

CC3100 SimpleLink™ Wi-Fi® and IoT Solution BoosterPack Hardware

User's Guide



Literature Number: SWRU371B
June 2014—Revised January 2015

1	Introduction.....	4
1.1	CC3100 BOOST.....	4
1.2	What Is Included	5
1.3	FCC/IC Regulatory Compliance	5
2	Hardware Description	6
2.1	Block Diagram	7
2.2	Hardware Features.....	7
2.3	Connector and Jumper Descriptions	8
2.4	Power.....	10
2.5	Measure the CC3100 Current Draw	13
2.6	Clocking	14
2.7	Performing Conducted Testing	14
3	Connecting to the PC Using EMUBOOST	15
3.1	CC31XXEMUBOOST	15
3.2	Connecting the Boards.....	17
3.3	Jumper Settings on the CC3100BOOST	17
3.4	Jumper Settings on the EMUBOOST	18
4	Connecting to a LaunchPad.....	18
4.1	LaunchPad Current Limitation	19
5	Additional Information	19
5.1	Design Files	19
5.2	Software.....	19
5.3	Hardware Change Log	20
5.4	Known Limitations	20
	Revision History.....	21
	Revision History.....	21

List of Figures

1	CC3100BOOST Front Side.....	6
2	CC3100 Block Diagram	7
3	Signal Assignments.....	9
4	3.3 V Power From MCU	11
5	Feed USB on the BoosterPack (if the LaunchPad cannot source 5 V on 20-pin connector)	11
6	3.3 V Power From LDO	12
7	Feed USB on the BoosterPack (always while using the on-board LDO)	12
8	Low Current Measurement	13
9	Active Current Measurement	13
10	Connectors on the Board.....	14
11	Radiated Mode (Left) vs Conducted Mode (Right)	14
12	CC31XXEMUBOOST Board	15
13	Portable Devices	16
14	The CC3100BOOST Connected to the EMUBOOST	17
15	CC3100BP connected to MSP430F5529 LaunchPad.....	18
16	Jumper Settings When Used With LaunchPad.....	19

List of Tables

1	Push Buttons	8
2	LEDs.....	8
3	Jumper Settings.....	8
4	Outer Row Connectors.....	9
5	Inner Row Connectors	10
6	Ports Available on J6	15
7	Ports Available on J5	16
8	CC3100BOOST Jumper Settings	17
9	EMUBOOST Jumper Settings	18
10	Hardware Change Log.....	20

CC3100 SimpleLink™ Wi-Fi® and IoT Solution BoosterPack Hardware

1 Introduction

1.1 CC3100 BOOST

The CC3100 SimpleLink™ Wi-Fi® solution provides the flexibility to add Wi-Fi to any microcontroller (MCU). This user guide explains the various configurations of the CC3100 hardware BoosterPack™. This internet on a chip solution contains everything that you need to easily create IoT solutions – security, quick connection, cloud support and more. The CC3100 BoosterPack can be used in several ways. First, it can be connected to a TI MCU LaunchPad (software examples provided for MSP-EXP430F5529LP). Second, it can be plugged into a CC31XXEMUBOOST¹ board and connected to a PC for MCU emulation. Finally, it can be connected onto an adapter board (MCU-ADAPT), which allows customers to use CC3100BOOST with additional platforms beyond TI LaunchPads.

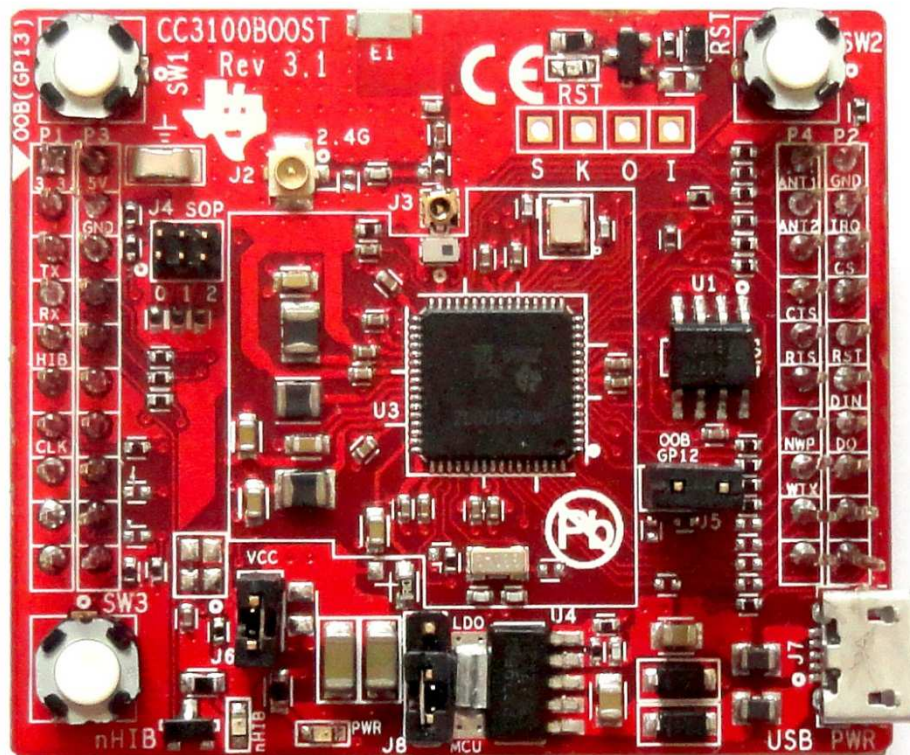
This kit comes in three configurations:

- CC3100BOOST + CC31XXEMUBOOST + MSP-EXP430F5529LP – Able to run all software in SDK, and develop on MSP430F5529 MCU.
- CC3100BOOST + CC31XXEMUBOOST – Used for any CC3100 development.
- CC3100BOOST – If extra CC3100 BoosterPacks are needed, and the user already has CC31XXEMUBOOST.

NOTE: ¹ CC31XXEMUBOOST is an advanced emulation board that is required for flashing CC3100BOOST, using the radio tool (Radio performance testing or putting into certification modes), and for doing networking processing logs for advanced debug.

NOTE: The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all people and must not be co-located or operate in conjunction with any other antenna or transmitter.

NOTE: The pictures used in this document refer to Rev 3.x, but the contents also apply to Rev4.0 and higher unless otherwise stated. For the changes across the various revisions of board, please refer to [Section 5.3](#).



1.2 What Is Included

- 1x CC3100BOOST
- 1x Micro USB cable
- 1x Quick start guide

1.3 FCC/IC Regulatory Compliance

The CC3100 SimpleLink Wi-Fi and IoT Solution BoosterPack Hardware is FCC Part 15 and IC ICES-003 Class A Compliant.

2 Hardware Description

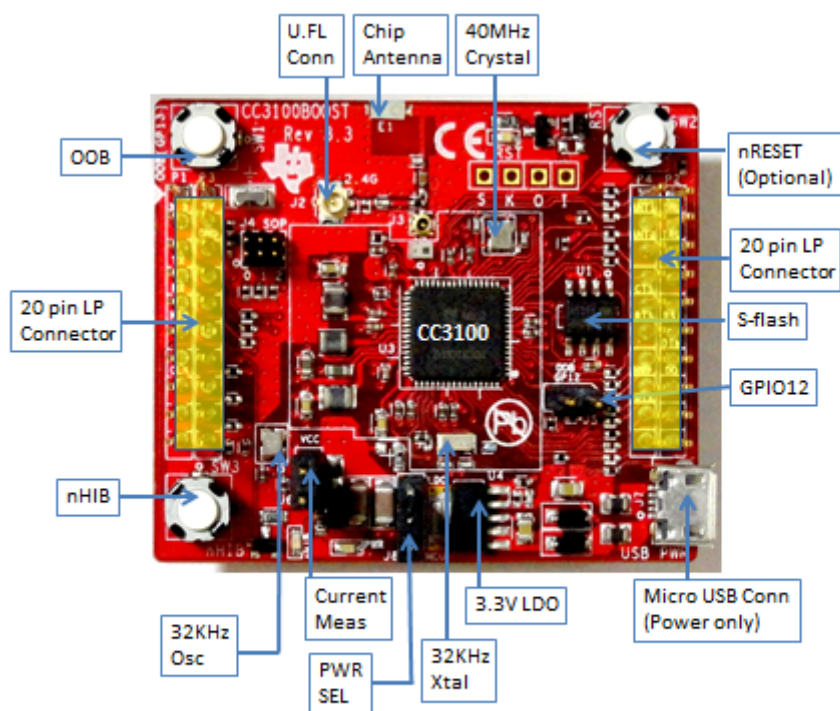


Figure 1. CC3100BOOST Front Side

2.1 Block Diagram

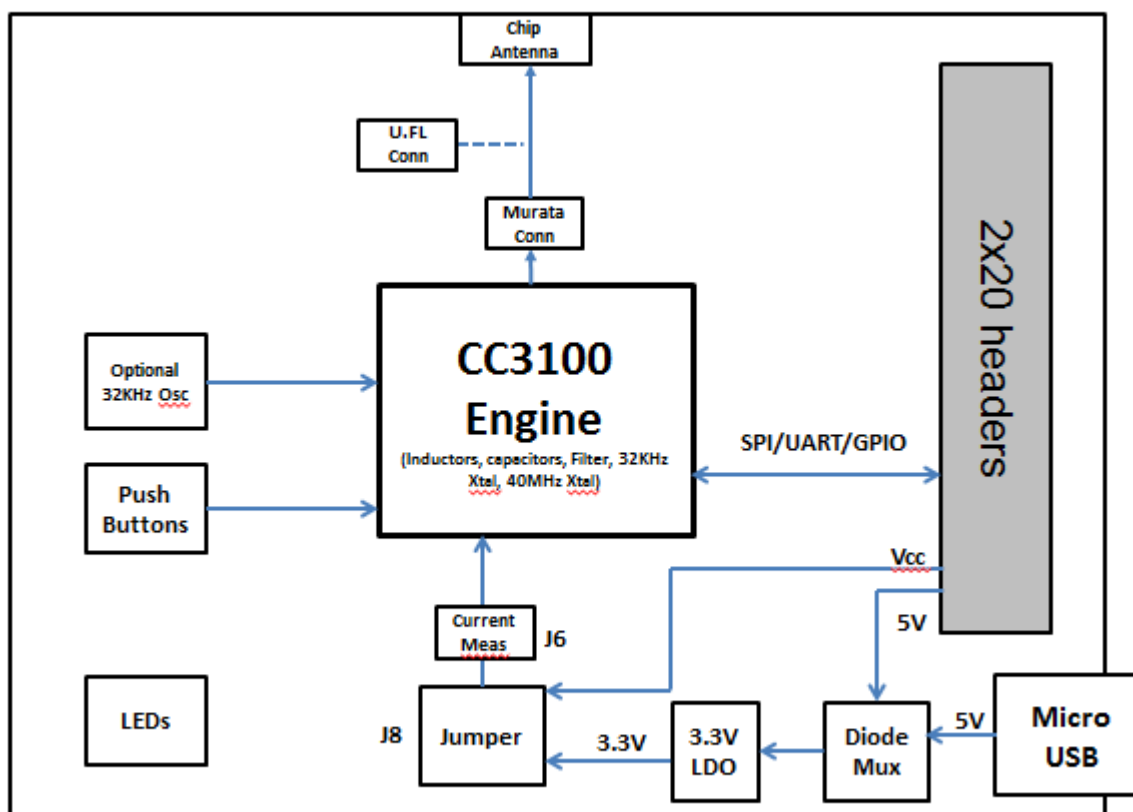


Figure 2. CC3100 Block Diagram

2.2 Hardware Features

- 2x20 pin stackable connectors
- On-board chip antenna with option for U.FL-based conducted testing
- Power from on-board LDO using USB or 3.3 V from MCU LaunchPad
- Three push buttons
- Two LEDs
- Jumper for current measurement with provision to mount 0.1R resistor for measurement with voltmeter
- 8 Mbit serial flash (M25PX80 from Micron)
- 40 MHz crystal, 32 KHz crystal and optional 32 KHz oscillator
- 4-layer PCB with 6 mil spacing and track width

2.3 Connector and Jumper Descriptions

2.3.1 Push Buttons and LEDs

Table 1. Push Buttons

Reference	Usage	Comments
SW1	OOB Demo	This is used as an input for the OOB demo.
SW2	RESET	The use of this pin is optional. It resets the device to a known state.
SW3	nHIB	This boots the device to the bootloader mode for flashing the firmware over a universal asynchronous receiver/transmitter (UART).

Table 2. LEDs

Reference	Colour	Usage	Comments
D5	RED	PWR indication	ON, when the 3.3 V power is provided to the board.
D1	Yellow	nRESET	This LED indicates the state of the nRESET pin. If this LED is glowing, the device is functional.
D6	Green	nHIB	This LED indicates the state of the nHIB pin. When the LED is OFF, the device is in hibernate state.

2.3.2 Jumper Settings

Table 3. Jumper Settings

Reference	Usage	Comments
J7	USB connector	For powering the BoosterPack when connected with a LaunchPad. This is mandatory when using "Z" devices (for example, CC3100HZ).
J8	Power selection	Choose the power supply from the Launchpad or the on-board USB. J8 (1-2) power from MCU LaunchPad J8 (2-3) power from on-board USB using 3.3 V LDO
J6	Current measurement	For Hibernate and LPDS currents, connect an ammeter across J26 : Range (< 500 μ A) For Active current, mount a 0.1 Ω resistor on R42 and measure the voltage across the 0.1 Ω resistor using a voltmeter (range (< 50 mV peak-peak)).
J5	Reserved	Closed: nHIB is pulled to VCC using 10K Open: nHIB pin is floating and is driven from EMUBOOST. (On Rev 3.3 and earlier, this was used to control GPIO_12)
J10, J9	BoosterPack header	2x10 pins each connected to the LaunchPad.
J3	RF Test	Murata connector (MM8030-2610) for production line tests.
J2	RF Test	U.FL connector for conducted testing in the lab.

2.3.3 2x20 Pin Connector Assignment

The signal assignment on the 2x20 pin connector is shown in Figure 3. The convention of J1...J4 is replaced with P1...P4 to avoid confusion with the actual board reference.

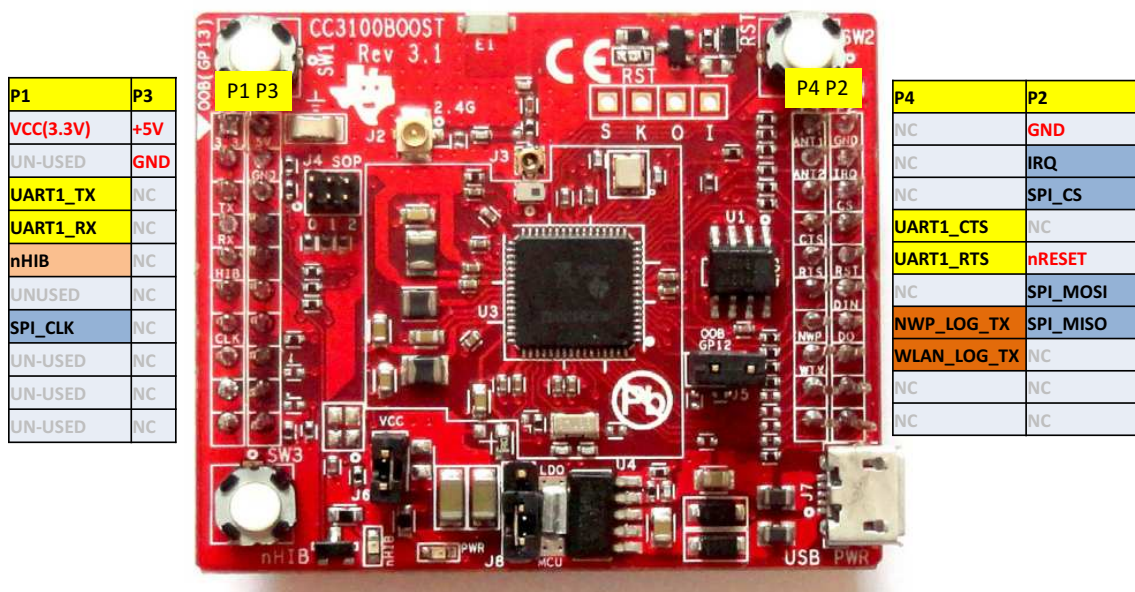


Figure 3. Signal Assignments

Table 4. Outer Row Connectors

Pin No	Signal Name	Direction	Pin No	Signal Name	Direction
P1.1	VCC (3.3 V)	IN	P2.1	GND	IN
P1.2	UNUSED	NA	P2.2	IRQ	OUT
P1.3	UART1_TX	OUT	P2.3	SPI_CS	IN
P1.4	UART1_RX	IN	P2.4	UNUSED	NA
P1.5	nHIB	IN	P2.5	nRESET	IN
P1.6	UNUSED	NA	P2.6	SPI_MOSI	IN
P1.7	SPI_CLK	IN	P2.7	SPI_MISO	OUT
P1.8	UNUSED	NA	P2.8	UNUSED	NA
P1.9	UNUSED	NA	P2.9	UNUSED	NA
P1.10	UNUSED	NA	P2.10	UNUSED	NA

Table 5. Inner Row Connectors

Pin No	Signal Name	Direction	Pin No	Signal Name	Direction
P3.1	+5 V	IN	P4.1	UNUSED	OUT
P3.2	GND	IN	P4.2	UNUSED	OUT
P3.3	UNUSED	NA	P4.3	UNUSED	NA
P3.4	UNUSED	NA	P4.4	UART1_CTS	IN
P3.5	UNUSED	NA	P4.5	UART1_RTS	OUT
P3.6	UNUSED	NA	P4.6	UNUSED	NA
P3.7	UNUSED	NA	P4.7	NWP_LOG_TX	OUT
P3.8	UNUSED	NA	P4.8	WLAN_LOG_TX	OUT
P3.9	UNUSED	NA	P4.9	UNUSED	IN
P3.10	UNUSED	NA	P4.10	UNUSED	OUT

NOTE: All signals are 3.3 V CMOS 400mA logic levels and are referred w.r.t. CC3100 IC. For example, UART1_TX is an output from the CC3100. For the SPI lines, the CC3100 always acts like a slave.

2.4 Power

The board is designed to accept power from a connected LaunchPad or from the CC3100EMUBOOST board. Some of the LaunchPads are not capable of sourcing the peak current requirements of Wi-Fi. In such a case, the USB connector on the CC3100BOOST can be used to aid the peak current. The use of Schottky diodes ensure that the load sharing happens between the USB connectors on the LaunchPad and the BoosterPack without any board modifications.

Also the 3.3 V power can be sourced from the LaunchPad or from the 3.3 V LDO on the board. This is done by using jumper J8. In the case where the LaunchPad is not able to source the 3.3 V up to 350mA, then the J8 needs to be configured to work from the on-board LDO.

2.4.1 Power From the LaunchPad or CC3100EMUBOOST

The most common scenario is to power the CC3100BOOST from the connected LaunchPad. In this case, the LaunchPad provides 3.3 V to the BoosterPack for its operation (see [Figure 4](#)). In addition to the 3.3 V, some LaunchPads provide a 5 V from the USB (see [Figure 5](#)), which is used to drive a 3.3 V LDO on the BoosterPack. In case the LaunchPad is not able to provide the 5V (for e.g. the LaunchPad with only 20 pins), then the USB connector on the CC3100BOOST should be used to provide the LDO input as shown below.

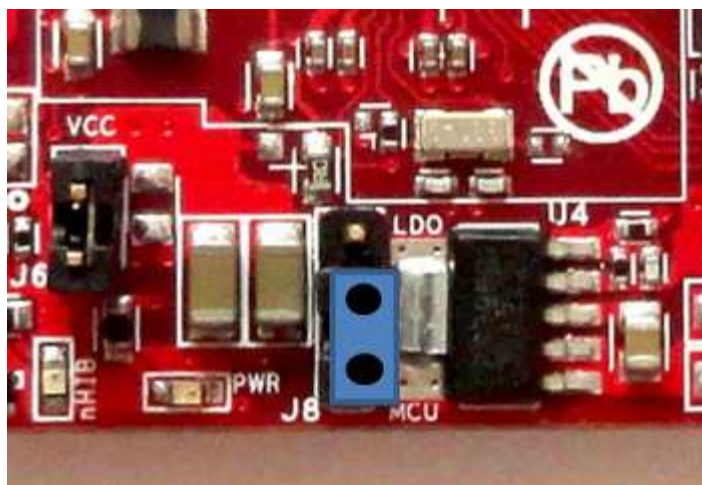


Figure 4. 3.3 V Power From MCU

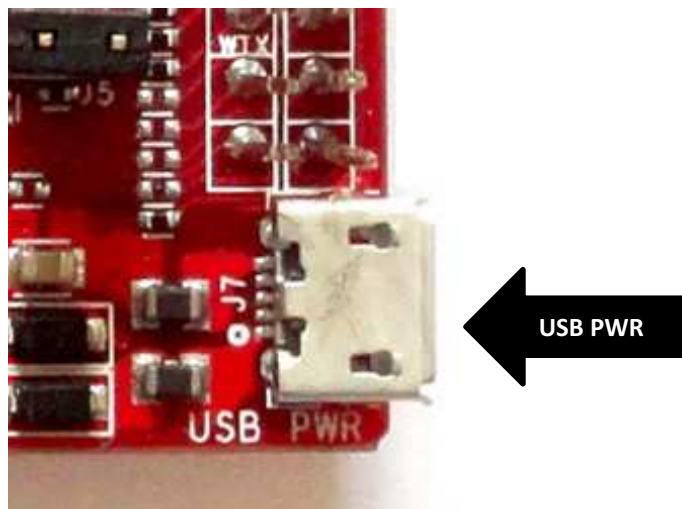


Figure 5. Feed USB on the BoosterPack (if the LaunchPad cannot source 5 V on 20-pin connector)

2.4.2 On-Board LDO Power Supply

On some LaunchPads, the 3.3 V is not capable of sourcing the 350 mA peak current needed for the CC3100BOOST. In such a case, the on-board 3.3 V LDO can be used (see [Figure 6](#)). This LDO would be sourced from the USB connector on the CC3100BOOST and the LaunchPad in a shared load manner.

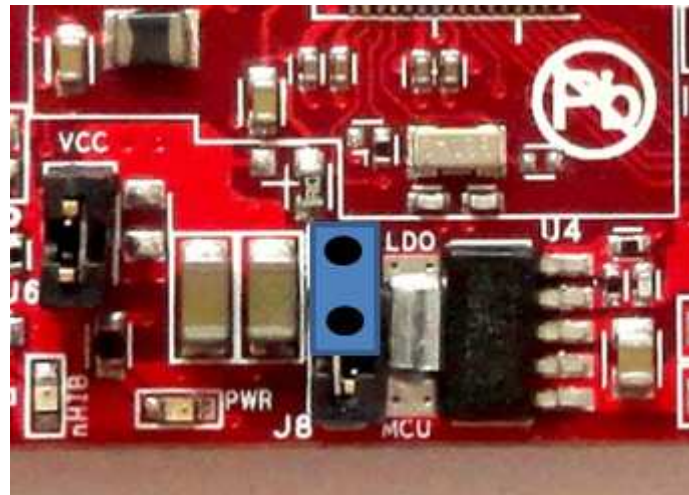


Figure 6. 3.3 V Power From LDO

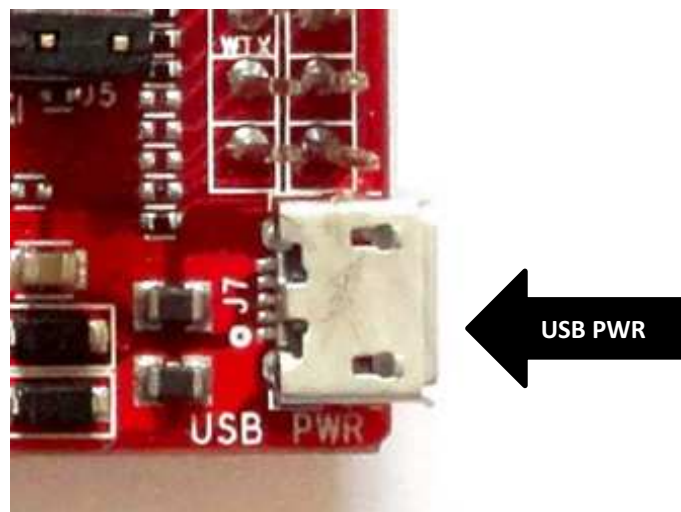


Figure 7. Feed USB on the BoosterPack (always while using the on-board LDO)

2.5 Measure the CC3100 Current Draw

2.5.1 Low Current Measurement (Hibernate and LPDS)

To measure the current draw of the CC3100 device, a jumper is provided on the board labeled J6. By removing this jumper, you can place an ammeter into this path and the current can be observed. This method is recommended for measuring LPDS and hibernate currents that are of the order of few 10s of micro amps.

The jumper is removed and an ammeter is added in series to measure the hibernate and LPDS currents (see [Figure 8](#)).

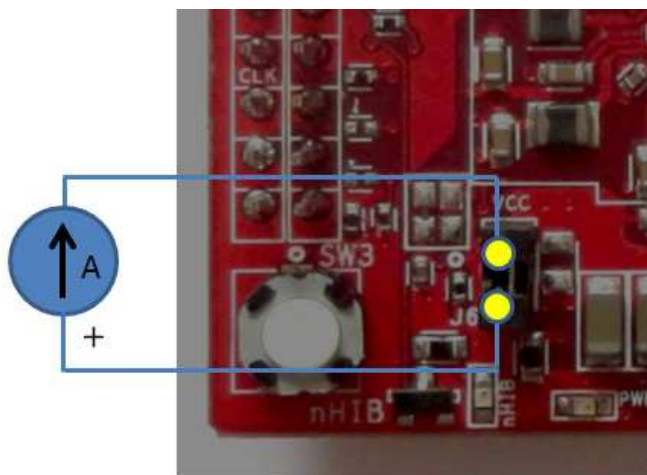


Figure 8. Low Current Measurement

2.5.2 Active Current Measurement

To measure active current in a profile form, it is recommended to use a $0.1\ \Omega$ 1% resistor on the board and measure the differential voltage across it. This can be done using a voltmeter or an oscilloscope for measuring the current profile.

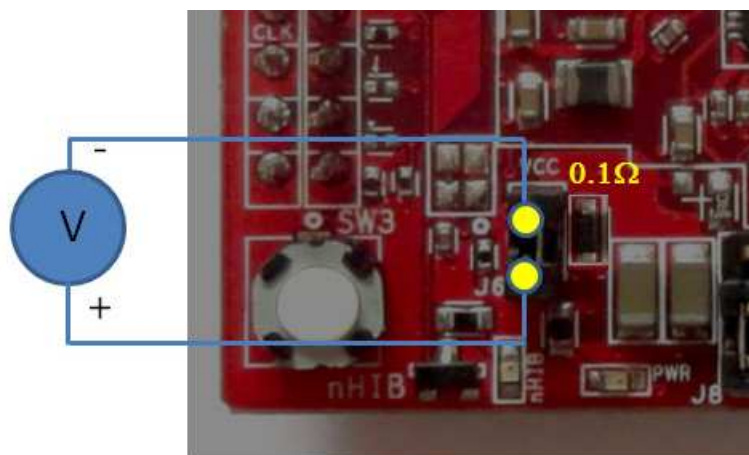


Figure 9. Active Current Measurement

2.6 Clocking

The board provides two crystals and one oscillator for the clocks to the device:

- Y1: a 40-MHz crystal
- Y2: a 32KHz oscillator
- Y3: a 32KHz crystal used as a sleep clock

The 32-kHz crystal allows for lower LPDS sleep currents than other low-frequency clock sources. The presence of the crystal allows the full range of low-power modes to be used.

2.7 Performing Conducted Testing

The BoosterPack by default ships with the RF signal connected to the on-board chip antenna. [Figure 10](#) illustrates that there is a miniature UMC connector (Murata MM8030-2610) on the board's RF path that can be used for measuring the performance in a conducted mode.

In addition to the Murata connector, there is a U.FL connector on the board (see [Figure 11](#)) that can be used for conducting testing or to connect an external antenna. This requires a board modification, as illustrated in the figures below.

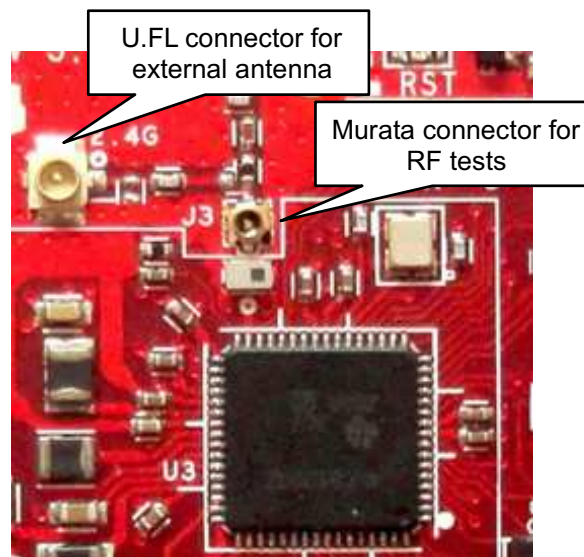


Figure 10. Connectors on the Board

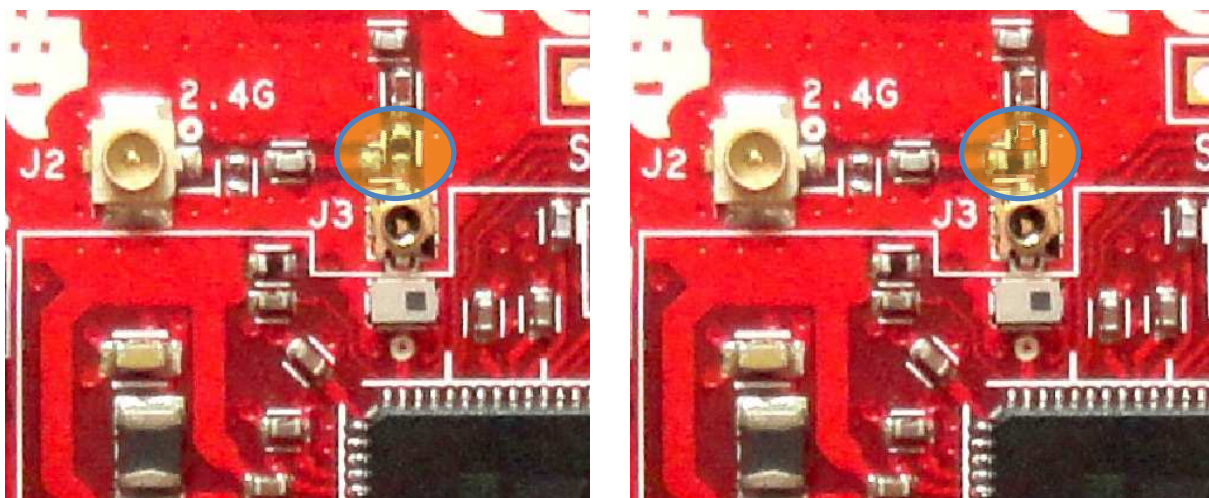


Figure 11. Radiated Mode (Left) vs Conducted Mode (Right)

3 Connecting to the PC Using EMUBOOST

3.1 CC31XXEMUBOOST

3.1.1 Overview

The CC31XXEMUBOOST is designed to connect the BoosterPack to a PC using a USB connection. This updates the firmware patches, which are stored in the serial flash, on the BoosterPack; and in software development using SimpleLink Studio.

3.1.2 Hardware Details

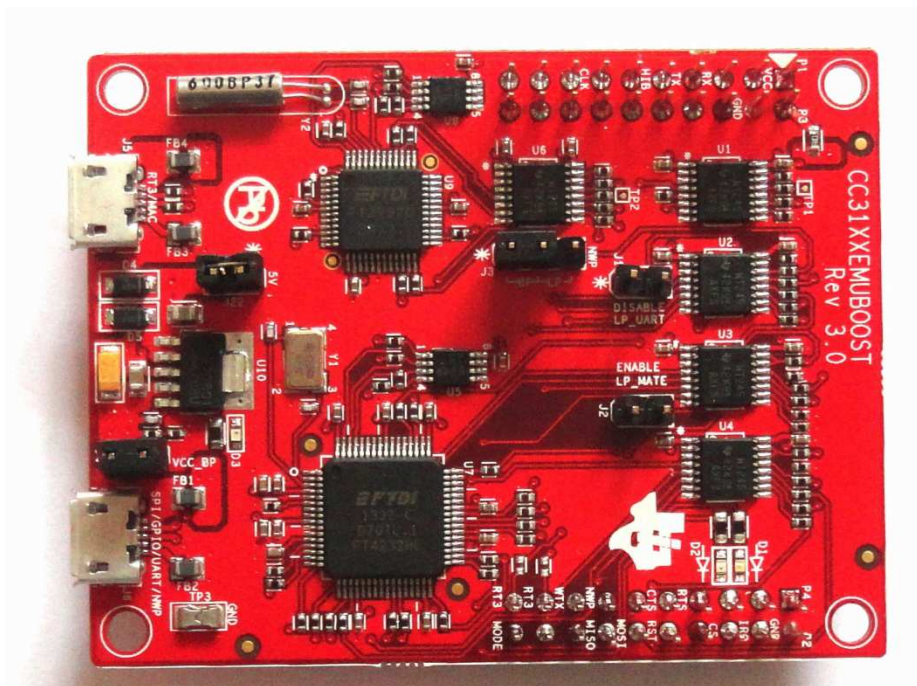


Figure 12. CC31XXEMUBOOST Board

The board has two FTDI ICs to enumerate multiple COM and D2XX ports. The details of the ports are given in [Table 6](#).

Table 6. Ports Available on J6

Port Number	Port Type	Usage	Comments
1	D2XX	SPI port for SL Studio	
2	D2XX	GPIO for SL Studio	Control the nRESET, nHIB, IRQ
3	VCP	COM port for Flash programming	
4	VCP	NWP	Network processor logger output. Used with specific tools to analyze the network processor logs. For TI use only.

NOTE: On the PC, only two of the four ports would be visible on the Device Manager. The D2XX ports are not listed under the "Ports" tab.

The first COM port in the list is used for the Flash programming.



Figure 13. Portable Devices

Table 7. Ports Available on J5

Port Number	Port Type	Usage	Comments
1	VCP	RT3	Used for TI internal debug only.
2	VCP	MAC logger	Used for TI internal debug only.

3.1.3 Driver Requirements

The FTDI Debug board requires you to install the associated drivers on a PC. This package is available as part of the SDK release and is located at:

[Install-Path]\cc3100-sdk\tools\cc31xx_board_drivers\.

The install path is usually C:\ti\cc3100SDK.

3.2 Connecting the Boards

Figure 14 shows the connection of the CC3100 BoosterPack to the EMUBOOST Board. The connectors should be aligned carefully as it does not have polarity protection and the sFlash can be erased as a result. The pins #1 of the connectors are marked on the board using a small triangle marking; these should be aligned while connecting.

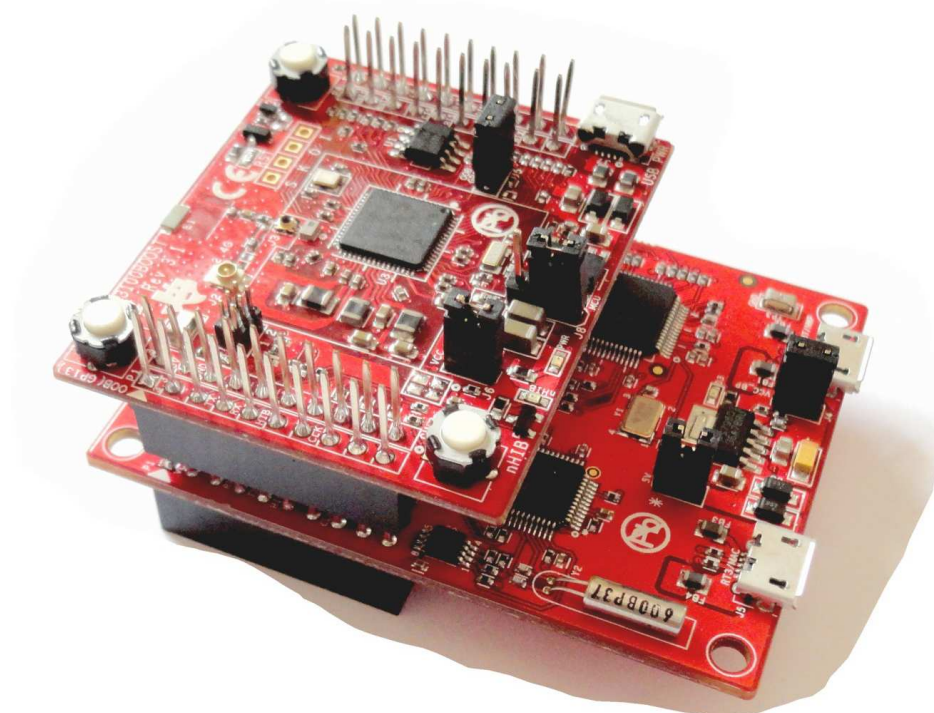


Figure 14. The CC3100BOOST Connected to the EMUBOOST

CAUTION

Align the pin-1 of the boards together using the triangle marking on the PCB. An incorrect connection can destroy the boards permanently.

Ensure that none of the header pins are bent before connecting the two boards. Jumper settings on the CC3100BOOST.

3.3 Jumper Settings on the CC3100BOOST

The following table specifies the jumpers to be installed on the CC3100BOOOST before pairing with the EMUBOOST board.

Table 8. CC3100BOOST Jumper Settings

No	Jumper Settings	Notes
1	J8 (1-2)	Power the BoosterPack from the EMU BOOST. The jumper shall be placed so that it is nearer to the edge of the PCB.
3	J6 (short)	No current measurement.
4	J5 (short)	OOB demo jumper.

3.4 Jumper Settings on the EMUBOOST

Table 9 specifies the jumpers to be installed while pairing with the FTDI board.

Table 9. EMUBOOST Jumper Settings

No	Jumper Settings	Notes
1	J4 (short)	Provide 3.3 V to the BoosterPack
2	J22 (short)	Provide 5.0 V to the BoosterPack
3	J3 (1-2)	Route the NWP logs to the Dual port also

The rest of the jumpers can remain open.

4 Connecting to a LaunchPad

The CC3100 BoosterPack can be directly connected to a compatible LaunchPad using the standard 2x20 pin connectors. The jumper settings needed for this connection are the same as that needed for the EMUBOOST board as described in Section 3.4.

Ensure that the Pin1 of the 2x20 pins are aligned correctly before pairing. Figure 15 illustrates the connected setup. Note that the USB cable is directly connected to the BoosterPack to power it only. For debugging, the USB cable on the LaunchPad is also required.

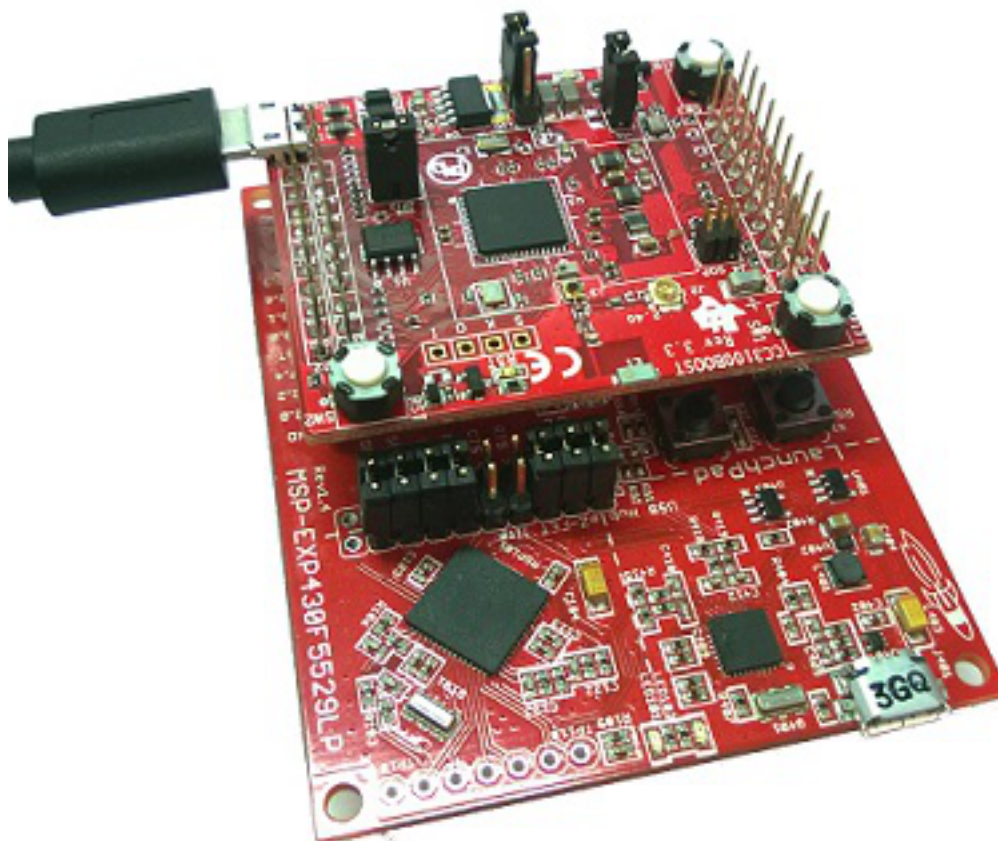


Figure 15. CC3100BP connected to MSP430F5529 LaunchPad

4.1 LaunchPad Current Limitation

Some of the LaunchPads, including the MSP430FRAM, do not provide enough current to power the CC3100 BoosterPack. The BoosterPack can consume up to 400 mA peak from the 3.3 V and it may be needed to power is separately.

For this, a USB connector is provided on the BoosterPack to provide the 3.3 V separately.

The power supply jumpers should be configured as shown in Figure 16 when the power is supplied from the on-board USB connector.

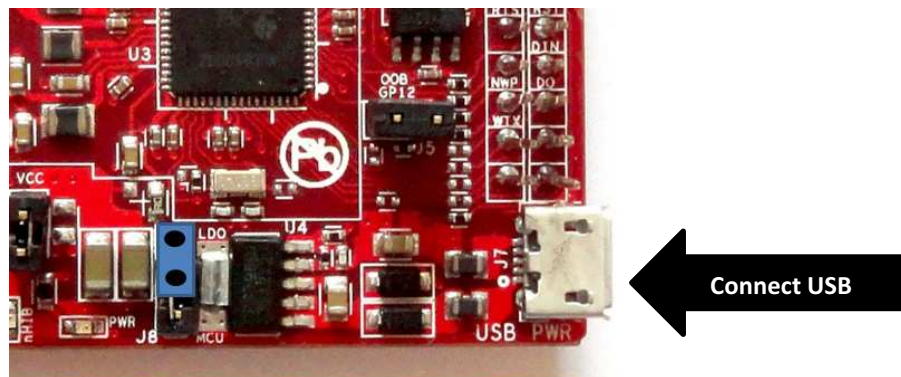


Figure 16. Jumper Settings When Used With LaunchPad

NOTE: Since there are two power sources in this setup, it is important to follow the power-up sequence.

NOTE: Always power the BoosterPack before powering the LaunchPad.

5 Additional Information

5.1 Design Files

All design files including schematics, layout, Bill of Materials (BOM), Gerber files, and documentation are made available in a zip folder that can be downloaded from the following URL:

<http://www.ti.com/lit/zip/swrc288>.

5.2 Software

All design files including TI-TXT object-code firmware images, software example projects, and documentation are available from the [CC3100 device's product page](#).

The Software Development Kit (SDK) to use with the CC3100 BoosterPack is available from <http://www.ti.com/tool/cc3100sdk>.

5.3 Hardware Change Log

Table 10. Hardware Change Log

PCB Revision	Description
Rev 2.0B	First release
Rev 3.0A	- Added push button for nHIB - Added Murata Connector for RF test - Added LED for nRESET - Routed the VDD_FLASH to 3.3 V - Moved the 100uF cap from VCC_BRD to VBAT_CC. Changed cap to 100uF ceramic from Tantalum - Removed 0.1 Ohm resistor for current measurement by default - Removed RS232 UART connection by default
Rev 3.1	- Initial prototype run. - Changed the JTAG test points to Thru-hole from SMD
Rev 3.2	- Layout changes on L1 and L2 layers for mask improvement - Updated the grounding for the DC-DC input capacitors to reduce the loop area. Results in overall mask improvement by 1.5 to 2.0dB.
Rev 3.3	Silk screen changes to mark different part number for the PCB
Rev 4.0	- Added pull-up/down resistors for the serial flash (improves current in hibernate mode to 7 uA, including serial flash). - Added pulls for all floating output pins - Re-assigned J5 for nHIB for use in OOB demo (this was used for GPIO12 on Rev 3.1, 3.2 and 3.3 but re-assigned to control nHIB on Rev 4.0 onwards). - Modified R12 to from 10K to 100K - R13 is changed from 3.3K to 10K

5.4 Known Limitations

5.4.1 Floating Signals (Rev 4.0)

When the CC3100 device goes into hibernate state, all the digital IOs would be floating; this includes all input and output pins. While the floating inputs on the CC3100 would not cause any leakage, the outputs need to be held at valid states so that the connected LaunchPad or board does not have a glitch. For example, the UART_TX line needs to be pulled high on the board using an external pull-up (100K) so that the external MCU does not get triggered by a false start bit. Similar pulls are needed on all the output pins from the device, if these cannot be provided on the MCU.

5.4.2 Board Modification for LPDS mode

There must be a 100K pull-down resistor on the pin19 (JTAG_TCK) for the device to reliably enter the LPDS mode. This is not present on the boards.

5.4.3 High Hibernate Currents (All Revs before 4.0)

The serial flash used on the board does not have any pull-ups and pull-downs on the CS, CLK and DATA lines. The CC3100 device does not hold them at valid logic levels when the device goes to hibernate state (low power). This can cause some leakage current to flow into the serial flash during this mode. To measure the lowest possible hibernate current, add the following components on the board: 100K pull-up on CS#, 100K pull-downs on DATA in and CLK in for the serial flash.

5.4.4 OOB Demo (All Revs before 4.0)

When the CC3100BOOST is used standalone (without any Launchpad or EMUBOOST board), the digital IOs of the device are floating. The nHIB pin of the device causes the device to always be in Hibernate state. For the out-of-the-box demo, this pin must be held at logic 1 using a jumper wire on the 20 pin connector.

Revision History

Changes from A Revision (August 2014) to B Revision	Page
• Added Board Modification for LPDS mode section.....	20

Revision History

Changes from Original (June 2014) to A Revision	Page
• Added note.	4
• Changed J5 value in Jumper Settings table.	8
• Added Rev 4.0 value for table.....	20
• Added information to Hardware Change Log table.....	20
• Added High Hibernate Currents and OOB Demo sections.	20

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.
 - 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. *Regulatory Notices:*
 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*
This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】

本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿6丁目24番1号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

4 EVM Use Restrictions and Warnings:

- 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
- 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
- 4.3 *Safety-Related Warnings and Restrictions:*

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

- 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
- 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
- 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
6. *Disclaimers:*
- 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
- 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.
7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.
8. *Limitations on Damages and Liability:*

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

- 8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS AND CONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.
- 8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.
9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.
10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com