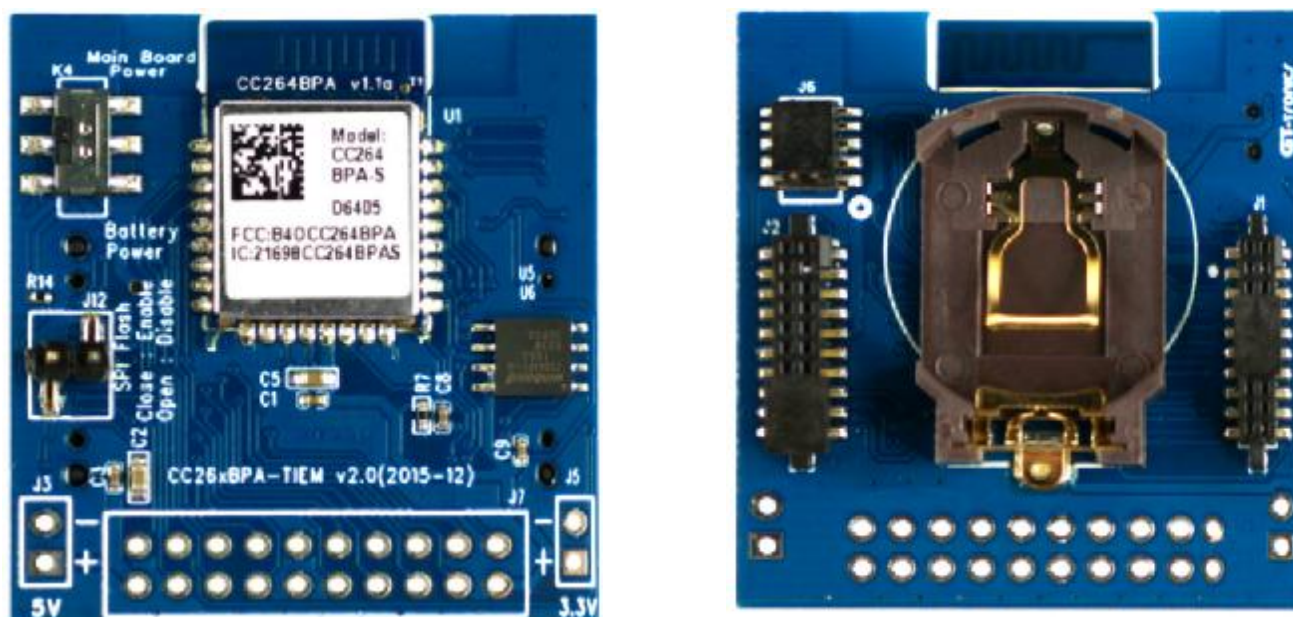


CC26xBPA TIEM Evaluation Module

User Guide



Revision 07

Evaluation Module Overview

CC26xBPA-TIEM evaluation module provides a hardware environment for TI CC26xx SimpleLink Development Kits, and facilitates development and evaluation of designs targeting the CC26xBxA series of RF modules from GT-tronics. CC26xBPA-TIEM evaluation module is compatible with TI SmartRF06 Evaluation Board, CC2650DK Development Kit, SensorTag Debugger DevPack, and is a near-drop-in replacement to CC2650EMK-5XD Evaluation Module for Bluetooth Low Energy (BLE), ZigBee, and 6LowPan protocol.

By plugging in a CR2032 coin cell (not provided in the package) to the TIEM evaluation module, the board can run as a standalone wireless device, providing simple function such as iBeacon. The breakout pins on the E-interface allows further hardware feature extension. Actuator control, temperature and motion sensing, for example. This is a perfect fit for quick prototyping Internet of Things (IoT) hardware demo.

Board Features

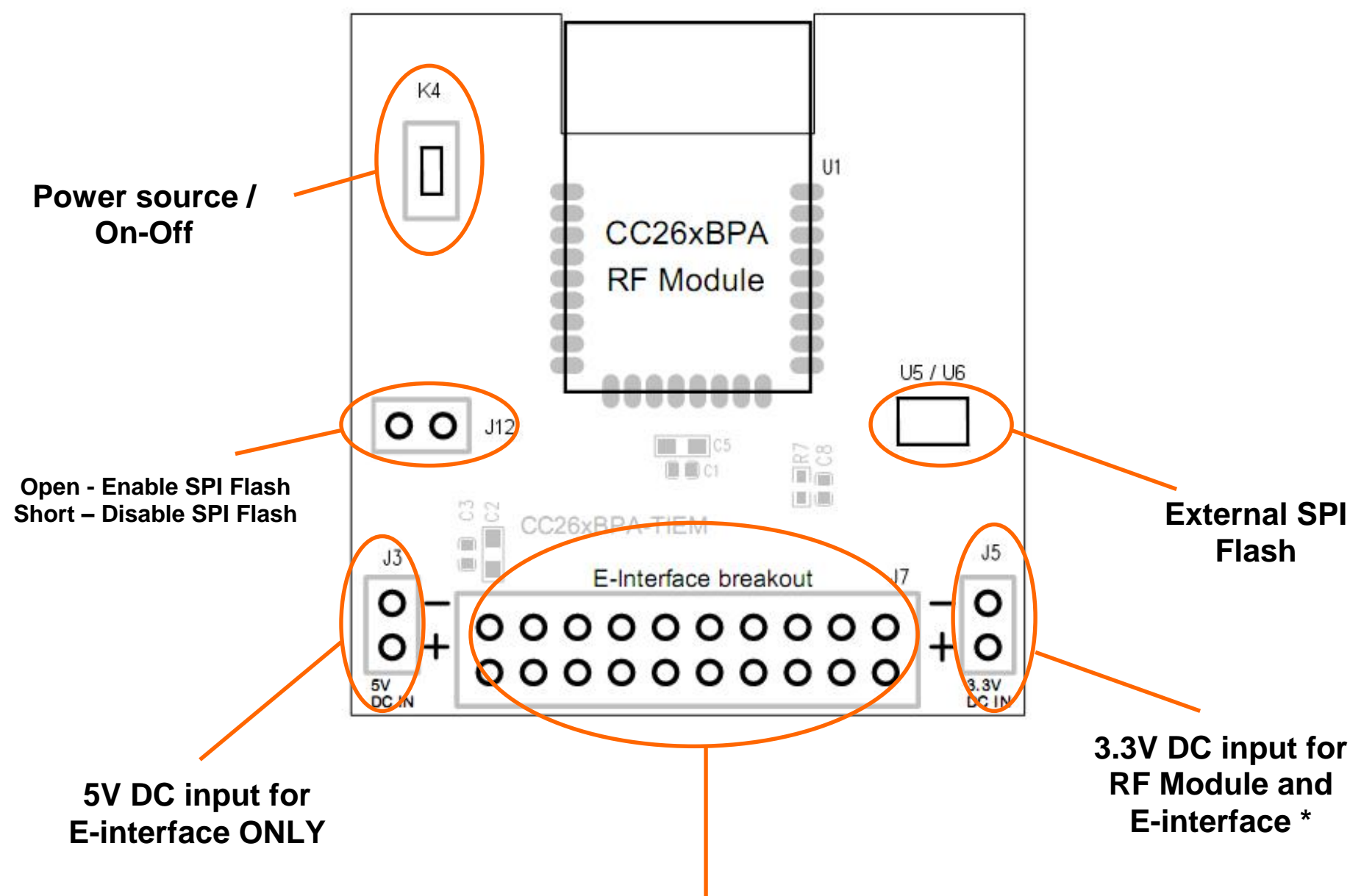
- Featuring TI CC26xx SimpleLink Wireless SoC
- Operate on battery as standalone wireless RF device
- Complete BLE and Zigbee RF solution including built-in antenna
- E-interface break out pins for hardware extension
- Compatible with TI SmartRF06, CC2650DK, and SensorTag Debugger DevPack

Additional Resources

- See *CC26xBxA Bluetooth Smart and IoT Module DataSheet* for the specifications of the RF module on the CC26xBxA Evaluation Module.
- Check out Texas Instruments' web site (<http://www.ti.com>) for availability of the SmartRF06 evaluation board, and *SmartRF06 Evaluation Board User's Guide* from Texas Instruments for the operation of the SmartRF06 evaluation board.
- Check out Texas Instruments' web site (<http://www.ti.com>) for availability of the SensorTag Debugger DevPack, and *SensorTag DevPack Getting Started* from Texas Instruments for the operation of the SmartRF06 evaluation board.
- If using DataExchanger solution with the CC26xBxA Evaluation Module, refer to *Data Exchanger-AT BLE Application Package*.

Board Layout

CC26xBPA-TIEM v2.0 / v2.1 Front View

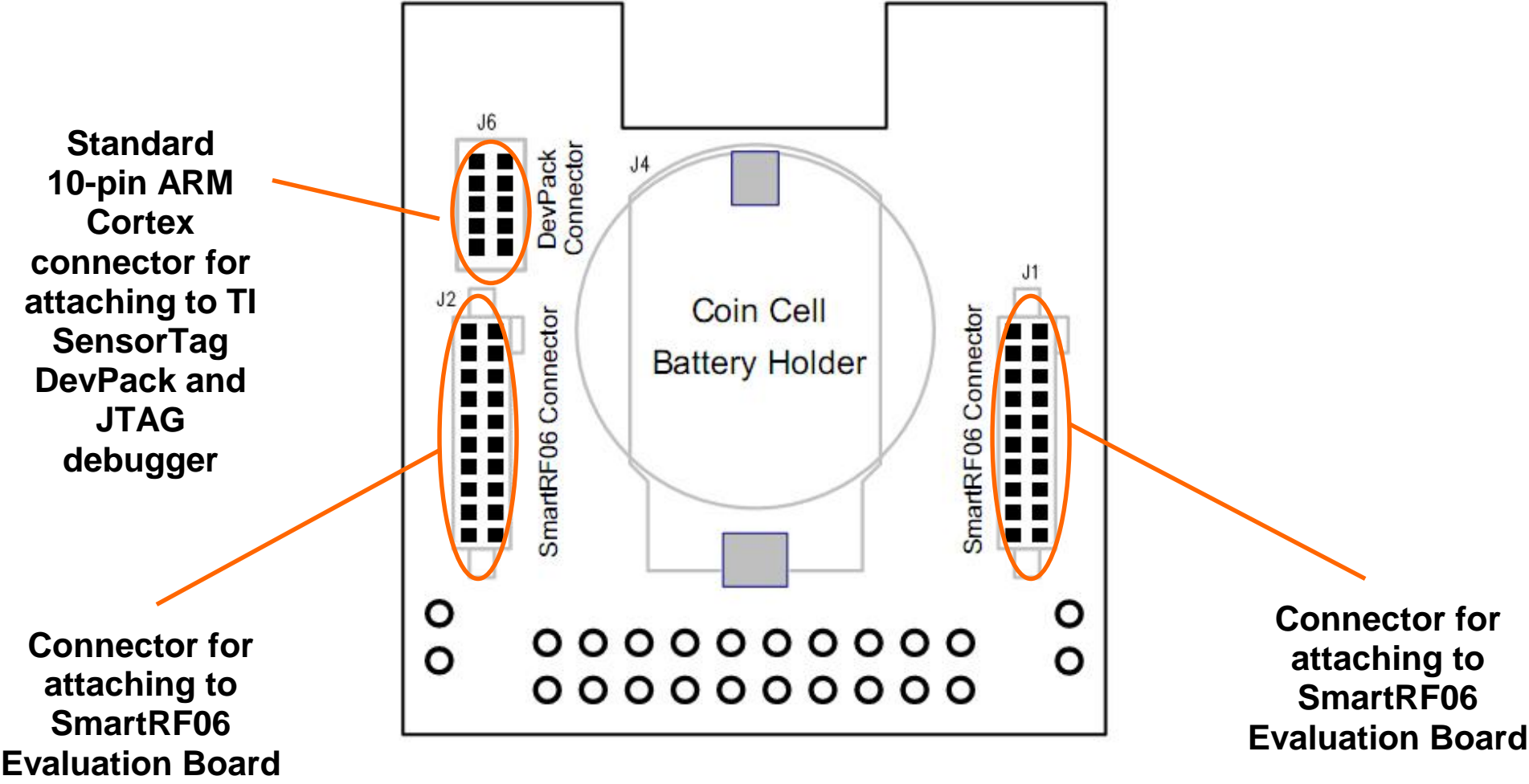


E-interface Pin Assignments

RSTB	DIO1	DIO2	DIO3	GND	DIO4	DIO5	DIO6	DIO13	DIO14
VDD_5V	DIO0	DIO7	DIO8	GND	DIO9	DIO10	DIO11	DIO12	VDD_3.3V

* **Caution** – Coin cell battery must be removed before applying 3.3V DC power input

CC26xBPA-TIEM v2.0 / v2.1 Back View



CC264BPA-TIEM mounted on SmartRF06 Development Board



CC264BPA-TIEM and TI SensorTag DevPack

Application Notes

- **Using coin cell battery as power source**

If the TIEM evaluation module is running on CR2032 coin cell battery (i.e. VDD=3V or less), the logic level of all IOs on E-interface will follow this VDD, which is determined by the battery level. If there is any external hardware connected through the E-interface to the CC2640BPA module with logic levels different from this battery level (e.g. connecting USB-UART dongle with 3.3v logic levels), power rail mismatch problem may arise. In this case, it is suggested to supply 3.3v external power to DC power input connection (J3) of TIEM and remove the coin cell battery.

Caution – Coin cell battery must be removed before applying 3.3V (max. allowable level) to DC power input (J3) of the TIEM evaluation module.

- **Connection to JTAG debugger**

CC26x4BPA SMD and TIEM evaluation module support both compact JTAG (aka cJTAG) (2 wire) and normal JTAG (4-wire). The JTAG pins on TIEM's J6 and CC26x4BPA module are (as specified in the module datasheet):

TIEM_Pin_2, Module_Pin_11: JTAG_TMSC (used by cJTAG and JTAG)
TIEM_Pin_4, Module_Pin_13: JTAG_TCKC (used by cJTAG and JTAG)
TIEM_Pin_6, Module_Pin_14: DIO5/JTAG_TDO (used by JTAG only)
TIEM_Pin_8, Module_Pin_15: DIO6/JTAG_TDI (used by JTAG only)

Although the JTAG core signal pins (2-wire or 4-wire) are mandatory, your JTAG emulator may require other supporting pins to work properly. Please refer to TI's *XDS Target Connection Guide* and your XDS100v3 JTAG enumerator manufacturer for the support. TIEM evaluation module's J6 connector is a standard 10-pin ARM cortex header.

In general, in addition to the core signal pins, the following pins may need attention.

1. nRESET (Target Reset) - connect to CC2640's Reset pin (TIEM's J6 pin 10).
2. TDIS (Target Disconnect) - connect to the ground of the target (TIEM's J6 pin 9).
3. TVRef (Target Voltage Reference) - connect to the VDD of the target (TIEM's J6 pin 1).

- **External SPI Flash**

On v2.x version of the TIEM evaluation module, there is a Winbond W25Q64 8MByte SPI flash (U5 / U6) available for data storage and firmware code swapping. Short the J12 jumper to enable this external SPI flash. If you enable the flash and want to minimize the current consumed by the external flash while the flash is idle, you can send command to put the flash in deep sleep mode in your firmware. Check the datasheet of Winbond W25Q64 for more details.

Please refer to the schematics of the TIEM evaluation module for the DIO connections of the CC26x4BPA module to the external SPI flash IC.

- **Accessing peripheral devices on SmartRF06 development board**

If you want to use the sensors and peripheral devices available on SmartRF06 development board, you need to pay attention to the IO mappings. For example, the interrupts of the BMA250 accelerometer available on the SmartRF06 are configured by default to DIO 28/29, which are not available on the 5x5 IC package used by TIEM evaluation module. You will need to route the accelerometer IOs to valid DIOs available on TIEM evaluation module by re-wiring the jumpers on the SmartRF06 board, and then modify your codes accordingly.

Preparing CC2640 Firmware Build (for CCS)

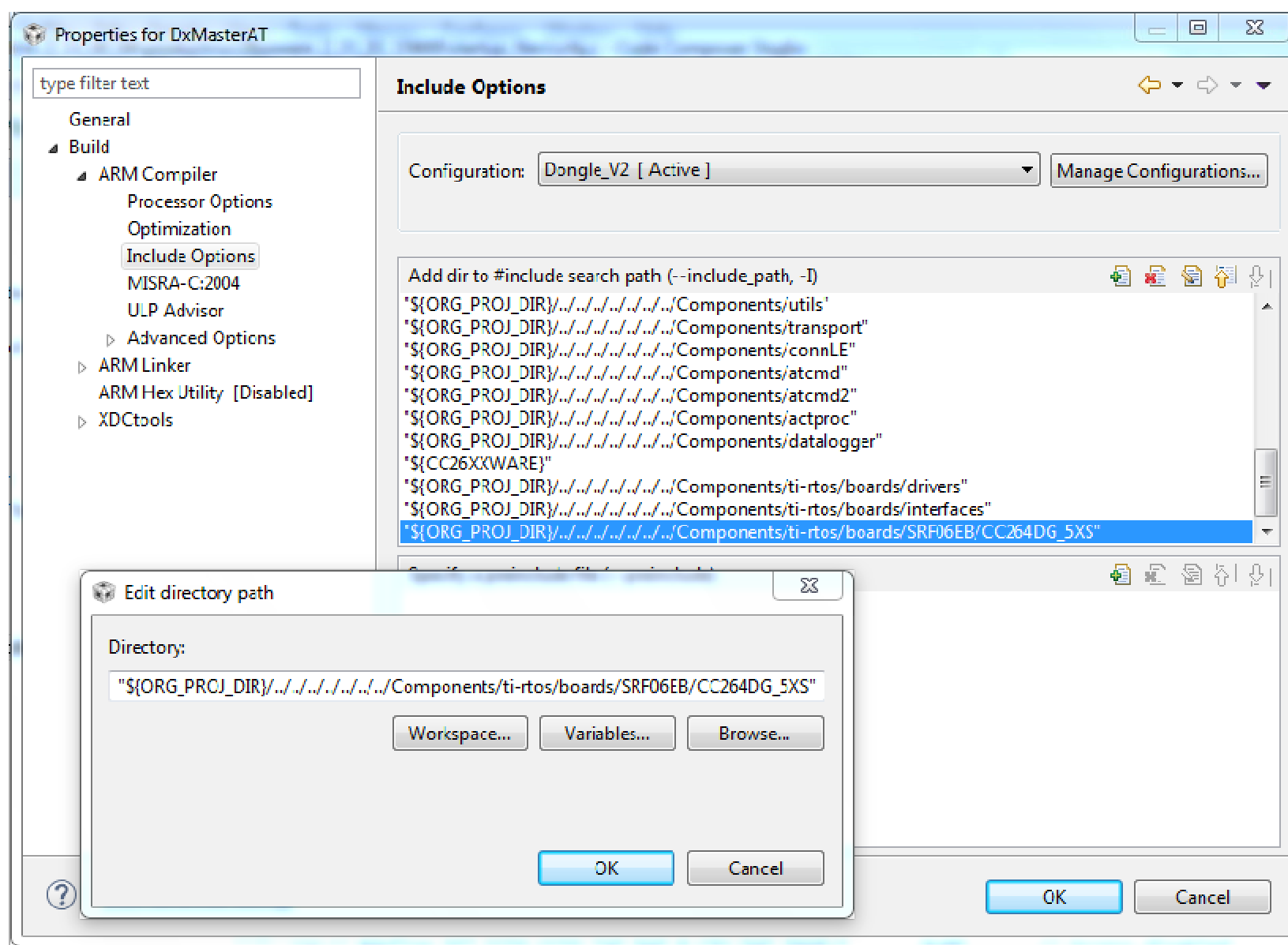
TI CC2640 SoC comes in different packages with different antenna design options and I/O mapping. To build a proper firmware for this dongle, you need to prepare the correct board files. Follow the steps below for the preparation.

1. For BLE SDK 2.1.x, the default project directory is "C:\ti\simplelink\ble_cc26xx_2_01_00_44423". Apply the ble_cc26xx_2_01_00_44423_patch_<timestamp>.rar to the ble_cc26xx_2_01_00_44423 directory accordingly. The patch contains new/modified files needed to support the firmware build for this dongle and other GT-tronics hardware. Please note: if you have already done this step for another hardware (e.g. TIEM), you can skip it as long as the patch file that has already been applied is the same or newer – compare the timestamps of the patch files.
2. In Project Properties, update the Build->ARM Compiler->Include Options with the following line. The line to be replaced usually is the last in the list. See the screenshot below for reference.

```

${ORG_PROJ_DIR}/../../../../../../../../Components/ti-rtos/boards/SRF06EB/CC264DG_5XS

```
3. Add "C:\ti\simplelink\ble_cc26xx_2_01_00_44423\Components\ti-rtos\boards\SRF06EB\board.c" in your project, then exclude (or remove) the build of the original board.c - you can find the original board.c in the "Startup" folder

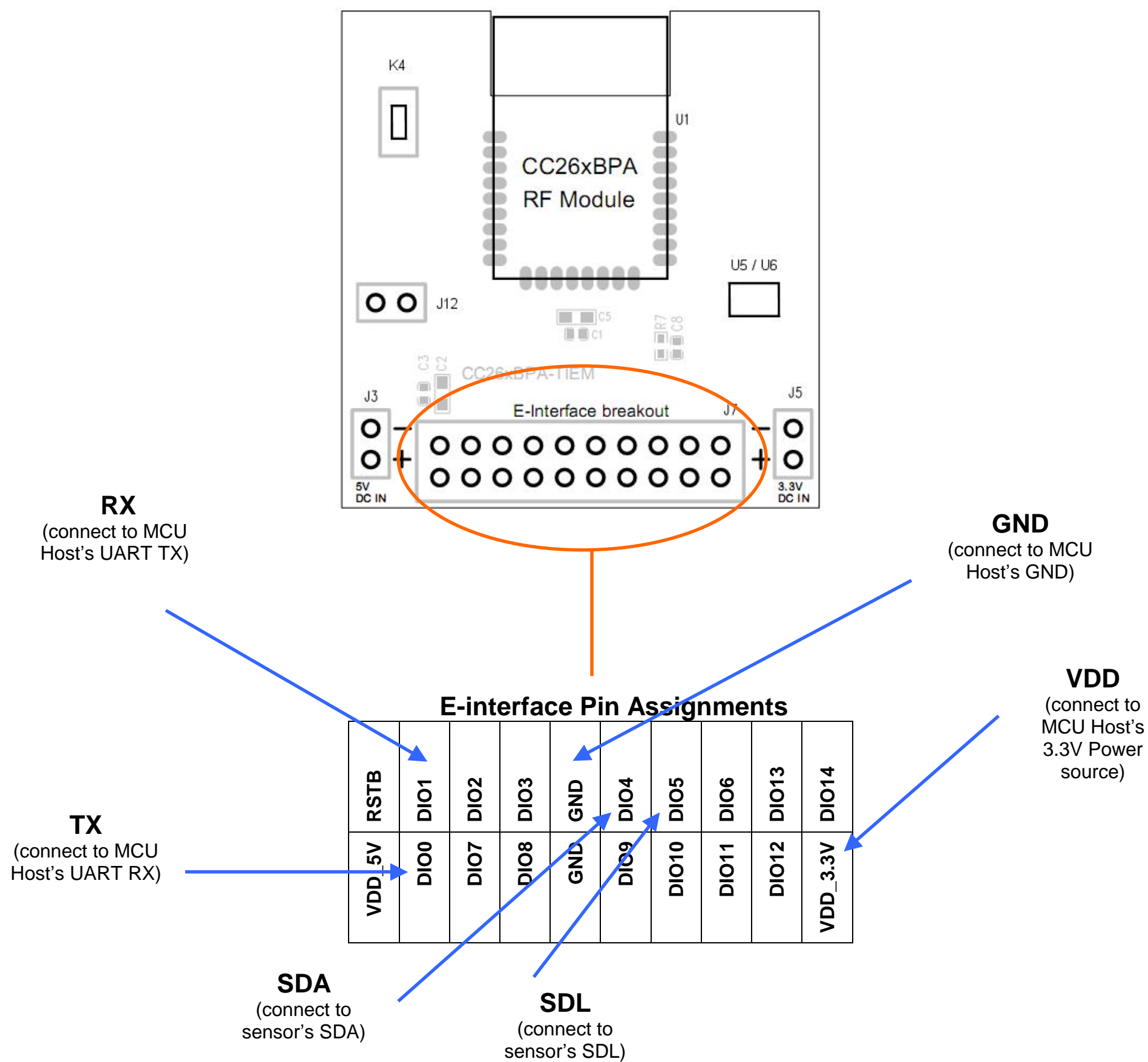


After the above alterations, rebuild your project to take effect.

Using with DataExchanger Firmware

The TIEM evaluation module is preloaded with DataExchanger-AT Firmware at factory. DataExchanger-AT is an embedded application running on CC264BPA modules that enables customers to incorporate Bluetooth connectivity for their applications and products. DataExchanger-AT features a serial communication interface to connect to customers' host MCU for data transfer and command line. Through its command line, DataExchanger-AT also can control local peripherals via other interfaces where sensors, actuators, and lights, etc, can be hooked up to. The key advantage of using DataExchanger-AT is its substantial saving in design effort that allows fast time-to-market but without adding much cost. DataExchanger-AT is ideal to be used in applications and products that require connection to smartphones, PC, standalone wireless console, and IoT gateways.

Connection Diagram for Default DataExchanger-AT Application Settings



- The operating voltage range is 1.8-3.3V. 3.0-3.3V is recommended.
- Add 10uF cap between VDD_3.3v and GND at J7.
- Use thick wires for ground and VDD_3.3v connections for the best possible RF performance.
- Use thicker connection wires whenever possible, to connect J7's VDD_3.3v and GND to the battery holder's +ve and -ve terminals on the bottom side. The two wires should be twisted together to reduce wire inductance. This may further reduce the power and ground resistance to the module, and hence, may get some improvements on the RF performance. However, this is not a must.
- VDD_3.3v and GND connecting to J7 should be tapped out from the power source on your main board (e.g. battery, LDOs etc) as direct as possible.
- TX and RX signal logic voltage levels are same as VDD.



Ordering Information

Part Number	FW Code Preloaded	Description
CC264BPA-TIEM	Please check with GT-tronics distributors	Integrated PCB antenna, CC2640-128 SoC, Shielded, BLE
CC265BPA-TIEM		Integrated PCB antenna, CC2650-128 SoC, Shielded, BLE/Zigbee/6LowPan

Revision History

Rev.	Date	Description	By
01	2015-05-29	Initial release for Board v1.2	Paul
02	2015-06-10	Added application note section	Dominic
03	2015-08-08	Added JTAG connection info to application note section	Dominic
04	2015-10-30	Added board config info for TI development tool chain	Ming
05	2015-11-16	Added notes about using peripherals on SmartRF06	Ming
06	2016-02-01	Modified board layout and added notes for v2.0 design	Dominic
07	2017-03-30	Modified board layout and added notes for v2.1 design	Dominic

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