# CC3235MODSF SimpleLink™ Wi-Fi® and IoT Solution With MCU LaunchPad™ Hardware

# User's Guide

Literature Number: SWRU548B
February 2019–Revised February 2020

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# CC3235MODSF LaunchPad™ Development Kit (LAUNCHCC3235MOD)

Start your design with the industry's first programmable FCC, IC/ISED, ETSI/CE, MIC, and SRRC [1] Certified SimpleLink™ Wi-Fi® CC3235MOD Dual-Band Wireless Microcontroller Module with built-in Dual-Band (2.4 GHz and 5 GHz) Wi-Fi® connectivity. Created for the Internet-of-Things (IoT), the SimpleLink™ CC3235MODx and CC3235MODAx family of devices from Texas Instruments are wireless modules that integrate two physically separated, on-chip MCUs:

- An application processor – Arm® Cortex®-M4 MCU with a user-dedicated 256KB of RAM and an optional 1MB of serial flash.
- A network processor MCU to run all Wi-Fi and Internet logic layers. This ROM based subsystem includes an 802.11 a/b/g/n radio, baseband, and MAC with a powerful crypto engine for fast, secure internet connections with 256-bit encryption.

The CC3235MODx and CC3235MODAx have four total variants:

- CC3235MODSM2MOB
  - Requires an external antenna
- CC3235MODSF12MOB
  - Requires an external antenna
  - Contains 1MB of serial flash
- CC3235MODASM2MON
  - Contains an integral antenna
- CC3235MODASF12MON
  - Contains an integral antenna
  - Contains 1MB of serial flash

The LAUNCHCC3235MOD is a low-cost evaluation platform for MCUs based on Arm® Cortex®-M4 devices. The LaunchPad™ design highlights the CC3235MODSF fully-integrated industrial module solution and Dual-Band Wi-Fi capabilities. The LAUNCHCC3235MOD also features temperature and accelerometer sensors, programmable user buttons, an RGB LED for custom applications, and onboard emulation for debugging. The stackable headers interface demonstrates how easy it is to expand the functionality of the LaunchPad when interfacing with other peripherals on existing BoosterPack™ add-on boards, such as graphical displays, audio codec, antenna selection, environmental sensing, and more.

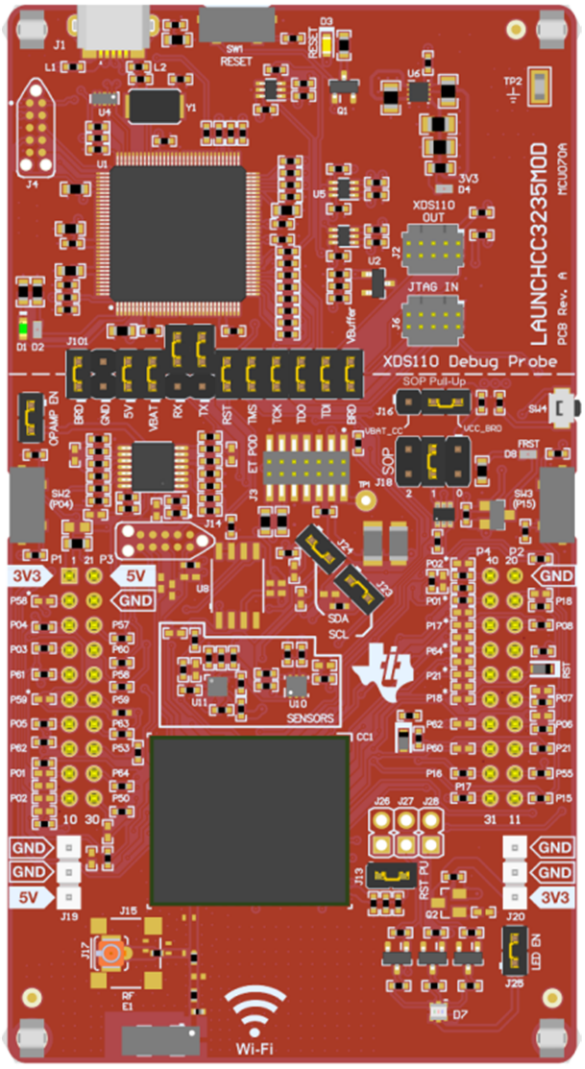
Figure 1 shows the CC3235MODSF LaunchPad development kit.

[1] Contact TI for more information on using SRRC ID Certification: www.ti.com/tool/SIMPLELINK-CC3XXX-CERTIFICATION



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**Figure 1. CC3235MODSF SimpleLink™ Wi-Fi® LaunchPad™ Development Kit**





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# 1 Introduction

## 1.1 CC3235MODSF LaunchPad™

Created for the Internet of Things (IoT), the SimpleLink CC3235MODx is a wireless module with built-in Dual-Band Wi-Fi connectivity for the LaunchPad ecosystem, which integrates a high-performance Arm® Cortex®-M4 MCU and lets customers develop an entire application with one device. With on-chip Wi-Fi, Internet, and robust security protocols, no prior Wi-Fi experience is required for fast development.

The CC3235MODSF LaunchPad, referred to by its part number LAUNCHCC3235MOD, is a low-cost evaluation platform for Arm® Cortex®-M4-based MCUs. The LaunchPad design highlights the CC3235MODSF Internet-on-a chip solution and Dual-Band Wi-Fi capabilities. The CC3235MODSF LaunchPad also features temperature and accelerometer sensors, programmable user buttons, an RGB LED for custom applications, and onboard emulation for debugging. The stackable headers of the CC3235MODSF LaunchPad XL interface demonstrate how easy it is to expand the functionality of the LaunchPad when interfacing with other peripherals on many existing BoosterPack add-on boards, such as graphical displays, audio codecs, antenna selection, environmental sensing, and more. Figure 1 shows the CC3235MOD LaunchPad.

Multiple development environment tools are also available, including TI's Eclipse-based Code Composer Studio™ (CCS) integrated development environment (IDE) and IAR Embedded Workbench®. More information about the LaunchPad, the supported BoosterPack modules, and the available resources can be found at TI's LaunchPad portal.

**NOTE:** The maximum RF power transmitted in each WLAN 2.4 GHz band is 19 dBm (EIRP power).

The maximum RF power transmitted in each WLAN 5 GHz band is 18.8 dBm (EIRP power).

**NOTE:** The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons, and must not be collocated or operating in conjunction with any other antenna or transmitter.



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## 1.2 LAUNCHCC3235MOD Key Features

The LAUNCHCC3235MOD SimpleLink LaunchPad includes the following features:

- CC3235MODSF, SimpleLink™ Dual-Band Wi-Fi® module solution
  - Integrated MCU
  - 40.0-MHz crystal
  - 32.768-kHz crystal (RTC)
  - 32-Mbit SPI serial flash
  - RF and full power-management components
- 40-pin LaunchPad kit standard that leverages the BoosterPack ecosystem
- TI standard, XDS110-based JTAG emulation with serial port for flash programming
- Supports 4-wire JTAG and 2-wire SWD
- Two buttons and one RGB LED for user interaction
- Back-channel universal asynchronous receiver/transmitter (UART) through USB to PC
- Onboard chip antenna with U.FL for conducted testing selectable using 0-Ω resistors
- Onboard accelerometer and temperature sensor for out-of-box demo with option to isolate the sensors from the inter-integrated circuit ($I^2C$) bus
- Micro-USB connector for power and debug connections
- Headers for current measurement and external JTAG connection (option to use the onboard XDS110 to debug customer platforms)
- Bus-powered device with no external power required for Wi-Fi
- Long-range transmission with highly optimized antenna (200 m typical in open air using an access point with 6-dBi antenna AP)
- Can be powered externally, with two AA or two AAA alkaline batteries working down to 2.3-V typical
- Dimensions: 106.1 mm (L) × 58.42 mm (W)

## 1.3 What's Included

### 1.3.1 Kit Contents

- CC3235MODSF LaunchPad development kit (LAUNCHCC3235MOD)
- Micro USB cable
- Quick start guide

### 1.3.2 Software Examples

- Out-of-box experience (OOBE) software

## 1.4 REACH Compliance

In compliance with the Article 33 provision of the EU REACH regulation we are notifying you that this EVM includes component(s) containing at least one Substance of Very High Concern (SVHC) above 0.1%. These uses from Texas Instruments do not exceed 1 ton per year. The SVHCs are:

| Component Manufacturer | Component Type | Component Part Number | SVHC Substance | SVHC CAS (When Available) |
|---|---|---|---|---|
| Abracon | Crystal | ABM3-16.000MHZ-D2Y-T | Diboron Trioxide | 1303-86-2 |
| Abracon | Crystal | ABM3-16.000MHZ-D2Y-T | Lead Oxide | 1317-36-8 |


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## 1.5 Regulatory Compliance

The SimpleLink CC3235MODx Wi-Fi LaunchPad kits 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 LAUNCHCC3235MOD are in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:

- LAUNCHCC3235MOD Certification of Documents
- LAUNCHCC3235MOD Declaration of Conformity

**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 |

## 1.6 First Steps: Out-of-Box Experience

An easy way to get started with the EVM is by using its preprogrammed out-of-box experience code. It demonstrates some key features of the EVM.

### 1.6.1 Connecting to the Computer

Connect the LaunchPad development kit by connecting the included USB cable to a computer. A red power LED should illuminate. For proper operation, the SimpleLink drivers and Service Pack from the CC3235 Software Development Kit (SDK) are needed. The SDK is available at http://www.ti.com/tool/simplelink-cc32xx-sdk.

### 1.6.2 Running the Out-of-Box Experience

The CC3235MODSF LaunchPad development kit's Out-of-Box Experience (OOBE) demonstrates and highlights the following features:

- Easy connection to the CC3235MODSF LaunchPad:
  - Using the SimpleLink™ Wi-Fi® Starter Pro application (available on iOS and Android™), users can use Access Point (AP) provisioning or SmartConfig™ provisioning for a fast CC3235MOD connection.
  - Configuring the device in AP mode gives users a direct connection to the CC3235MODSF LaunchPad.

  Once the device is provisioned and connected to an AP in station mode, the profile is stored on the local file system so that any reset to the CC3235MODSF automatically connects it to the AP.
- Easy access to the CC3235MODSF through its internal web server, using either:
  - The SimpleLink™ Wi-Fi® Starter Pro application
  - Any browser; web pages stored on the serial flash are loaded on the browser, to provide ease of use.

  This feature demonstrates configuring and reading onboard sensors.
- Over-The-Air (OTA) updates that demonstrate an update of a full image. OTA service enables in-system updates of the MCU application, CC3235 firmware releases (Service Pack) made available by TI, and other vendor files. An update procedure executed in a full-system integrity fashion, such as failure to upgrade any image components, results in rolling back to the previous valid version.

Visit the CC3235 LaunchPad Out-of-Box Experience Guide on SimpleLink Academy (see Section 6.3) for more details.



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## 1.7 Next Steps: Looking into the Provided Code

After the EVM features have been explored, the user can open an integrated development environment and start editing the code examples from the SDK. See Section 6.2 for available IDEs and where to download them. The Out-of-Box source code and more code examples are provided in the CC3235 SDK. Code is licensed under BSD, and TI encourages reuse and modifications to fit specific needs.

With the onboard XDS110 debug probe, debugging and downloading new code is simple. A USB connection between the EVM and a PC through the provided USB cable is all that is needed.

## 1.8 Trademarks

E2E, SimpleLink, LaunchPad, BoosterPack, Code Composer Studio are trademarks of Texas Instruments.
Arm, Cortex are registered trademarks of Arm Limited.
IAR Embedded Workbench is a registered trademark of IAR Systems AB.
WPA, WPA2 are trademarks of Wi-Fi Alliance.
Wi-Fi, Wi-Fi Direct are registered trademarks of Wi-Fi Alliance.
All other trademarks are the property of their respective owners.

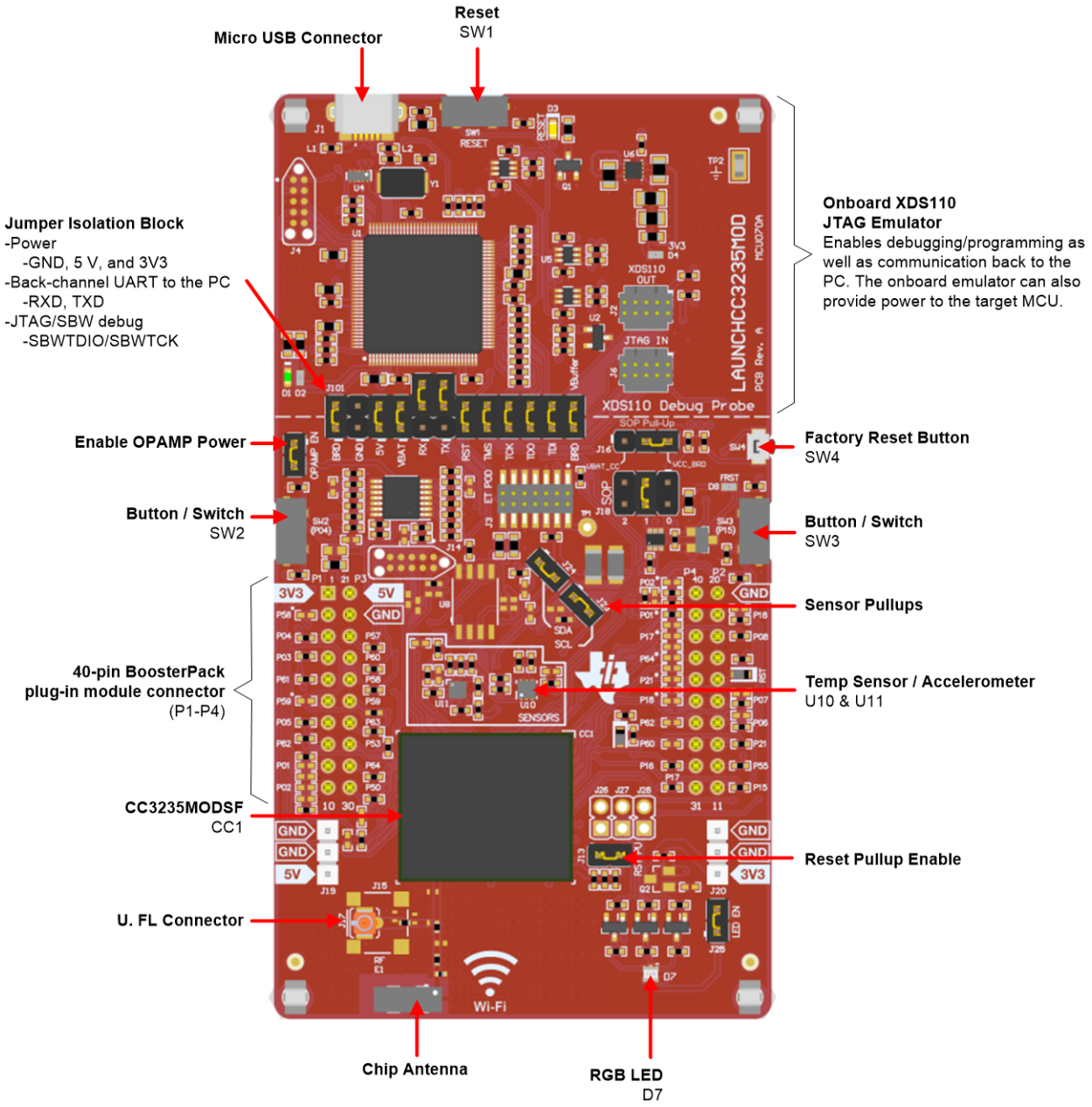


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## 2 Hardware

Figure 2 shows the CC3235MODSF LaunchPad EVM.

**Figure 2. CC3235MODSF LaunchPad™ EVM Overview**



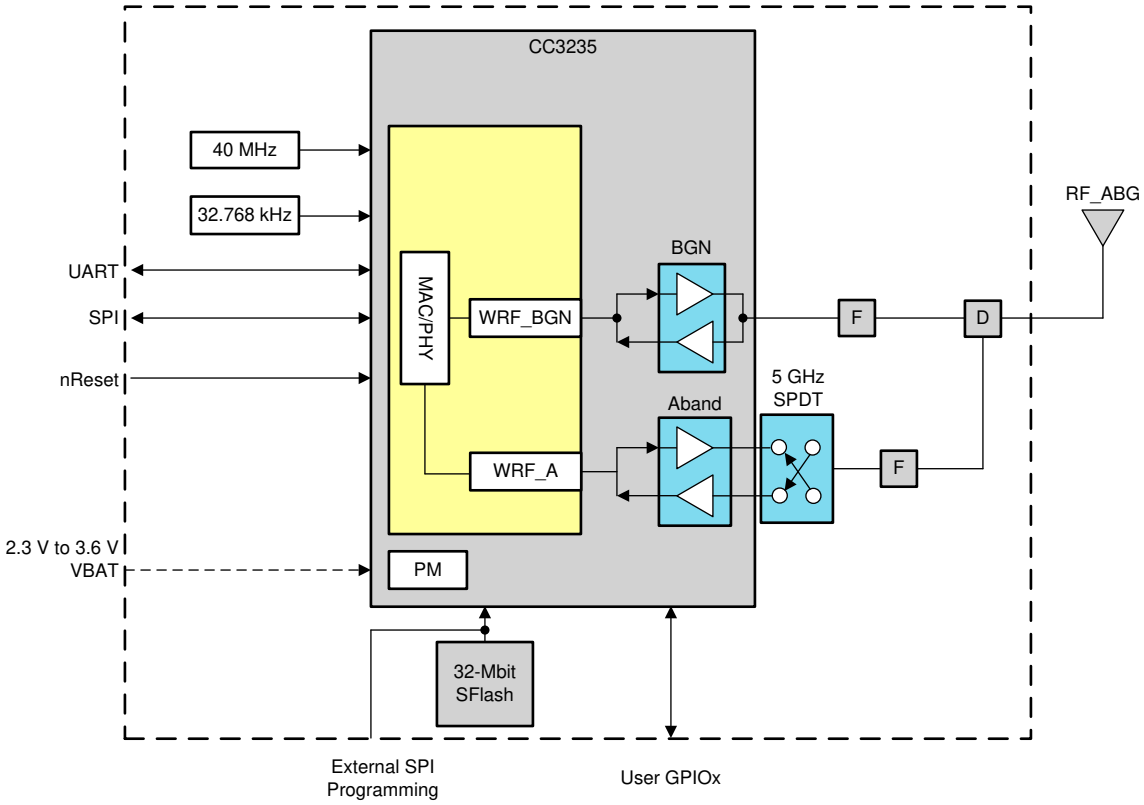



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## 2.1 Block Diagram

Figure 3 shows a functional block diagram of the CC3235MODx module.

**Figure 3. CC3235MODx Functional Block Diagram**

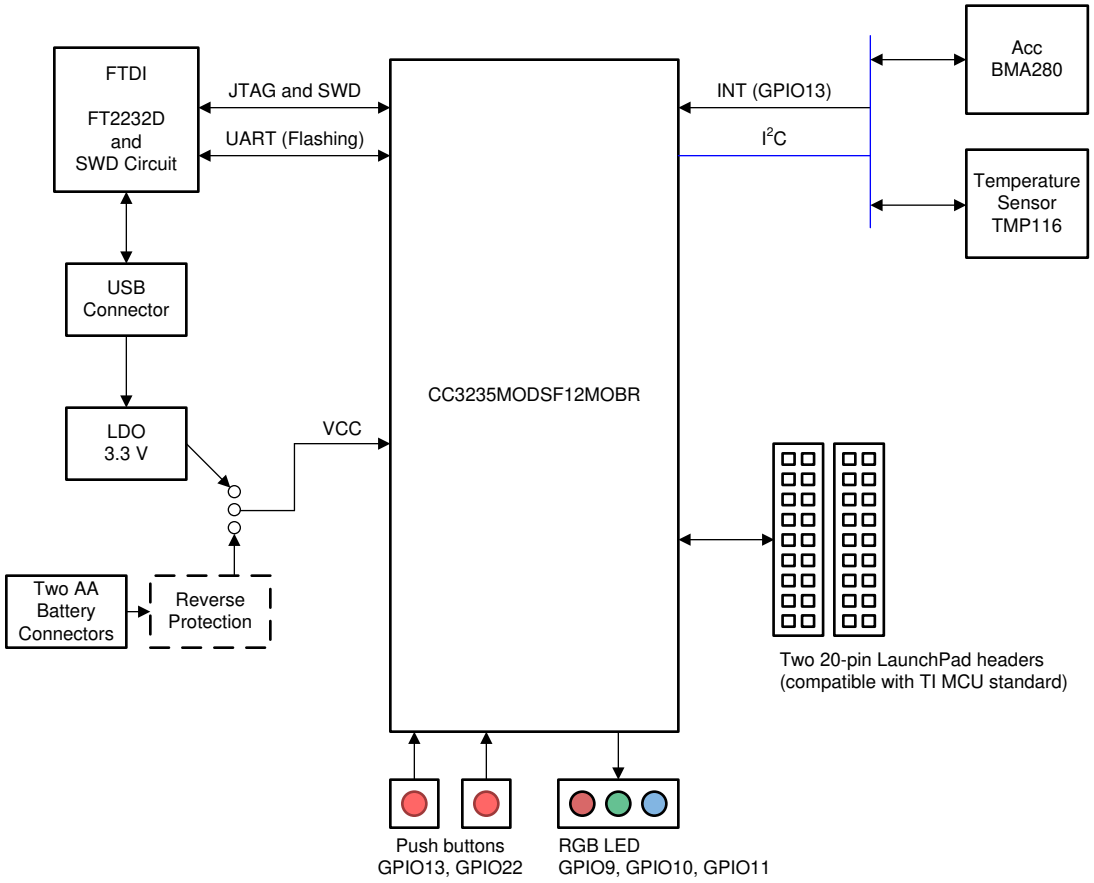





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Figure 4 shows a functional block diagram of the LAUNCHCC3235MOD SimpleLink LaunchPad.

**Figure 4. LAUNCHCC3235MOD Functional Block Diagram**






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## 2.2 Hardware Features

- CC3235MODSF, SimpleLink™ Dual-Band Wi-Fi® module solution with integrated MCU
- 40-pin LaunchPad™ standard that leverages the BoosterPack™ ecosystem
- TI Standard XDS110-based JTAG emulation with serial port for flash programming
- Supports both 4-wire JTAG and 2-wire SWD
- Two buttons and a RGB LED for user interaction
- Virtual COM port UART through USB on PC
- Onboard chip antenna with U.FL or SMA for conducted testing, selectable using 0-Ω resistors
- Onboard accelerometer and temperature sensor for out-of-box demo, with the option to isolate them from the inter-integrated circuit ($I^2C$) bus
- Micro USB connector for power and debug connections
- Headers for current measurement and external JTAG connection, with an option to use the onboard XDS110 to debug customer platforms
- Bus-powered device, with no external power required for Wi-Fi®
- Long-range transmission with a highly optimized antenna (200-meter typical in open air with a 6-dBi antenna AP)
- Can be powered externally, working down to 2.3 V

### 2.2.1 Key Benefits

The CC3235MODx and CC3235MODAx modules offer the following benefits:

- CC3235MODS and CC3235MODAS are Wi-Fi modules that consist of the CC3235SM2ARGK while the CC3235MODSF and the CC3220MODASF consist of the CC3235SF12ARGK single-chip MCUs, respectively. The fully integrated and green/RoHS modules includes all required clocks, spi flash, and passives
- 802.11 a/b/g/n: 2.4 GHz and 5 GHz
- FCC, IC/ISED, ETSI/CE, MIC. and SRRC (2) Certified
- FIPS 140-2 Level 1 validated IC inside
- Multilayered security features, help developers protect identities, data, and software IP
- Low-power modes for battery powered application
- Coexistence with 2.4-GHz radios
- Industrial temperature: –40°C to +85°C
- CC3235MODx multiple-core architecture, system-on-chip (SoC)
- 1.27-mm pitch QFM package for easy assembly and low-cost PCB design
- Transferrable Wi-Fi Alliance® certification
- Application microcontroller subsystem:
  - Arm® Cortex®-M4 core at 80 MHz
  - User-dedicated memory
    - CC3235MODS and CC3235MODAS variant includes 256KB RAM
    - CC3235MODSF and CC3235MODASF variant is flash-based MCU with an integrated 1MB executable flash and 256KB of RAM.
  - Rich set of peripherals and timers
  - 26 I/O pins with flexible multiplexing options
    - UART, I2S, $I^2C$, SPI, SD, ADC, and 8-bit parallel interface
    - 8-bit synchronous image interface
    - Timers and PWM
  - Debug interfaces: JTAG, cJTAG, and SWD

(2) Contact TI for more information on using SRRC ID Certification: www.ti.com/tool/SIMPLELINK-CC3XXX-CERTIFICATION


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- Wi-Fi network processor subsystem:
  - Wi-Fi® core:
    - 802.11 a/b/g/n 2.4 GHz and 5 GHz
    - Modes:
      - Access point (AP)
      - Station (STA)
      - Wi-Fi Direct® (only supported on 2.4 GHz)
    - Security:
      - WEP
      - WPA™/WPA2™ PSK
      - WPA2 Enterprise
  - Internet and application protocols:
    - HTTPs server, mDNS, DNS-SD, DHCP
    - IPv4 and IPv6 TCP/IP stack
    - 16 BSD sockets (fully secured TLS v1.2 and SSL 3.0)
  - Built-in power management subsystem:
    - Configurable low-power profiles (always, intermittent, tag)
    - Advanced low-power modes
    - Integrated DC/DC regulators
- Multilayered security features:
  - Separate execution environments
  - Networking security
  - Device identity and key
  - Hardware accelerator cryptographic engines (AES, DES, SHA/MD5, CRC)
  - Application-level security (encryption, authentication, access control)
  - Initial secure programming
  - Software tamper detection
  - Secure boot
  - Certificate signing request (CSR)
  - Unique per device key pair
- Application Throughput
  - UDP: 16 Mbps
  - TCP: 13 Mbps


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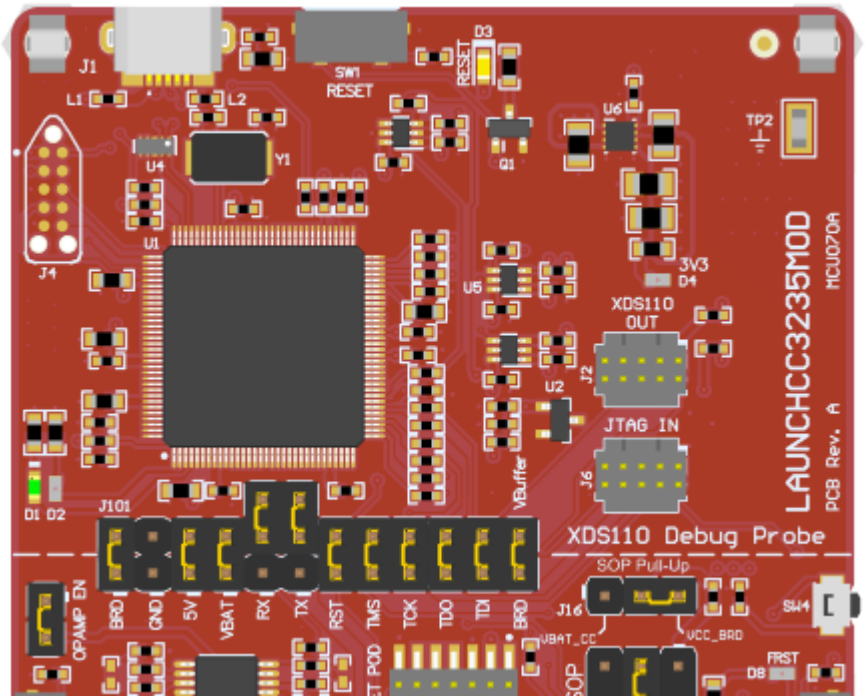
- Power-management subsystem:
  - Integrated DC/DC converters support a wide range of supply voltage:
    - Single wide-voltage supply, VBAT: 2.3 V to 3.6 V
  - Advanced low-power modes:
    - Shutdown: 1 µA, hibernate: 5.5 µA
    - Low-power deep sleep (LPDS): 120 µA
    - Idle connected (MCU in LPDS): 710 µA
    - RX traffic (MCU active): 59 mA
    - TX traffic (MCU active): 223 mA
  - Wi-Fi TX power
    - 2.4 GHz: 16 dBm at 1 DSSS
    - 5 GHz: 15.1 dBm at 6 OFDM
  - Wi-Fi RX sensitivity
    - 2.4 GHz: –94.5 dBm at 1 DSSS
    - 5 GHz: –89 dBm at 6 OFDM
- Additional integrated components
  - 40.0-MHz crystal
  - 32.768-kHz crystal (RTC)
  - 32Mbit SPI serial flash
  - RF filters, diplexer, and passive components
- Footprint compatible QFM package
  - CC3235MODx: 1.27-mm pitch, 63-pin, 20.5-mm × 17.5-mm
- Module supports SimpleLink Developer's Ecosystem


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### 2.2.2 XDS110-Based Onboard Debug Probe

To keep development easy and cost effective, TI's LaunchPad development kits integrate an onboard debug probe, which eliminates the need for expensive programmers. The CC3235MODSF LaunchPad has the XDS-110-based debug probe (see Figure 5), which is a simple and low-cost debugger that supports nearly all TI Arm device derivatives.

**Figure 5. XDS-110 Debug Probe**




The dotted line through J101 shown in Figure 5 divides the XDS110 debug probe from the target area. The signals that cross this line can be disconnected by jumpers on J101, the isolation jumper block. More details on the isolation jumper block are in Section 2.2.3.

The XDS110 debug probe also provides a "backchannel" UART-over-USB connection with the host, which can be very useful during debugging and for easy communication with a PC. More details can be found in Section 2.2.4.

The XDS110 debug probe hardware can be found in the schematics in Section 7.2 and in the CC3235MOD LaunchPad hardware design files.



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### 2.2.3 Debug Probe Connection: Isolation Jumper Block

The isolation jumper block at jumper J101 allows the user to connect or disconnect signals that cross from the XDS110 domain into the CC3235MOD target domain. This includes JTAG signals, application UART signals, and 3.3-V and 5-V power.

Reasons to open these connections:

- To remove any and all influence from the XDS110 debug probe for high accuracy target power measurements
- To control 3-V and 5-V power flow between the XDS110 and target domains
- To expose the target MCU pins for other use than onboard debugging and application UART communication
- To expose the programming and UART interface of the XDS110 so that it can be used for devices other than the onboard MCU.

**Table 1. Isolation Block Connections**

| Jumper | Description |
|---|---|
| BRD | Board Power. Supplies the board power from the onboard DC-DC converter. The board power includes the sensors, LED, and the OPAMP used to drive the ADC input. |
| GND | Ground reference |
| 5V | 5-V VBUS from USB |
| VBAT | 3.3-V rail, derived from VBUS in the XDS110 domain. Can also be used to measure the current flowing into the CC3235MOD. |
| RX | Backchannel UART: The target CC3235MODSF receives data through this signal. |
| TX | Backchannel UART: The target CC3235MODSF sends data through this signal. |
| RST | This pin functions as the RST signal (active low). |
| TMS | Serial wire data input (SWDIO) / JTAG test mode select (TMS) |
| TCK | Serial wire clock input (SWCLK) / JTAG clock input (TCK) |
| TDO | JTAG test data out |
| TDI | JTAG test data in |
| VBUFFER | Used to power the level shifters located on the emulator side of the board. The level shifters can be powered by shorting this pin with a jumper. Removing the jumper enables low current measurement. |


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### 2.2.4 Application (or "Backchannel") UART

The board supports a USB-based virtual COM port, using the SimpeLink™ MSP432E401Y Arm® MCU. The LaunchPad is shipped with the UART lines from the CC3235MODSF connected to the UART on the MSP432E4 MCU. The CC3235MODSF's UART can also be routed to the 20-pin connector for use as a GPIO or external UART. The selection is performed using jumpers on the board.

Figure 6 shows the UART routed to USB COM port. Ensure that a jumper is also placed on the VBUFFER header to power the level shifters located on the emulator side of the board. Figure 7 shows the UART routed to 20-pin header connector.

**Figure 6. UART Routed to USB COM Port**

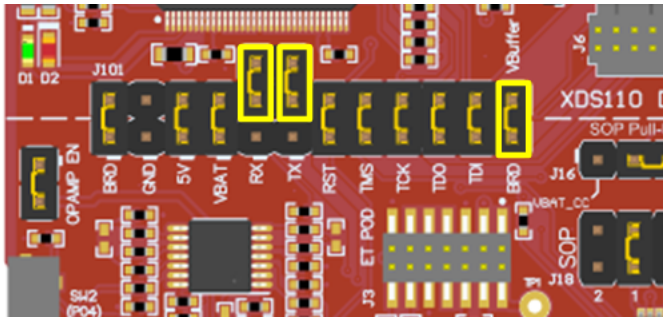
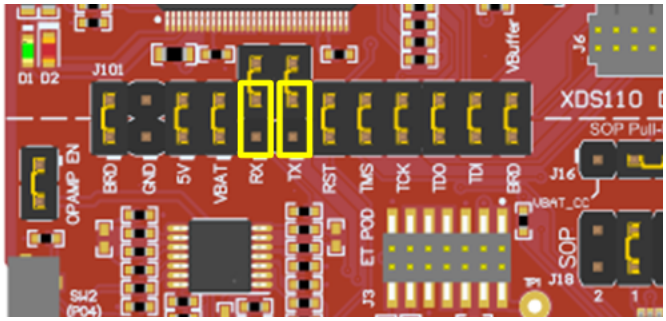



**Figure 7. UART Routed to 20-Pin Header Connector**



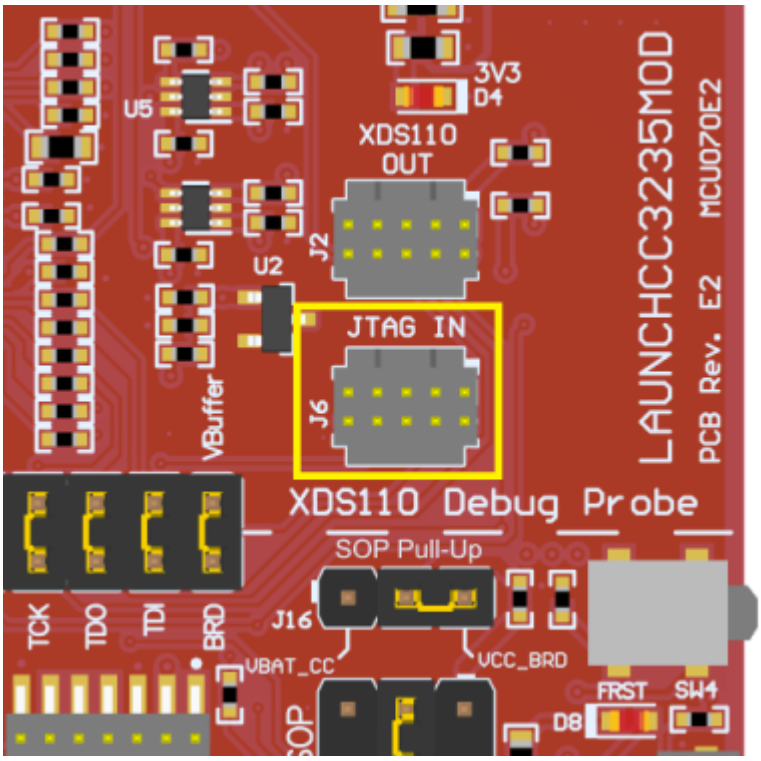



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### 2.2.5 JTAG Headers

The headers are provided on the board to isolate the CC3235MOD from the onboard XDS110-based JTAG emulator. These jumpers are shorted by default when the board is shipped from TI. Figure 5 and Table 1 are for default configurations, and Figure 8 shows the external emulator connection. To connect an external emulator, remove the isolation block JTAG jumpers and place the external emulator on the JTAG IN connector.

**Figure 8. JTAG IN Connector (J6)**



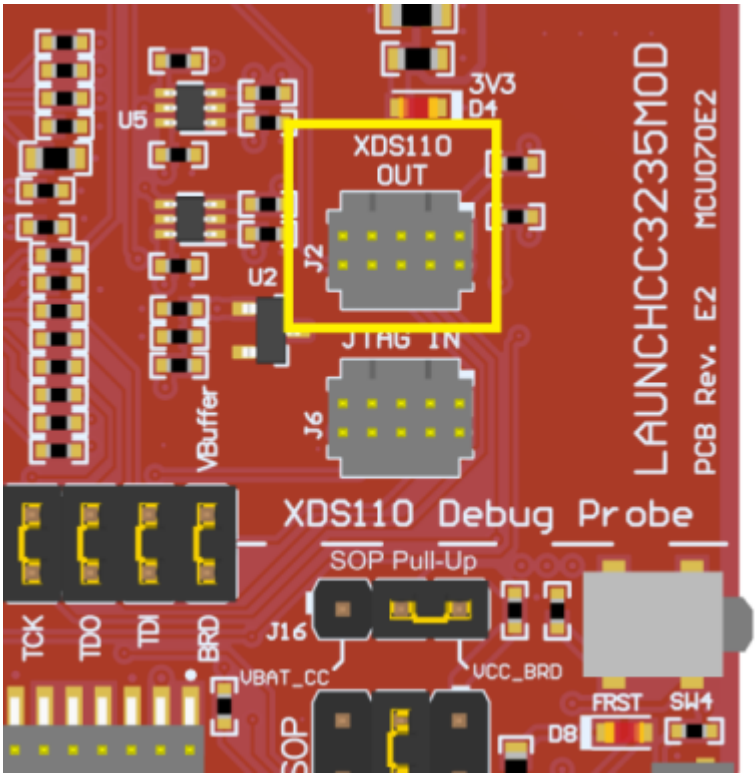



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### 2.2.6 Using the XDS110 Debug Probe with a Different Target

The XDS110 debug probe on the LaunchPad development kit can interface to most Arm® Cortex®-M devices, not just the onboard target CC3235MODSF device. This functionality is enabled by the J2 10-pin Cortex-M JTAG connector (see Figure 9) and a 10-pin cable, such as the FFSD-05-D-06.00-01-N (sold separately from the LaunchPad development kit).

**Figure 9. XDS110 OUT Connector (J2)**




Header J2 follows the Arm Cortex-M standard; however, pin 1 is not a voltage sense pin. The XDS110 outputs only 3.3-V JTAG signals. If another voltage level is needed, the user must provide level shifters to translate the JTAG signal voltages.

1. Remove jumpers on the JTAG signals on the isolation block, including RST, TMS, TCK, TDO, and TDI.
2. Plug the 10-pin cable into J2, and connect to an external target.
   J2 follows the Arm Cortex Debug Connector standard outlined in *Cortex-M Debug Connectors*.
3. Plug USB power into the LaunchPad development kit, or power it externally
   JTAG levels are 3.3-V ONLY

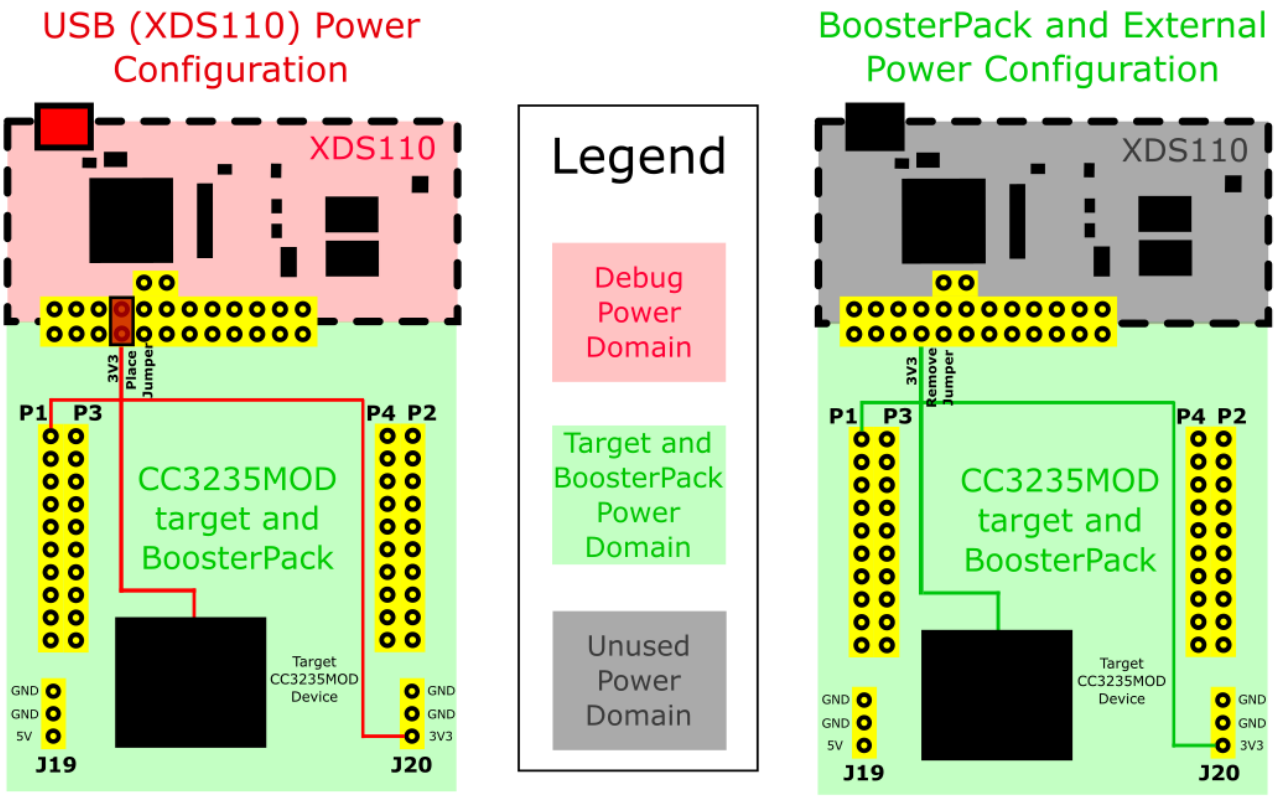


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### 2.2.7 Power Connections

The board accommodates various power methods, including through the onboard XDS110 as well as external or BoosterPack plug-in module power (see Figure 10).

**Figure 10. LAUNCHCC3235MOD Power Block Diagram**



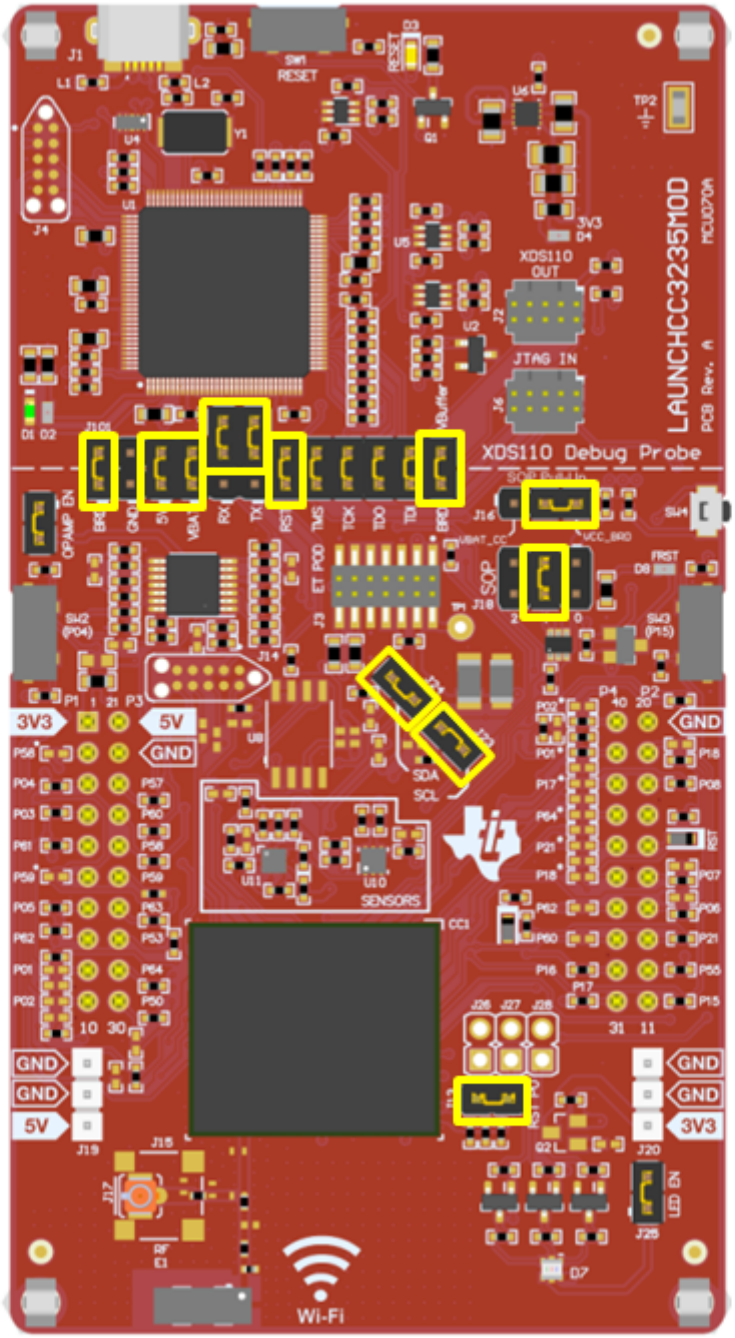


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#### 2.2.7.1 XDS110 USB Power

The most common power-supply scenario is from USB through the XDS110 debugger. This provides 5-V power from the USB and also regulates this power rail to 3.3 V for XDS110 operation and 3.3-V to the target side of the LaunchPad development kit. Power from the XDS110 is controlled by jumper J101. When the board is powered from the USB connector, ensure that the jumpers are placed on the following headers, shown in Figure 11.

**Figure 11. Powering the CC3235MODSF LP from USB**





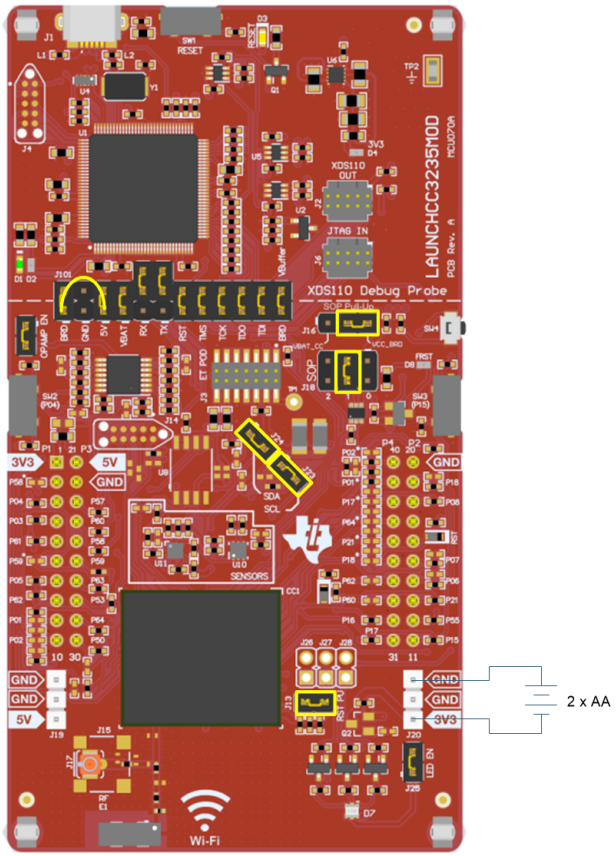

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### 2.2.7.2 BoosterPack Plug-in Module and External Power Supply

Headers J19 and J20 are present on the board to supply external power directly when USB power is not available. Use the following precautions before using the board with an external power supply.

1. Remove the USB cable.
2. Ensure that jumpers are only placed on the headers shown in Figure 12.
3. Use a jumper wire to connect VBAT and BRD.
4. Plug in the external power supply on J20 with the correct polarity.

**Figure 12. Powering the CC3235MODSF LP from an External Power Supply**




The OPAMP EN and LED EN jumpers are also available to remove any current draw from the onboard OpAmp and LEDs being driven by the GPIOs, see Table 2.

**Table 2. External Supply Connections and Enable Jumpers**

| Reference | Use | Comments |
|---|---|---|
| J19 | 5-V power input | Used to power the board from an external 5-V supply |
| J20 | 3.3-V power input | Used to power the board from an external 3.3-V supply. |
| J21 | OPAMP EN | If uninstalled, the power supply to the operational amplifier is cut off. This can be used to enable low-power measurements. |
| J26 | LED EN | If uninstalled, the LEDs connected to the GPIO are disabled; this can be used to enable low-power measurements. |


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### 2.2.8 Reset Pullup Jumper

Table 3 lists the reset pullup jumper.

**Table 3. Reset Pullup Jumper**

| Reference | Use | Comments |
|---|---|---|
| J13 | RESET pullup | Install this jumper to enable the pullup resistor on the nRESET pin of the device, when the board is powered from an external supply. |

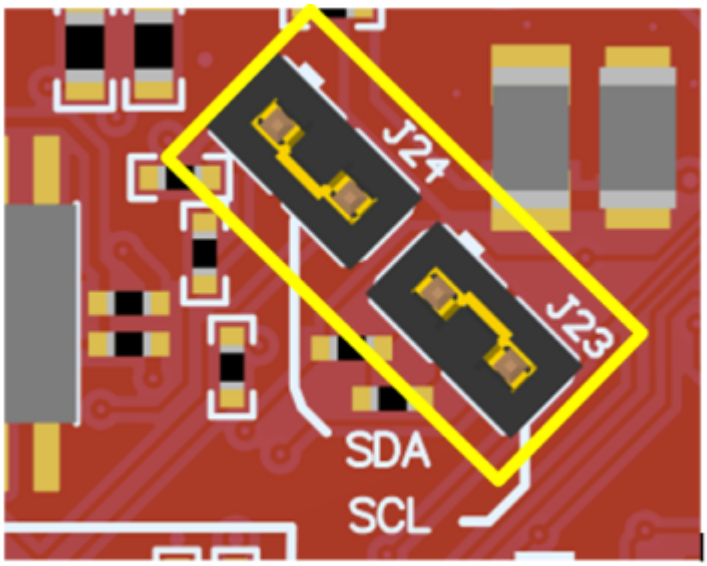
### 2.2.9 Clocking

All of the required clocks are inside the module. There is no need to supply any external clock.

### 2.2.10 I²C Connection

The board features an accelerometer and a temperature sensor for the out-of-box demo. These are connected to the I²C bus, and can be isolated using the jumpers provided (shown as yellow jumpers J23 and J24 in Figure 13).

**Figure 13. I²C Connections**




By removing J23 and J24, the accelerometer and the temperature sensors are isolated from the I²C bus. This measure also removes the I²C pullup resistors from the sensor side of the circuit, and therefore any connection to the circuit requires the user to install external pullup resistors.

Table 4 lists the I²C jumper definitions.

**Table 4. I²C Jumper Definitions**

| Reference | Use | Comments |
|---|---|---|
| J23 | I2C SCL | Populated: CC3235MOD SCL connected to onboard sensors with pullup |
| | | Open: CC3235MOD SCL disconnected from onboard sensors |
| J24 | I2C SDA | Populated: CC3235MOD SDA connected to onboard sensors with pullup |
| | | Open: CC3235MOD SDA disconnected from onboard sensors |



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#### 2.2.10.1 Default I2C Addresses

Table 5 lists the default I²C addresses of the onboard sensors.

**Table 5. Default I²C Addresses (of Onboard Sensors)**

| Sensor Type | Reference Designator on LP | Part Number (Manufacturer) | Default Slave Address (Hex) |
|---|---|---|---|
| Temperature (Digital ) | U10 | TMP116 (TI) | 0x49 |
| Accelerometer (Triaxial) | U11 | BMA280 (Bosch) | 0x30 |

### 2.2.11 Sense on Power (SOP)

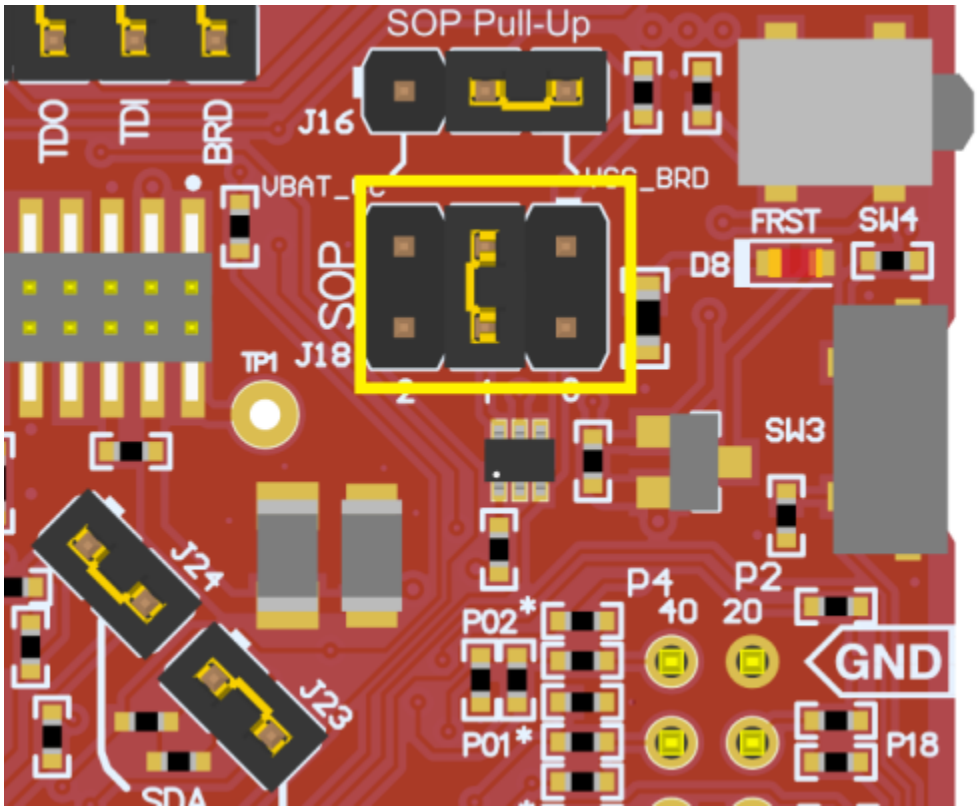
The CC3235MODx device can be set to operate in four different modes based on the state of the sense on power (SOP) lines. The SOP lines are pins 23, 24, and 34 on the CC3235MODx module. Table 6 shows the state of the device and Figure 14 shows the SOP jumpers.

**Table 6. SOP[2:0]**

| Binary Value | Function |
|---|---|
| 100 | Flash programming |
| 000 | Functional mode and 4-wire JTAG |
| 001 | Functional mode and SWD |
| 010 | Functional mode and flash |

**NOTE:** SOP[2:0] corresponds to J18 on the LaunchPad kit.

**Figure 14. SOP Jumpers (Default Setting Shown)**





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**NOTE:** Placing no jumpers on the block ensures that the line is pulled low using 100K pull down resistors. Placing the jumper pulls the pin high using a 10K resistor.

### 2.2.12 Push-Buttons and LED Indicators

Table 7 lists the push-button definitions.

**Table 7. Push-Button Definitions**

| Reference | Use | Comments |
|---|---|---|
| SW1 | RESET | This is used to reset the CC3235MOD device. This signal is also output on the 20-pin connector to reset any external BoosterPack which may be stacked. The reset can be isolated using the RST jumper at the isolation block. |
| SW2 | GPIO_13 | When pushed, GPIO_13 is pulled to VCC. |
| SW3 | GPIO_22 | When pushed, GPIO_22 is pulled to VCC. |
| SW4 | Factory default | Pressing this button and toggling RESET restores the factory default image on the serial flash. This can be used to recover a corrupted serial flash, provided the s-flash was programmed with a recovery image. |

Table 8 lists the LED indicators.

**Table 8. LED Indicators**

| Reference | Color | Use | Comments |
|---|---|---|---|
| D1, D2 | Green and Red | Debug | Indicates the state of the JTAG emulator. For TI use only. |
| D3 | Yellow | nRESET | Indicates the state of the NRESET pin. If this LED is on, the device is functional. |
| D4 | Red | Power | Indicates when the 3.3-V power is supplied to the board. |
| D7 | RGB | GPIO_09 | Glows when the GPIO is logic-1. |
| | RGB | GPIO_10 (1) | Glows when the GPIO is logic-1. |
| | RGB | GPIO_11 (1) | Glows when the GPIO is logic-1. |
| D8 | Red | Factory Reset | Indicates that the push-button for the factory reset is pressed. |

(1) GPIO_10 and GPIO_11 are also used as $I^2C$. Whenever the pullups are enabled, the LEDs glow by default without configuring the GPIOs.

## 2.3 Electrical Characteristics

For electrical characteristics of the CC3235MODx modules, see *CC3235MODx SimpleLink™ Wi-Fi CERTIFIED® Dual-Band Wireless MCU Module data sheet*.

## 2.4 Antenna Characteristics

The CC3235MODSM2MOB and the CC3235MODSF12MOB reference design detail the use of an on-board antenna. For more information on the antenna VSWR, efficiency, and electrical characteristics, see *M830520*.



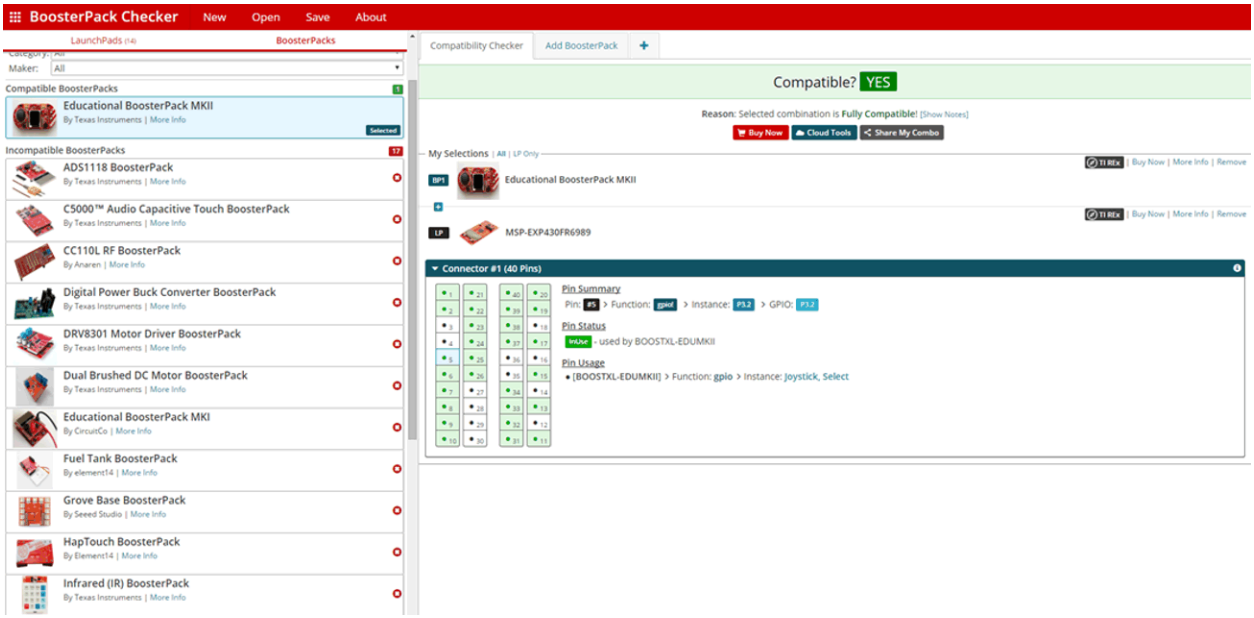
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## 2.5 BoosterPack™ Plug-in Module Pinout

The LaunchPad development kit adheres to the 40-pin LaunchPad development kit pinout standard. This standard was created to aid compatibility between LaunchPad development kits and BoosterPack plug-in modules across the TI ecosystem.

While most BoosterPack plug-in modules are compliant with the standard, some are not. The LAUNCHCC3235MOD LaunchPad development kit is compatible with all 40-pin BoosterPack plug-in modules that are compliant with the standard. If the reseller or owner of the BoosterPack plug-in module does not explicitly indicate compatibility with the LAUNCHCC3235MOD LaunchPad development kit, compare the schematic of the candidate BoosterPack plug-in module with the LaunchPad development kit to ensure compatibility. Keep in mind that sometimes conflicts can be resolved by changing the CC3235MODSF12MOB device pin function configuration in software.

**Figure 15. BoosterPack Checker Tool**



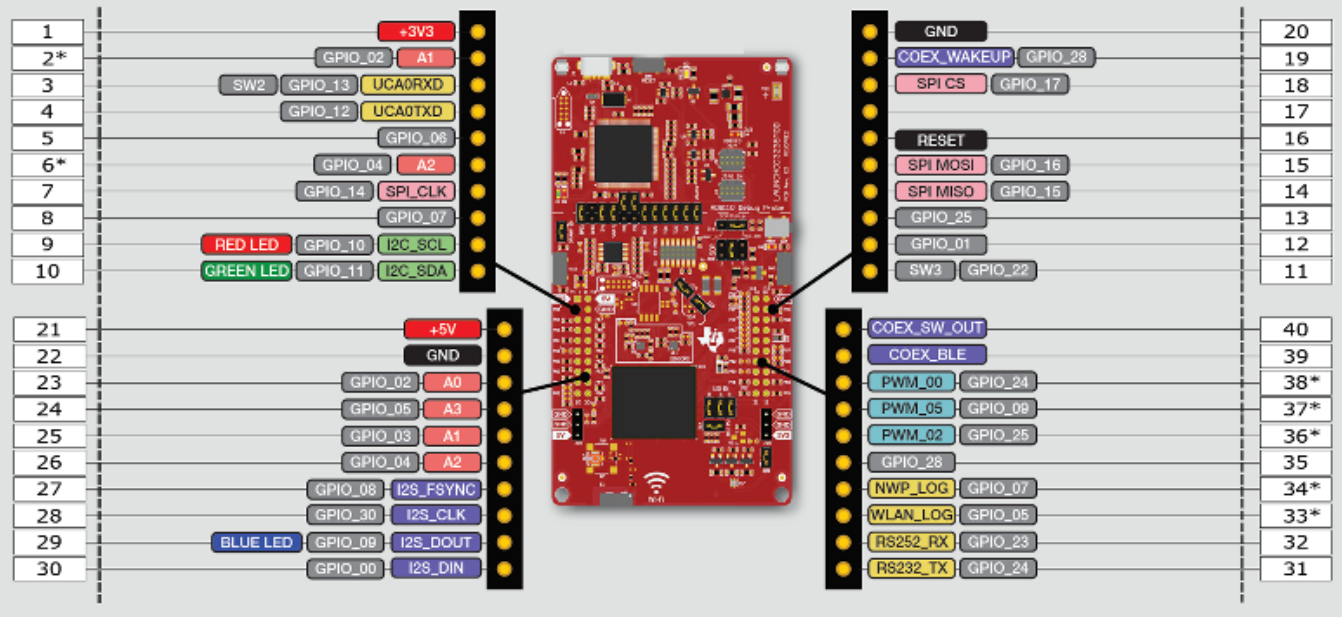

To check the compatibility of a BoosterPack plug-in module with the LaunchPad development kit of your choice, use the BoosterPack Checker Tool. This allows you to select any LaunchPad development kit that TI offers and determine its compatibility with any number of BoosterPack plug-in modules that we offer. You can also add your own BoosterPack plug-in module to check its compatibility as you prototype that next design.

Figure 16 shows the 40-pin pinout of the LAUNCHCC3235MOD LaunchPad development kit.

Note that software's configuration of the pin functions plays a role in compatibility. The LaunchPad development kit side of the dashed line shows only the applicable function for conforming to the standard. However, each pin has other functionality that can be configured by the software. See the CC3235MODx device data sheet for more details on individual pin functions.


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**Figure 16. LAUNCHCC3235MOD BoosterPack™ Header Pin Assignments**




**NOTE:** RESET output is an open-drain-type output and can only drive the pin low. The pullup ensures that the line is pulled back high when the button is released. No external BoosterPack can drive this pin low.

All the signals are referred to by the pin number in the SDK; Figure 16 shows the default mappings. Some of the pins are repeated across the connector. For instance, pin 62 is available on P1 and P4, but only P1 is connected by default. The signal on P4 is marked with an asterisk (*) to signify that it is not connected by default. The signal can be routed to the pin by using a 0-Ω resistor in the path. For the exact resistor placement, see the CC3235MODSF SimpleLink™ Wi-Fi® Wireless MCU LaunchPad Board Design Files.



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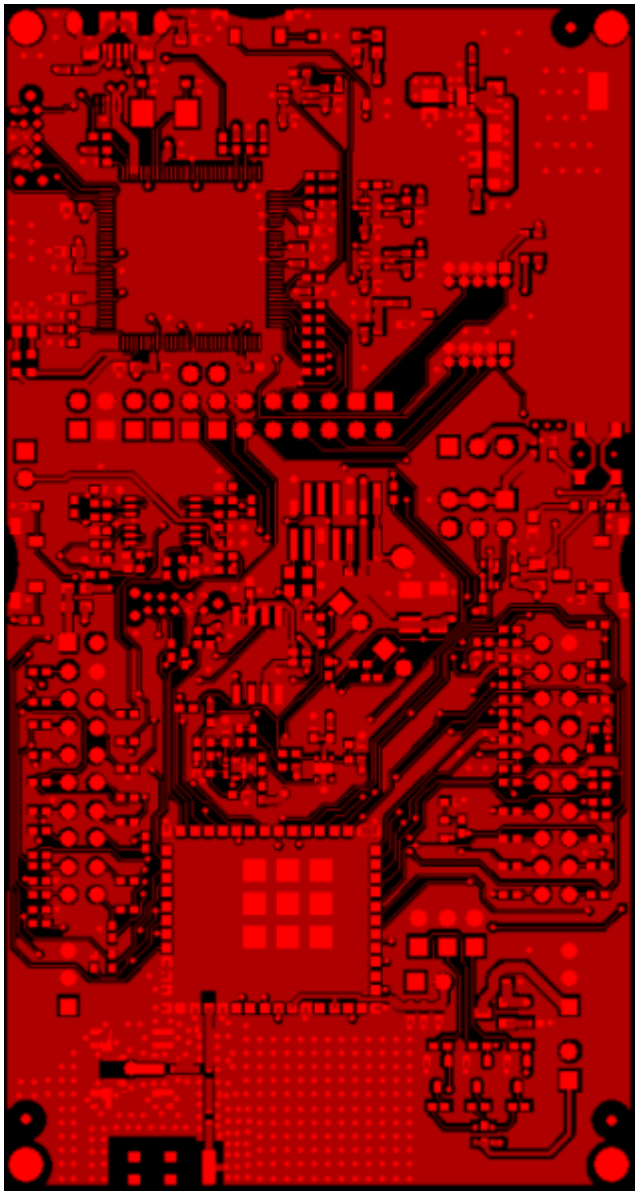
# 3 Layout Guidelines

The integrator of the CC3235MODx and CC3235MODAx modules must comply with the PCB layout recommendations described in the following subsections to preserve and minimize the risk with regulatory certifications for FCC, ISED/IC, ETSI/CE, MIC, and SRRC [3]. Also, TI recommends that customers follow the guidelines described in this section to achieve similar performance.

## *3.1 LAUNCHCC3235MOD Board Layout*

The reference layout consists of a four-layer design. Figure 17 shows the LAUNCHCC3235MOD top layer.

**Figure 17. LAUNCHCC3235MOD Top Layer**



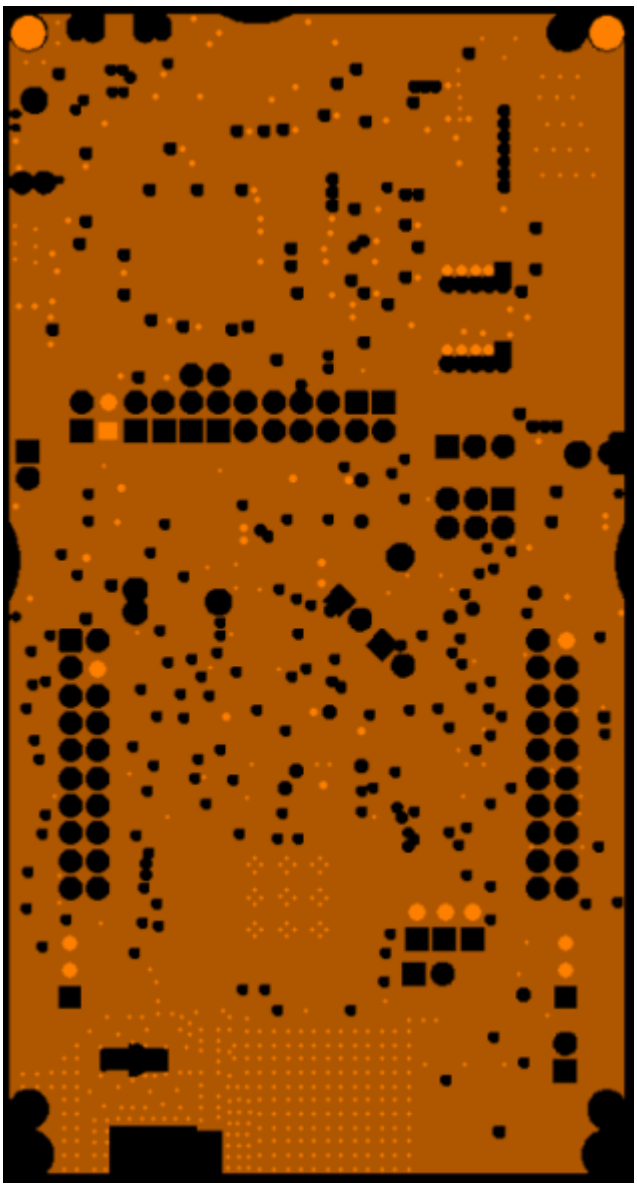
[3] Contact TI for more information on using SRRC ID Certification: www.ti.com/tool/SIMPLELINK-CC3XXX-CERTIFICATION



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Figure 18 shows the LAUNCHCC3235MOD first inner layer.

**Figure 18. LAUNCHCC3235MOD First Inner Layer**

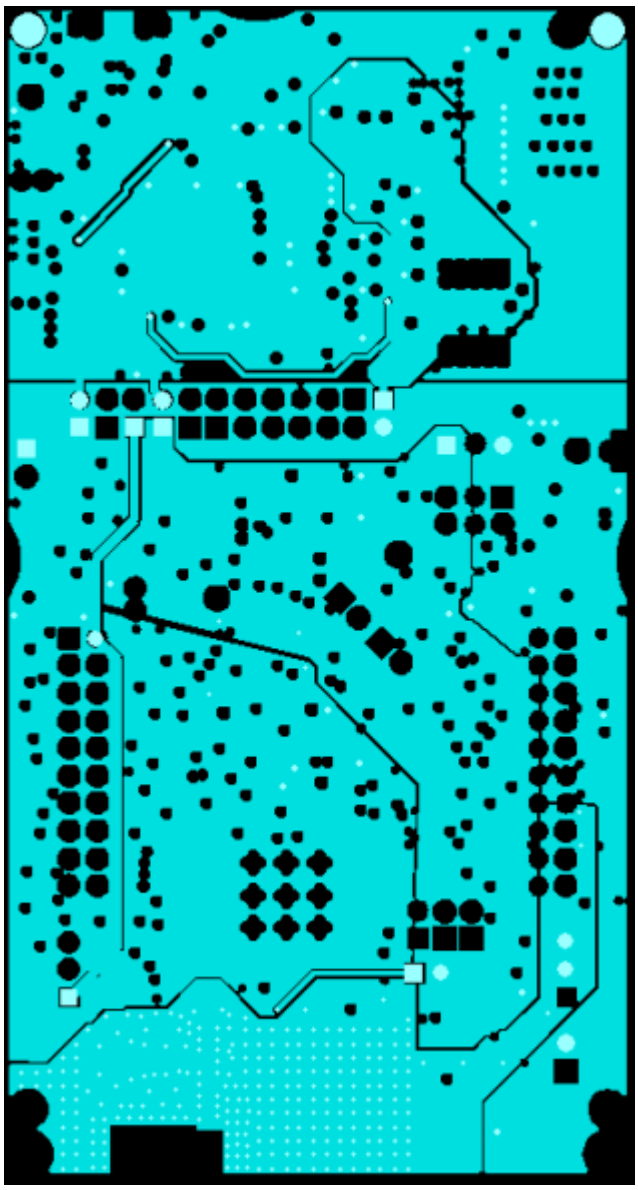




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Figure 19 shows the LAUNCHCC3235MOD second inner layer.

**Figure 19. LAUNCHCC3235MOD Second Inner Layer**

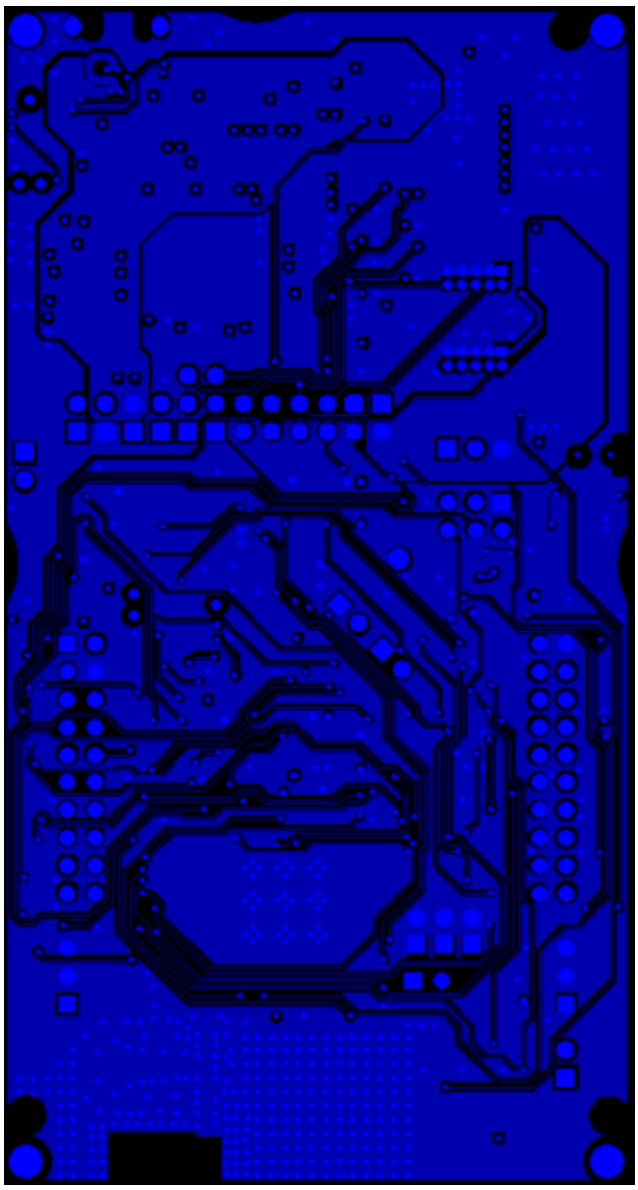




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Figure 20 shows the LAUNCHCC3235MOD bottom layer.

**Figure 20. LAUNCHCC3235MOD Bottom Layer**





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## 3.2 General Layout Recommendations

Ensure that the following general layout recommendations are followed:

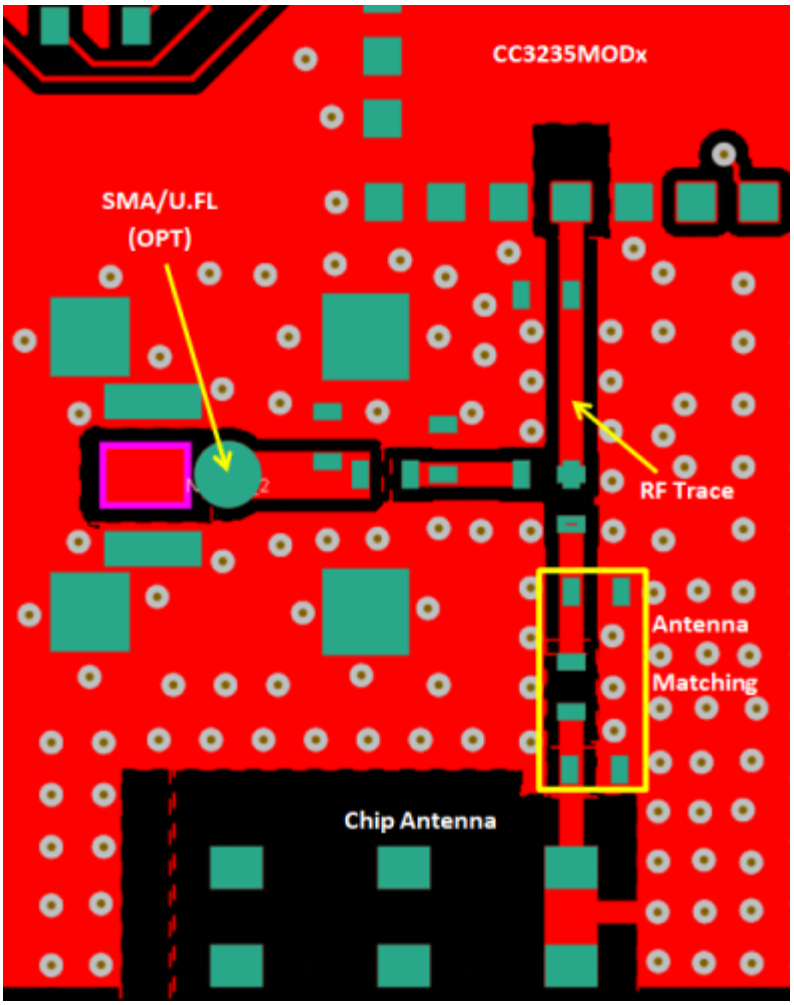
- Have a solid ground plane and ground vias under the module for stable system and thermal dissipation.
- Do not run signal traces underneath the module on a layer where the module is mounted.

## 3.3 RF Layout Recommendations

The RF section of this wireless module gets top priority in terms of layout. It is very important for the RF section to be laid out correctly to ensure optimum performance from the module. A poor layout can cause low-output power, EVM degradation, sensitivity degradation, and mask violations.

Figure 21 shows the RF placement and routing of the CC3235MODSF module.

**Figure 21. RF Section Layout**





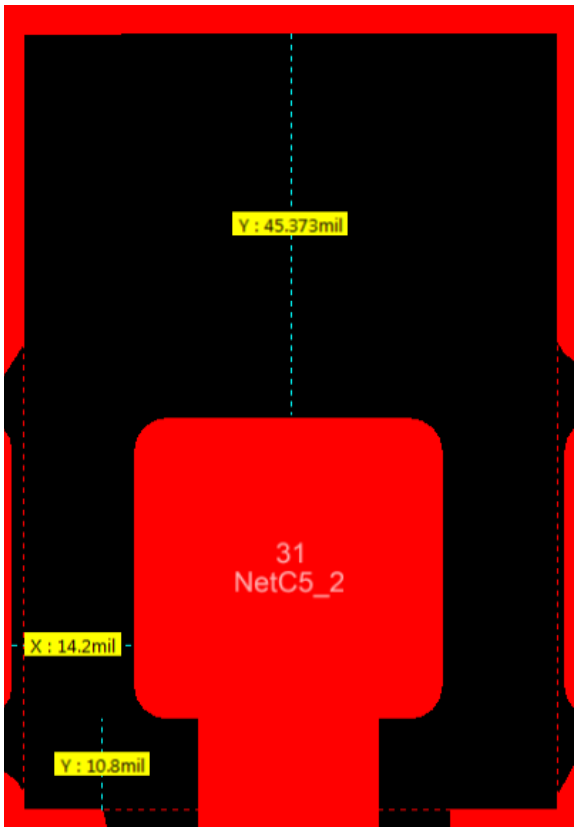
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Use the following RF layout recommendations for the CC3235MODx module:

- RF traces must have 50-Ω impedance.
- RF trace bends must be made with gradual curves, and 90 degree bends must be avoided.
- RF traces must not have sharp corners.
- There must be no traces or ground under the antenna section.
- RF traces must have via stitching on the ground plane beside the RF trace on both sides.
- RF traces must be as short as possible. The antenna, RF traces, and the module must be on the edge of the PCB product in consideration of the product enclosure material and proximity.

For optimal RF performance, ensure the copper cut out on the top layer under the RF-BG pin (pin 31) is as shown in Figure 22.

**Figure 22. Top Layer Copper Pullback on RF Pads**




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## 3.4 Antenna Placement and Routing

The antenna is the element used to convert the guided waves on the PCB traces to the free space electromagnetic radiation. The placement and layout of the antenna are the keys to increased range and data rates. Table 9 provides a summary of the recommended antennas to use with the CC3235MODx module.

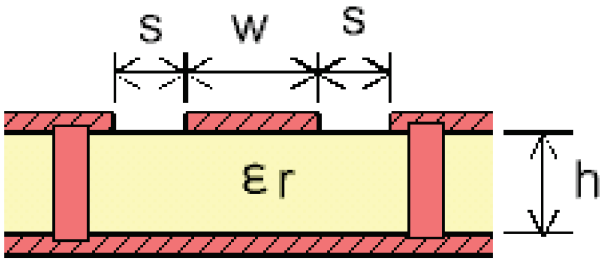
**Table 9. Antenna Guidelines**

| SR NO. | GUIDELINES |
|---|---|
| 1 | Place the antenna on an edge or corner of the PCB. |
| 2 | Ensure that no signals are routed across the antenna elements on all the layers of the PCB. |
| 3 | Most antennas, including the chip antenna used on the LaunchPad, require ground clearance on all the layers of the PCB. Ensure that the ground is cleared on inner layers as well. |
| 4 | Ensure that there is provision to place matching components for the antenna. These must be tuned for best return loss when the complete board is assembled. Any plastics or casing must also be mounted while tuning the antenna because this can impact the impedance. |
| 5 | Ensure that the antenna impedance is 50 Ω because the module is rated to work only with a 50-Ω system. |
| 6 | In case of printed antenna, ensure that the simulation is performed with the solder mask in consideration. |
| 7 | Ensure that the antenna has a near omnidirectional pattern. |
| 8 | The feed point of the antenna is required to be grounded. This is only for the antenna type used on the CC3235MODx LaunchPad. See the specific antenna data sheets for the recommendations. |

## 3.5 Transmission Line Considerations

The RF signal from the module is routed to the antenna using a coplanar waveguide with ground (CPW-G) structure. CPW-G structure offers the maximum amount of isolation and the best possible shielding to the RF lines. In addition to the ground on the L1 layer, placing GND vias along the line also provides additional shielding. Figure 23 shows a cross section of the coplanar waveguide with the critical dimensions.

**Figure 23. Coplanar Waveguide (Cross Section)**

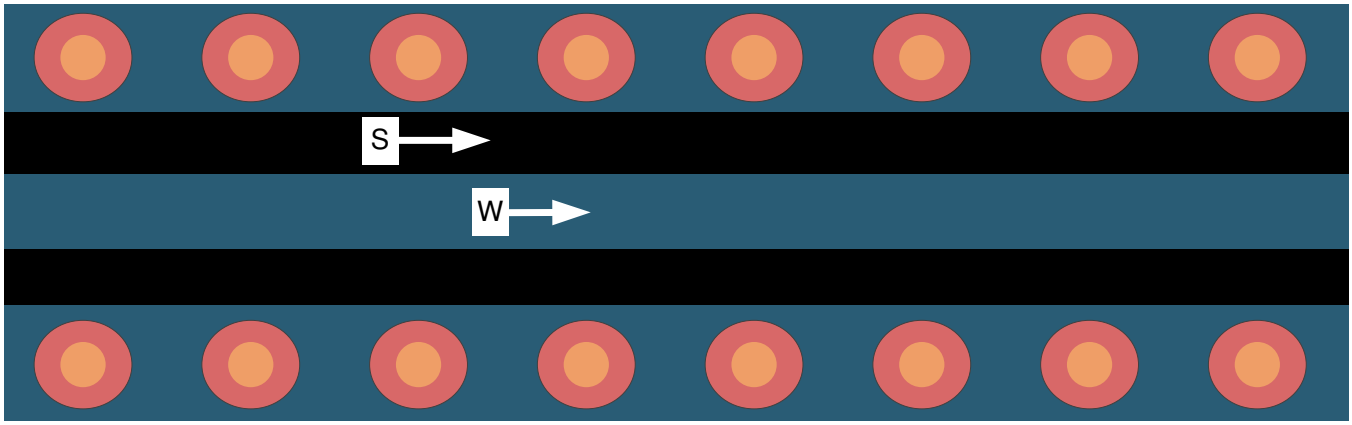




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Figure 24 shows the top view of the coplanar waveguide with GND and via stitching.

**Figure 24. CPW With GND and Via Stitching (Top View)**




The recommended values for the PCB are provided for 2-layer boards in Table 10 and for 4-layer boards in Table 11.

**Table 10. Recommended PCB Values for 2-Layer Board (L1 to L2 = 42.1 mils)**

| PARAMETER | VALUE | UNIT |
|---|---|---|
| W | 26 | mils |
| S | 5.5 | mils |
| H | 42.1 | mils |
| Er (FR-4 substrate) | 4.2 | F/m |

**Table 11. Recommended PCB Values for 4-Layer Board (L1 to L2 = 16 mils)**

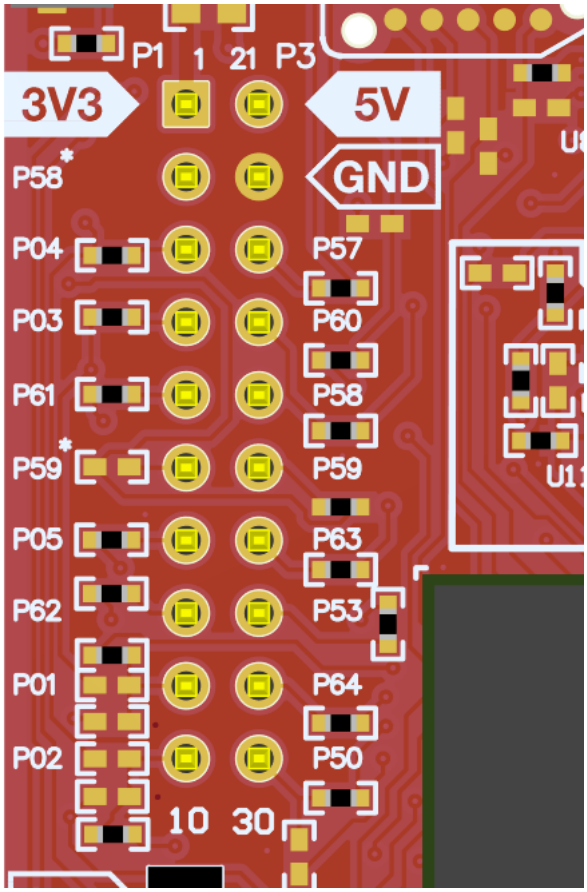
| PARAMETER | VALUE | UNITS |
|---|---|---|
| W | 21 | mils |
| S | 10 | mils |
| H | 16 | mils |
| Er (FR-4 substrate) | 4.5 | F/m |


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# 4 Operational Setup and Testing

A compatible BoosterPack module can be stacked on top of the LaunchPad kit using the two 20-pin connectors. The connectors do not have a key to prevent the misalignment of the pins or reverse connection. Ensure that the VCC and 5-V pins are aligned with the BoosterPack header pins. On the CC3235MODSF LaunchPad kit, a small white symbol is provided near pin 1 (see Figure 25) to orient all BoosterPack modules.

**Figure 25. Pin 1 Marking on LaunchPad (3V3 Mark)**





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## 4.1 Measuring the CC3235MOD Current Draw

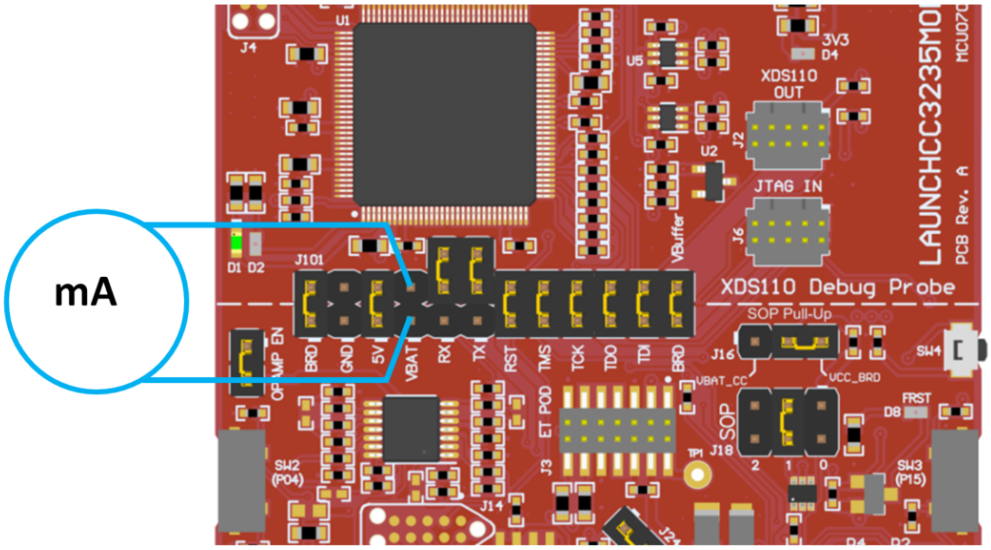
To measure the current draw of the CC3235MOD device using a multimeter, use the VBAT jumper on the J101 isolation block. The current draw measured in this mode includes only the CC3235MOD device, the serial flash internal to the module, and any current drawn through the BoosterPack plug-in module headers. Furthermore, if the module's GPIO is driving a high current load such as an LED, then this will also be included in the measurement.

### 4.1.1 Low-Current Measurement with USB Power (<1 mA)

See the following instructions to measure ultra-low power when powering with a USB cable.

1. Remove the VBAT jumper in the J101 isolation block, and attach an ammeter across this jumper. See Figure 26.
2. Consider the effect that the backchannel UART and any circuitry attached to the CC3235MOD may have on current draw. Consider disconnecting these at the isolation jumper block, or at least consider their current sinking and sourcing capability in the final measurement.
3. Begin target execution and set the device to low-power modes (LPDS or hibernate).
4. Measure the current. Remember that if the current levels are fluctuating, it may be difficult to get a stable measurement. It is easier to measure quiescent states. See the "Power Measurement Guide" in CC3135, CC3235x SimpleLink™ Wi-Fi® Internet-on-a chip™ Networking Subsystem Power Management for more current consumption measurement techniques.

**Figure 26. Low Current Measurement**






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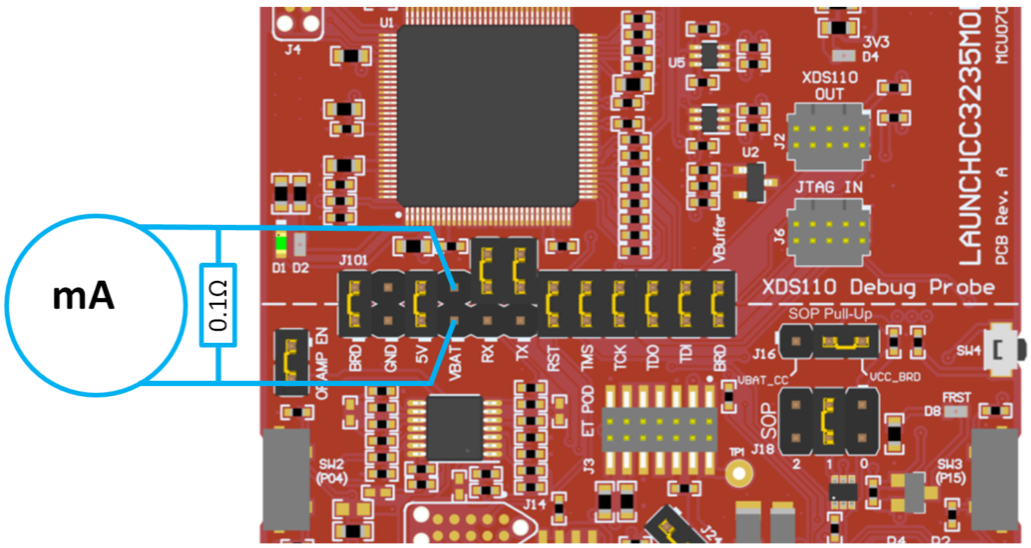
### 4.1.2 Active Current Measurements

See the following instructions to measure active power.

1. Remove the VBAT jumper (J18) as shown in Figure 27.
2. Solder a 0.1-Ω resistor on a wire which can be connected to a voltmeter/oscilloscope. Or, attach a jumper across J18 so that it can be used with a current probe.
3. Measure the voltage across the resistor using an oscilloscope with a differential probe. For the current probe, coil the wire around the sensor several times for good sensitivity.

   An ammeter can also be used for this measurement, but the results may be erroneous due to the switching nature of the current. See the "Power Measurement Guide" in CC3135, CC3235x SimpleLink™ Wi-Fi® Internet-on-a chip™ Networking Subsystem Power Management for more current consumption measurement techniques.

**Figure 27. Active Current Measurement**





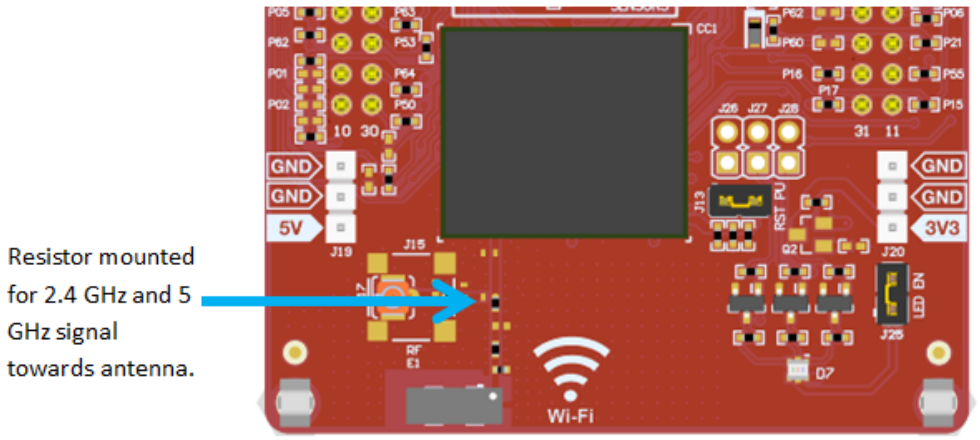

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## 4.2 RF Connections

### 4.2.1 AP Connection Testing

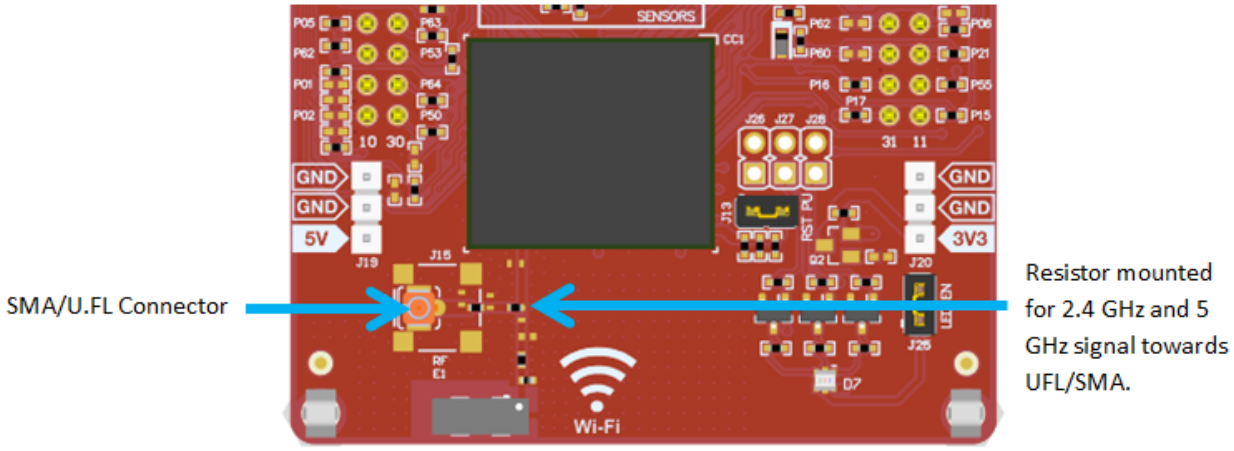
By default, the board ships with the 2.4 GHz and 5 GHz RF signals routed to the onboard chip antenna, as shown in Figure 28.

**Figure 28. Using Onboard Antenna (Default Condition)**




A U.FL connector J17 provides a way to test in the lab using a compatible cable. Alternatively, trackpads for an SMA connector J15 are provided onboard to replace the J17 U.FL connector for testing conducted measurements. A rework must be performed before these connectors can be used; this involves swapping the position of a resistor. Figure 29 shows the modified board.

**Figure 29. Board Modified for External Antenna Connections (Measure 2.4 GHz or 5 GHz)**






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## 4.3 Design Files

### 4.3.1 Hardware Design Files

Schematics can be found in Section 7.2. All design files, including schematics, layout, Bill of Materials (BOM), Gerber files, and documentation are available for download from LAUNCHCC3235MOD.

## 4.4 Software

All design files, including firmware patches, software example projects, and documentation are available from the CC3235 Software Development Kit. Inside of the SDK, a set of very simple CC3235 code examples can be found that demonstrates how to use the entire set of CC3235 peripherals. When starting a new project or adding a new peripheral, these examples serve as a great starting point.

# 5 Development Environment Requirements

The following software examples with the LaunchPad require an integrated development environment (IDE) that supports the CC3235MOD.

The *CC313x and CC323x SimpleLink™ Wi-Fi® Embedded Programming User's Guide* has detailed information about software environment setup with examples. See this document for further details on the software sample examples.

## 5.1 CCS

CCS 6.0 or higher is required. When CCS is launched, and a workspace directory is chosen, use *Project → Import Existing CCS Eclipse Project*. Direct it to the desired demo project directory containing main.c.

## 5.2 IAR

IAR 6.70 or higher is required. To open the demo in IAR, choose *File → Open → Workspace…*, and direct it to the *.eww workspace file inside the \IAR subdirectory of the desired demo. All workspace information is within this file.

The subdirectory also has an *.ewp project file; this file can be opened into an existing workspace, using *Project → Add-Existing-Project….*


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# 6 Additional Resources

## 6.1 CC3235MODx Product Page

For more information on the CC3235MODSF device, visit the CC3235MODSF product page, which includes the *CC3235MODx SimpleLink™ Wi-Fi® Wireless and Internet-of-Things Solution, a Single-Chip Wireless MCU data sheet* and key documents such as the *CC32xx SimpleLink™ Wi-Fi® and Internet-of-Things Technical Reference Manual*. For more information on the CC3235MODS device, visit the CC3235MODS product page.

## 6.2 Download CCS or IAR

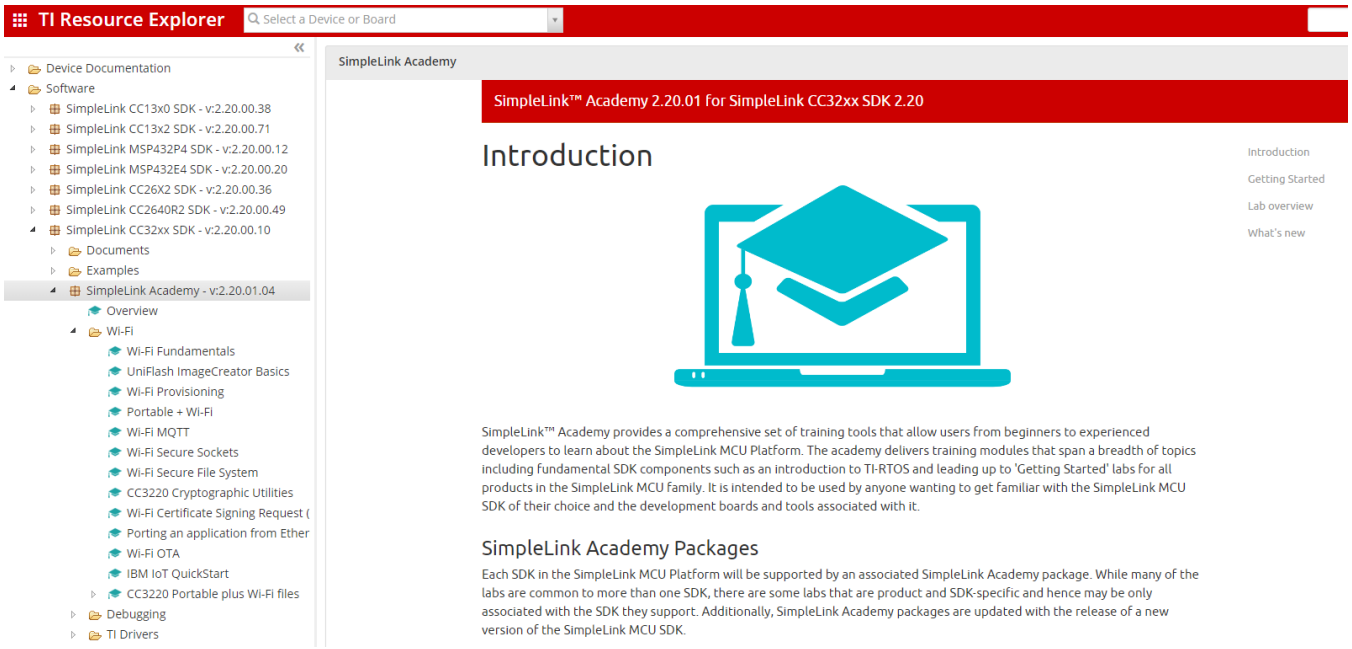
Although the files can be viewed with any text editor, more can be done with the projects if they are opened with a development environment such as Code Composer Studio (CCS), IAR, or Energia. CCS and IAR are each available in a full version, or a free, code-size-limited version. The full out-of-box demo cannot be built with the free version of CCS or IAR (IAR Kickstart), due to the code-size limit. To bypass this limitation, a code-size-limited CCS version is provided that has most functionality integrated into a library. The code built into the library is able to be viewed by the user, but it cannot be edited. For full functionality, download the full version of either CCS or IAR.

## 6.3 SimpleLink™ Academy for CC3235 SDK

The SimpleLink™ Academy is a collection of curated training modules developed by TI subject matter experts to help developers get up and running as quickly as possible with a SimpleLink MCU device and its SDK. The training is delivered using TI Resource Explorer, which offers a powerful cloud-enabled environment that includes background information, interactive exercises, code snippets, quizzes, and more.

Experience the SimpleLink™ Academy now using the TI Resource Explorer at dev.ti.com.

**Figure 30. CC32xx SimpleLink™ Academy**




## 6.4 TI E2E™ Support Forums

TI E2E support forums are an engineer's go-to source for help throughout every step of the design process. Our engineers answer your technical questions and share their knowledge to help you quickly solve your design issues.

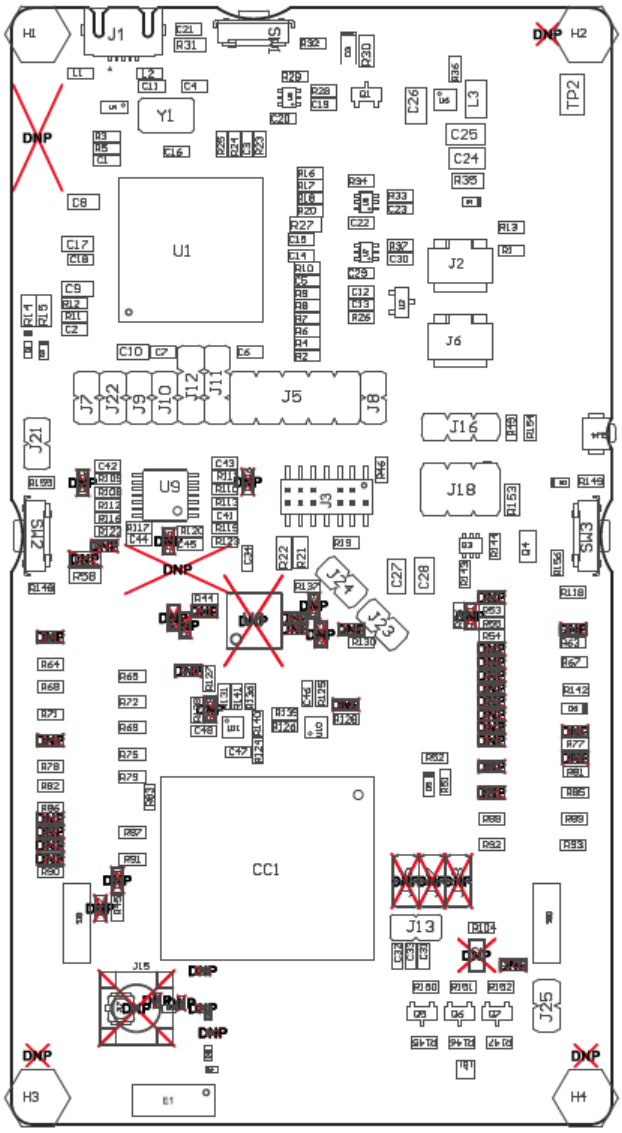


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# 7 Assembly Drawing and Schematics

## 7.1 Assembly Drawing

**Figure 31. LAUNCHCC3235MOD Top-Layer Assembly Drawing**

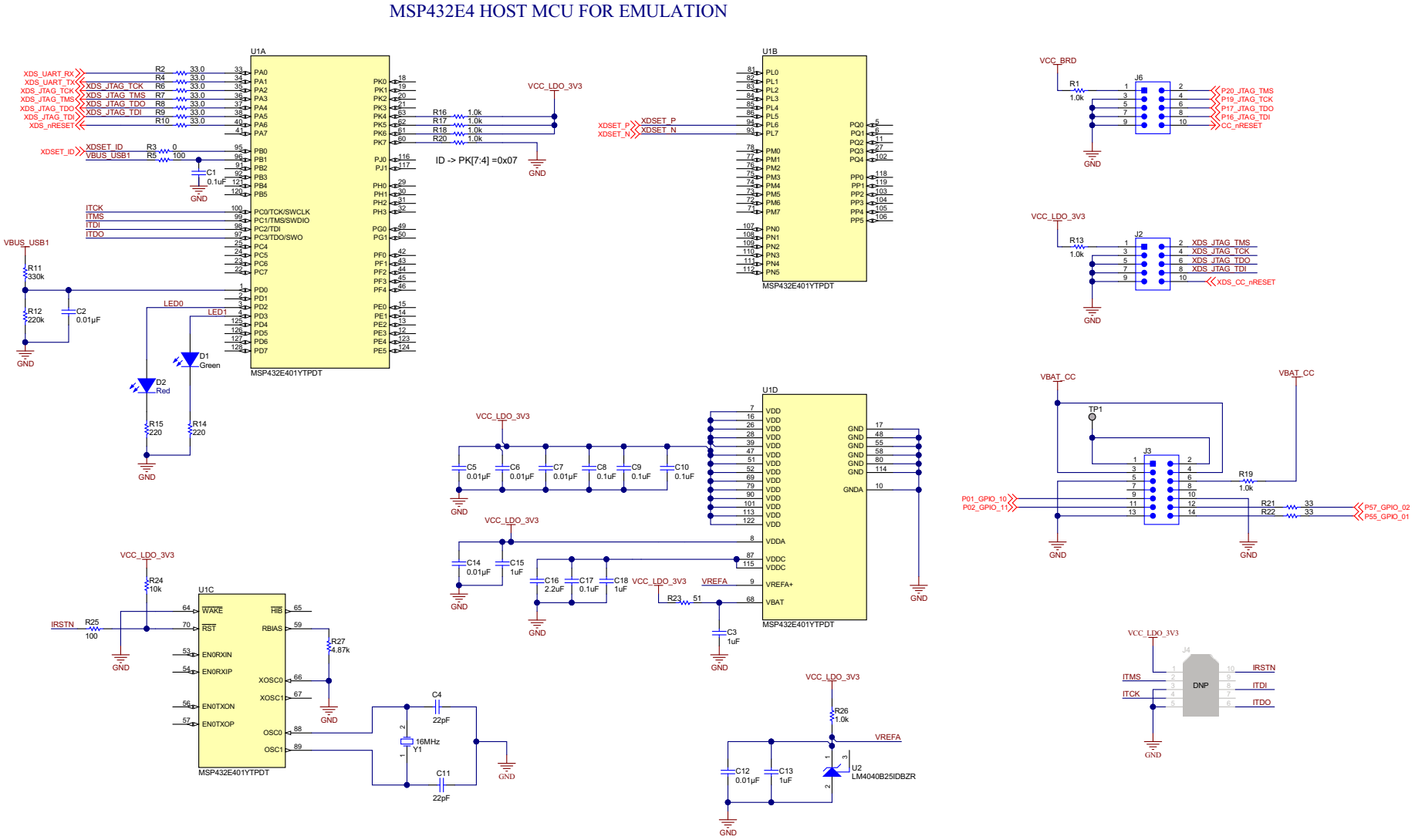




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## 7.2 Schematics

**Figure 32. Schematics (1 of 5)**

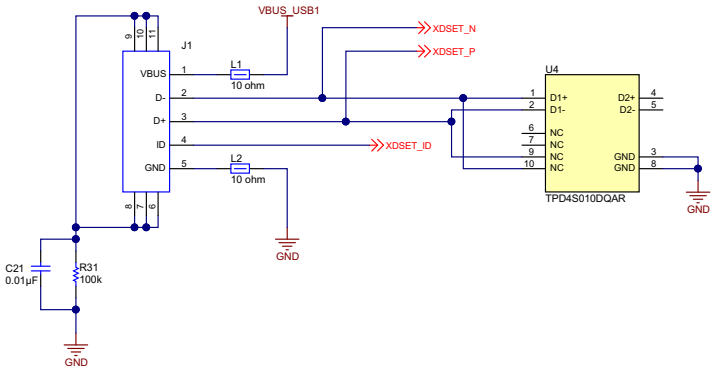


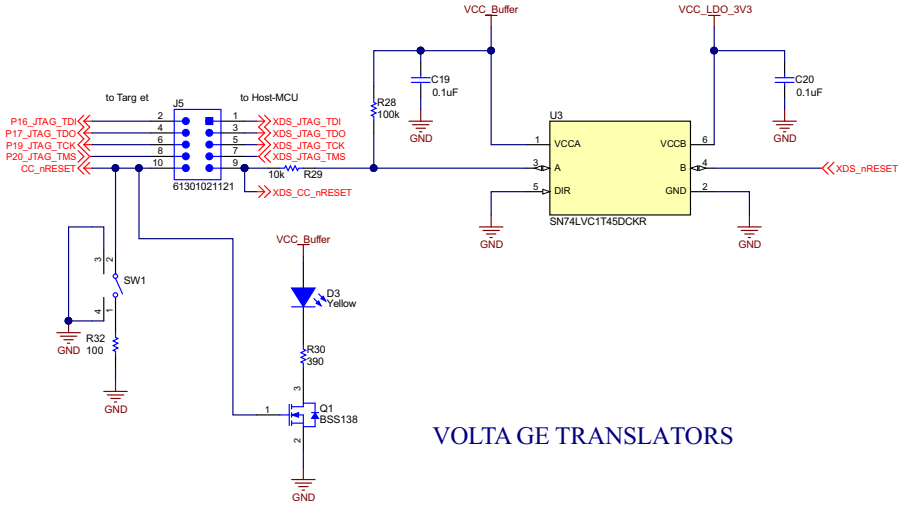



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**Figure 33. Schematics (2 of 5)**

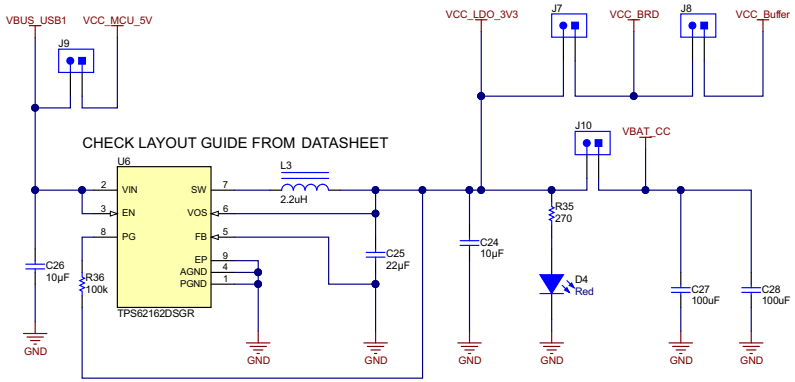
USB-INTERFACE

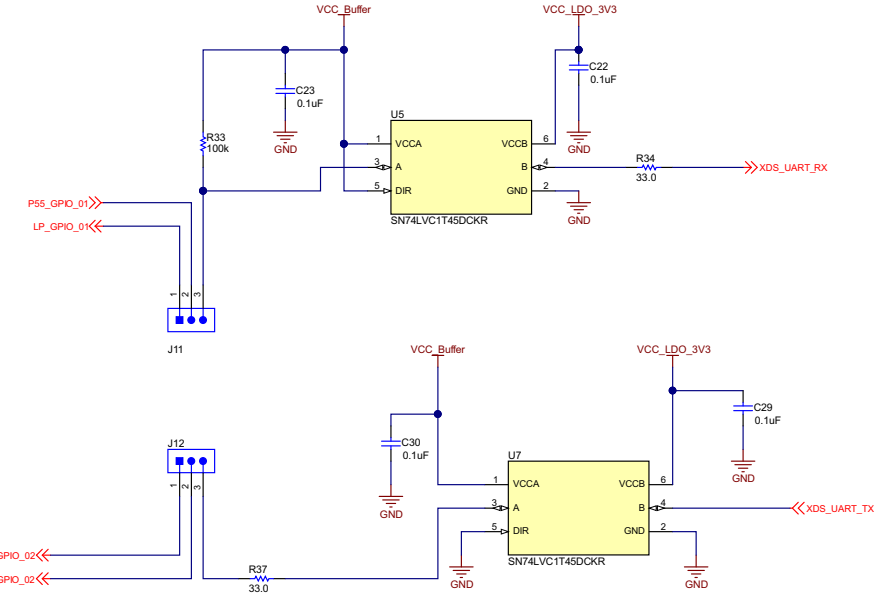



VOLTA GE TRANSLATORS

POWER MANAGEMENT

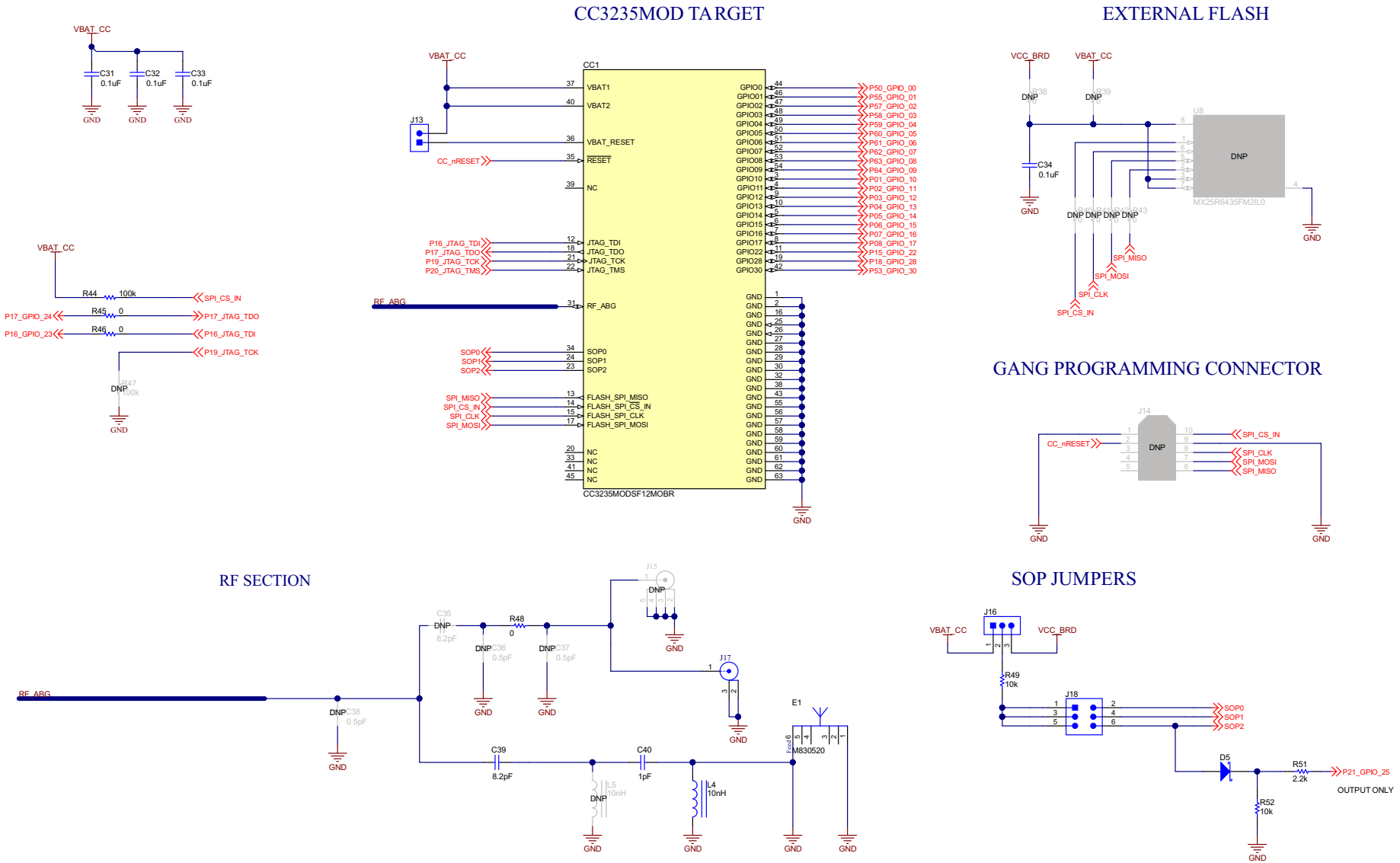





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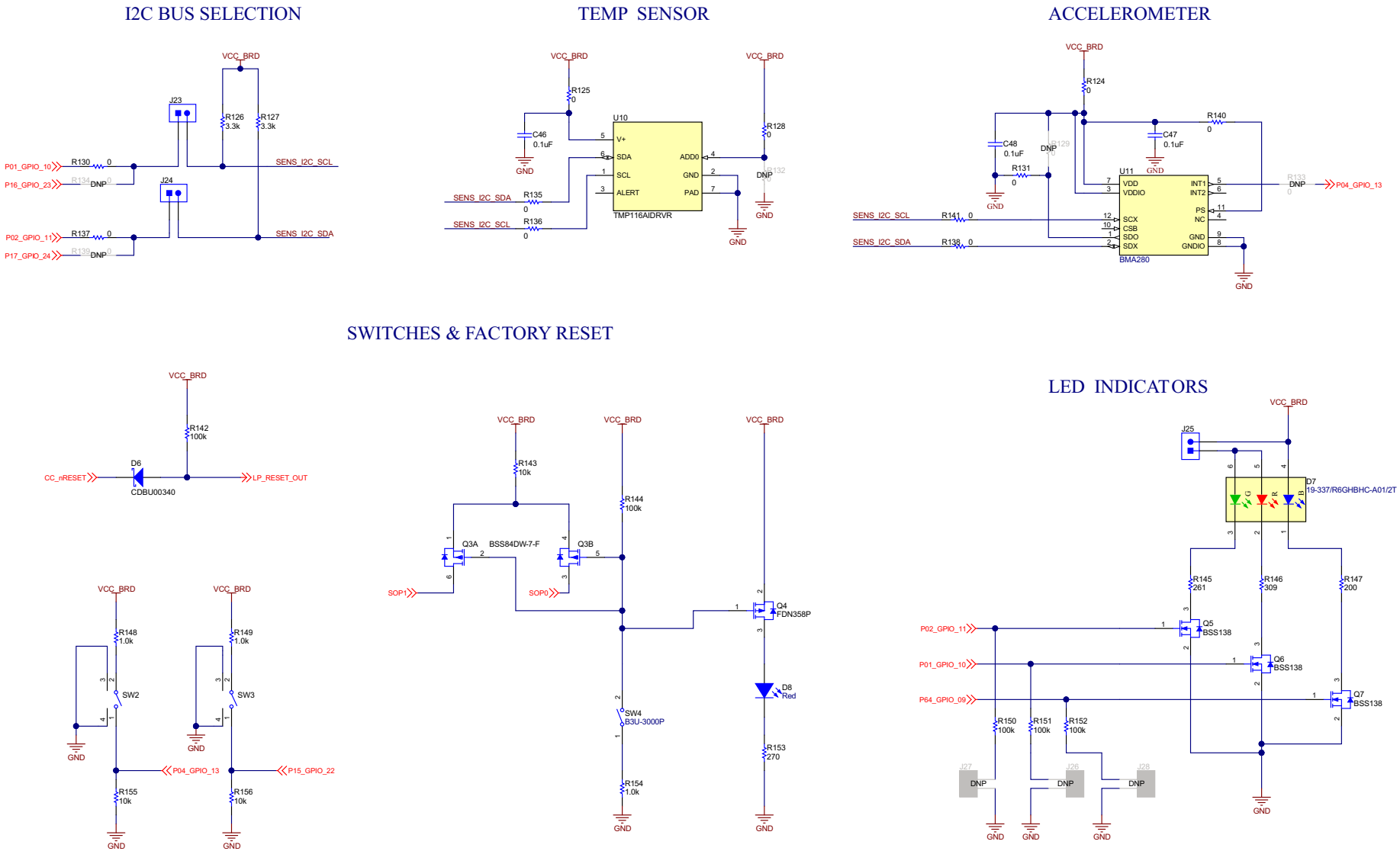
**Figure 34. Schematics (3 of 5)**






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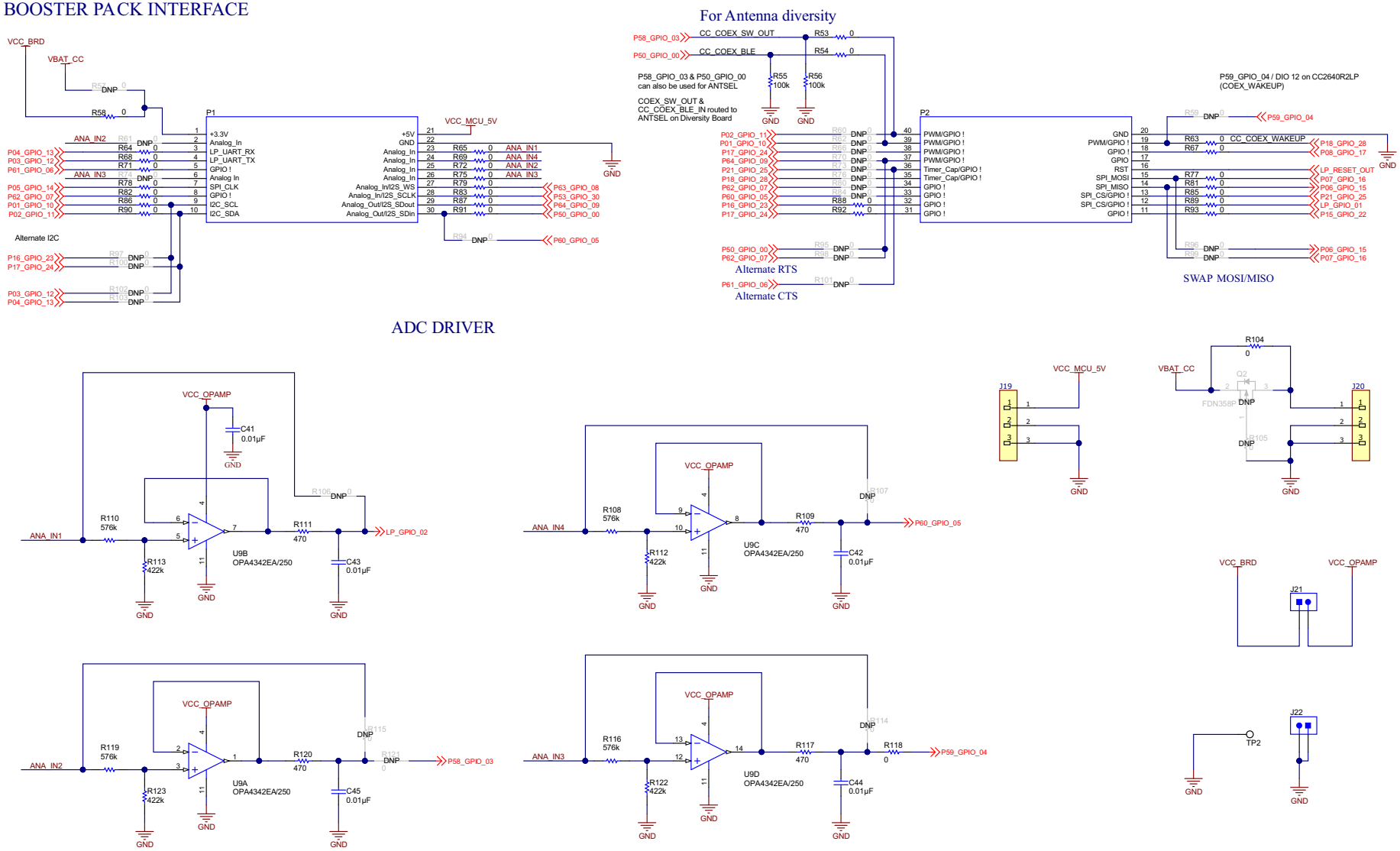
**Figure 35. Schematics (4 of 5)**






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**Figure 36. Schematics (5 of 5)**






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# Manual Information to the End User

## A.1 End User Manual

The OEM integrator must be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual must include all required regulatory information and warnings as shown in this manual.

## A.2 RF Function and Frequency Range

The CC3235MODSM2MOB, CC3235MODSF12MOB, CC3235MODASM2MON, and CC3235MODASF12MON devices are designed to operate in the WLAN 2.4-GHz and 5-GHz band. The CC3235MODSM2MOB, CC3235MODSF12MOB, CC3235MODASM2MON, and CC3235MODASF12MON devices support the following channels dependent on the region of operation:

- FCC and IC: Ch 1 to 11 (2142 MHz to 2462 MHz) and 36 to 161 (5180 MHz to 5805 MHz)
- EU: Channels 1 through 13 (2142 MHz to 2472 MHz) and 36 to 136 (5180 MHz to 5680 MHz)
- JP: Channels 1 through 13 (2142 MHz to 2472 MHz) and 36 to 136 (5180 MHz to 5680 MHz)

Note that the CC3235MODx and CC3235MODAx devices do not support determination of its region through any external mechanism. The region is set by the application SW, or at the time of programming of the device. The end user is unable to change the region of operation at any time.

**NOTE:** The maximum RF power transmitted in each WLAN 2.4 GHz band is 19 dBm (EIRP power).

The maximum RF power transmitted in each WLAN 5 GHz band is 18.8 dBm (EIRP power).

## A.3 FCC and IC Certification and Statement

This device is intended for OEM integrators under the following conditions:

- The antenna must be installed so 20 cm of space is maintained between the antenna and the users.
- The transmitter module may not be collocated with any other transmitter of antenna.
- To comply with FCC and IC regulations limiting maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:
  - +2.5 dBi in WLAN 2.4 GHz
  - +4.5 dBi in WLAN 5 GHz

In the event that these conditions cannot be met (for example, certain laptop configurations or collocation with another transmitter), then the FCC and IC authorization is no longer considered valid and the FCC and IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and IC authorization.

### A.3.1 FCC

The TI CC3235MODx and CC3235MODAx modules are certified for FCC as a single-modular transmitter. The module is an FCC-certified radio module that carries a modular grant.


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You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation of the device.

**CAUTION**

**FCC RF Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

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 the one the receiver is connected to.
- Consult the dealer or an experienced radio or TV technician for help.

The antennas listed in Table 12 of this document were verified in the compliance testing. Use only the antennas listed in Table 12 . A separate approval is required for all other operating configurations, including different antenna configurations

### A.3.2 CAN ICES-3(B) and NMB-3(B) Certification and Statement

The TI CC3235MODx and CC3235MODAx modules are certified for IC as a single-modular transmitter. The TI CC3235MODx and CC3235MODAx modules meet IC modular approval and labeling requirements. The IC follows the same testing and rules as the FCC regarding certified modules in authorized equipment.

This device complies with Industry Canada license-exempt RSS standards.

Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deus conditions suivantes:

- L'appareil ne doit pas produire de brouillage.
- L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage ests susceptible d'en compromettre lu fonctionnement.



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**CAUTION**

**IC RF Radiation Exposure Statement:**

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

**Déclaration d'exposition aux radiations:**

Cut équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

This radio transmitter (451I-CC3235MOD) has been approved by Industry Canada to operated with the antenna types listed in Table 12 of this document with the maximum permissible gain 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.

The antennas listed in Table 12 of this document were verified in the compliance testing. Use only the antennas listed in Table 12 . A separate approval is required for all other operating configurations, including different antenna configurations.

### A.3.3 End Product Labeling

This module is designed to comply with the FCC statement, FCC ID: Z64-CC3220MOD. The host system using this module must display a visible label indicating the following text:

- Contains FCC ID: Z64-CC3235MOD

This module is designed to comply with the IC statement, IC: 451I-CC3220MOD. The host system using this module must display a visible label indicating the following text:

- Contains IC: 451I-CC3235MOD

This module is designed to comply with JP statement 201-190033. The host system using this module must display a visible label indicating the following text:

- Contains transmitter module with certificate module 201-190033

### A.3.4 Device Classifications

Because host devices vary widely with design features and configurations, module integrators shall reference the following guidelines regarding device classification and simultaneous transmission, and seek guidance from their preferred regulatory test lab to determine how regulatory guidelines will impact the device compliance. Proactive management of the regulatory process will minimize unexpected schedule delays and costs due to unplanned testing activities.

The module integrator must determine the minimum distance required between their host device and the body of the user. The FCC provides device classification definitions to assist in making the correct determination. Note that these classifications are guidelines only; strict adherence to a device classification may not satisfy the regulatory requirement as near-body device design details may vary widely. The user-preferred test lab will be able to assist in determining the appropriate device category for the host product and if a KDB or PBA must be submitted to the FCC.

Note, the module that the user is using has been granted modular approval for mobile applications. Portable applications may require further RF exposure (SAR) evaluations. It is also likely that the host and module combination will need to undergo testing for FCC Part 15, regardless of the device classification. The preferred test lab of the user will be able to assist in determining the exact tests which are required on the host and module combination.


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### A.3.5 FCC Definitions

**Portable: (§2.1093)—** A portable device is defined as a transmitting device designed to be used so that the radiating structures of the device is or are within 20 centimeters of the body of the user.

**Mobile: (§2.1091) (b)—** A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Per §2.1091d(d)(4) In some cases (for example, modular or desktop transmitters), the potential conditions of use of a device may not allow easy classification of that device as either Mobile or Portable. In these cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength, or power density, whichever is most appropriate.

### A.3.6 Simultaneous Transmission Evaluation

This module has not been evaluated or approved for simultaneous transmission as it is impossible to determine the exact multi-transmission scenario that a host manufacturer may choose. Any simultaneous transmission condition established through module integration into a host product must be evaluated per the requirements in KDB447498D01(8) and KDB616217D01,D03 (for laptop, notebook, netbook, and tablet applications).

These requirements include, but are not limited to:

- Transmitters and modules certified for mobile or portable exposure conditions can be incorporated in mobile host devices without further testing or certification when:
  - The closest separation among all simultaneous transmitting antennas is >20 cm

    or
  - Antenna separation distance and MPE compliance requirements for ALL simultaneous transmitting antennas have been specified in the application filing of at least one of the certified transmitters within the host device. In addition, when transmitters certified for portable use are incorporated in a mobile host device, the antennas must be >5 cm from all other simultaneous transmitting antennas
- All antennas in the final product must be at least 20 cm from users and nearby persons.

## *A.4 EU Certification and Statement*

### A.4.1 RF Exposure Information (MPE)

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure. To comply with the RF exposure requirements, this module must be installed in a host platform that is intended to be operated in a minimum of 20-cm separation distance to the user.

### A.4.2 Simplified DoC Statement

#### *A.4.2.1 CC3235MODx and CC3235MODAx Modules*

Hereby, Texas Instruments declares that the radio equipment type CC3235MODSM2MOB, CC3235MODSF12MOB, CC3235MODASM2MON, and CC3235MODASF12MON are in compliance with Directive 2014/53/EU.

The full text of the EU declarations of conformity are available at the following links.

- *CC3235MODSM2MOB EC Declaration of Conformity (DoC)*
- *CC3235MODSF12MOB EC Declaration of Conformity (DoC)*
- *CC3235MODASM2MON EC Declaration of Conformity (DoC)*
- *CC3235MODASF12MON EC Declaration of Conformity (DoC)*



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#### *A.4.2.2 LAUNCHCC3235MOD*

Hereby, Texas Instruments declares that the radio equipment type LAUNCHCC3235MOD is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at *LAUNCHCC3235MOD EC Declaration of Conformity (DoC)*.

### A.4.3 Waste Electrical and Electronic Equipment (WEEE)



**Waste Electrical and Electronic Equipment (WEEE)**

This symbol means that according to local laws and regulations your product and/or battery shall be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Proper recycling of your product will protect human health and the environment.

### A.4.4 OEM and Host Manufacturer Responsibilities

OEM and host manufacturers are ultimately responsible for the compliance of the host and module. The final product must be reassessed against all of the essential requirements of the RED before it can be placed on the EU market. This includes reassessing the transmitter module for compliance with the radio and EMF essential requirements of the RED. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

### A.4.5 Antenna Specifications

In all cases, assessment of the final product must be met against the Essential requirements of RE Directive Article 3.1(a) and (b), safety and EMC respectively, as well as any relevant Article 3.3 requirements.

1. The antennas listed in Table 12 were verified in the conformity testing, and for compliance the antenna shall not be modified. A separate approval is required for all other operating configurations, including different antenna configurations.
2. If any other simultaneous transmission radio is installed in the host platform together with this module, or above restrictions cannot be kept, a separate RF exposure assessment and CE equipment certification is required.

## *A.5 CC3235MODx Approved Antennas*

**Table 12. CC3235MODx Approved Antennas**

| Antenna Information | | | | | |
|---|---|---|---|---|---|
| **Number** | **Brand** | **Antenna Type** | **Model** | **2.4-GHz Gain** | **5-GHz Gain** |
| 1 | Pulse | Chip | W3078 | 1.7 | 4.3 |
| 2 | Yageo | | ANT5320LL04R2455A | 2.17 | 3.51 |
| 3 | Ethertronics | | M830520 | 1 | 2.6 |
| 4 | | PCB | 1000423 | -0.6 | 4.5 |
| 5 | Laird | | CAF94504 | 2 | 4 |
| 6 | | | CAF94505 | 2 | 4 |
| 7 | LSR | Dipole | 001-0012 | 2 | 2 |
| 8 | | | 080-0013 | 2 | 2 |
| 9 | | | 080-0014 | 2 | 2 |
| 10 | | PIFA | 001-0016 | 2.5 | 3 |
| 11 | | | 001-0021 | 2.5 | 3 |


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## Revision History

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

| Changes from February 20, 2019 to February 11, 2020 | Page |
|---|---|
| • Added description of the CC3235MODAx devices throughout document | 4 |



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