User's Guide

SWRU497A–November 2016–Revised August 2019

CC2564C TI Dual-Mode Bluetooth® Stack on MSP432™ MCUs

1 Introduction

The CC2564C dual-mode *Bluetooth*® stack on MSP432™ microcontroller unit (MCU) software (CC2564CMSP432BTBLESW) for Bluetooth and Bluetooth low energy from TI enables the MSP432 MCU and is comprised of single-mode and dual-mode offerings implementing the Bluetooth 4.2 specification. The Bluetooth stack is fully qualified (QDID 85355 and QDID 69886), provides simple command line sample applications to speed development, and has MFi capability upon request.

For a complete evaluation solution, the CC2564CMSP432BTBLESW software development kit (SDK) works directly with the MSP-EXP432P401R LaunchPad™ Development Kit. The stack for the MSP432 MCU is certified and royalty free (CC2564CMSP432BTBLESW).

The software works with the dual-mode Bluetooth CC256XCQFN-EM evaluation module (EM) through the BOOST-CCEMADAPTER. For audio and voice applications, the software requires an audio codec EVM like the CC3200AUDBOOST. The software also provides a complete Bluetooth BR, EDR, and low energy HCI solution that reduces design effort and ensures a faster time to market. The dual-mode Bluetooth BoosterPack™ Plug-in Module includes TI's seventh-generation Bluetooth core and provides a product-proven solution that is Bluetooth-4.2 compliant. The device provides one of the best Bluetooth RF performances with a transmit power and receive sensitivity that provides a range of about 2× compared to other Bluetooth Low Energy only solutions. TI's power-management hardware and software algorithms provide significant power savings in commonly used Bluetooth BR, EDR, and Low Energy modes of operation.

2 Features

Features of the device include the following:

- Supports dual-mode Bluetooth 4.2—Bluetooth certified and royalty free
- Offers fully qualified Bluetooth stack (QDID 85355 and QDID 69886)
- Offers full-thread safety
- Supports nonthreaded (no OS) environment
- Offers fully documented API interface
- Works with any MSP432 MCU
- Includes available sample applications for the MSP-EXP432P401R LaunchPad development kit with the support of the CC256xCQFN-EM through the BOOST-CCEMADAPTER
- Supports CCS, Keil®, and IAR Embedded Workbench® IDEs

(1) MSP432, LaunchPad, BoosterPack, Code Composer Studio are trademarks of Texas Instruments.
(2) Keil, ARM, µVision are registered trademarks of ARM Limited (or its subsidiaries).
(3) Bluetooth is a registered trademark of Bluetooth SIG.
(4) IAR Embedded Workbench is a registered trademark of IAR Systems AB.
(5) Bluetopia is a registered trademark of QUALCOMM ATHEROS, INC.; STONESTREET ONE, LLC; SS1 ACQUISITION, LLC; Stonestreet One, Inc.
(6) All other trademarks are the property of their respective owners.

Copyright © 2016–2019, Texas Instruments Incorporated

2.1 Classic Bluetooth Profiles Available

- Advanced audio distribution profile (A2DP 1.2): Internal SBC encoding/decoding is implemented (Assisted A2DP)

NOTE: Due to a lack of PCM routing in the MSP LaunchPad, manual prototyping is required to interface an external audio codec EVM (for example, CC3200AUDBOOST).

- Audio and video transport protocols (AVDTP 1.2)
- Audio and video remote control profile (AVRCP 1.3)
- Generic access profile (GAP)
- Headset Profile (HSP) and Hands Free Profile (HFP)

NOTE: Due to a lack of PCM routing in the MSP LaunchPad, manual prototyping is required to interface an external audio codec EVM (for example, CC3200AUDBOOST).

- Headset profile (HSP 1.2)
- Hands free profile (HFP 1.6)
- Human-interface device profile (HID 1.0)
- Message access profile (MAP 1.0)
- Phonebook access profile (PBAP 1.0)
- RFCOMM protocol (RFCOMM)
- Service discovery profile (SDP)
- Serial port profile (SPP)

2.2 Bluetooth low energy Profiles Available

- Alert notification service (ANS 1.0)
- Battery service (BAS 1.0)
- Cycle speed and cadence service (CSCS 1.0)
- Device information service (DIS 1.0)
- Find me profile (FMP 1.0)
- Generic access profile service (GAPS 1.0)
- Generic attribute profile (GATT 1.0)
- Health thermometer service (HTS 1.0)
- Heart rate service (HRS 1.0)
- Human-interface device service (HIDS 1.0)
- Immediate alert service (IAS 1.0)
- Link loss service (LLS 1.0)
- Phone alert state service (PASS 1.0)
- Proximity profile (PXP 1.0)
- TX power service (TPS 1.0)

2.3 MFi Support

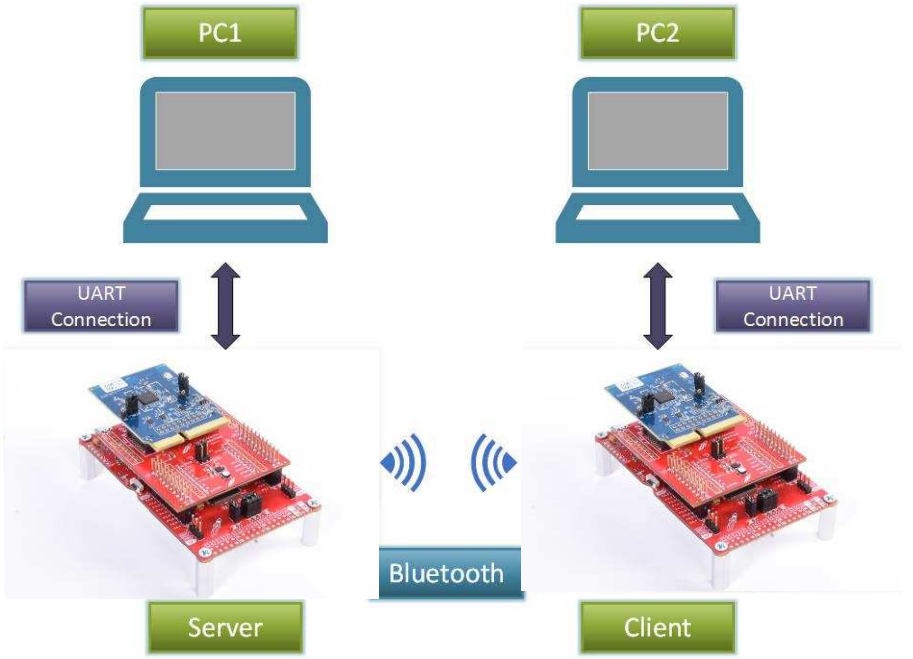
iAP Protocol (iAP 1/iAP 2)

Provided as an add-on upon request

Copyright © 2016–2019, Texas Instruments Incorporated

3 Sample Application Overview

The Sample Applications included in the CC2564CMSP432BTBLESW allow the users to evaluate TI's CC2564C dual-mode Bluetooth 4.2 device with the MSP-EXP432P401R LaunchPad development kit. The MSP-EXP432P401R Bluetooth sample applications are provided to enable a feature-rich and easy-to-use out-of-box experience for the user. These applications let the user use a console to send Bluetooth commands, set up a Bluetooth device to accept connections, connect to a remote Bluetooth device, and communicate over Bluetooth. Each profile is supported with simple command-line based sample applications to speed development. Figure 1 shows an overview of the demonstration example.



Copyright © 2016, Texas Instruments Incorporated

Figure 1. Demonstration Example Overview

Copyright © 2016–2019, Texas Instruments Incorporated

4 Requirements

The following hardware and software tools are required for a complete evaluation:

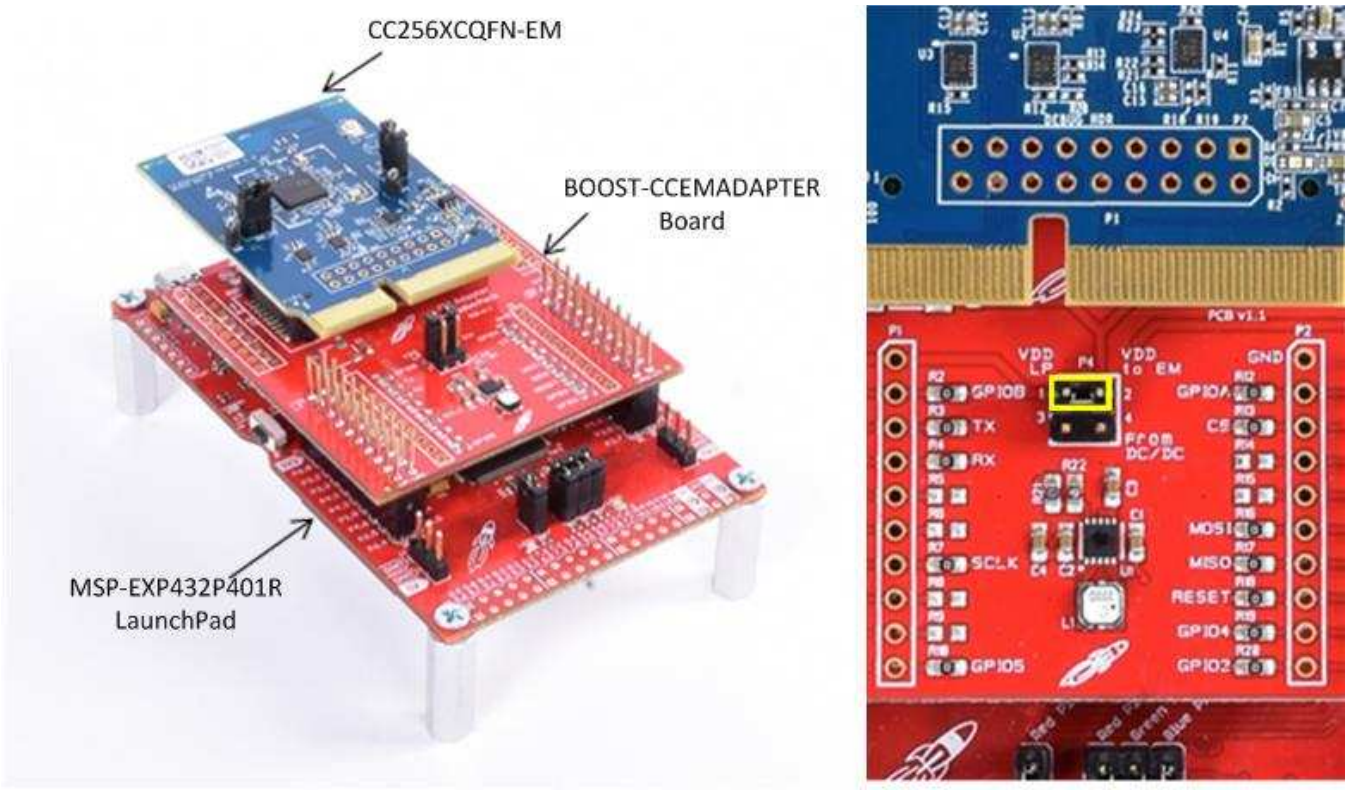
Hardware

- One MSP432 LaunchPad Development Kit
  - MSP-EXP432P401R
- One EM Adapter BoosterPack
  - BOOST-CCEMADAPTER
- One CC2564C QFN EM board
  - CC256XCQFN-EM
- One SimpleLink Wi-Fi CC3200 Audio BoosterPack (optional) for audio and voice sample applications
  - CC3200AUDBOOST

Software

- TI Dual-Mode Bluetooth stack
  - On MSP432 MCUs: CC2564CMSP432BTBLESW
- Recommended IDE versions for testing
  - Code Composer Studio™ integrated development environment (CCS 6.1.1.00022)
  - IAR Embedded Workbench® v7.3
  - ARM® Keil® µVision®® IDE v5.17.0.0

Figure 2 and Figure 4 show the hardware requirement combinations.



Copyright © 2016, Texas Instruments Incorporated

Figure 2. Hardware Requirement Combinations

Copyright © 2016–2019, Texas Instruments Incorporated

5 Hardware Setup

Using TI's dual-mode Bluetooth CC2564C QFN EM board (CC256XCQFN-EM) and the EM BoosterPack Adapter (BOOST-CCEMADAPTER), the MSP432 MCU LaunchPad Development Kit (MSP-EXP432P401R) can evaluate both classic and Bluetooth low energy capabilities with TI's dual-mode Bluetooth stack on MSP432 MCUs. Additionally, the TI BoosterPack plug-in module for audio and voice (CC3200AUDBOOST) can be connected to the BOOST-CCEMADAPTER and the MSP-EXP432P401R to evaluate the audio and voice sample applications.

5.1 Setting Up the Hardware

To set up the hardware, do as follows:

1. Fit the CC256XCQFN-EM on the EM BoosterPack Adapter (BOOST-CCEMADAPTER).
2. Stack the BOOST-CCEMADAPTER onto the MSP432 LaunchPad (MSP-EXP432P401R).

NOTE: The boards must be set to their default settings.

For more information on the jumper positions and default settings for the BOOST-CCEMADAPTER, see the *CC256XCQFNEM Quick Start Guide* and the *Dual-Mode Bluetooth CC2564C QFN EM User's Guide*. For jumper positions and configurations for the MSP-EXP432P401R development kit, see the *MSP432 LaunchPad Development Kit User's Guide*.

Ensure that the connectors of the LaunchPad and the BOOST-CCEMADAPTER are aligned.

3. To use the CC3200AUDBOOST device for audio and voice applications (optional), do as follows:
   - Ensure that the directions of the PCM signals are properly set on the CC256XCQFN-EM to evaluate audio and voice sample applications. The directions of the PCM signals can be configured so that the PCM port on the CC2564C device is either PCM master or PCM slave, depending on the sample application. See Table 1 to ensure that the R18, R19, and R11 on the CC256XCQFN-EM are properly configured for complete evaluation of the audio and voice sample applications.

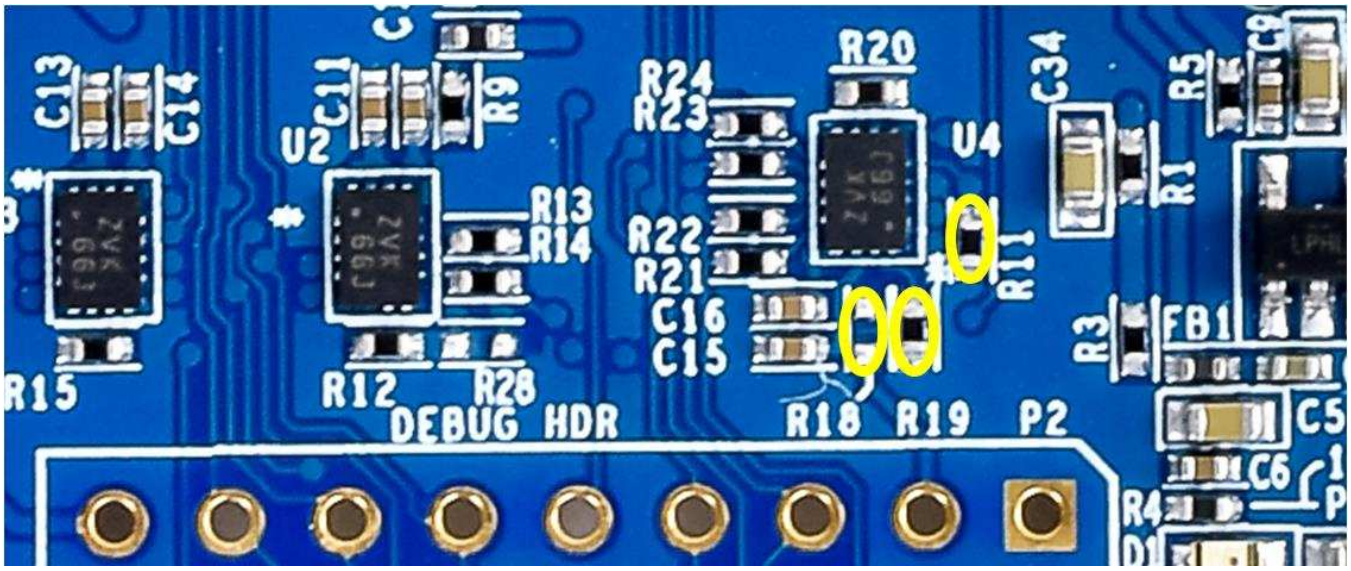
Table 1. CC256XCQFN-EM PCM Direction for Audio and Voice Sample Applications

Demo Name	CC256XCQFN-EM PCM Role	R18[(1)]	R19[(1)]	R11[(1)]
A3DP Demo_SNK	Master (Default)	DNI	10K Ω	0 Ω or DNI
A3DP Demo_SRC, HFP Demo_AG, HFP Demo_HF, and HSP Demo	Master	DNI	10K Ω	DNI

(1) DNI indicates *Do not install*.

Copyright © 2016–2019, Texas Instruments Incorporated

Figure 3 shows the position of the R18, R19, and R11 resistors on the CC256XCQFN-EM board.



Copyright © 2016, Texas Instruments Incorporated

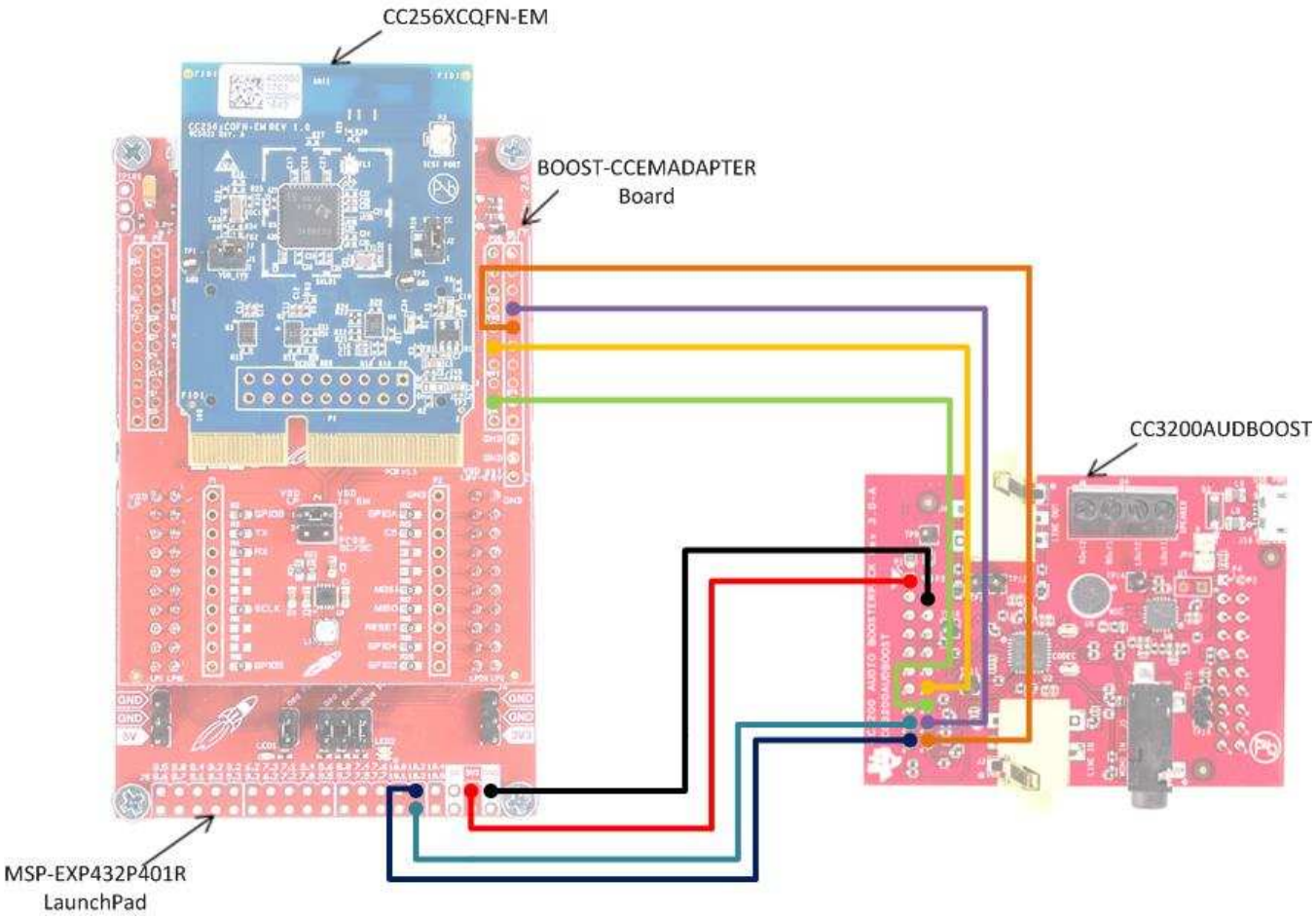
Figure 3. CC256XCQFN-EM PCM Role Selection for Audio and Voice Sample Applications

For more details regarding the PCM role selection on the CC256XCQFN-EM board, refer to *CC256xCQFN-EM User's Guide* and *Dual-Mode Bluetooth® CC2564CQFN-EM Evaluation Board*.

- Connect the CC3200AUDBOOST audio codec board to the BOOST-CCEMADAPTER and the MSP-EXP432P401R, as shown in Figure 4.

NOTE: Because the BOOST-CCEMADAPTER and CC3200AUDBOOST BoosterPack pinouts conflict with each other, the CC3200AUDBOOST cannot be stacked on the MSP432 LaunchPad while the BOOST-CCEMADAPTER is being used. Minor prototyping and jumper wire connections are required to connect the CC3200AUDBOOST with the BOOST-CCEMADAPTER and the MSP-EXP432P401R.

Copyright © 2016–2019, Texas Instruments Incorporated



Copyright © 2016, Texas Instruments Incorporated

Connection Designator	BOOST-CCEMADAPTER Pin	CC3200AUDBOOST Pin
AUD_IN	P21-4	J1-18
AUD_OUT	P21-5	J1-20
AUD_FSYNC	P20-6	J1-14
AUD_CLK	P20-9	J1-16

Connection Designator	MSP-EXP432P401R Pin	CC3200AUDBOOST Pin
3V3 Power	3V3	J1-1
Ground	GND	J1-4
I2C_SDA	10.2	J1-19
I2C_SCL	10.3	J1-17

Figure 4. CC3200AUDBOOST Connection With BOOST-CCEMADAPTER and MSP-EXP432P401R

Copyright © 2016–2019, Texas Instruments Incorporated

Table 2. CC3200AUDBOOST Ports or Audio Sample Applications

Sample Applications	CC3200AUDBOOST Port
A3DP Demo_SRC	LINE_IN (J3)
A3DP Demo_SNK	LINE_OUT (J4)
HFP Demo_AG	Mic (U6) LINE_OUT (J4)
HFP Demo_HF	Mic (U6) LINE_OUT (J4)
HSP Demo	Mic (U6) LINE_OUT (J4)

NOTE: For the default settings for the CC3200AUDBOOST device, see the *CC3200 SimpleLink™ Wi-Fi® and IoT Solution, a Single Chip Wireless MCU - Audio BoosterPack* user's guide. Ensure the reliability of the connections that are shown in Figure 4.

For more details regarding the PCM role selection on the CC256XCQFN-EM board, refer to *CC256xCQFN-EM User's Guide* and *Dual-Mode Bluetooth® CC2564CQFN-EM Evaluation Board*.

6 Software Setup

6.1 Downloading and Installing

To download and install the Bluetooth software development kit (SDK), do as follows:

NOTE: To download the SDK, a TI login is required.

1. Create a TI login (if necessary).
2. Complete the export approval form.

NOTE: A request is submitted to TI for approval. When the request is approved, a confirmation appears on the next page with a link to download the software.

3. Click *Download* to start the download.
4. Run the setup file (for example, CC256XMSP432BTBLESW-v4.2.x.x.x.x-Setup.exe).
5. Accept the TI *Bluetooth Stack Clickwrap License Agreement*.

NOTE: The SDK installs to *C:\TI\Connectivity\CC256X BT\CC256x MSP432 Bluetopia® SDK*.

6. Navigate to the SDK through *Start → Programs → Texas Instruments → C256X BT → CC256X MSP432 Bluetopia SDK v4.2.x.x.x.x* to access the file.

Copyright © 2016–2019, Texas Instruments Incorporated

6.2 Building and Flashing the Bluetooth Code (MSP-EXP432P401R)

Sample applications are available for CCS, IAR, and Keil. To set up the sample applications on each IDE version, do as follows:

CCS

1. Navigate to the workspace through Project → Import CCS Projects.
2. Open *C:\TI\Connectivity\CC256X BT\CC256x MSP432 Bluetopia SDK\4.2.x.x\Samples*.
3. Select the demonstration to load onto the device (for this example, the *SPPDemo*).
4. Navigate to *SPPDemo* → *CCS*.

NOTE: The CCS SPPDemo project opens (see Figure 5).

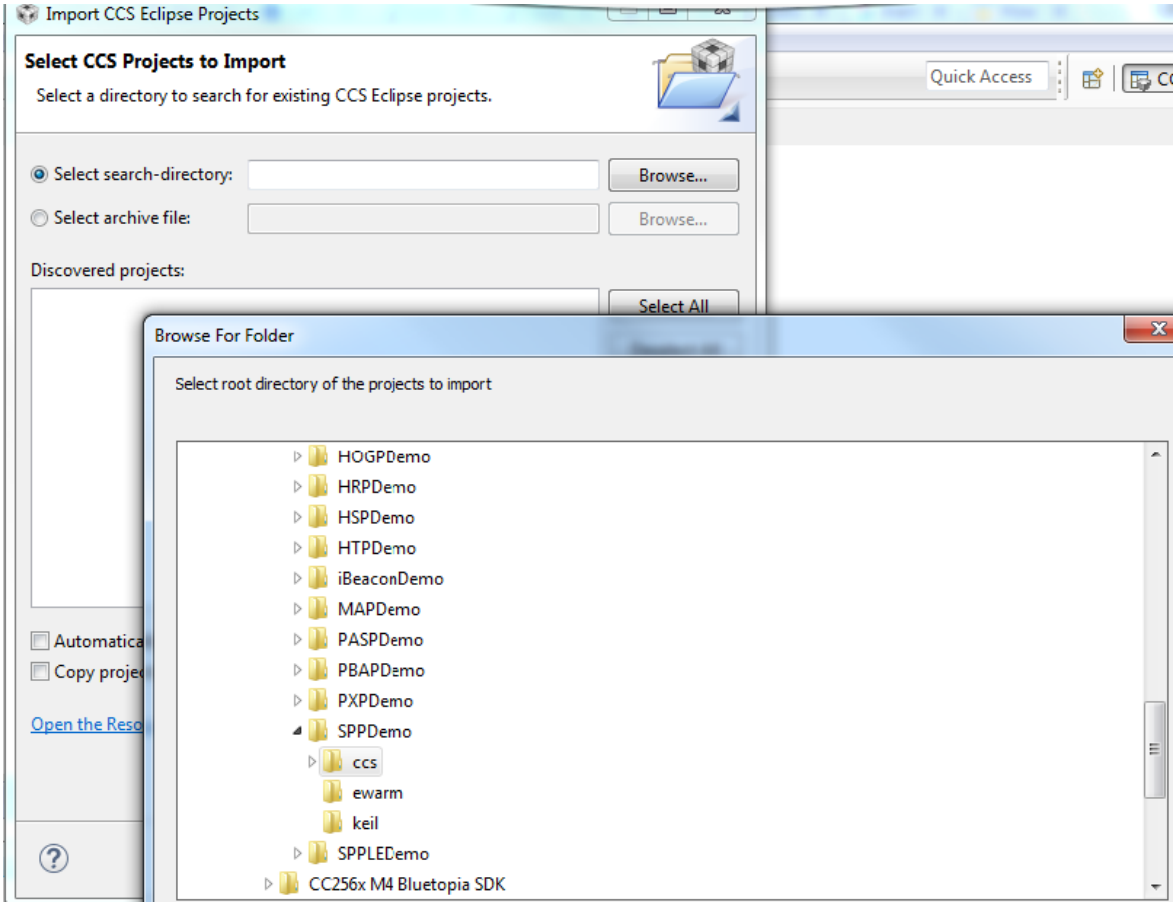


Figure 5. CCS Project Folder

Copyright © 2016–2019, Texas Instruments Incorporated

5. Open *Project* → *Properties* → *General*, and ensure that the "Manage the project's target-configuration automatically" checkbox is set. See Figure 6.

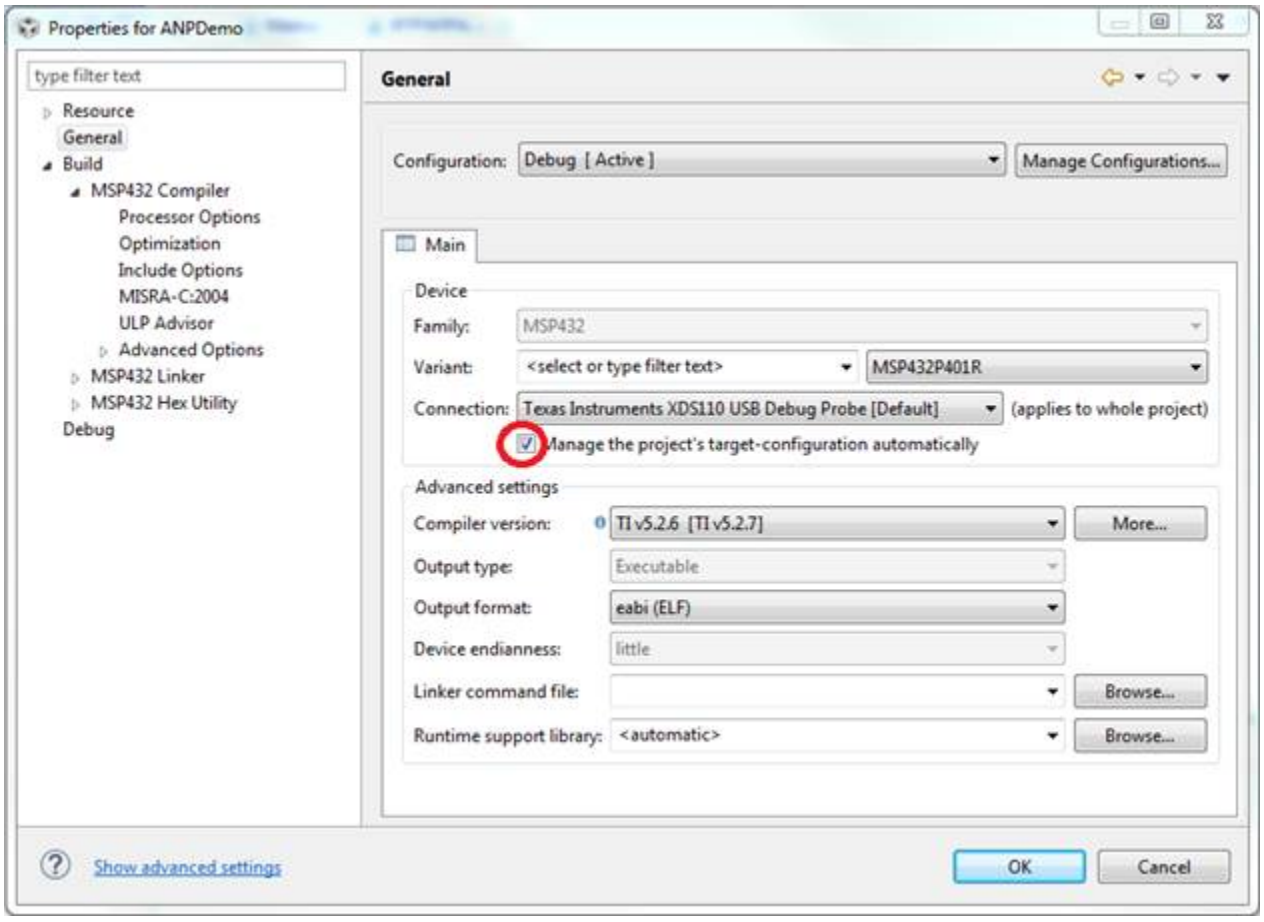


Figure 6. Project Properties / General

6. Ensure the MSP432 device is connected.

Copyright © 2016–2019, Texas Instruments Incorporated

7. Select the debug icon from the toolbar (see Figure 7).

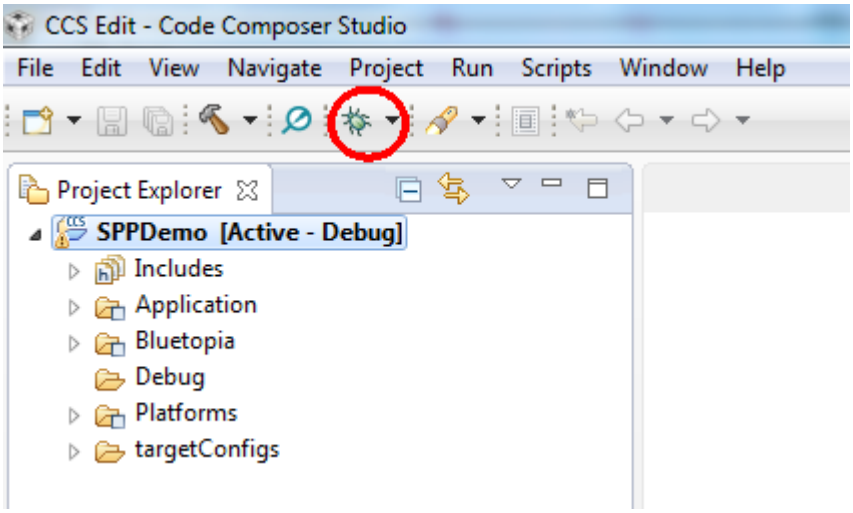


Figure 7. Debug Icon

NOTE: Let the IDE debug and load the software onto the device. This process may take 5 to 10 minutes. After the IDE loads the software, the it is ready to use.

To begin using the profile, do as follows:

1. Click the play and resume icon on the CCS toolbar (see Figure 8).

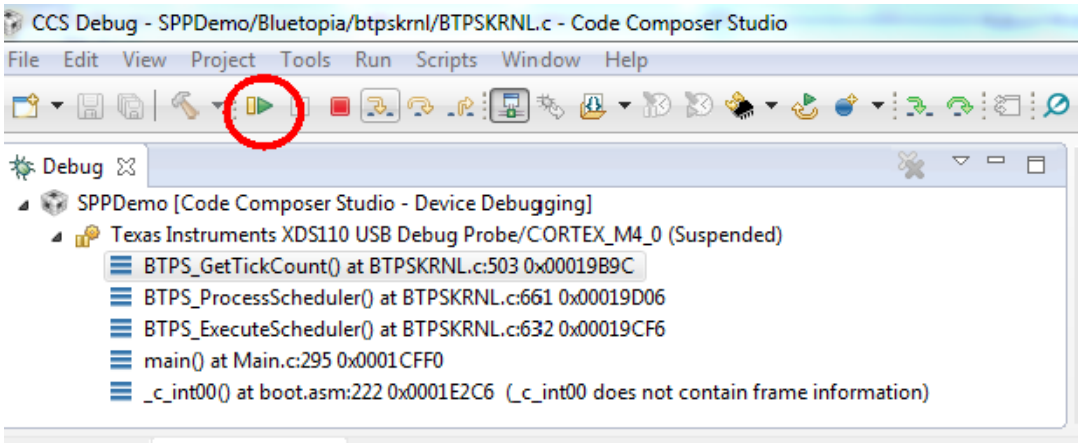


Figure 8. Play and Resume Icon

IAR

To open the workspace, do as follows:

1. Navigate to *C:\TI\Connectivity\CC256X BT\CC256x MSP432 Bluetopia SDK\4.2.x.x\Samples*.
2. Select the demonstration to load onto the device (for this example, the *SPPDemo*).
3. Navigate to *SPPDemo → EWARM*.
4. Select *SPPDemo.eww*.

NOTE: The IAR IDE opens.

Copyright © 2016–2019, Texas Instruments Incorporated

5. Select either the *Debug* or *Release* configuration from the drop-down menu (in this example, select *Debug*, see Figure 9).

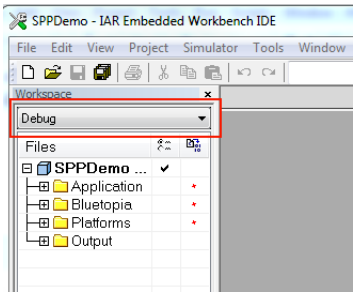


Figure 9. Debug Workspace

6. Ensure that the MSP-EXP432P401R LaunchPad development kit is connected.
7. Select *Download and Debug* from the *Project* tab or the play icon (see Figure 10).

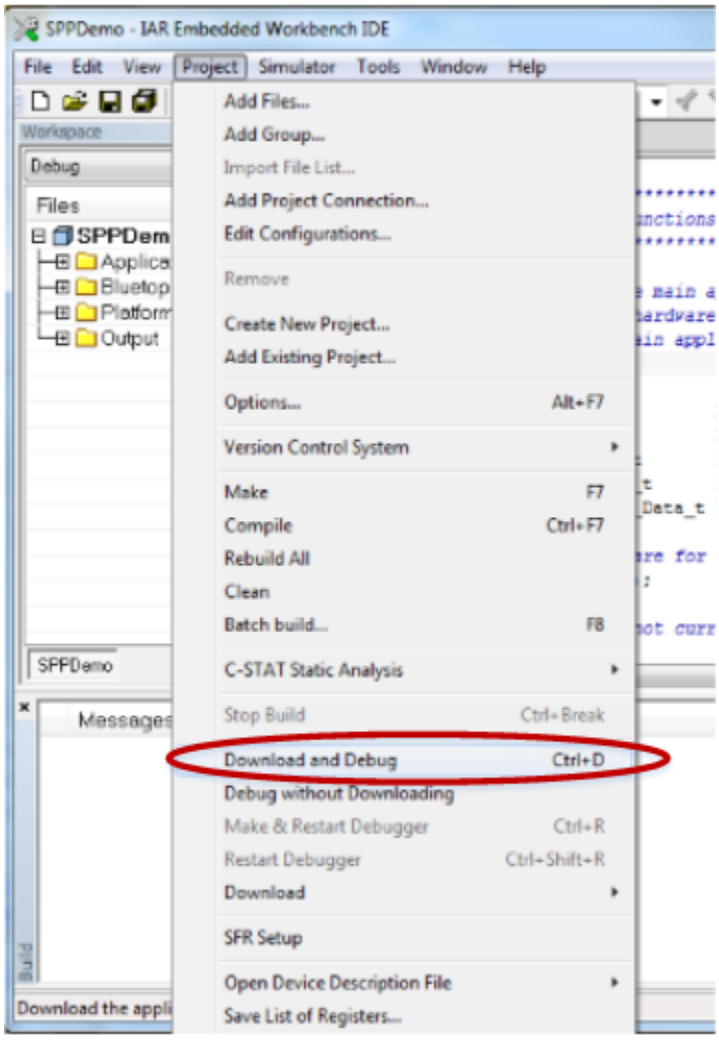


Figure 10. Download and Debug

NOTE: Let the IDE debug and load the software onto the device. This process may take 5 to 10 minutes.

Copyright © 2016–2019, Texas Instruments Incorporated

8. Click the red X icon in the IAR toolbar to stop debugging (see Figure 11).

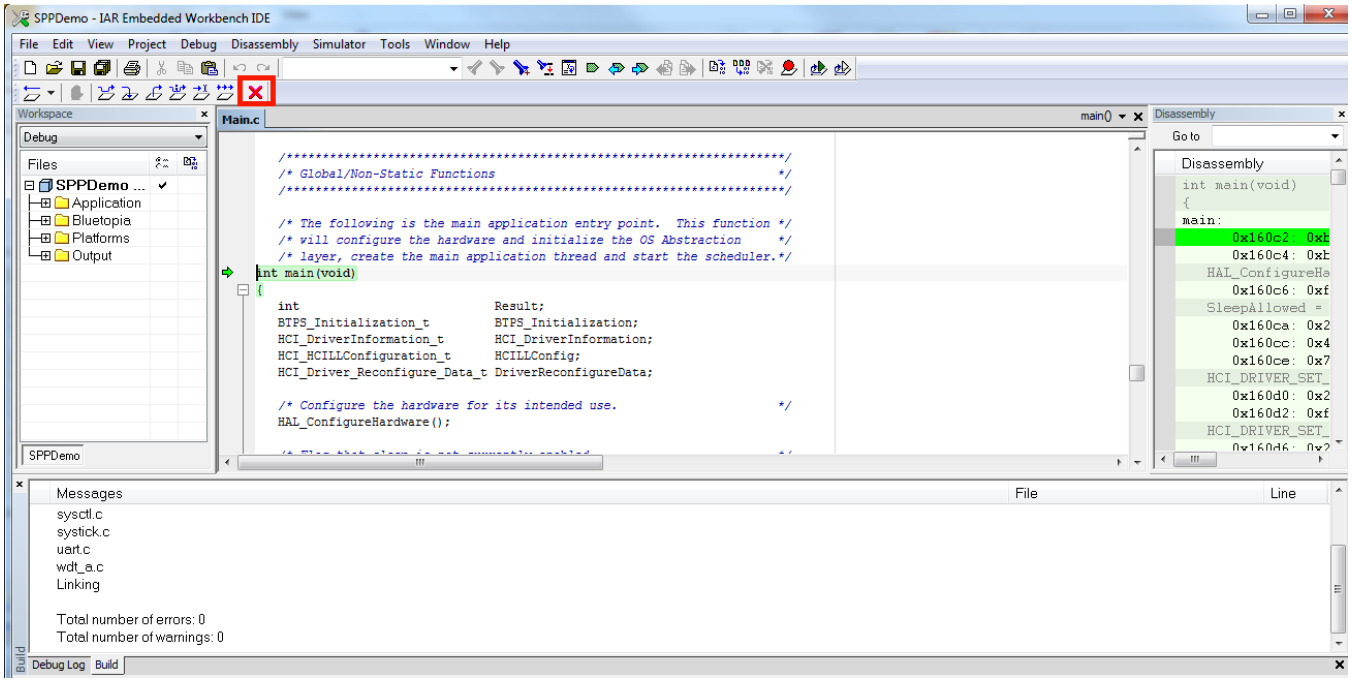


Figure 11. Red X

To begin using the profile, do as follows:

1. Click the *Go* icon in IAR (see Figure 12).



Figure 12. The Go Button

Copyright © 2016–2019, Texas Instruments Incorporated

Keil

To open the workspace, do as follows:

1. Navigate to *C:\TI\Connectivity\CC256X BT\CC256x MSP432 Bluetopia SDK\4.2.x.x\Samples*.
2. Select the demonstration to load on the device (for this example, use *SPPDemo*).
3. Navigate to *SPPDemo* → *Keil* in the samples list.
4. Select *SPPDemo.uvprojx*.

NOTE: Keil µVision5 opens.

5. Select either the *Debug* or *Release* configuration from the drop-down menu (in this example, select *Debug*, see Figure 13).

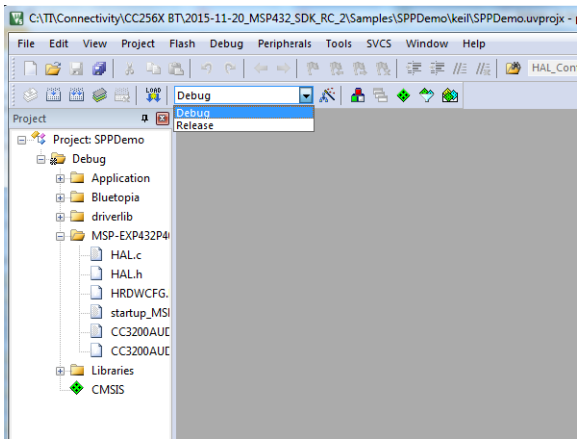


Figure 13. Configurations

Copyright © 2016–2019, Texas Instruments Incorporated

To build the code, do as follows:

1. Navigate to *Project → Build Target* in the program menu (see Figure 14).

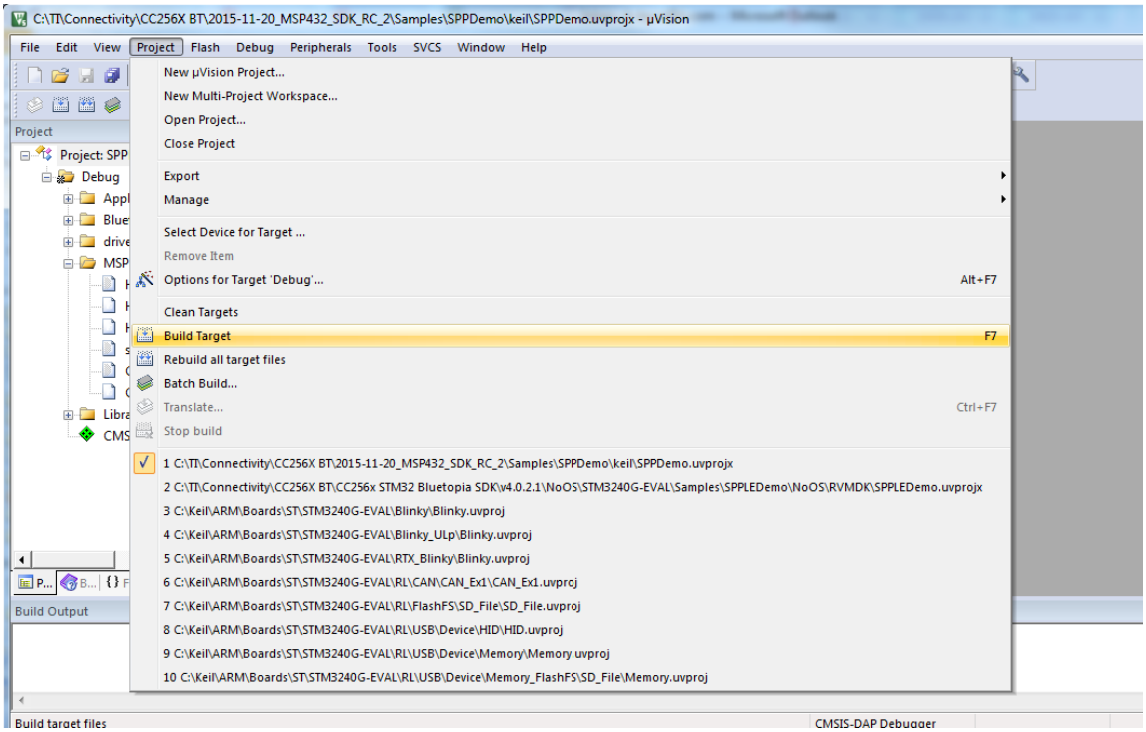


Figure 14. Build *Project → Target*

NOTE: After a few minutes, the build process finishes and should build a .axf file. Each time the configuration is changed, a new .axf file must be built.

2. Choose from the following two options.
   - For Debug Mode Only, do as follows:
     a. Select *Start/Stop Debug Session* to start loading the profile on the MSP432 device (see Figure 15).

Copyright © 2016–2019, Texas Instruments Incorporated

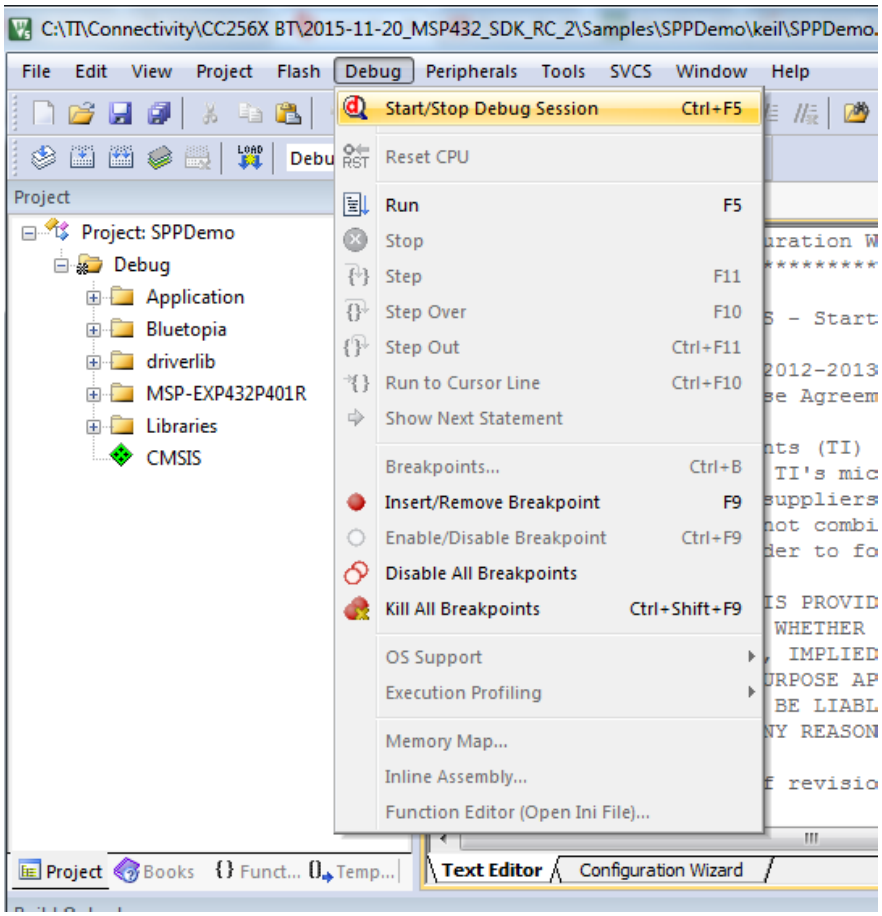


Figure 15. Start/Stop Debug Session

NOTE: The debug session finishes in a few minutes.

b. Stop the debugging session from the *Debug* menu.

NOTE: The profile loads on the MSP-EXP432P401R LaunchPad development kit.

c. Unplug the device.

d. Plug in the device.

Copyright © 2016–2019, Texas Instruments Incorporated

- For Release and Debug Modes:
  a. Press the LOAD icon to start loading the profile on the MSP432 device (see Figure 16).

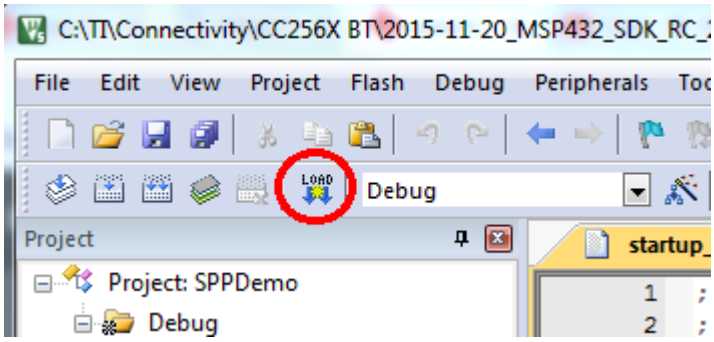


Figure 16. LOAD Button

NOTE: The profile finishes in a few minutes. The profile loads on the MSP-EXP432P401R LaunchPad development kit.

  b. Unplug the device.
  c. Plug in the device.

Copyright © 2016–2019, Texas Instruments Incorporated

7 Sample Applications

TI dual-mode Bluetooth stack on MSP432 MCUs includes sample applications directory available with source code which demonstrates the use of the TI's Bluetooth stack. These sample applications are a simple, command line applications that display a list of available commands. Table 3 lists the specific audio connectors for the audio sample applications. The parameters for this port are as follows:

- Baud: 115,200
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

Table 3 lists available profiles for Bluetooth SDK.

Table 3. Available Profiles for Bluetooth SDK

Profile	Role	NoOS	Platforms
A3DP Demo_SNK	Sink Controller	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM CC3200AUDBOOST(1)(2)
A3DP Demo_SRC	Source Target	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM CC3200AUDBOOST(1)(2)
ANP Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
CSCP Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
FMP Demo	Target Locator	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
HFP Demo_AG	Audio Gateway	IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM CC3200AUDBOOST(1)(2)
HFP Demo_HF	Audio Gateway Hands-Free unit	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM CC3200AUDBOOST(1)(2)
HID Demo	Host Device	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
HOGP Demo	Host Device	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
HRP Demo	Collector Sensor	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
HSP Demo	Audio Gateway Headset	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM CC3200AUDBOOST(1)(2)

(1) To evaluate the audio and voice sample application, a codec EVM like the CC3200AUDBOOST must be connected to the P10 port of the MSP432. Regarding the proper PCM direction setting on the CC256XCQFN-EM board for this sample application, see Section 5.1.

(2) Because the BOOST-CCEMADAPTER and CC3200AUDBOOST BoosterPack pinouts conflict with each other, the CC3200AUDBOOST cannot be stacked on the MSP432 LaunchPad while the BOOST-CCEMADAPTER is being used. For details on how to connect the CC3200AUDBOOST through jumper wires for audio and voice sample applications, see Section 5.1.

Copyright © 2016–2019, Texas Instruments Incorporated

Table 3. Available Profiles for Bluetooth SDK (continued)

Profile	Role	NoOS	Platforms
HTP Demo	Collector Thermometer	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
iBeacon Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
MAP Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
PASP Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
PBAP Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
PXP Demo	Monitor Reporter	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
SPP Demo	Device A Device B	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
SPPDMMulti Demo	Server	CCS(3) IAR(3) Keil(3)	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM
SPPLE Demo	Server Client	CCS IAR Keil	MSP-EXP432P401R BOOST-CCEMADAPTER CC256XCQFNEM

(3) The SPPDMMulti Demo application allows the user to simultaneously evaluate complex scenarios and multiple connections in various roles using Bluetooth Classic and Bluetooth low energy. Enabling all those features causes the size of the application code to exceed the code space limitation of the MSP432P401R (256K flash) device in debug mode build configuration (no compiler optimization) for CCS, IAR, and Keil IDEs. This limitation can be avoided by changing the compiler optimization in debug mode settings to reduce code size or by evaluating the sample application in release mode build configuration.

7.1 Classic Bluetooth Sample Applications

A3DP Sink Demo

- The assisted advanced audio distribution profile (A3DP) shows how to send stereo audio over Bluetooth.
- For a step-by-step demonstration of how to run this application for the sink role, visit the A3DP demo sink wiki.

A3DP Source Demo

- The assisted advanced audio distribution profile shows how to send stereo audio over Bluetooth.
- For a step-by-step demonstration of how to run this audio gateway application for the source role, visit the A3DP demo source wiki.

HFP Demo

- The hands-free profile (HFP) lets the user demonstrate the use of hands-free profile on embedded device. The HFP is used to connect a headset or speaker phone with a mobile device to provide remote control and voice connections.
- The HFP supports two roles: hands free and audio gateway.
- For a step-by-step demonstration of how to run the audio gateway application, visit the HFP AG demo application wiki.
- For a step-by-step demonstration of how to run the hands-free application, visit the HFP HG Demo application wiki.

Copyright © 2016–2019, Texas Instruments Incorporated

HID Demo

- The human interface device (HID) enables a host to connect and control a HID device.
- For a step-by-step demonstration of how to run this application, visit the HID demo wiki.

HSP Demo

- The headset profile (HSP) lets the user demonstrate the use of HSP on embedded device. The HSP is used to connect a headset or speaker phone with a mobile device or to connect an audio gateway with a headset device to provide basic control and voice connections.
- For a step-by-step demonstration of how to run this application, visit the HSP demo wiki.

MAP Demo

- The MAP demo lets the user exchange message objects over Bluetooth.
- For a step-by-step demonstration of how to run this application, visit the MAP demo application wiki.

PBAP Demo

- The PBAP demo lets the user exchange phonebook objects over Bluetooth.
- For a step-by-step demonstration of how to run this application, visit the PBAP demo application wiki.

SPP Demo

- This application shows how to use the SPP module and how to handle the different callback events. The application can be used to interface with a remote SPP client or server.
- For a step-by-step demonstration of how to run this application, visit the SPP demo application wiki.

7.2 Classic Bluetooth + Bluetooth low energy Sample Applications

SPP + SPPLE Demo

- This application shows how to use low energy (LE) and the GATT profile. This sample emulates using SPP over LE using the GATT profile. This sample acts as an LE master and an LE slave.
- This application also shows how to use the SPP module and how to handle the different SPP callback events. The application acts as either an SPP server or an SPP client and exposes the same command set for SPP as the SPPDemo.
- For a step-by-step demonstration of how to run this application, visit the SPP + SPPLE demo wiki.

SPPDMMulti Demo

- This application is based on the SPP + SPPLE Demo application and demonstrates how to utilize the chosen features from Bluetooth specification 4.1 and Bluetooth specification 4.2:
  - LE Dual Mode Topology: Connect in classic Bluetooth and Bluetooth low energy to the same device.
  - LE Link Layer Topology: Support multiple simultaneous roles, that is, Peripheral and Central.
  - L2CAP LE Connection Oriented: Support LE Credit Based Flow Control Mode.
  - LE Ping: Used to verify presence of the remote Link Layer. In addition, can be used to verify message integrity in the LE ACL by forcing the remote device to send an LE ACL packet that contains a valid MIC.
  - LE Low Duty Cycle Advertising: Designed for a case where reconnecting with a specific device is required, but time is not of the essence or when it is not known if the central device is in range
  - 32-bit UUID: Register services with aliases that are represented as 32-bit values instead of 128-bit UUIDs
  - LE Secure Connections: Enhance the LE Security Manager with public key Elliptic Curve Diffie-Hellman (ECDH) key generation.
- The application allows the user establish connection between multiple BLE devices using the SPPLE custom service, send Bluetooth commands and exchange data over BLE. This application also shows how to use the SPP module and how to handle the different SPP callback events. The application acts as either an SPP server or an SPP client and exposes the same command set for SPP as the SPPDemo.
- For a step-by-step demonstration of how to run this application, visit SPPDMMulti demo wiki.

Copyright © 2016–2019, Texas Instruments Incorporated

7.3 Bluetooth low energy Sample Applications

ANP Demo

- This application shows how to use LE and the GATT profile. This sample implements the alert notification profile (ANP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the ANP demo wiki.

iBeacon Demo

- The iBeacon profile is used to provide a different type of location-based information and services. There are two roles defined in this profile: a server and a client. The server transmits a user-defined message, which is received by any client that is in range. The received iBeacon message can trigger different behaviors.
- This application lets the user advertise specific Bluetooth low energy data that can be read by an iBeacon scanner (client).
- For a step-by-step demonstration of how to run this application, visit the iBeacon demo wiki.

HRP Demonstration

- This application shows how to use LE and the GATT profile. This sample implements the heart rate monitoring profile (HRP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the HRP demo wiki.

HTP Demonstration

- This application shows how to use LE and the GATT profile. This sample implements the health thermometer profile (HTP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the HTP demo wiki.

PASP Demo

- This application shows how to use LE and the GATT profile. This sample implements the phone alert status profile (PASP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the PASP demo wiki.

HOGP Demo

- This application shows how to use LE and the GATT profile. This sample implements the HID using the GATT profile.
- For a step-by-step demonstration of how to run this application, visit the HOGP demo wiki.

PXP Demon

- This application shows how to use LE and the GATT profile. This sample implements the proximity profile (PXP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the PXP demo wiki.

FMP Demo

- This application shows how to use LE and the GATT profile. This sample implements the find me profile (FMP) using the GATT profile. This sample acts as an LE master and an LE slave.
- For a step-by-step demonstration of how to run this application, visit the FMP demo wiki.

CSCP Demo

- This application shows how to use LE and the GATT profile establish connection between two Bluetooth low energy devices with the cycling speed and cadence service (CSCS), notify measurements and change the sensor location and cumulative wheel value in the Speed Cadence (SC) Control Point.
- For a step-by-step demonstration of how to run this application, visit the CSCP demo wiki.

Copyright © 2016–2019, Texas Instruments Incorporated

Revision History

Changes from Original (November 2016) to A Revision	Page
• Updated CC256XCQFN-EM PCM Direction for Audio and Voice Sample Applications table.	5

Copyright © 2016–2019, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2019, Texas Instruments Incorporated