User's Guide
SWAU106–January 2019

CC3135 SimpleLink™ Wi-Fi® BoosterPack™ Development Kit (BOOSTXL-CC3135)

The CC3135 device is part of the SimpleLink™ microcontroller (MCU) platform which consists of Wi-Fi®, *Bluetooth*® low energy, Sub-1 GHz radios and host MCUs. All share a common, easy-to-use development environment with a single core software development kit (SDK) and rich tool set. A one-time integration of the SimpleLink™ platform lets you add any combination of devices from the portfolio into your design. The ultimate goal of the SimpleLink™ platform is to achieve 100 percent code reuse when your design requirements change. For more information, visit www.ti.com/simplelink.

The SimpleLink™ Wi-Fi® CC3135 dual band wireless network processor from Texas Instruments™ provides users the flexibility to add Wi-Fi® to an MCU. This user's guide explains the various configurations of the CC3135 BoosterPack™ Plug-In Module.

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1 Introduction

1.1 CC3135 BoosterPack™

The SimpleLink™ Wi-Fi® CC3135 dual band (2.4GHz and 5GHz) wireless network processor provides users the flexibility to add Wi-Fi® to any microcontroller (MCU). This user's guide explains the various configurations of the CC3135 BoosterPack™ Plug-in Module. This Internet-on-a chip™ integrated circuit solution contains everything needed to easily create Internet of Things (IoT) solutions, including enhanced security features, quick connection establishment, cloud support, and more. The CC3135 BoosterPack™ module can be used in the following ways:

- The module can be connected to a TI MCU LaunchPad™ Development Kit (software examples provided for MSP-EXP432E401Y).
- The module can be plugged into a CC31xxEMUBOOST board, and connected to a PC for MCU emulation.
- The module can be connected to an adapter board DISCOVERY-ADAPT, which enables customers use the BOOSTXL-CC3135 with additional platforms beyond TI LaunchPad™ kits.

The CC3135 BoosterPack™ kit can be purchased in three configurations:

1. BOOSTXL-CC3135 plus CC31XXEMUBOOST board plus MSP-EXP432P401R LaunchPad™

   Can run all software in the software design kit (SDK), and develop on the MSP430F5529 MCU
2. BOOSTXL-CC3135 plus CC31XXEMUBOOST board

   Used for any CC3135 device development
3. BOOSTXL-CC3135

   If extra CC3135 BoosterPack™ modules are needed.

NOTE: The CC31XXEMUBOOST board is an advanced emulation board that is required for flashing the BOOSTXL-CC3135, using the radio tool (radio performance testing or putting into certification modes), and doing networking processing logs for advanced debugging.

The pictures used in this user's guide refer to the Revision A board, but the contents also apply to any higher revisions unless otherwise stated. For changes across the various revisions of the board, see Section 5.3.

The maximum RF power transmitted in each WLAN 2.4-GHz band is 18.3 dBm. The maximum RF power transmitted in each WLAN 5-GHz band is 17 dBm.

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 colocated or operating in conjunction with any other antenna or transmitter.

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1.2 Key Features

- CC3135 Dual Band (2.4GHz and 5GHz) SimpleLink™ Wi-Fi®, Internet-on-a chip™ solution
- 40-pin BoosterPack™ pinout that leverages the BoosterPack™ ecosystem
- Onboard chip antenna with U.FL connector for conducted testing
- additional Micro USB connector for external power connections.

1.3 What is Included

- One BOOSTXL-CC3135 Board
- One Micro USB Cable
- Quick Start Guide

1.4 FCC/IC Regulatory Compliance

The CC3135 SimpleLink™ Wi-Fi® BoosterPacks™ are tested for and found to be in compliance with FCC and ISED regulations regarding unlicensed intentional radiators. Hereby, Texas Instruments Inc. declares that the radio equipment type BOOSTXL-CC3135 are in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet addresses:

- BOOSTXL-CC3135 Certification Documents
- BOOSTXL-CC3135 Declaration of Conformity (DoC)

Indoor Usage Restrictions:

The device is restricted to indoor use only when operating in the 5150 to 5350 MHz frequency range.

	AT	BE	BG	HR	CY	CZ	DK
	EE	FI	FR	DE	EL	HU	IE
	IT	LV	LT	LU	MT	NL	PL
	PT	RO	SK	SI	ES	SE	UK

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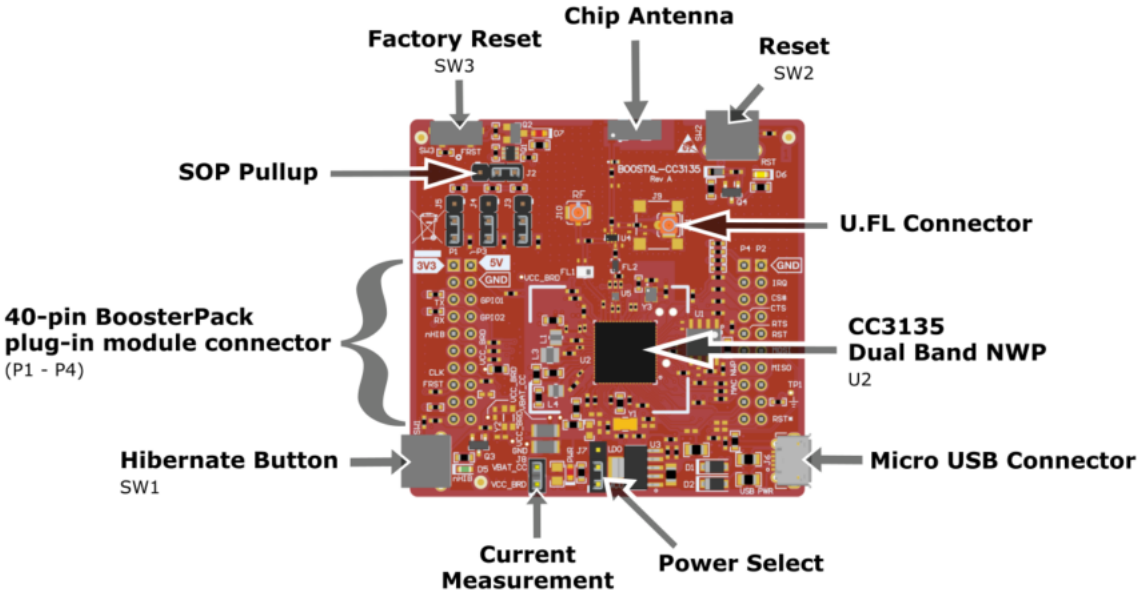
2 Hardware Description

Figure 1 shows the front side of the BOOSTXL-CC3135.

Figure 1. BOOSTXL-CC3135 Overview



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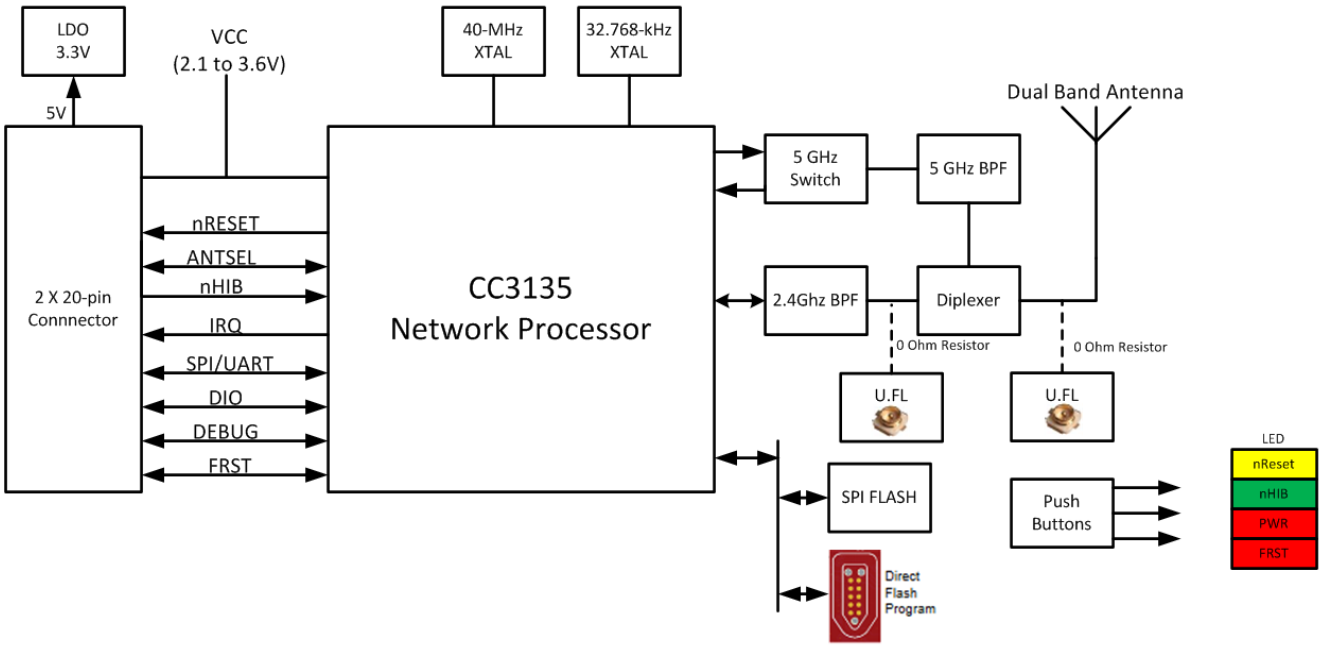
2.1 Block Diagram

Figure 2 shows the block diagram of the CC3135 device.

Figure 2. CC3135 Device Block Diagram



2.2 Hardware Features

- Two 20-pin stackable connectors (BoosterPack Standard)
- Onboard chip dual-band antenna with on-board U.FL connector for conducted RF testing
- Power from onboard LDO using USB or 3.3 V from MCU LaunchPad™
- Three push-buttons
- 4 LEDs
- Jumper for current measurement with provision to mount 0.1 ohm (0603) resistor for measurement with voltmeter
- A 16-Mb serial flash (MX25R from Macronix™)
- A 40-MHz crystal, 32-kHz crystal, and optional 32-kHz oscillator (not mounted on the PCB)
- A 4-layer PCB with 6-mil spacing and track width

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2.3 Connector and Jumper Descriptions

2.3.1 Push-buttons and LEDs

Table 1 lists the push-button descriptions.

Table 1. Push-buttons

Reference	Usage	Comments
SW3	Factory default	This button is used to restore the serial flash to the factory default image. Hold the button and then toggle the RESET push-button.
SW2	RESET	This button can be used to reset the device. Holding the button down sets the device in the SHUTDOWN state.
SW1	nHIB	This button boots the device to the bootloader mode for flashing the firmware over a universal asynchronous receiver/transmitter (UART).

Table 2 lists the LED descriptions.

Table 2. LEDs

Reference	Color	Usage	Comments
D3	Red	PWR indication	On, when the 3.3-V power is provided to the board.
D6	Yellow	nRESET	This LED indicates the state of the nRESET pin. If this LED is glowing, the device is functional.
D5	Green	nHIB	This LED indicates the state of the nHIB pin. When the LED is off the device is in HIBERNATE state.
D7	Red	Factory default	This LED indicates whether the factory default switch is pressed on. The RESET button must be pressed for this LED to function.

2.3.2 Jumper Settings

Table 3 lists the jumper settings.

Table 3. Jumper Settings

Reference	Usage	Comments
J6	USB connector	For powering the BoosterPack™ when connected with a LaunchPad™, which cannot source enough current.
J7	Power selection	Choose the power supply from the LauchPad™ kit or the onboard USB. J8 (1 to 2) power from the MCU LaunchPad™ J8 (2 to 3) power from the onboard USB using a 3.3-V LDO
J8	Current measurement	For hibernate and LPDS currents, connect an ammeter across J26 (range < 500 µA). 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).
P1…P4	BoosterPack™ header	2 × 10 pins each connected to the LaunchPad™
J10	RF test (2.4 Ghz only)	U.FL connector for conducted testing in the lab. Using this requires an ECO be made to the board by swapping two resistors.
J11	RF test (2.4 GHz + 5 GHz)	U.FL connector for conducted testing in the lab. Using this requires an ECO be made to the board by swapping two resistors.

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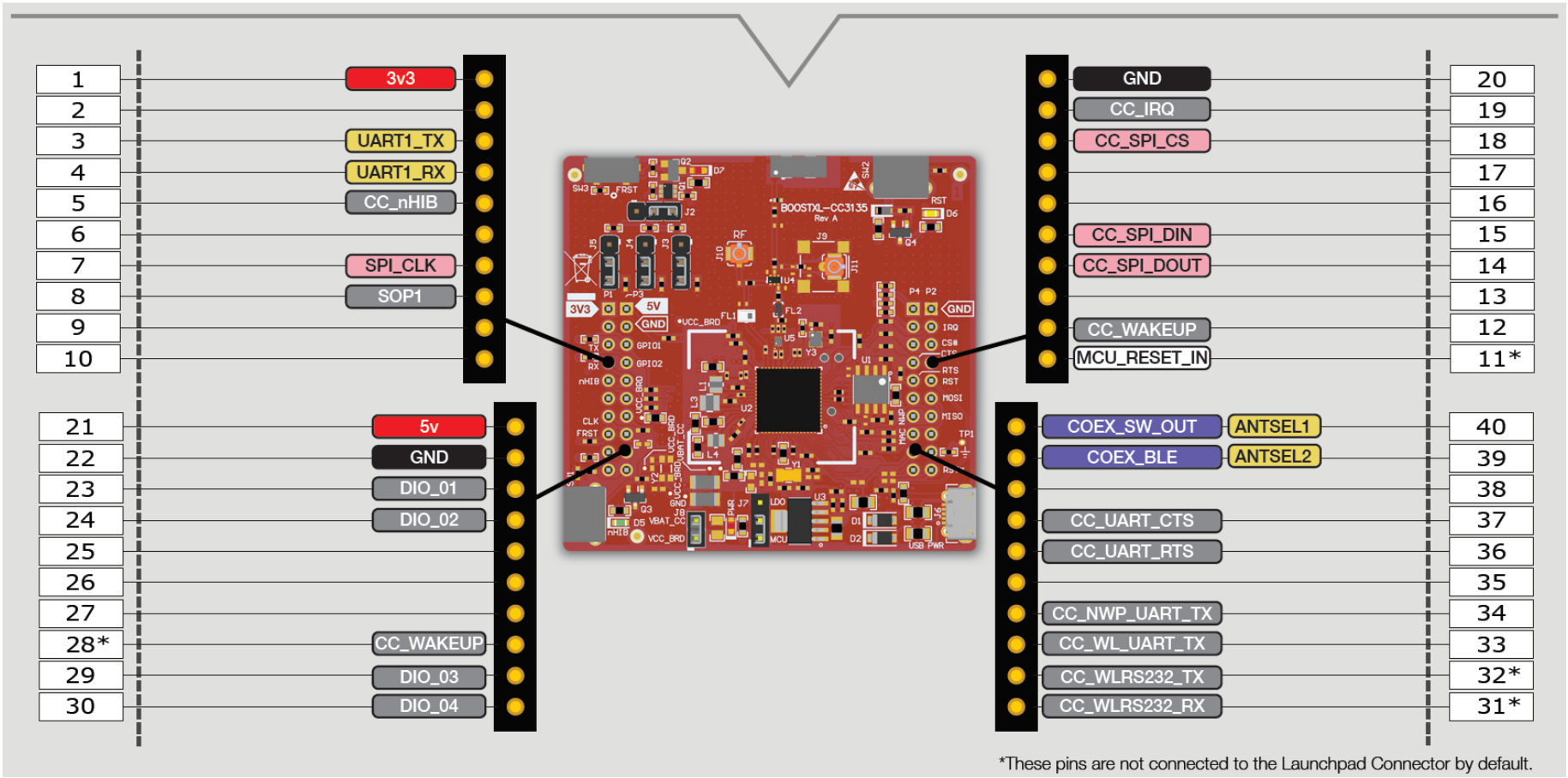
2.3.3 Assignment of the Two 20-Pin Connectors

Figure 3 shows the signal assignment on the two 20-pin connectors. The convention of J1...J4 is replaced with P1…P4 to avoid confusion with the actual board reference.

Figure 3. Pin Connector Assignment



NOTE: All signals are 3.3-V CMOS logic levels, and are referred with respect to the CC3135 device. For example, UART1_TX is an output from the CC3135. For the SPI lines, the CC3135 device always acts like a slave.

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2.4 Power

The board is designed to accept power from a connected LaunchPad™ kit, or through the CC31xxEMUBOOST board. Some LaunchPad kits cannot source the peak current requirements of Wi-Fi, which may be as high as 450 mA. In such cases, the USB connector on the BOOSTXL-CC3135 can be used to aid the peak current. The use of Schottky diodes ensure that load sharing occurs between the USB connectors on the LaunchPad kit and the BoosterPack™ module without any board modifications.

Also, the 3.3-V power can be sourced from the LaunchPad kit or from the 3.3-V LDO on the board. This sourcing is done by using jumper J8. If the LaunchPad kit is unable to source the 3.3 V up to 450 mA, then J8 must be configured to work from the onboard LDO.

2.4.1 Power From the LaunchPad™ Kit or CC3135EMUBOOST

The most common scenario is powering the BOOSTXL-CC3135 from the connected LaunchPad™ kit. In this case, the LaunchPad kit provides 3.3 V to the BoosterPack™ module for its operation (see Figure 4). In addition to the 3.3 V, some LaunchPad kits provide 5 V from the USB (see Figure 5), which is used to drive a 3.3-V LDO on the BoosterPack module. If the LaunchPad kit is unable to provide the 5 V (for example, the LaunchPad kit with only 20 pins), then the USB connector on the BOOSTXL-CC3135 must be used to provide the LDO input, as shown in Figure 5.

Figure 4. 3.3-V Power From MCU LaunchPad™ Kit

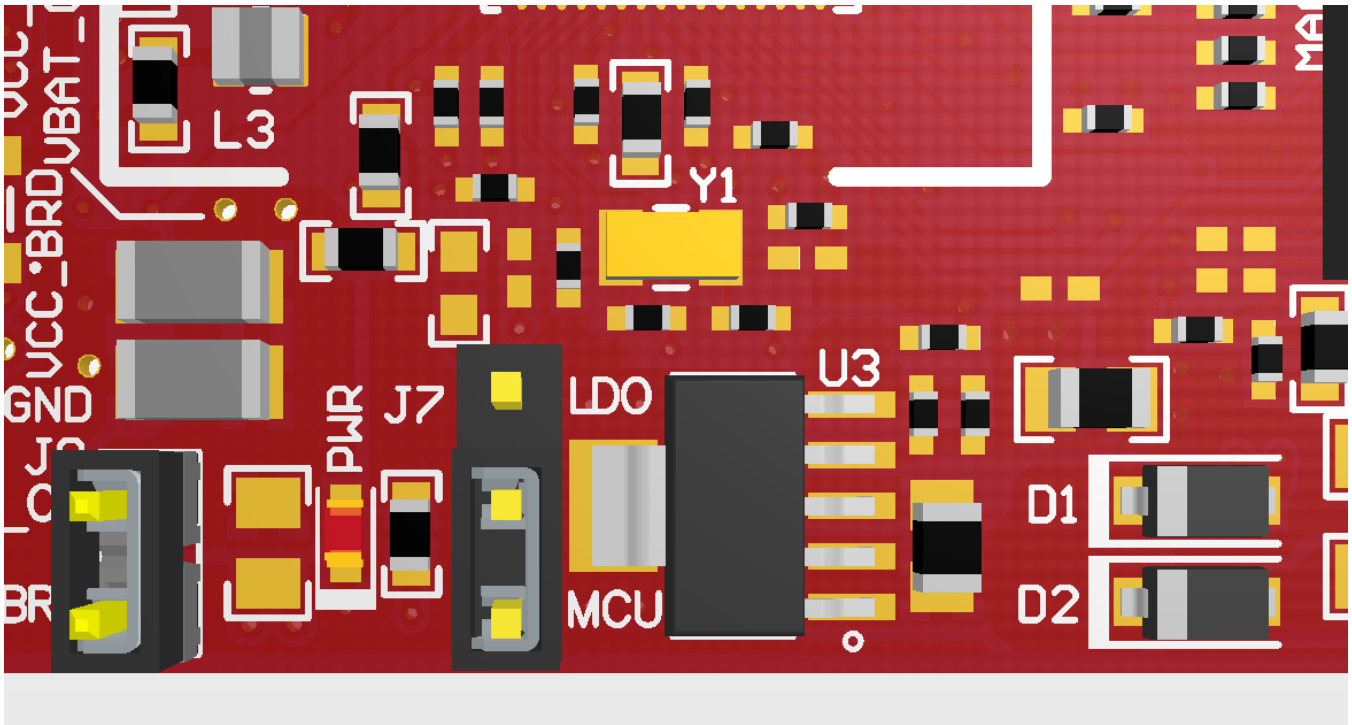

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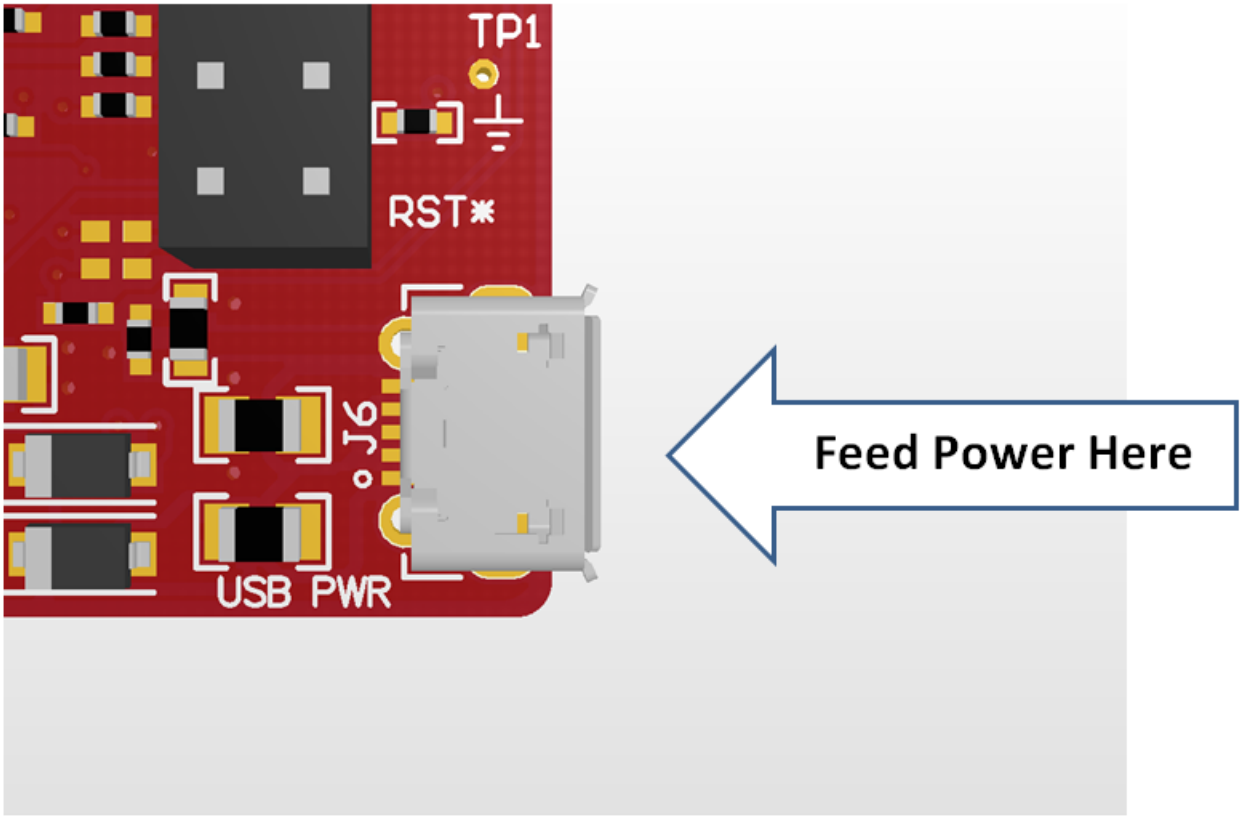
Figure 5. Feed USB on the BoosterPack™ Module (LaunchPad™ Kit Cannot Source 5 V on 20-Pin Connector)



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2.4.2 Onboard LDO Power Supply

On some LaunchPad™ kits, the 3.3 V cannot source the 450-mA peak current needed for the BOOSTXL-CC3135 board. In such a case, the onboard 3.3-V LDO can be used (see Figure 6). This LDO would be sourced from the USB connector on the BOOSTXL-CC3135 and LaunchPad kit in a shared-load manner (see Figure 7).

Figure 6. 3.3-V Power from LDO

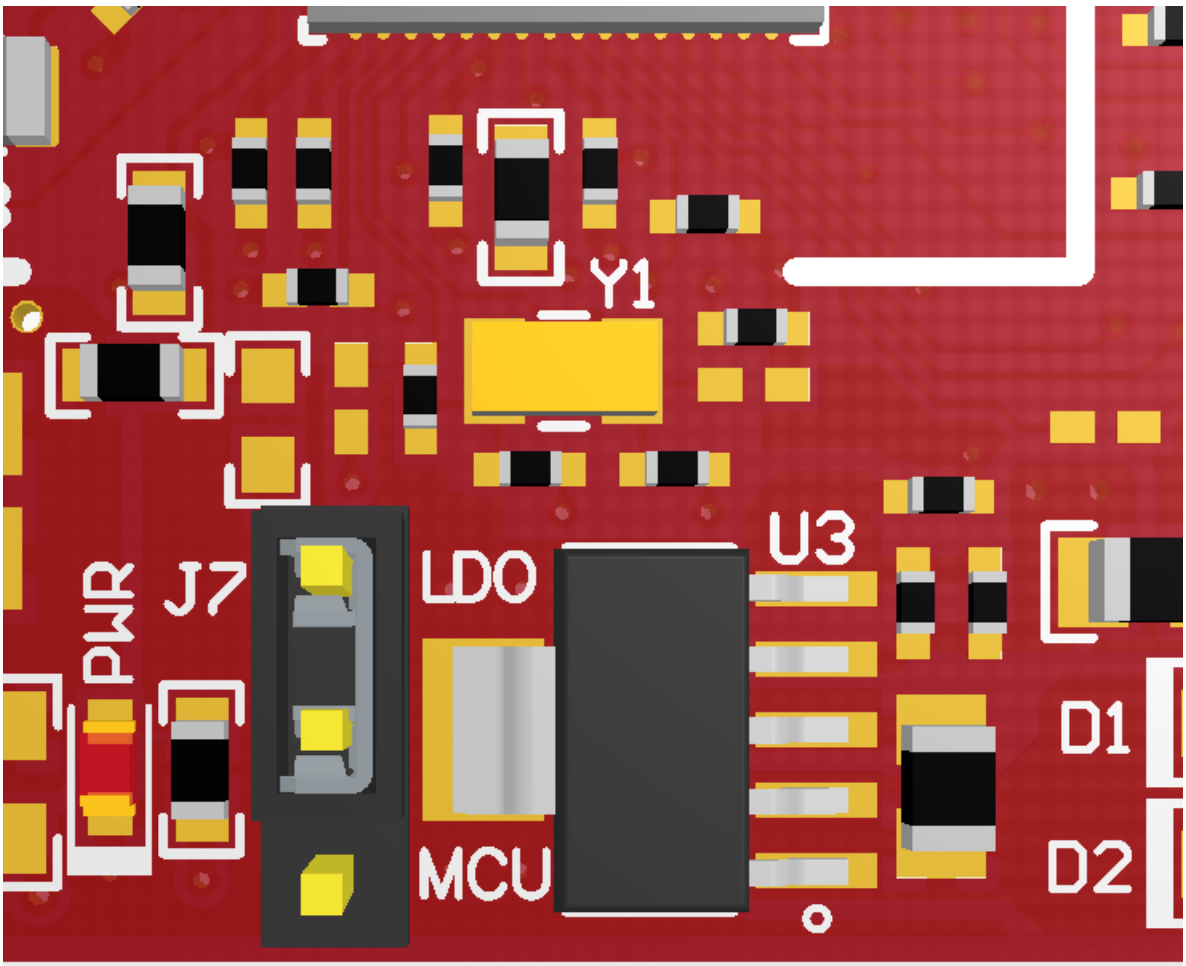

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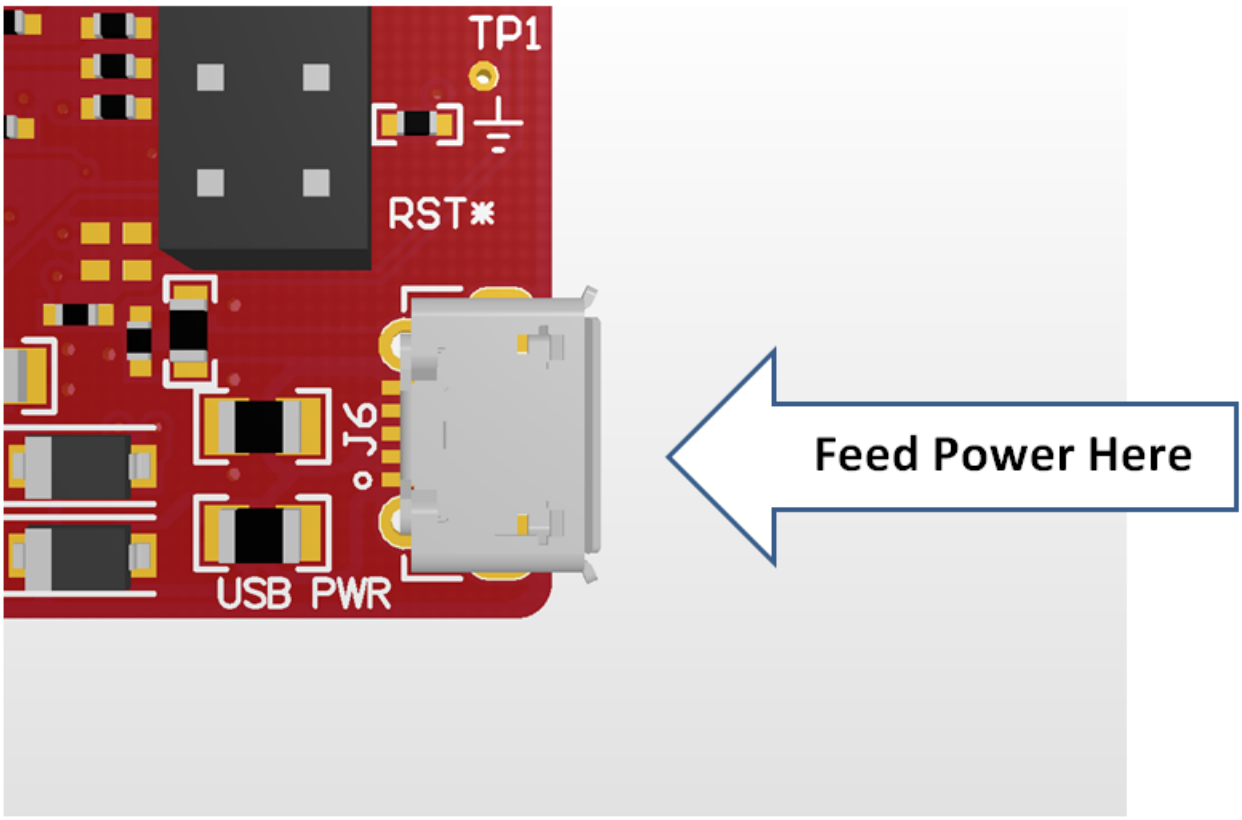
Figure 7. Feed USB on the BoosterPack™ Module (Always While Using the Onboard LDO)



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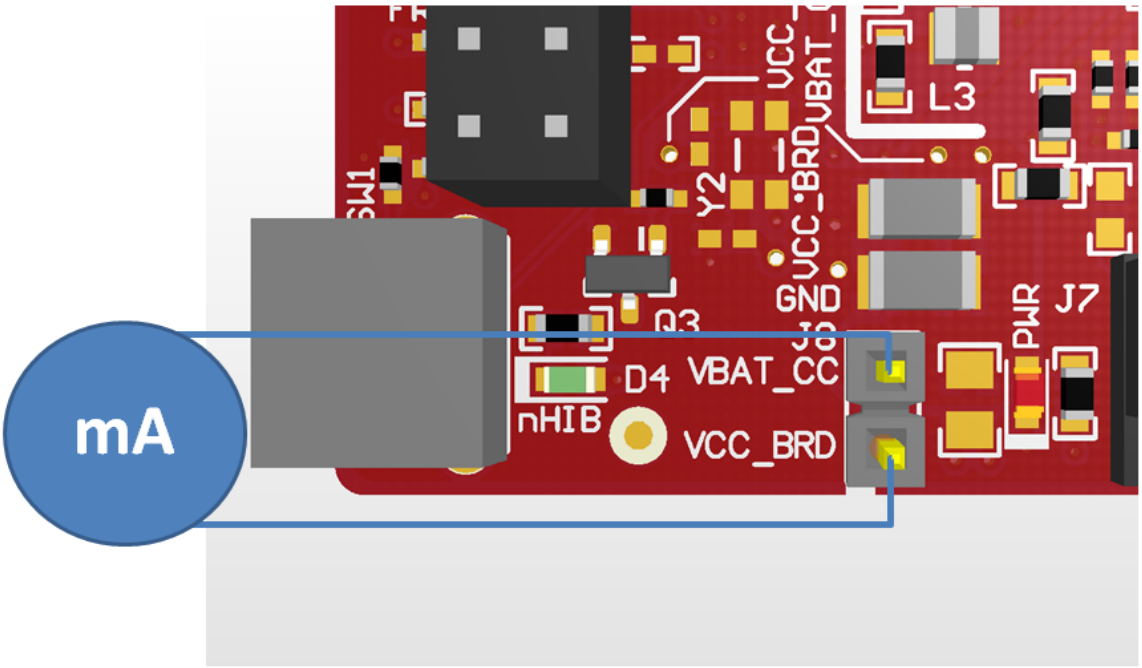
2.5 Measure the CC3135 Current Draw

2.5.1 Low Current Measurement (Hibernate and LPDS)

To measure the current draw of the CC3135 device, and the serial flash, a jumper labeled J8 is provided on the board. By removing J6, users can place an ammeter into this path to observe the current. TI recommends this method for measuring the LPDS and hibernate currents.

Jumper J6 is removed, and an ammeter is added in series to measure the hibernate and LPDS currents (see Figure 8).

Figure 8. Low Current Measurement



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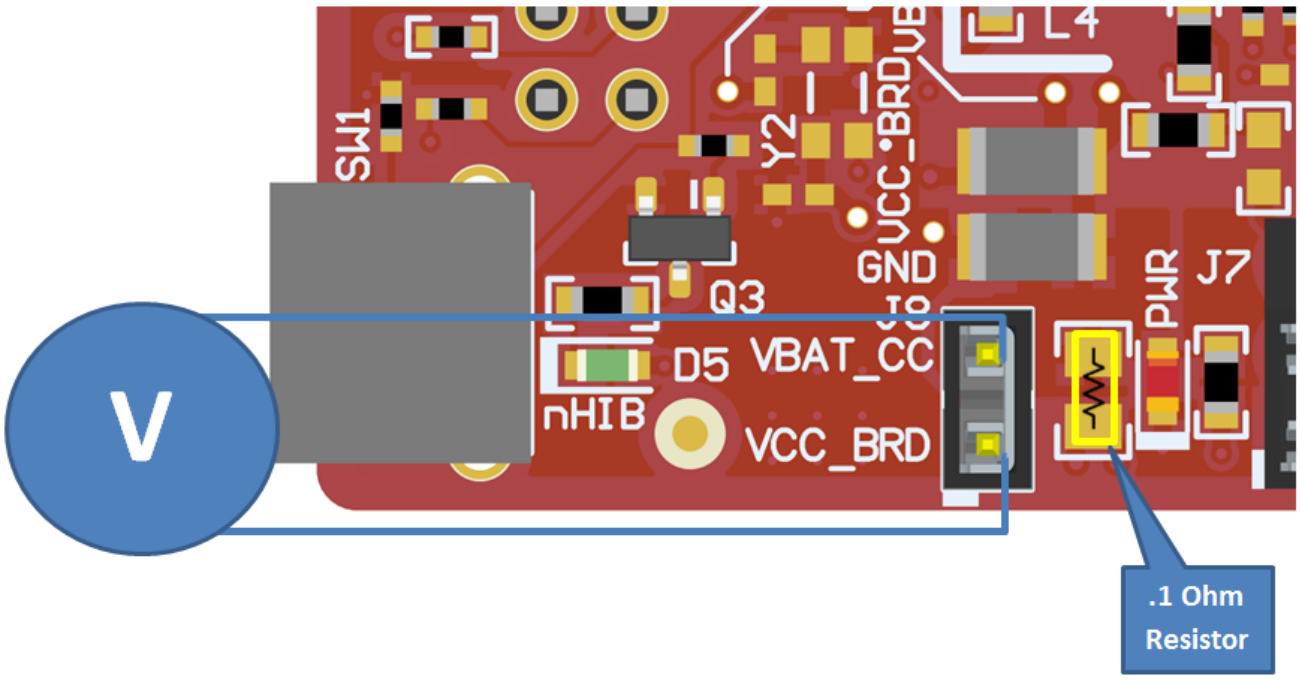
2.5.2 Active Current Measurement

To measure active current in a profile form, TI recommends using a 0.1-Ω 1% 0603 resistor on the board, and measuring the differential voltage across the resistor. This measurement 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 for the clocks to the device:

- Y1 is a 40MHz crystal.
- Y3 is a 32kHz crystal used as a sleep clock.

The 32kHz crystal (Y3) allows for lower LPDS sleep currents than other low-frequency clock sources. The presence of the crystal allows use of the full range of low-power modes.

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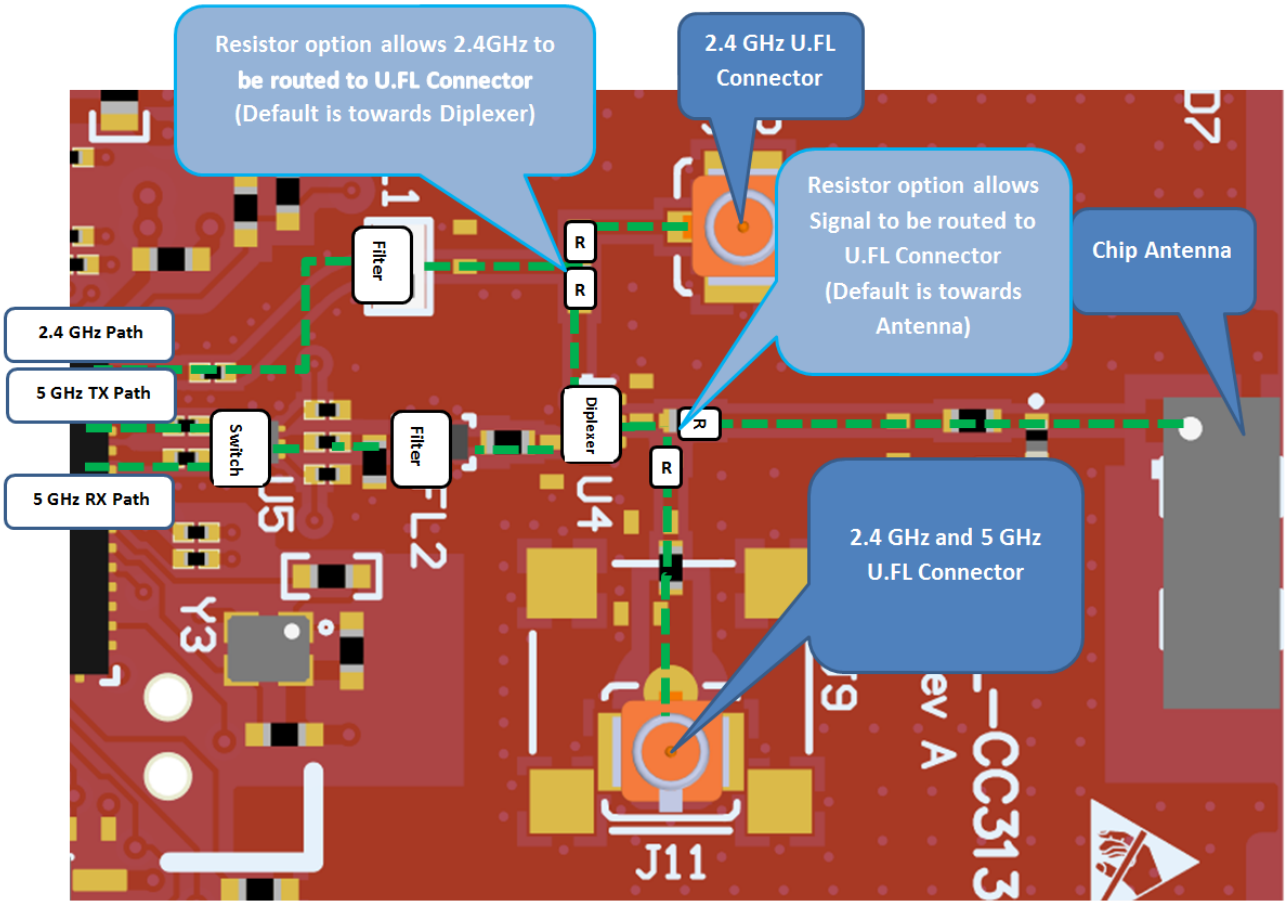
2.7 Performing Conducted Testing

The BoosterPack™ board by default ships with the RF signal connected to the onboard dual band chip antenna. In addition to the dual band antenna, the board contains two U.FL connectorsthat can be used for conduct testing, or connect an external antenna. One connector is present for 2.4 GHz only testing, and another is provided after the diplexer to allow for dual band RF testing. The use of these connectors requires a rework to be performed, which involves swapping the position of a resistor, as shown in Figure 10.

Figure 10. RF Path on BOOSTXL-CC3135



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3 Connecting to the PC Using CC31XXEMUBOOST Board

3.1 CC31XXEMUBOOST Board

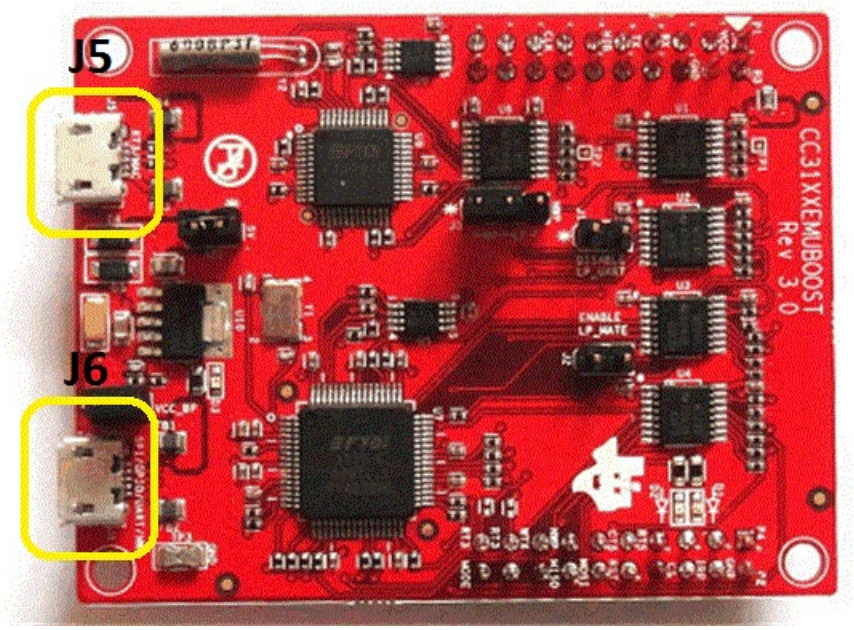
3.1.1 Overview

The CC31XXEMUBOOST board is designed to connect the BoosterPack™ module to a PC through a USB connection. This connection updates the firmware patches, which are stored in the serial flash on the BoosterPack, and in software development using SimpleLink Studio. The board is also used to measure the RF performance using a software tool named *RadioTool*. For more information, see the CC31xx & CC32xx Radio Tool wiki page.

3.1.2 Hardware Details

Figure 11 shows the CC31XXEMUBOOST board.

Figure 11. CC31XXEMUBOOST Board



The CC31XXEMUBOOST board has two FTDI ICs to enumerate multiple COM and D2XX ports. Table 4 gives the details of the ports.

Table 4. Ports Available on J6

Port Number	Port Type	Usage	Comments
1	D2XX	SPI port for SimpleLInk Studio	
2	D2XX	GPIO for SimpleLink 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.

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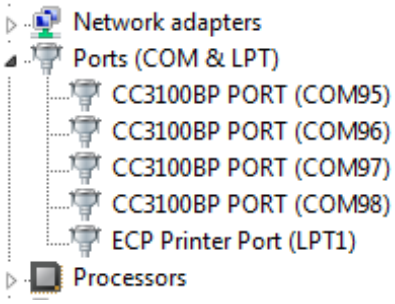
The third COM port in the list is used for the flash programming (see Figure 12).

Figure 12. Portable Devices



NOTE: The third COM port shown (COM97 for the example in Figure 12) is used for flash programming.

Table 5 lists the ports available on J5.

Table 5. 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 users to install the associated drivers on a PC. This package is available as part of the SDK release in the following folder:

`[Install-Path]\CC3135-sdk\tools\cc31xx_board_drivers\`

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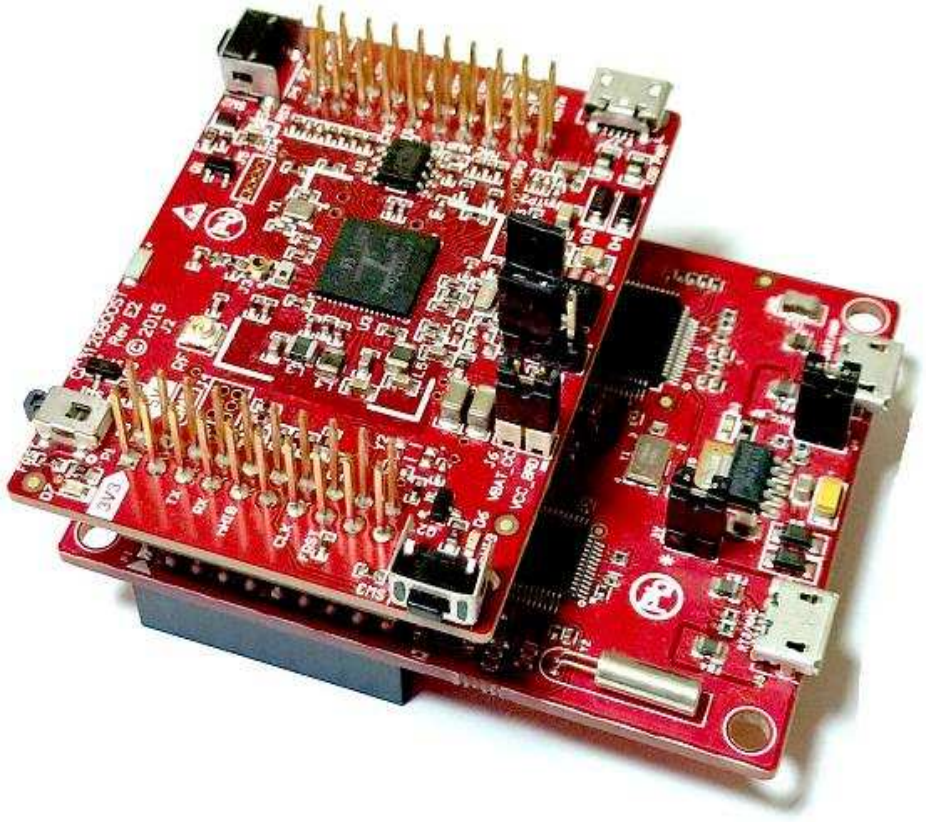
3.2 Connecting the Boards

Figure 13 shows the connection of the CC3135 BoosterPack™ module to the CC31XXEMUBOOST board. The connectors must be aligned carefully, because the CC31XXEMUBOOST board does not have polarity protection, and the serial flash can be erased as a result. Pin 1 on each of the connectors is marked on the board using a small triangle marking; these pins must be aligned while connecting.

Figure 13. BOOSTXL-CC3135 Connected to the CC31XXEMUBOOST Board



CAUTION

Align 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.

3.3 Jumper Settings on the BOOSTXL-CC3135 Board

Table 6 specifies the jumpers to be installed on the BOOSTXL-CC3135 before pairing with the CC31XXEMUBOOST board.

Table 6. BOOSTXL-CC3135 Jumper Settings

Number	Jumper Settings	Notes
1	J8 (1-2)	Powers the BoosterPack™ from the CC31XXEMUBOOST board. The jumper shall be placed so that it is near the edge of the PCB.
3	J6 (short)	No current measurement.

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3.4 Jumper Settings on the CC31XXEMUBOOST Board

Table 7 specifies the jumpers to be installed while pairing with the CC31XXEMUBOOST board.

Table 7. Jumper Settings on the CC31XXEMUBOOST Board

No	Jumper Settings	Notes
1	J4 (short)	Provides 3.3 V to the BoosterPack™
2	J22 (short)	Provides 5.0 V to the BoosterPack™
3	J3 (1 to 2)	Routes the NWP logs to the dual port also

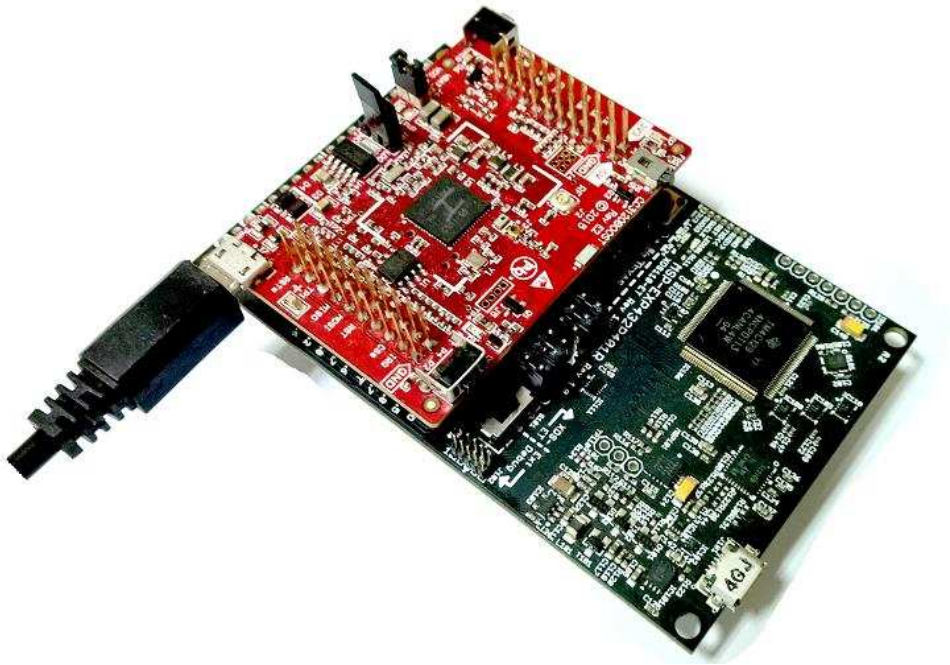
The remaining jumpers can remain open.

4 Connecting to a LaunchPad™ Kit

The CC3135 BoosterPack™ module can be directly connected to a compatible LaunchPad™ development kit using the standard two 20-pin connectors. The jumper settings needed for this connection are the same as those needed for the CC31XXEMUBOOST board, as described in Section 3.3.

Ensure that pin 1 of the two 20-pin connectors are aligned correctly before pairing. Figure 14 shows the connected setup. The USB cable is directly connected to the BoosterPack module to power it only. For debugging, the USB cable on the LaunchPad kit is also required.

Figure 14. CC3135BP Connected to MSP432™ LaunchPad™ Kit



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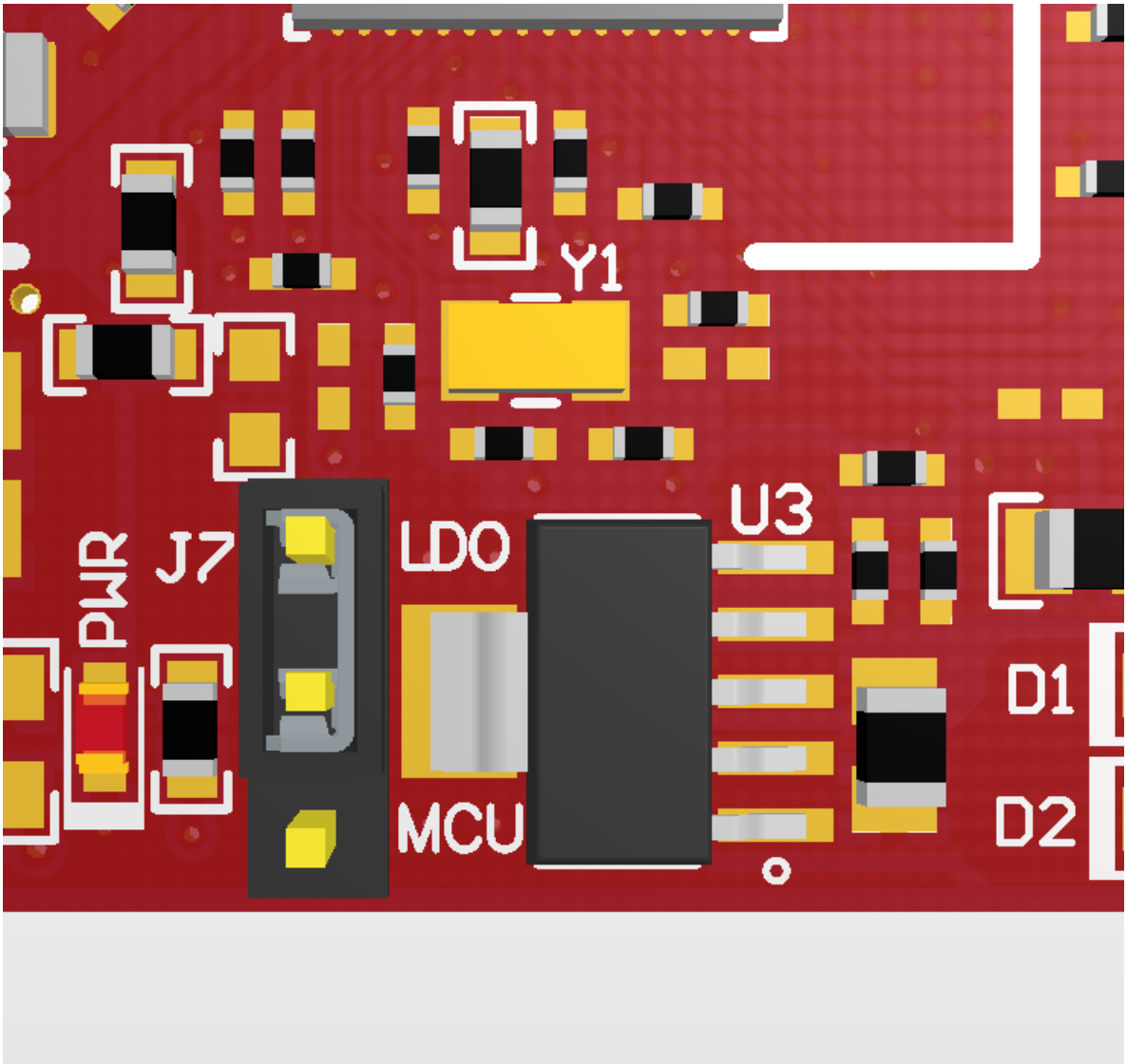
4.1 LaunchPad™ Kit Current Limitation

Some of the LaunchPad™ kits, including the MSP430FRAM, do not provide enough current to power the CC3135 BoosterPack™ module. The BoosterPack module can consume up to 400-mA peak current from the 3.3 V, and may need to be powered separately. For this, a USB connector is provided on the BoosterPack module to provide the 3.3 V separately.

The power supply jumpers (J7) should be configured, as shown in Figure 15, when the power is supplied from the onboard USB connector.

Figure 15. Jumper Settings When Used With LaunchPad™ Kit



CAUTION

Because two power sources exist in this setup, it is important to follow the power-up sequence. Always power the BoosterPack™ module before powering the LaunchPad™ kit.

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5 Additional Information

5.1 Design Files

All design files including schematics, layout, bill of materials (BOM), Gerber files, and documentation are available for download from: *CC3135 SimpleLink WI-Fi and Internet of Things - Hardware Design Files* .

5.2 Software

All design files including TI-TXT object-code firmware images, software example projects, and documentation are available at www.ti.com/product/CC3135.

The Software Development Kit (SDK) to use with the CC3135 BoosterPack™ is available at http://www.ti.com/tool/SIMPLELINK-WIFI-CC3120-SDK-PLUGIN

5.3 Hardware Change Log

Table 8 lists the hardware change log.

Table 8. Hardware Change Log

PCB Revision	Description
Rev A	First release

5.4 Known Limitations

5.4.1 Enabling Low-Power Measurement From the LaunchPad™ Kit

When the BOOSTXL-CC3135 is powered by a LaunchPad™ kit, the 3.3-V supply from the LaunchPad is used to power the CC3135 BoosterPack™ module, as well as other parts on the board including the serial flash, LEDs, and more. The total power drawn into the 3.3-V supply would be several mA in shutdown or hibernate mode. To measure the low-power numbers, users are advised to remove the LEDs (D1, D5, and D6 on the board). Similarly, the shutdown mode would leak about 33 µA into the pullup resistor (R27) on the nRESET pin. This pullup resistor also must be removed to measure the total current below 1 µA in shutdown mode. In hibernate mode, pullup resistor **R296** must be removed to enable the lowest current state.

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