC Creator Schematic

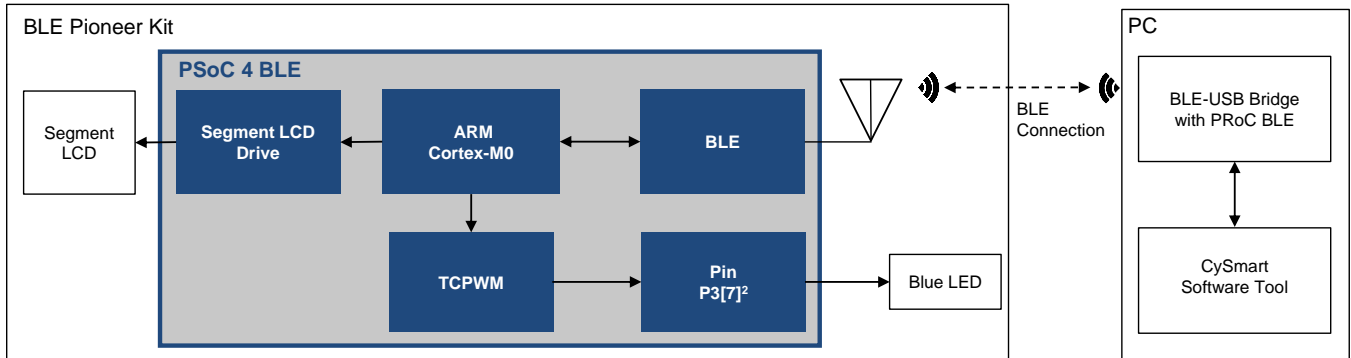
Figure 1 PSoC Creator Schematic



Hardware Setup

A custom segment LCD is used for this project. You can use a segment LCD with 3 Commons and 12 Segments. Refer to [AN87391 - PSoC® 4 Segment LCD Direct Drive](#) to know more about the types of LCDs supported.

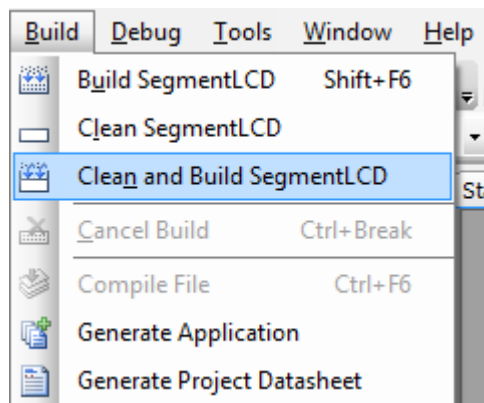
Figure 2: Block Diagram



Operation

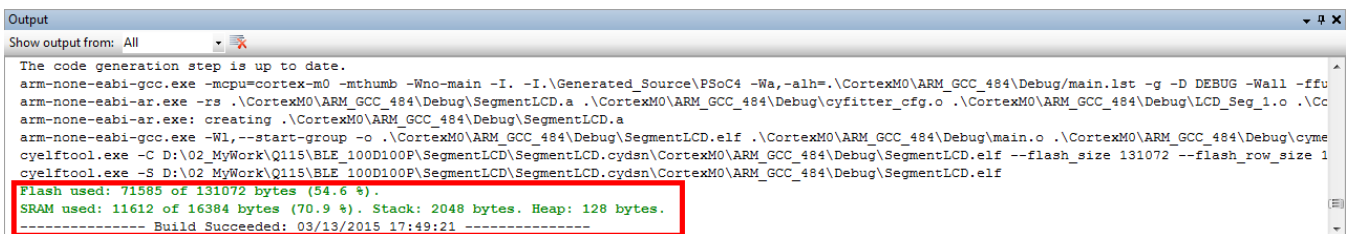
1. Open the project **SegmentLCD.cywrk** in PSoC Creator 3.1 Service Pack 1.
2. In PSoC Creator, select **Build > Clean and Build SegmentLCD**, as shown in Figure 3.

Figure 3 Build Project



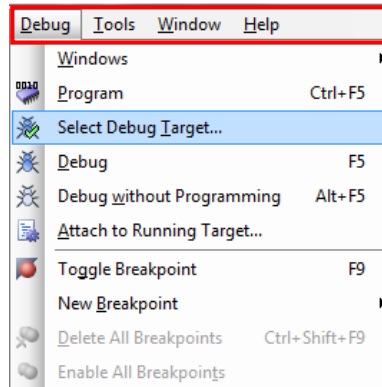
3. On a successful build, the total flash and SRAM usage is reported as shown in Figure 4.

Figure 4 Build Succeeded



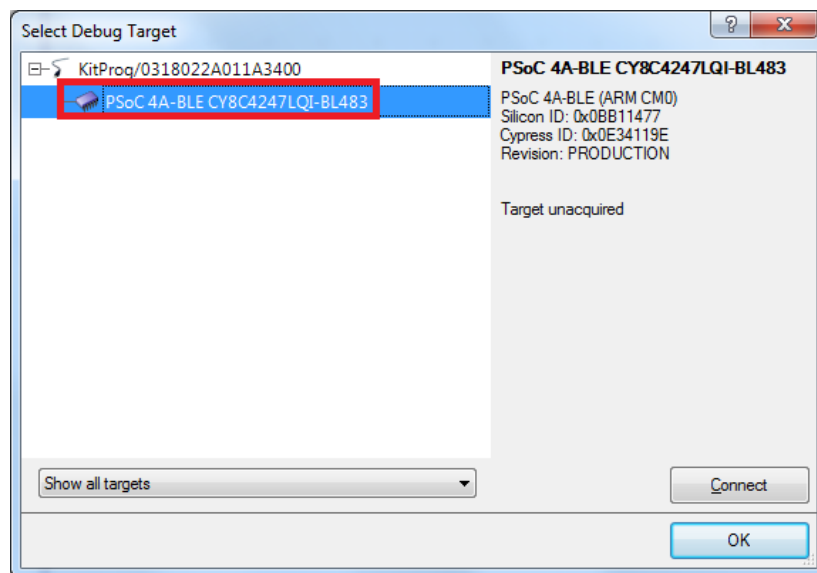
4. Select **Debug > Select Debug Target**, as shown in Figure 5.

Figure 5 Selecting Debug Target



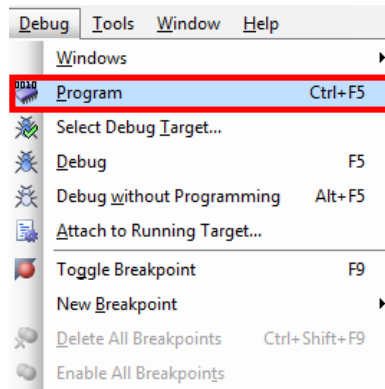
5. In the **Select Debug Target** dialog box, click **Port Acquire**, and then click **Connect** as shown in Figure 6. Click **OK** to close the dialog box.

Figure 6 Connecting to a Device



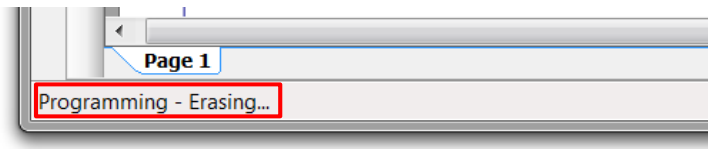
6. Select **Debug > Program** to program the device with the project, as shown in Figure 7.

Figure 7 Programming the Device



7. You can view the programming status on the PSoC Creator status bar (lower-left corner of the window). See Figure 8.

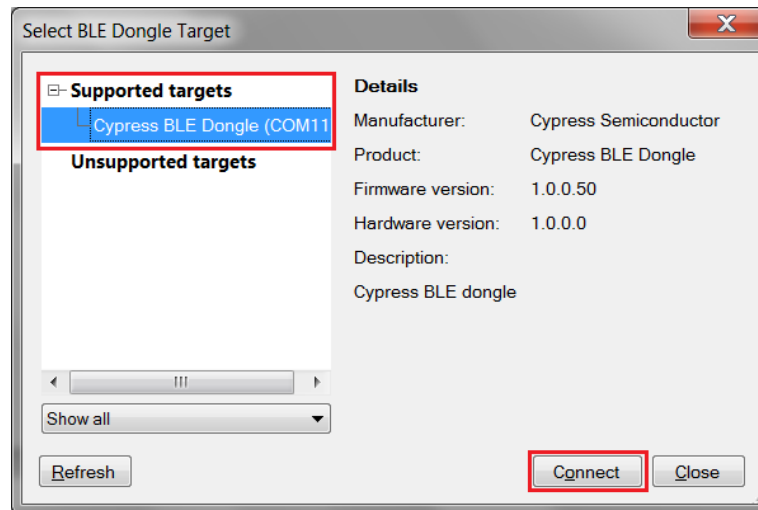
Figure 8 Programming Status



Testing

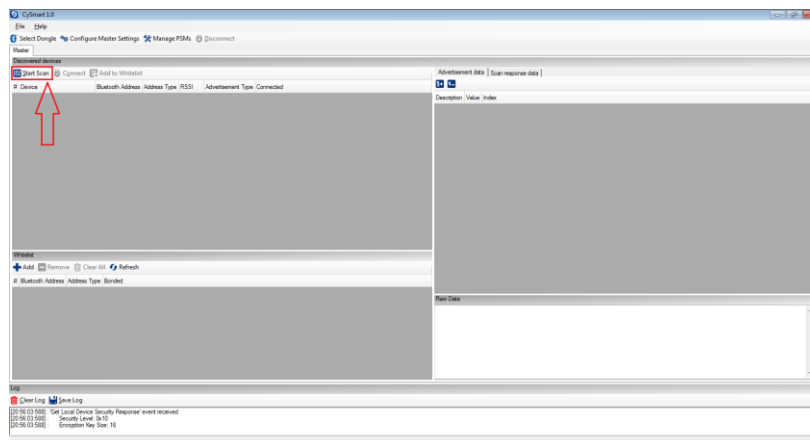
1. Plug the **CySmart USB Dongle** (included with the BLE Pioneer Kit) in your computer's USB port.
2. On your computer, launch **CySmart 1.0**. It is located in the **All Programs -> Cypress -> CySmart** folder in the Windows start menu. The tool opens up and asks you to **Select BLE Dongle Target**. Select the **Cypress BLE Dongle (COMxx)** and click **Connect**, as shown in Figure 9.

Figure 9 CySmart: Select BLE Dongle Target



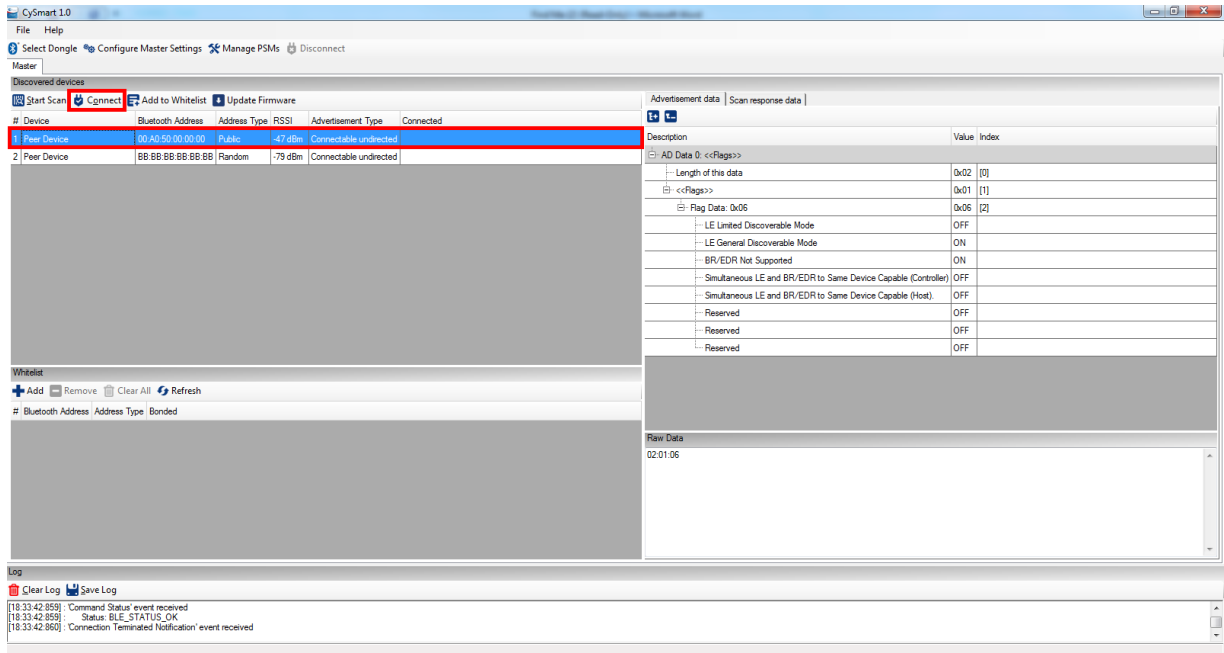
3. When the **CySmart USB Dongle** is connected, click on **Start Scan** to find your BLE device. See Figure 10.

Figure 10 Finding a BLE Device



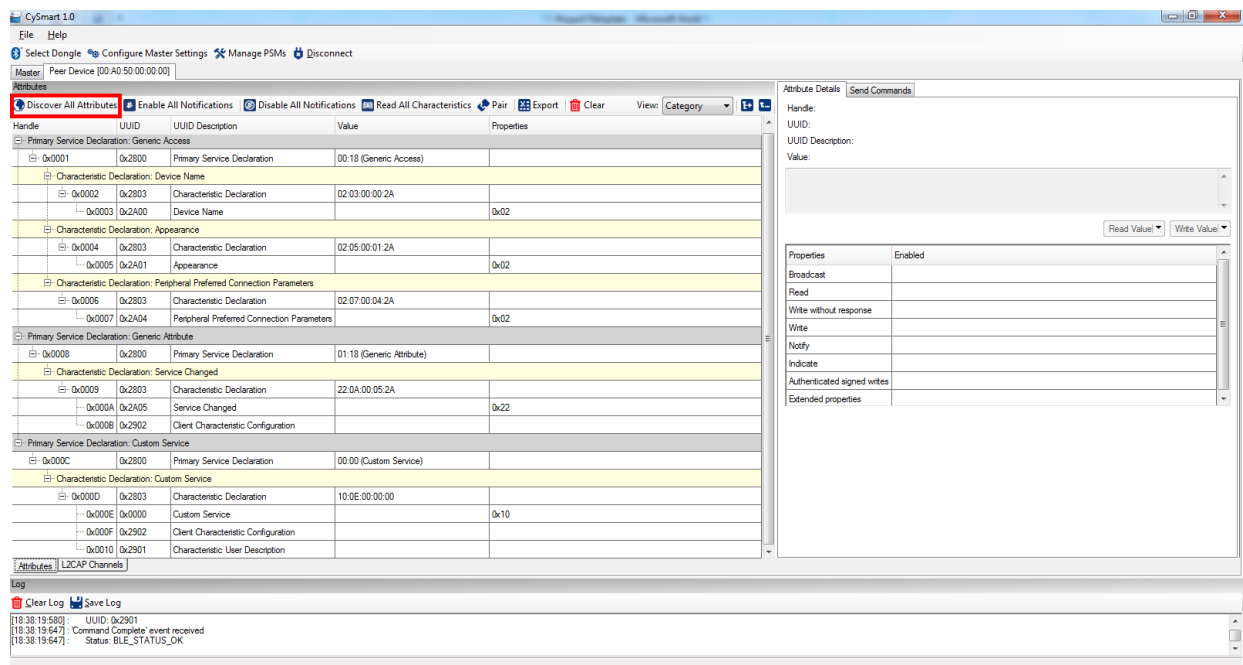
4. The scanning stops automatically once all the nearby devices are known. The tool lists all the nearby devices in the Discovered devices section.
5. Click on your device name to see the Advertisement data and Scan response data packets on the right. See Figure 11.

Figure 11 Checking Discovery Details of a Connected BLE Device



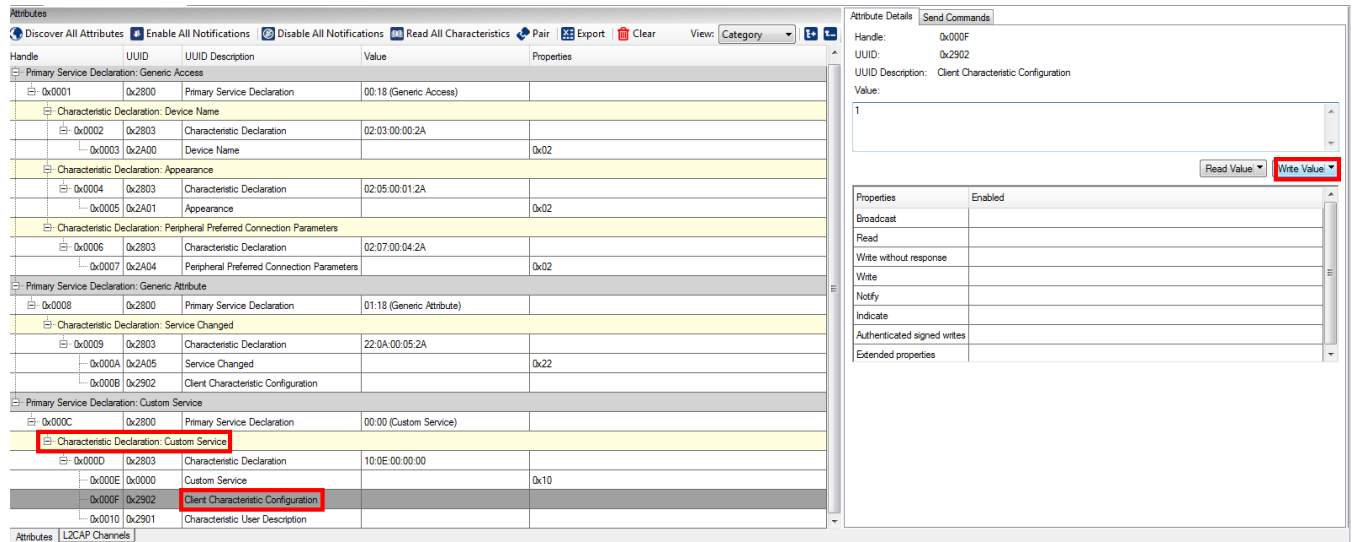
6. Click **Connect** as seen in Figure 11 to connect to your BLE device.
7. The tool will now open a separate tab for the device. Click **Discover All Attributes** to list all the **Attributes** in the device, with their respective **UUIDs** and descriptions. See Figure 12

Figure 12 Discovering Attributes of a Connected BLE Device



- Locate the **Client Characteristic Configuration Attribute** under **Custom Service**. On the right, write a value of 1 to start the timer on the kit. See Figure 13.

Figure 13 Writing Attribute Value

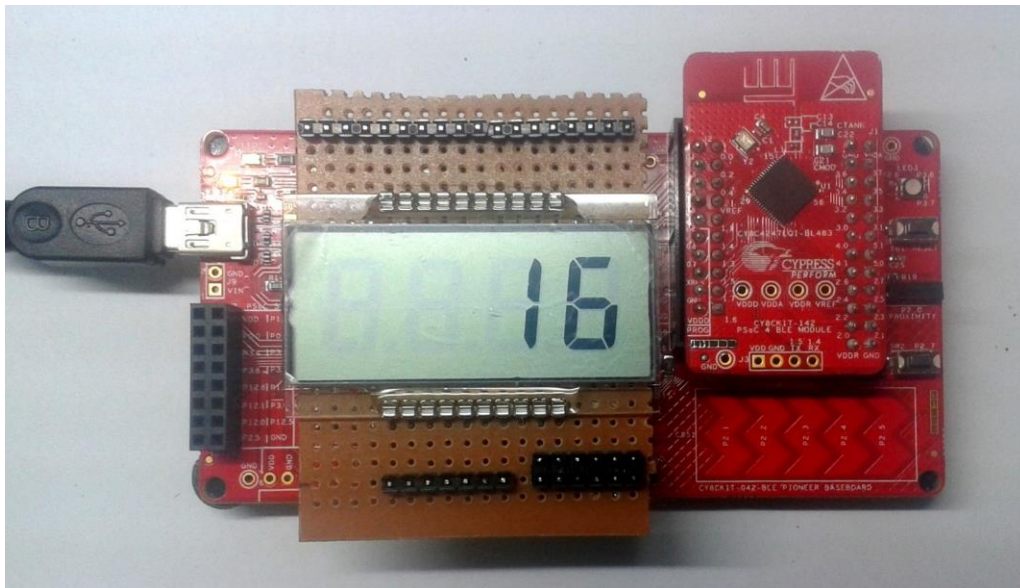


Handle	UUID	UUID Description	Value	Properties
Primary Service Declaration: Generic Access				
0x0001	0x2800	Primary Service Declaration	00:18 (Generic Access)	
Characteristic Declaration: Device Name				
0x0002	0x2803	Characteristic Declaration	02:03:00:00:2A	
0x0003	0x2A00	Device Name		0x02
Characteristic Declaration: Appearance				
0x0004	0x2803	Characteristic Declaration	02:05:00:01:2A	
0x0005	0x2A01	Appearance		0x02
Characteristic Declaration: Peripheral Preferred Connection Parameters				
0x0006	0x2803	Characteristic Declaration	02:07:00:04:2A	
0x0007	0x2A04	Peripheral Preferred Connection Parameters		0x02
Primary Service Declaration: Generic Attribute				
0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)	
Characteristic Declaration: Service Changed				
0x0009	0x2803	Characteristic Declaration	22:0A:00:05:2A	
0x000A	0x2A05	Service Changed		0x22
0x000B	0x2902	Client Characteristic Configuration		
Primary Service Declaration: Custom Service				
0x000C	0x2800	Primary Service Declaration	00:00 (Custom Service)	
Characteristic Declaration: Custom Service				
0x000D	0x2803	Characteristic Declaration	10:0E:00:00:00	
0x000E	0x0000	Custom Service		0x10
0x000F	0x2902	Client Characteristic Configuration		
0x0010	0x2901	Characteristic User Description		

- Write a value of 2 to stop the timer.

Expected Results

Figure 14: Timer Running on the BLE Pioneer Kit



Related Documents

Table 1 lists all relevant application notes, code examples, knowledge base articles, device datasheets, and Component / user module datasheets.

Table 1. Related Documents

Document	Title	Comment
AN91267	Getting Started with PSoC 4 BLE	Provides an introduction to PSoC 4 BLE device that integrates a Bluetooth Low Energy radio system along with programmable analog and digital resources.
AN91445	Antenna Design Guide	Provides guidelines on how to design an antenna for BLE applications.
AN87391	PSoC® 4 Segment LCD Direct Drive	Demonstrates how to interface a segment LCD glass with PSoC 4