EVM User's Guide: LP-EM-CC35X1

CC35xxE LaunchPad™ Development Kit for SimpleLink™ Wi-Fi 6 and Bluetooth® Low Energy Wireless MCU



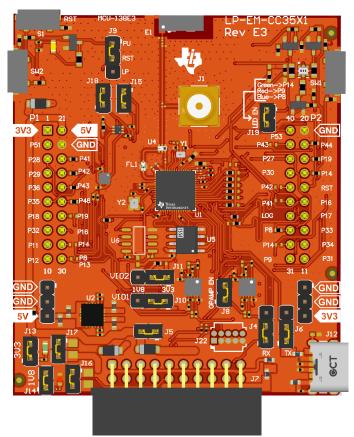
Description

The SimpleLink™ CC3501E and CC3551E Wi-Fi 6 and Bluetooth® low-energy wireless MCUs enable affordable, reliable, and secure connectivity integrated with a powerful Arm® Cortex®-M33 application processor. The CC35xxE LaunchPad™ development kit (LP-EM-CC35X1) is a test and development board that features onboard sensors, buttons, and easy interface options to emulators for a full out-of-the-box experience and rapid development. **Note:** This user's guide is relevant for LP-EM-CC35X1 hardware revision E3.

Features

 CC3551E SimpleLink Wi-Fi 6 and Bluetooth low energy, Internet-on-a chip[™] design with integrated MCU

- 2×20 pin stackable connectors (BoosterPack[™] headers) to connect to TI LaunchPads and other BoosterPack plug-in modules
- 20-pin header for XDS110-based JTAG emulation with serial port for flash programming
- Onboard chip antenna with SMA/U.FL connector for conducted testing
- Easy access to all I/O signals with the BoosterPack plug-in module connectors
- Jumpers for current measurement on both power supplies (3.3V and 1.8V)
- Two buttons and RGB LED for user interaction
- · Onboard accelerometer and temperature sensor
- USB Type-C[®] connector for power



Evaluation Module Overview www.ti.com

1 Evaluation Module Overview

1.1 Introduction

Created for the Internet of Things (IoT), the SimpleLink Wi-Fi 6 and Bluetooth Low Energy CC3501E and CC3551E devices are single-chip microcontrollers (MCU) with built-in Wi-Fi® connectivity for the LaunchPad ecosystem, which integrates a high-performance Arm Cortex -M33 MCU and lets customers develop an entire application with one device.

No prior Wi-Fi experience is required for fast development with the CC35xxE devices to quickly enable Wi-Fi and Bluetooth Low Energy using its high-performance CP and robust security features. The CC35xxE LaunchPad kit, referred to by the part number, LP-EM-CC35X1, is a low-cost evaluation platform for Arm Cortex -M33-based MCUs. The LaunchPad design highlights the CC35xxE Internet-on-a chip design and Wi-Fi capabilities. By default the CC3551ENJARSHR is populated on the LP-EM-CC35X1, however, the board and accompanying software are designed to support the CC3500E, CC3501E, CC3550E, and CC3551E.

The CC35xxE LaunchPad also features temperature and accelerometer sensors, programmable user buttons, RGB LED for custom applications, and easy connection to emulation boards for debugging. The stackable headers of the CC35xxE LaunchPad interface demonstrate the ease 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.

This evaluation module is specifically designed for development with the Eclipse-based Code Composer Studio™ (CCS) from Texas Instruments. More information about the LaunchPad, the supported BoosterPack modules, and the available resources can be found at the LaunchPad portal from TI. Also, visit the CC35xxE product page for design resources and example projects.

1.2 Kit Contents

- LP-EM-CC35X1—LaunchPad development tool
- USB type-C cable
- · Quick Start Guide

www.ti.com Evaluation Module Overview

1.3 Specification

The LP-EM-CC35X1 is a board designed to enable rapid and easy software and hardware development for the CC35xxE device. The block diagram for the LP-EM-CC35X1 is shown in Figure 1-1.

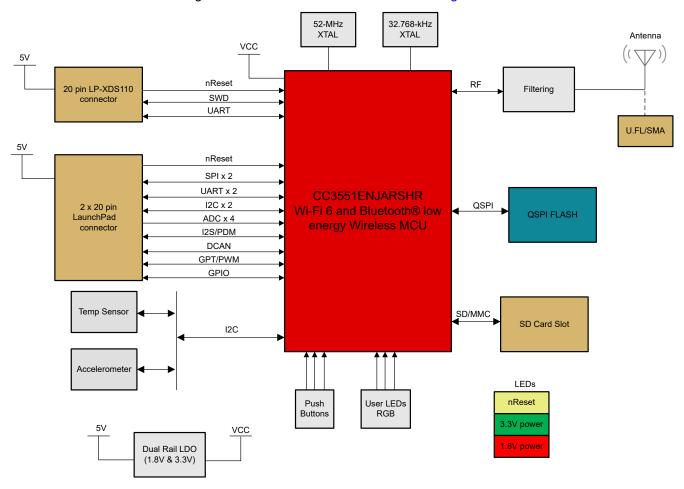


Figure 1-1. LP-EM-CC35X1 Block Diagram

1.4 Device Information

The purpose of the LP-EM-CC35X1 is to showcase the hardware and software capabilities of the CC35xxE device. The other components on the board are populated for testing and support of this main device.

Hardware www.ti.com

2 Hardware

The overview of the LP-EM-CC35X1 is shown in Figure 2-1.

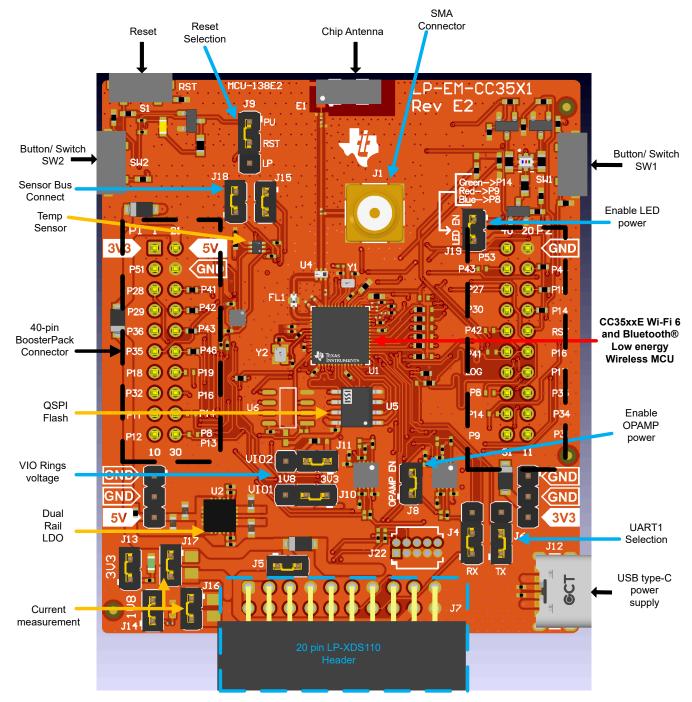


Figure 2-1. CC35xxE LaunchPad Board Overview

2.1 Wired Connections, Jumper Settings, Buttons, and LEDs

2.1.1 SWD Interface

The LP-EM-CC35X1 supports Serial Wire Debug (SWD) interface to an external XDS110 or other JTAG-based debuggers. The SWD interface to the CC35xxE device is used for flashing the device and basic debugging. The SWD lines are part of the VIO1 IO ring, the voltage of which can be controlled by shunt J10, see Section 2.2.1.

The default SWD connection is to the LP-XDS110 20-pin header on the bottom of the LP-EM-CC35X1 (J7).

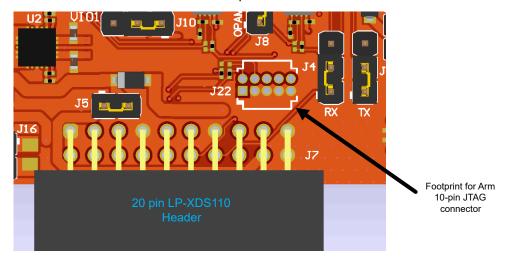


Figure 2-2. SWD Interfaces

Table 2-1. 20 pin LP-XDS110 Connector Assignment

	Table 2-1. 20 pm LP-ADS 110 Connector Assignment			
Pin	Signal Name	Description		
J7.6	SWCLK	Serial wire clock		
J7.8	SWDIO	Serial wire data in/out		
J7.10	XDS_RESET	nRESET (enable line to the CC3551E)		
J7.12	UART1_TX_XDS	The CC3551E UART TX (from CC3551E) (can be disconnected with jumpers; see Section 2.1.3)		
J7.14	UART1_RX_XDS	The CC3551E UART RX (to CC3551E) (can be disconnected with jumpers; see Section 2.1.3)		
J7.16	VIO1	VIO1 supply reference voltage to connector		
J7.18	VCC_BRD_5V	5V supply to LP-EM-CC35X1 from LP-XDS110		
J7.1, J7.7, J7.13, J7.19, J7.20	GND	Board ground		

Hardware www.ti.com

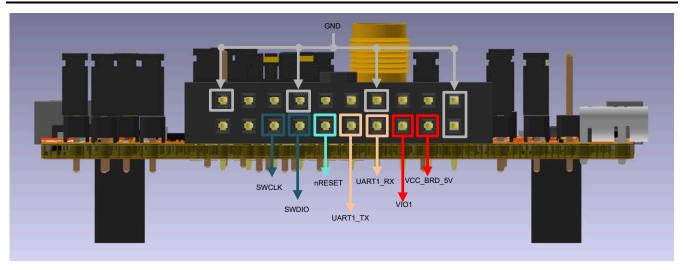


Figure 2-3. 20-Pin LP-XDS110 Connector (J7)

There is also the option to use the ARM Cortex-M 10-pin (CM10) connector for the SWD interface. This connector is not assembled by default but a CM10 header can be soldered on the J22 footprint on the LP-EM-CC35X1. For J22 footprint location, see Figure 2-2.

The pinout of the CM10 connector when assembled is shown in Figure 2-4 and Table 2-2.

Note

In addition to assembling the CM10 connector, 0 ohm resisters must change the assembly location for the SWD interface to this connector. R106 and R107 must be placed on the top two solder pads **instead** of the default bottom two solder pads, as shown in Figure 2-4.

Table 2-2. CM10 Connector (J22) Assignment

Pin	Signal Name	Description
J22.1	VIO1	VIO1 supply reference voltage to connector
J22.2	SWDIO	Serial wire data in/out (See note)
J22.4	SWCLK	Serial wire clock (See note)
J22.10	XDS_RESET	nRESET (enable line to the CC3551E)
J22.3, J22.5, J22.7, J22.9	GND	Board Ground

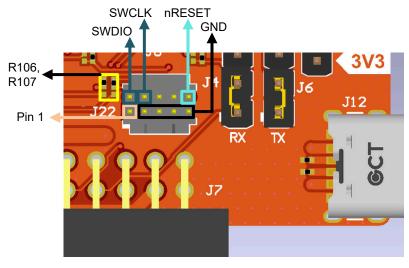


Figure 2-4. CM10 Connector (J22)

2.1.2 I²C Connections

The CC35xxE features two independent I^2C peripherals, called I^2C0 and I^2C1 . The LP-EM-CC35X1 allows you to interface to these I^2C buses via the LaunchPad header pins.

The LP-EM-CC35X1 also features an accelerometer and a temperature sensor for the out-of-box demo. These features are connected to the I²C1 bus, and can be isolated using the jumpers provided (J15 and J28). By removing J15 and J18, the accelerometer and the temperature sensors are isolated from the I²C1 bus.

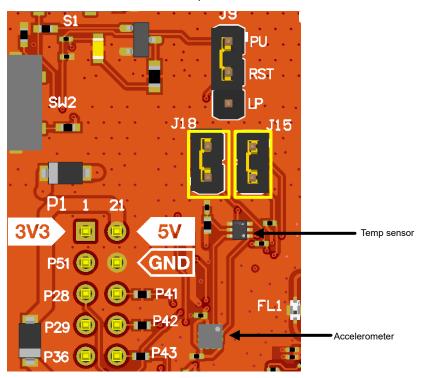


Figure 2-5. I²C Connections

Table 2-3. I2C Jumper Definitions

Reference	Use	Comments
J15	I2C1 CLK	Jumpers populated: onboard sensors connected
J18	I2C1 Data	Jumpers not populated: onboard sensors disconnected

Note

Both I²C buses have on-board pullup resistors on the data and clk lines.

2.1.2.1 Default I²C Addresses

The default I²C addresses of the onboard sensors are listed in Table 2-4.

Table 2-4. Default I²C Addresses (of Onboard Sensors)

Sensor Type	Reference Designator on LP-EM- CC35X1	Part Number (Manufacturer)	Default Target Address (Hex)
Temperature	U8	TMP1075NDRLR (TI)	0x48
Accelerometer	U9	BMA456 (BOSCH)	0x18

Hardware Www.ti.com

2.1.3 UART Signals

The CC35xxE includes two independent UART peripherals, UART0 and UART1. The LP-EM-CC35X1 allows you to interface with these UART signals through the LaunchPad header pins.

UART1 interface is by default connected to the 20-pin LP-XDS110 header (J7) for serial terminal interface (COM port) to a PC through the LP-XDS110. For more information on this header, see Section 2.1.1.

The routing selection of the UART1 TX and RX signals to header J7 or to the LaunchPad header pins is performed using onboard jumpers, J4 and J6, as seen in the figures below.

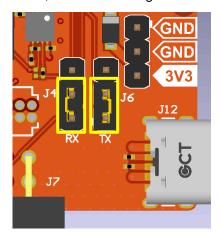


Figure 2-6. UART1 Routed to LP-XDS110

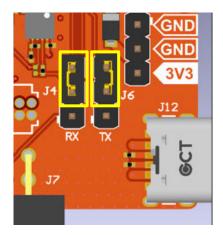


Figure 2-7. UART1 Routed To The LaunchPad Headers

Note

To allow the UART1 signals to route to the designated LaunchPad header pins, 0-ohm resistors can be placed. See Section 2.1.10.

2.1.4 SD Card Interface

The CC35xxE supports SD/MMC peripherals to write to SD memory cards. The LP-EM-CC35X1 features a footprint for an SD card slot (J3) on the back of the board.

To use the SD slot, the 693071010811 SD Slot must be assembled on the J3 footprint on the back (see Figure 2-8), and some resistors need to have the configuration changed (see Figure 2-9).

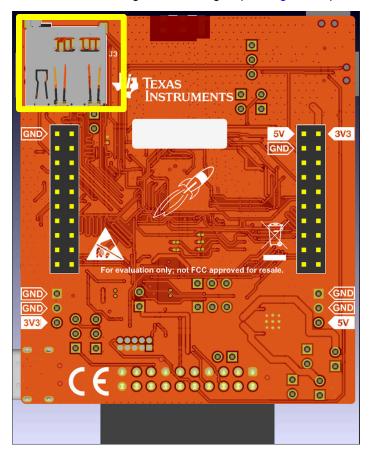


Figure 2-8. SD Card Slot

On the front side of the board, there are some resistors that need to be changed or added. See Figure 2-9.

- R34 footprint needs to have a 0-ohm resistor (0402) assembled.
- R29-R33, and R67 need to be placed on the right 2 solder pads instead of the default left two pads.

Hardware Superior INSTRUMENTS

www.ti.com

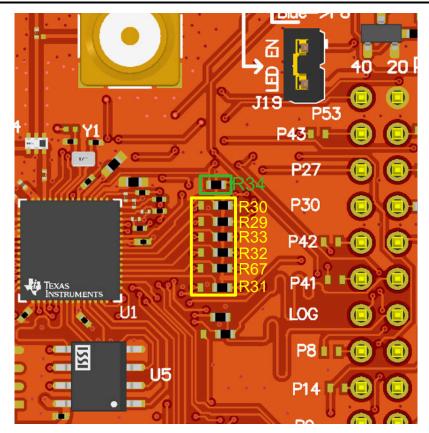


Figure 2-9. SD Slot Resistor Change

Note

Conventional SD memory cards normally require a 3.3V interface. Verify that the corresponding VIO ring for these SDMMC lines (VIO1) from the CC35xx is set to 3.3V using the appropriate VIO jumper. For details on this jumper, see Section 2.2.1.

2.1.5 External Memory Interface

The CC35xxE requires xSPI external flash memory for execution code. The LP-EM-CC35X1 features an onboard external flash (U5).

The xSPI signals from the CC35xxE are part of the VDDSF IO ring, and this voltage can be defined as either 1.8V or 3.3V, depending on the external flash used. The default voltage of VDDSF on the LP-EM-CC35X1 is 1.8V. This voltage provides the reference voltage for the xSPI lines from the CC35xxE and supply voltage to the external flash.

If users want to use a flash that interfaces at 3.3V instead, then R42 can be assembled on the right two solder pads instead of the left (left pads = 1.8V, right pads = 3.3V). The R42 is on the left solder pads, therefore, the VDDSF voltage is 1.8V, as shown in Figure 2-19.

2.1.6 ADC Interface

The CC35xxE features a 12-bit ADC with 8 channels. The LP-EM-CC35X1 enables use of 4 ADC channels with onboard buffers for impedance controlling. The two OPA2211 dual-channel operational amplifiers (U7, U10), which are configured as impedance buffers for four ADC channels can be seen in Figure 2-10.

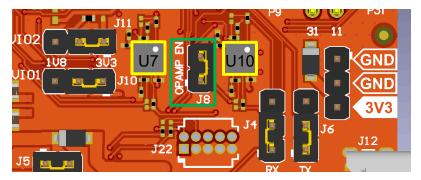


Figure 2-10. ADC Buffers

The four ADC channels available on the LP-EM-CC35X1 are ADC2, ADC3, ADC4, and ADC5. A jumper is also provided to disconnect the power to U7 and U10 for current measurements of the CC35xx.

If users want to use the corresponding GPIOs which are used as the ADC channels without the buffers, then there is the possibility to route around the buffers by removing and placing certain 0-ohm resistors.

The GPIO configuration of the ADC channels and which resistors need to be changed for buffer reroute can be seen in Table 2-5.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
ADC Channel	GPIO # (CC35xx)	LaunchPad Header Pin #	Needed Configuration For Unbuffered GPIO Use	
ADC2	GPIO6		remove: R44, R52 place: R71	
ADC3	GPIO5		remove: R73, R75 place: R79	
ADC4	GPIO4		remove: R41, R50 place: R70	
ADC5	GPIO3	26	remove: R72, R74 place: R78	

Table 2-5, ADC GPIO Configuration

The locations of the resistors mentioned in Table 2-5 can be seen in Figure 2-11.

As an example, if users want to use GPIO4 unbuffered, which is connected to LaunchPad header pin 26 on the LP-EM-CC35X1, then the following resistors need to be changed:

- Remove R41 and R50
- Place 0-ohm resistor (0201) R70

Hardware Very INSTRUMENTS

www.ti.com

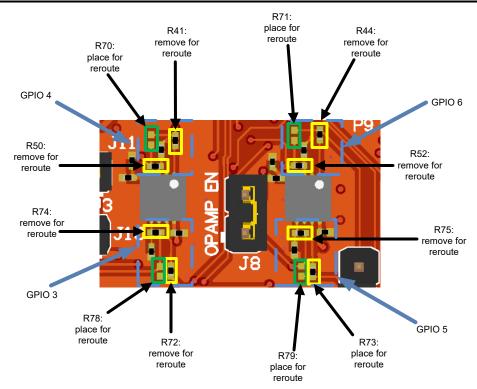


Figure 2-11. ADC Buffer Reroute Configuration

The area of the LP-EM-CC35X1 schematic which encompasses the ADC buffers is shown in Figure 2-12.

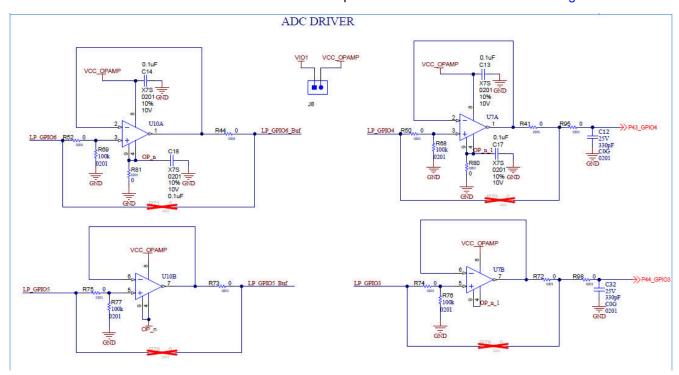


Figure 2-12. ADC Buffers Schematic

2.1.7 Reset Pullup Jumper

To enable the CC35xxE device, the nRESET line must be pulled high externally. On the LP-EM-CC35X1, the nRESET line is pulled up by default, therefore, the CC35xxE device is enabled when power is provided to the board.

The LP-EM-CC35X1 gives the option to route the Reset line to the LaunchPad header (pin 16) to control the reset line externally. To route the nRESET line to the LaunchPad header pin instead of the default pullup, jumper J9 needs to be placed on the bottom two pins. J9 is in the pullup (PU) configuration, therefore, the nRESET line is pulled up when power is supplied to the board, as shown in.Figure 2-13.

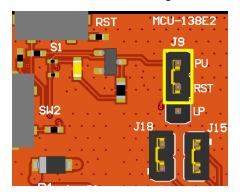


Figure 2-13. nReset Pullup

2.1.8 Push Buttons

The push-button definitions are shown in Table 2-6.

Table 2-6. Push Button Definitions

Reference	Use	Comments
S1	RESET	This signal is used to reset the CC35xxE device.
SW1	GPIO2	When pushed, GPIO2 is pulled to 3.3V.
SW2	GPIO36	When pushed, GPIO36 is pulled to 3.3V.

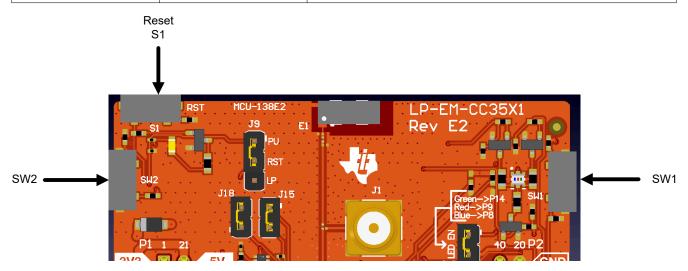


Figure 2-14. Push Buttons

Hardware Vincom

Vinco

2.1.9 LED Indicators

The LED indicators are listed in Table 2-7.

Table 2-7. LED Indicators

Reference	Color	Use	Comments	
D2	Yellow	nRESET	Indicates the state of the nRESET pin. If this LED is on, the device functional.	
D4	RGB	Green - GPIO30 Red - GPIO34 Blue - GPO35	On when the GPIOx is logic-1. (1)	
D9	Green	3.3V power indication	On: 3.3V power rail is up. Off: no 3.3V power supplied.	
D10	Red	1.8V power indication	On: 1.8V power rail is up. Off: no 1.8V power supplied	

(1) The RGB LEDs can be disconnected from the power supply by removing jumper J19 (LED EN). This can be used when measuring current to the CC35xxE.

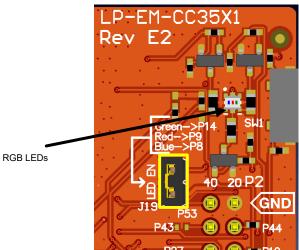


Figure 2-15. RGB LEDs

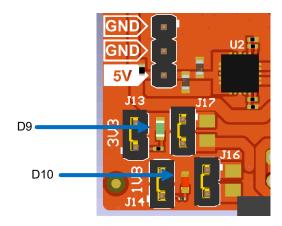


Figure 2-16. Power LEDs

2.1.10 LaunchPad™ Header Pin Assignment

The LP-EM-CC35X1 features 2 × 20-pin connectors that provide access to many of the CC35xxE pins and features. The LaunchPad header pinout is standard in TI, allowing easy stacking of other TI BoosterPacks on the LP-EM-CC35xx for quick interface with peripheral boards.

The CC35xxE LaunchPad follows this standard. For CC35xxE pin-mapping assignments and functions, see Figure 2-17.

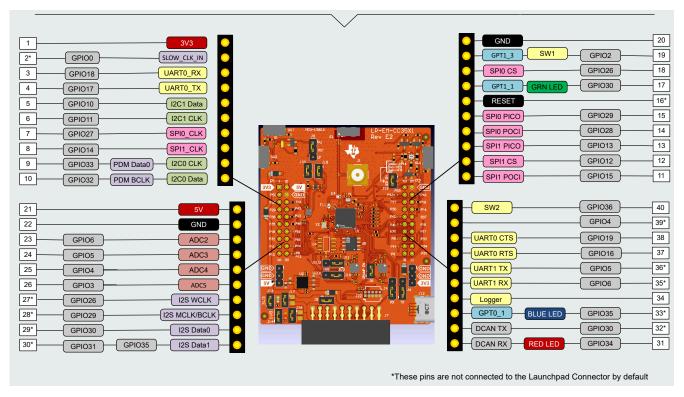


Figure 2-17. CC35xxE LaunchPad Header Pin Assignments

All the signals are referred to by the GPIOx in the SDK. The default mappings are shown in Figure 2-17. Some of the pins are repeated across the connector. For example, GPIO4 is available on header pin 25 and pin 39, but only pin 25 is connected by default. The signal on LaunchPad header pin 39 is marked with an asterisk (*) to signify that the signal is not connected by default. The signal can be routed to the pin by using a 0Ω resistor in the path.

Note

The LP-EM-CC35X1 has two jumpers, which can control the voltage of VIO1 and VIO2. The jumpers provide reference voltage for the various CC3551E IOs, and can be configured to 3.3V or 1.8V. When using the GPIOs connected to the LaunchPad header pins, knowing what VIO the jumpers correspond to, and how to configure them to be either 3.3V or 1.8V is important. For more information, refer to Section 2.2.1.

RUMENTS Hardware www.ti.com

2.2 Power

The LP-EM-CC35X1 is designed to accept power from a connected LP-XDS110 and an external USB-C power connection together.

WARNING

To verify the proper functioning of the board, the LP-XDS110 and USB-C power cable from the LP-EM-CC35X1 must be connected to the same computer. Do not connect the USB-C cable to a wall outlet or a different computer.

The use of Schottky diodes makes sure that load sharing occurs between the USB connectors on the LaunchPad kit and the BoosterPack module without any board modifications. The jumpers labeled J14 (1.8V) and J13 (3.3V) can be used to measure the total current consumption of the board from the onboard LDO.

2.2.1 VIO Selection

The CC35xxE device features three Voltage IO rings (VIOs) for choosing the reference voltage of the various IOs. These three VIOs are VIO1, VIO2, and VDDSF. Each one of the IO rings can be set to 1.8V or 3.3V independently of each other.

The LP-EM-CC35X1 features 2 jumpers (J10, J11) for easy voltage configuration for VIO1 and VIO2, either to 1.8V or 3.3V. By default both are set to 3.3V; see Figure 2-18.

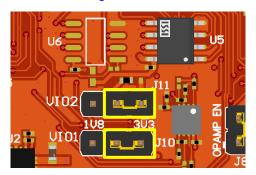


Figure 2-18. VIO Jumpers

To set either VIO to 1.8V instead of 3.3V, place the jumper on the left two header pins. For example, VIO1 is set to 1.8V and VIO2 is set to 3.3V as shown in Figure 2-19.

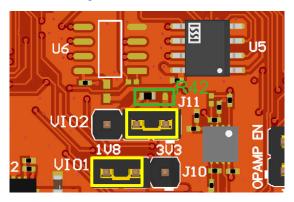


Figure 2-19. VIO Selection Example

VDDSF IO ring controls the reference voltage of the xSPI signals to the external flash. For more information on VDDSF, see Section 2.1.5.

For the VIO selection of each GPIO, see Table 2-8.

Table 2-8. GPIO VIO Selection

LaunchPad Header Pin #	Default Setting on LP-EM-CC35X1	CC35xx GPIO #	IO Ring
1	3.3V	N/A	N/A
2	SLOW_CLK_IN	GPIO0	VIO1
3	UART0 RX	GPIO18	VIO1
4	UART0 TX	GPIO17	VIO1
5	I2C1 Data	GPIO10	VIO1
6	I2C1 CLK	GPIO11	VIO1
7	SPI0 CLK	GPIO27	VIO2
8	SPI1 CLK	GPIO14	VIO1
9	I2C0 CLK, PDM Data0	GPIO33	VIO2
10	I2C0 Data, PDM BCLK	GPIO32	VIO2
11	SPI1 POCI	GPIO15	VIO1
12	SPI1 CS	GPIO12	VIO1
13	SPI1 PICO	GPIO13	VIO1
14	SPI0 POCI	GPIO28	VIO2
15	SPI0 PICO	GPIO29	VIO2
16	Reset	N/A	N/A
17	GPT1_1	GPIO30	VIO2
18	SPI0 CS	GPIO26	VIO2
19	GPT1_3	GPIO2	VIO1
20	GND	N/A	N/A
21	5V	N/A	N/A
22	GND	N/A	N/A
23	ADC2	GPIO6	VIO1
24	ADC3	GPIO5	VIO1
25	ADC4	GPIO4	VIO1
26	ADC5	GPIO3	VIO1
27	I2S WCLK	GPIO26	VIO2
28	I2S MCLK/BCLK	GPIO29	VIO2
29	I2S Data0	GPIO30	VIO2
30	I2S Data1	GPIO31, GPIO35	VIO2
31	DCAN RX	GPIO34	VIO2
32	DCAN TX	GPIO30	VIO2
33	GPT0_1	GPIO35	VIO2
34	Logger	N/A	N/A
35	UART1 RX	GPIO6	VIO1
36	UART1 TX	GPIO5	VIO1
37	UART0 RTS	GPIO16	VIO1
38	UARTO CTS	GPIO19	VIO1
39	GPIO	GPIO4	VIO1
40	N/A	GPIO36	VIO1

Hardware www.ti.com

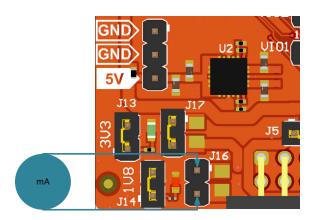
2.2.2 Measure the CC35xxE Current Draw

2.2.2.1 Low Current Measurement (LPDS)

To measure the current draw of the CC35xxE device for both power supplies (3.3V or 1.8V), a jumper labeled J17 (for 3.3V supply) and a jumper labeled J16 (for 1.8V supply) is provided on the board. By removing J16, users can place an ammeter into this path to observe the current on the 1.8V supply. The same process can be used for observing the current on the 3.3V supply with J17. TI recommends this method for measuring the LPDS.

Note

The current measured on the 3.3V and 1.8V jumpers is the total current that goes to the CC35xxE, not including VIO1, VIO2, and VDDSF. These supplies provide a reference voltage for all of the IOs and some of the peripherals on the LP-EM-CC35X1 (ADC buffers, sensors, and so forth).



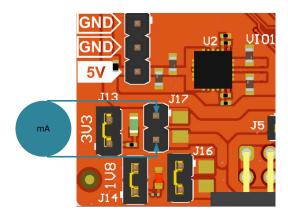


Figure 2-20. Low Current Measurement

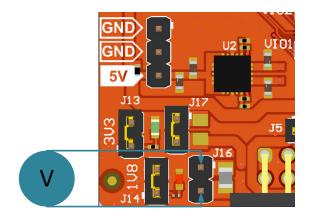
2.2.2.2 Active Current Measurement

To measure the active current of the CC35xxE device in a profile form, TI recommends using a 0.1Ω 1% 0603 resistor on the board and measuring the differential voltage across the resistor. This can be done using a voltmeter or an oscilloscope to measure the current profile for both power supplies (3.3V or 1.8V).

Jumper J16 shunt is removed and a 0.01 resistor is populated in parallel to measure the active currents on the 1.8V supply; see Figure 2-21. Perform a similar operation with J17 and 3.3V supply.

Note

The current measured on the 3.3V and 1.8V jumpers is the total current that goes to the CC35xxE, not including VIO1, VIO2, and VDDSF. These supplies provide a reference voltage for all of the IOs and some of the peripherals on the LP-EM-CC35X1 (ADC buffers, sensors, and so forth).



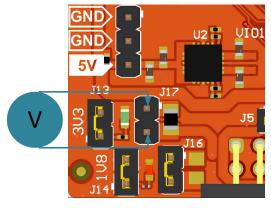


Figure 2-21. Active Current Measurement

2.3 Clocking

The LP-EM-CC35X1 provides two clock inputs to the CC35xxE device:

- Y2 is a 52MHz crystal for fast clock input.
- Y1 is a 32.768kHz XTAL for slow clock input.

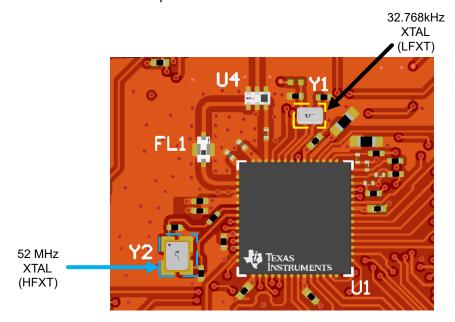


Figure 2-22. Clocks

The slow clock can be generated by an external oscillator instead of the XTAL, or generated internally by the CC35xxE.

If the user wants to provide an external slow clock through LaunchPad header pin (pin 2), then:

- · Remove Y1 XTAL .
- Populate 0-ohm resistor (0201) on the R5 pad.
- · Remove C6 capacitor .

See Figure 2-23.

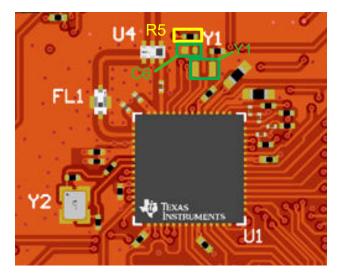


Figure 2-23. External Slow Clock

To use the CC35xxE internal slow clock, leave pin 2 floating when Y1 is not placed.

Hardware Www.ti.com

2.4 Conducted RF Testing

The LP-EM-CC35X1 can be used to test RF capabilities, using Radio Tool. For more information on Radio Tool and where to download, refer to Section 2.5.1.

As seen in Figure 2-24, the LP-EM-CC35X1 has an on-board SMA connector and component antenna. The SMA connector (J1) provides a way for testing conducted RF measurements. Alternately, a track pad for a U.FL connector (J2) is provided on-board to replace the SMA connector and provide a way to test in the lab using a compatible cable (see Figure 2-24). A rework is needed before using the connector on J1/J2. This involves swapping the position of the existing 3.9pF capacitor to lead the transmission line on the desired connection (see Figure 2-24).

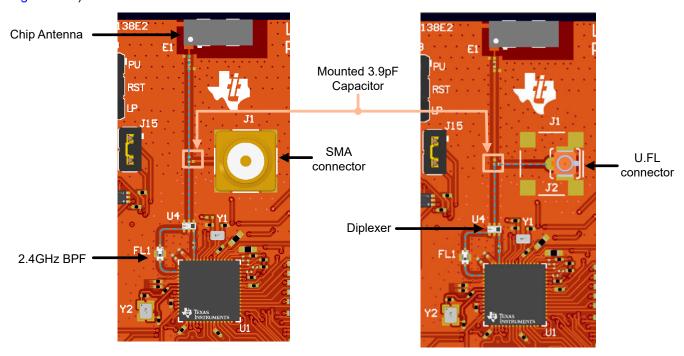


Figure 2-24. RF path on LP-EM-CC35X1

2.5 Evaluation Setup

The CC35xxE Launchpad is designed to work primarily with the LP-XDS110, which provides SWD and UART interface to external PC. The SWD interface is used for flashing the compiled image to the CC35xxE and basic debugging, while the UART is used for serial terminal access.

The LP-XDS110 or LP-XDS110ET can easily integrate with the LP-EM-CC35X1 by connecting the 20-pin LP-XDS110 connector (J7) to the corresponding connector on the LP-XDS110 (see Figure 2-25). Make sure that the jumper on the LP-XDS110 (labeled TGT VDD) is in the EXT. configuration, as shown in Figure 2-25. This verifies that the target voltage for the JTAG signals is sourced from the LP-EM-CC35X1 (which is controlled by VIO1) instead of the default LP-XDS110 target voltage (3.3V).

WARNING

To verify the proper functioning of the board, the LP-XDS110 and USB-C power cable from the LP-EM-CC35X1 must be connected to the same computer. Do not connect the USB-C cable to a wall outlet or a different computer.

To properly interface UART signals for the serial terminal interface, verify that jumpers J4 and J6 are placed in the correct configuration. See Section 2.1.3.

For more information on the 20-pin LP-XDS110 connector and the available pinout, see Section 2.1.1.

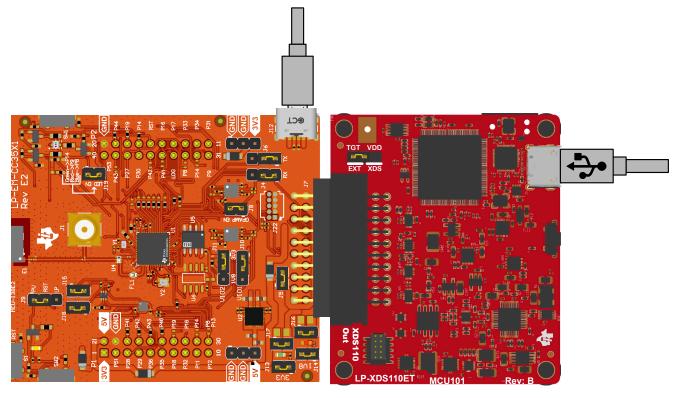


Figure 2-25. LP-EM-CC35X1 Connected to LP-XDS110(ET)

2.5.1 Wi-Fi Toolbox LP-EM-CC35X1 Hardware Setup

SimpleLink Wi-Fi toolbox is a GUI-based tool for the evaluation, programming, and testing of CC35xx designs during development and certification. Radio Tool is one of the tools included in the toolbox that allows for RF testing. The tool enables low-level radio testing capabilities by manually setting the radio into transmit or receive modes. Usage of the tool requires familiarity and knowledge of radio circuit theory and radio test methods. To perform conducted RF testing on the LP-EM-CC35X1, refer to Section 2.4. Note that a rework can be needed.

The user can download this tool from the CC35xx product page on ti.com.

HW Prerequisites

- Windows 10 64bit/ Ubuntu 18 (or higher) 64bit operation system
- · Latest Chrome web browser
- Installation of Simplelink Wi-Fi Toolbox
- LP-EM-CC35X1
- LP-XDS110 or LP-XDS110ET debugger for SWD communication

The LP-XDS110 enables direct communication to the CC35xx device via the SWD interface. This allows external tools, such as the Radio Tool, to send commands directly to the device without the use of flashing the application image.

3 Hardware Design Files

3.1 Schematics

Hardware Design Files

To access the schematics for the LP-EM-CC35X1, users can submit a request on the CC3551E tool folder under the *Request More Information* section.

3.2 PCB Layouts

To access the layout files for the LP-EM-CC35X1, users can submit a request on CC3551E tool folder under the Request More Information section.

3.3 Bill of Materials (BOM)

To access the BOM for the LP-EM-CC35X1, users can submit a request on the CC3551E tool folder under Request More Information section.

4 Additional Information

4.1 Trademarks

SimpleLink[™], LaunchPad[™], Internet-on-a chip[™], BoosterPack[™], and Code Composer Studio[™] are trademarks of Texas Instruments.

Bluetooth® is a registered trademark of Bluetooth SIG.

Arm® and Cortex® are registered trademarks of Arm Limited.

USB Type-C® is a registered trademark of USB Implementers Forum.

Wi-Fi® is a registered trademark of Wi-Fi Alliance.

All trademarks are the property of their respective owners.

5 Revision History

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

С	Changes from January 9, 2024 to January 1, 2025 (from Revision * (September 2024) to	
R	Revision A (February 2025))	Pag
•	Updated for hardware revision F3	

STANDARD TERMS FOR EVALUATION MODULES

- Delivery: TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or
 documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance
 with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
- 2 Limited Warranty and Related Remedies/Disclaimers:
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after the defect has been detected.
 - 2.3 Tl's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. Tl's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by Tl and that are determined by Tl not to conform to such warranty. If Tl elects to repair or replace such EVM, Tl shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

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

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

FCC Interference Statement for Class A EVM devices

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

FCC Interference Statement for Class B EVM devices

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

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

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

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

Concerning EVMs Including Detachable Antennas:

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

Concernant les EVMs avec antennes détachables

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

3.3 Japan

- 3.3.1 Notice for EVMs delivered in Japan: Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
 - https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html
- 3.3.2 Notice for Users of EVMs Considered "Radio Frequency Products" in Japan: EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの 措置を取っていただく必要がありますのでご注意ください。

- 1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用 いただく。
- 2. 実験局の免許を取得後ご使用いただく。
- 3. 技術基準適合証明を取得後ご使用いただく。
- なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。 上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿6丁目24番1号

西新宿三井ビル

- 3.3.3 Notice for EVMs for Power Line Communication: Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page 電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html
- 3.4 European Union
 - 3.4.1 For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

- 4 EVM Use Restrictions and Warnings:
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
 - 4.3 Safety-Related Warnings and Restrictions:
 - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
 - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
- 5. Accuracy of Information: To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. Disclaimers:

- 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
- 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
- 7. USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS. USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

- 8. Limitations on Damages and Liability:
 - 8.1 General Limitations. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TIMORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.
 - 8.2 Specific Limitations. IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.
- 9. Return Policy. Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.
- 10. Governing Law: These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2023, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

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

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale, TI's General Quality Guidelines, or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025