# Thundercomm

Empowering Every IoT Device with Our Technology

Thundercomm TurboX C6125 Development Kit

# Hardware User Manual

Rev. V1.0
Sep 29, 2021

## Revision History

| Revision | Date | Description |
|----------|------|-------------|
| 1.0 | Sep 29, 2021 | Initial release. |

# Table List

## About This Document

- Illustrations in this documentation might look different from your product.
- Depending on the model, some optional accessories, features, and software programs might not be available on your device.
- Depending on the version of operating systems and programs, some user interface instructions might not be applicable to your device.
- Documentation content is subject to change without notice. Thundercomm makes constant improvements on the documentation of your computer, including this guidebook.
- Button, tool, and key names appear in bold font, for example, click **Save** or press **Enter**.
- Folders and files are formatted in italic, for example, *turbox_flash_flat.sh*.

# Table of Contents

# Chapter 1. Introduction

This document introduces the features of TurboX C6125 EVB (Evaluation Verification Board), aiming to guide the developer on product design and verification based on Thundercomm TurboX C6125 SOM (System On Module).

➲ **NOTE:** "TurboX" referred to herein is the English text of our registered trademark T U Ꝛ Ǝ O ✕.

- **Version Identification:**

    You can find the following information on your EVB, for example: **C6125 IO BOARD Ver. 02**, which means the hardware version number of your board is 02.

- **Safety Precautions:**

    Required output of the power adaptor is 12V, with the current greater than or equal to 2A. The power adaptor provided by Thundercomm is recommended.

    As PCB (Printed circuit board) and hardware components are completely exposed to open environment, it is required to wear anti-static wrist strap or heel grounder as an electrostatic protection during daily use.

# Chapter 2. Overview

Turbox QCM6125 platform is one of the most powerful boards with high-performance Thundercomm C6125 SOM, rich peripherals, and flexible interfaces. With integrated Android OS (Operating System), it fits for evaluating, optimizing, testing, and releasing intelligent hardware products for developers, OEM (Original Equipment Manufacturer), consumer businesses, and producers of hardware modules (such as: smart speaker, smart assistant, mesh router, and soundbar producers).
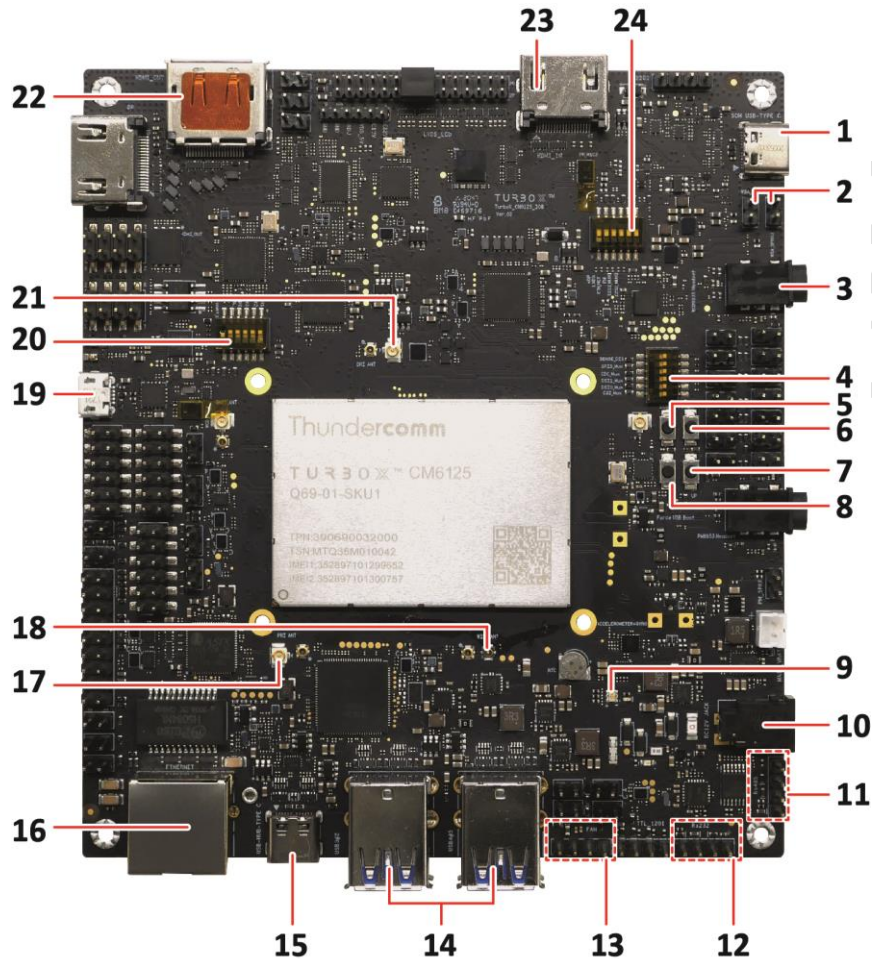
*Figure 2-1.TurboX C6125 Development Kit Top View*
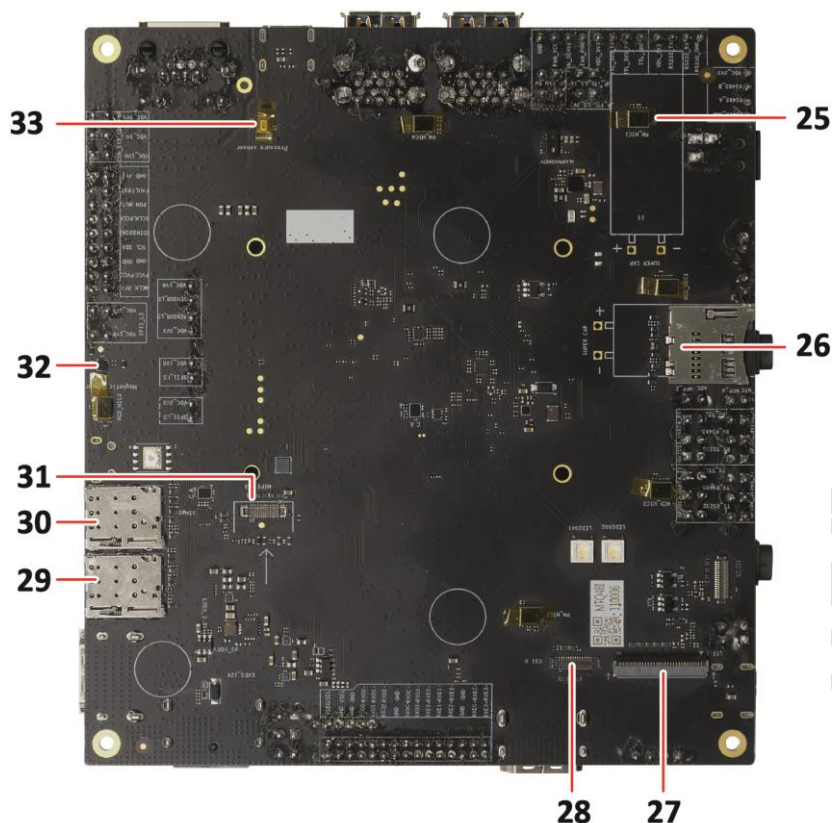
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*Figure 2-2.TurboX C6125 Development Kit Bottom View*

**Table 2-1. Interface list**

| | |
|---|---|
| 1. Type-C USB 3.1 connector 1 (for UART debug) | 18.Wi-Fi antenna slot |
| 2. Speaker connector | 19.Micro USB connector |
| 3. Headset connector | 20.Switch 3 |
| 4. Switch 1 | 21.Diversity antenna slot |
| 5. Volume down button | 22.DisplayPort connector |
| 6. Power on button | 23.HDMI IN connector |
| 7. Volume up button | 24.Switch 2 |
| 8. Force_USB_Boot button | 25.Integrated microphone |
| 9. LEDs | 26.SD card slot |
| 10.Power input connector | 27.Camera module connector 2 |
| 11.Rs485 connector | 28.Camera module connector 1 |
| 12.Rs232 connector | 29.SIM card slot 1 |
| 13.Fan connector | 30.SIM card slot 2 |
| 14.Type-A USB 3.1 connector | 31.MIPI LCD touch panel connector |
| 15.Type-C USB 3.1 connector 2 | 32.Magnetometer sensor |
| 16.Gb Ethernet connector (RJ45) | 33.Barometer sensor |
| 17.Primary antenna slot | |

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## 2.1. Features

*Table 2-2. General features and specifications*

| Item | Specification |
|---|---|
| Processor | **CPU:**<br>• Customized 64-bit Arm v-8.0 compliant applications processor (Qualcomm® Kryo™ 260 CPU)<br>• Kryo Gold: quad-core (2.0 GHz high-performance)<br>• Kryo Silver: quad-core (1.8 GHz low-power) |
| | **GPU:** Qualcomm® Adreno™ GPU 610 at 950 MHz graphics processing unit (GPU) with 64-bit addressing |
| | **DSP:** Qualcomm® Hexagon™ DSP with Qualcomm® Hexagon™ Vector eXtensions (dual HVX 512) |
| Memory | eMCP (eMMC 5.1 + LPDDR4X), uMCP (UFS + LPDDR4X) |
| Multimedia | • Alternative of 4-lane MIPI DSI interface or LVDS interface.<br>• Three 4-lane MIPI CSI interfaces.<br>• HDMI in and HDMI out 2.0 (TBD)<br>• Native DisplayPort 1.4<br>• FM (WCN3950/WCN3980) |
| USB | • 1 x USB 3.0 Type-C device port<br>• 1 x Micro USB 2.0 connector (for UART debug)<br>• Onboard HUB:<br>• 1 x USB host Type-C<br>• 4 x USB Type-A |
| Ethernet | 10BASE-Te/100BASE-Tx/1000BASE-T IEEE 802.3 compliant |
| SDIO | 1 x TF Card |
| Sensor | • 1 x IMU<br>• 1 x ALS + Proximity<br>• 1 x barometer<br>• 1 x Mag sensor |
| Power supply | DC-Jack: 1 x 12 V DC in |
| Audio | • WCD9335 audio codec<br>• 1 x 3.5 mm audio jack HP jack<br>• 2 x WSA8815 audio amplifiers<br>• 8x DMIC IN |
| Charge | PMI632 + SMB1355 |
| Button | • 1 x Power on<br>• 2 x Volume<br>• 1 x Force_USB_boot |
| SIMs | 2x UIM interface |
| Air interface | • WLAN<br>• BT |
| Operating temperature | -20℃ to +70℃ |

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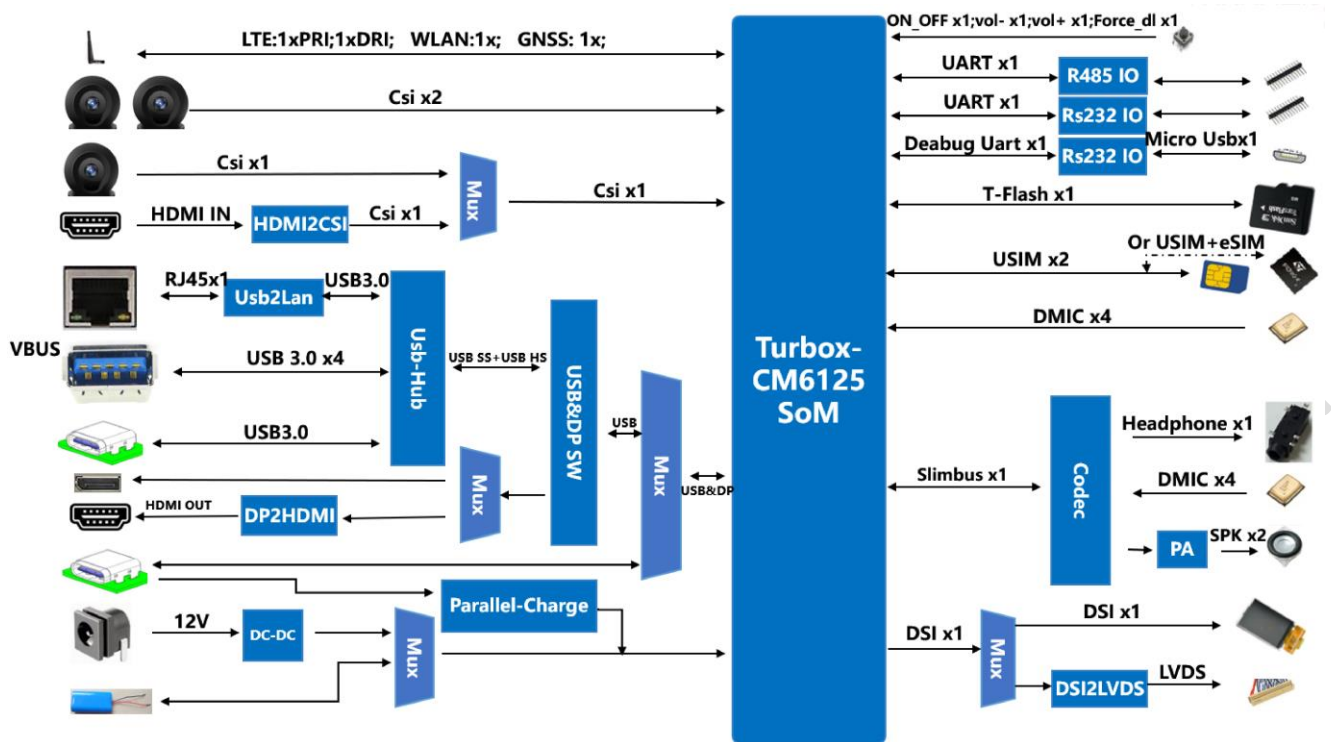
## 2.2. Block diagram



*Figure 2-3.Block Diagram*

## 2.3. Components

The Thundercomm TurboX C6125 EVB includes following hardware components:

- Camera module
- RF antenna (x2)
- Power adapter (12V/2.5A)
- EVB
- Wi-Fi antenna

# Chapter 3. Specifications

This chapter introduces the detailed hardware specifications of various features on board.

## 3.1. Switch

### 3.1.1. SWITCH 1 (SW2706)
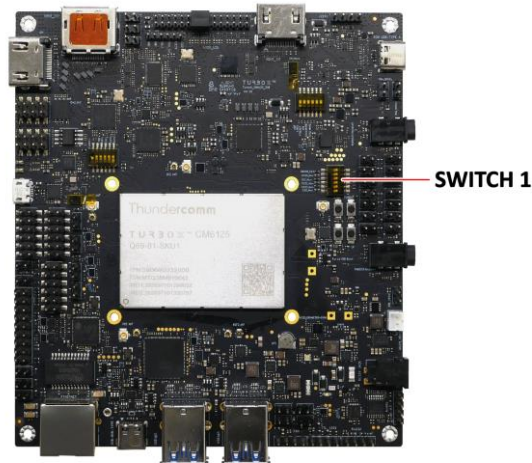


*Figure 3-1. Locate Switch 1*

**Table 3-1. Pin specifications for switch 1**

| Pin | Function | Comments |
| --- | --- | --- |
| 1 | CSI selection | ON: Camera CSI0<br>OFF: HDMI IN |
| 2 | DSI LCD/LVDS LCD | ON: LVDS<br>OFF: DSI LCD |
| 3 | DisplayPort/HDMI | ON: HDMI out<br>OFF: DisplayPort |
| 4 | EXT CODEC SEL/FM | ON: EXT CODEC<br>OFF: FM |
| 5 | EXT SPI/NFC | ON: EXT SPI<br>OFF: NFC |
| 6 | Unused | - |

### 3.1.2. SWITCH 2 (SW2707)



*Figure 3-2.   Locate Switch 2*

*Table 3-2. Pin specifications for switch 2*

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | USB function selection | ON: Type-C<br>OFF: DP/HUB |
| 2 | LVDS enable | ON: enable<br>OFF disable |
| 3 | Ethernet | ON: enable<br>OFF disable |
| 4 | FM_EN | ON: enable<br>OFF disable |
| 5 | SWITCH_MI2S2_MUX_SEL1 | ON means H<br>OFF means L |
| 6 | SWITCH_MI2S2_MUX_SEL2 | ON means H<br>OFF means L |

For detailed configuration for Pin 5 and Pin 6, refer to the table below.

*Table 3-3. Specifications of Pin 5 and Pin 6 in SW2707*

| Pin | EXT | HDMI | FM | NC |
|-----|-----|------|-----|-----|
| SWITCH_MI2S2_MUX_SEL1 | H | H | L | L |
| SWITCH_MI2S2_MUX_SEL2 | H | L | H | L |

### 3.1.3. SWITCH 3 (SW2705)
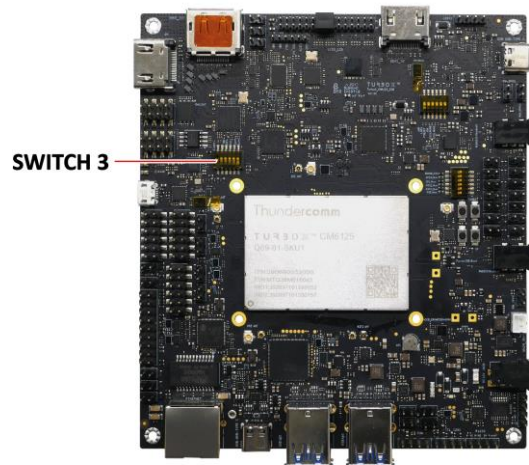


*Figure 3-3.   Locate Switch 3*

**Table 3-4. Pin specifications for switch 3**

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | BOOT_CONFIG_1 | Keep off |
| 2 | BOOT_CONFIG_2 | Keep off |
| 3 | BOOT_CONFIG_3 | ON: UFS<br>OFF: eMMC |
| 4 | WDOG_DISABLE | Keep off |
| 5 | CBL_PWR_N | Keep off |
| 6 | ONBOARD_DEBUG_UART_EN_N | OFF: Enable UART debug |

## 3.2. Interface

### 3.2.1. Type-C USB connector
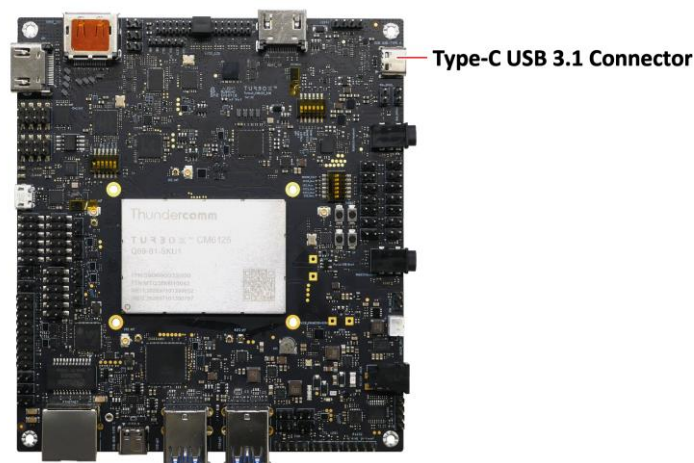


*Figure 3-4.   Locate Type-C USB 3.1 Connector*

**Major functions:**

- USB 3.1/2.0 device mode

- ADB debug port

- Download and transmit data by connecting with computer.

- Be compatible with both USB 3.1 connectors and USB 2.0 connectors standard.

## 3.2.2. Micro USB connector/UART debug connector

The connector converts UART debug port of SOM by chip FT23XQ-R.
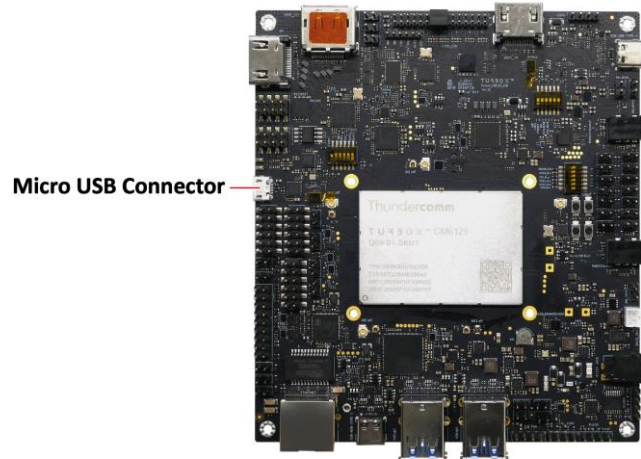


*Figure 3-5.  Locate Micro USB Connector*

## 3.2.3. Type-C USB 3.1 connector (based on HUB)

It is a downstream port supporting to connect the general USB devices.



*Figure 3-6.  Locate Type-C USB 3.1 Connector*

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## 3.2.4. Type-A USB 3.1 connectors (based on HUB)

It is a downstream port supporting to connect the general USB devices.



*Figure 3-7.   Locate Type-A USB 3.1 Connector*

## 3.2.5. Ethernet connector (RJ45)



*Figure 3-8.   Locate Ethernet Connector*

The Ethernet connector can be converted to transfer USB data stream and communicate with another device via USB hub connection.

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### 3.2.6. Power input connector

The connector supports to connect the power supply of 12V and 2A in minimum.
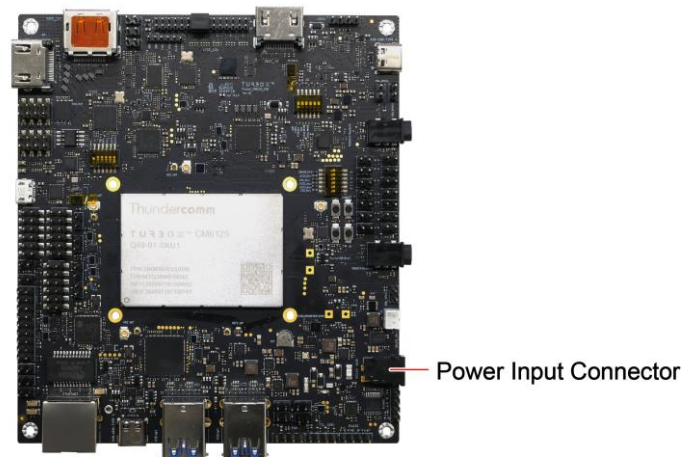


*Figure 3-9.  Locate Power Input Connector*

### 3.2.7. Speaker connectors (SPKR901, SPKR902)

Support 2 x WSA8815 Class-D smart speaker amplifiers, with stereo audio up to 4W/8Ω.
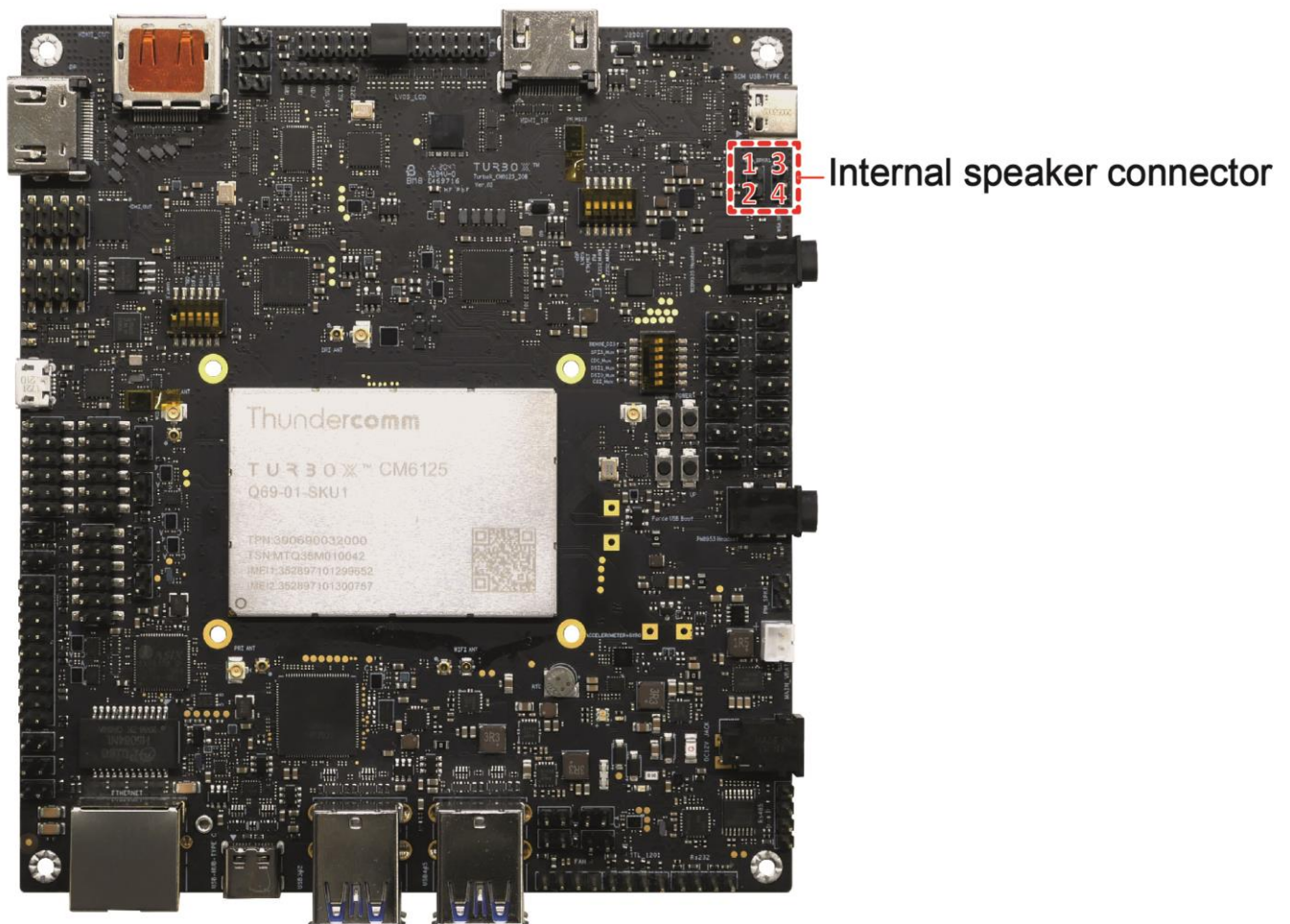


*Figure 3-10. Locate Internal Speaker Connector*

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*Table 3-5. Pin specifications for speaker connectors*

| Pin | Pin Definition | Type | Description |
|-----|----------------|------|-------------|
| 1 | SPK_L_OUT_P | Left channel output | Left speaker positive output |
| 2 | SPK_L_OUT_M | | Left speaker negative output |
| 3 | SPK_R_OUT_P | Right channel output | Right speaker positive output |
| 4 | SPK_R_OUT_M | | Right speaker negative output |

### 3.2.8. DSI board-to-board connector for LCM
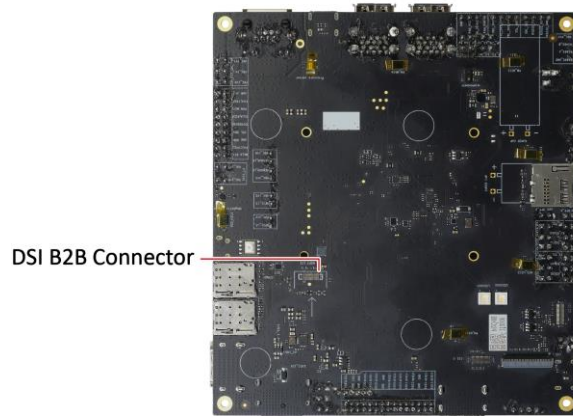


*Figure 3-11. Locate DSI B2B Connector*

### 3.2.9. Camera connectors (CSI0, CSI1, and CSI2)
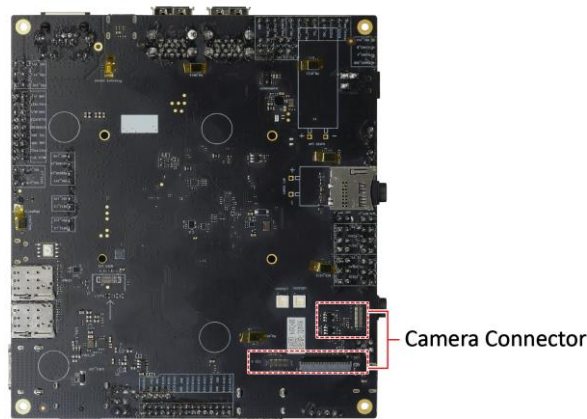


*Figure 3-12. Locate Camera Connectors*

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### 3.2.10. Headphone connector (WCD9335)

The board supports to connect 4-pole CTIA (Cellular Telecommunications Industry Association) standard headsets.
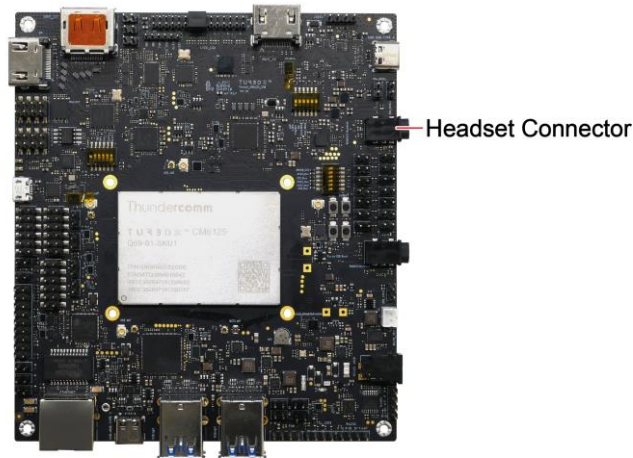


*Figure 3-13.Locate Headset Connector*

### 3.2.11. Digital microphones (DMICs)

There are 8 DMICs on the DK board, 4 DMICs input to the external audio codec (refer to DMIC (a) in Figure 3-18), and others are used directly by QCM6125 inside SOM (refer to DMIC (b) in Figure 3-18). Either solution can be selected.
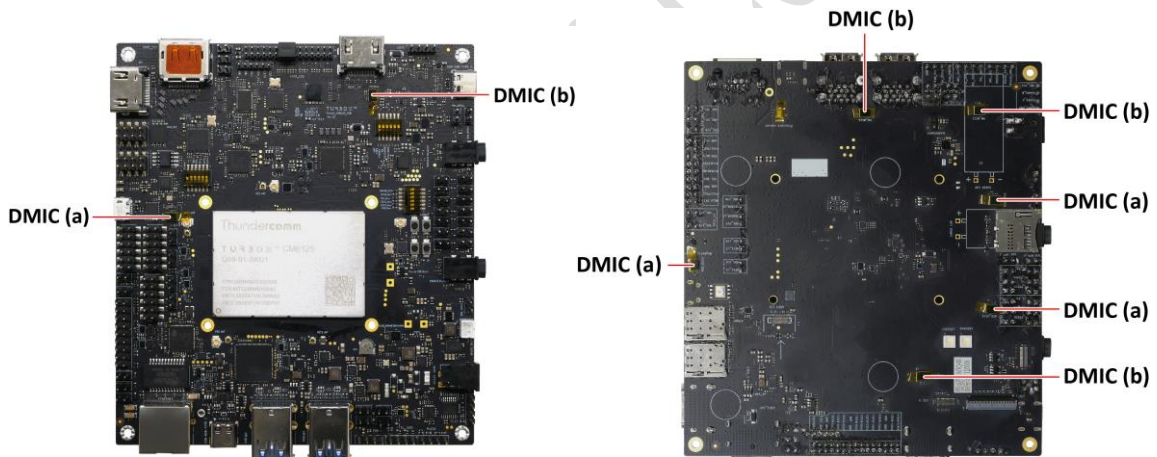


*Figure 3-14.Locate DMICs*

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## 3.2.12. Antenna slots
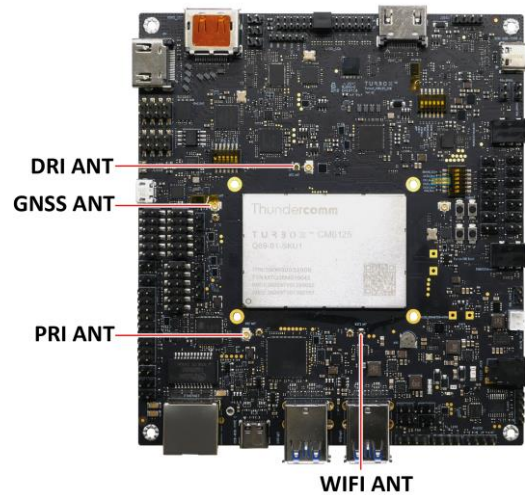


*Figure 3-15.Locate Wi-Fi Antenna Slots*

- **PRI ANT** is an antenna slot used for connecting the primary antenna.

- **DRI ANT** is an antenna slot used for connecting the diversified auxiliary antenna.

- **GNSS ANT** is an antenna slot used for connecting the GNSS signal-receiving antenna.

- **WIFI ANT** is an antenna slot used for connecting antennas to receive 2.4G/5G Wi-Fi network.

## 3.2.13. Jumpers for UART
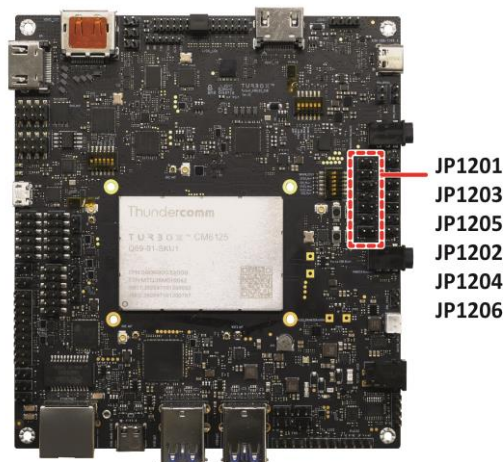


*Figure 3-16.Locate Pins for UART*

**Table 3-6. Pin specifications for UART**

| Jumper No. | Function | Comments |
|---|---|---|
| JP1202 | UART_TX to RS232 | Alternative, just one head can be shorten to active the function. |
| JP1204 | UART_TX to RS485 | |
| JP1206 | UART_TX_TTL | |
| JP1201 | UART_TX_RS232 | Alternative, just one head can be shorten to active the function |
| JP1203 | UART_TX_RS485 | |
| JP1205 | UART_TX_TTL | |

## 3.2.14. Jumpers for debug UART
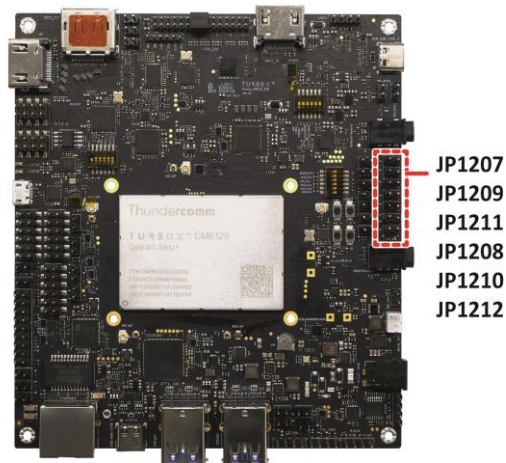


*Figure 3-17. Locate Pins for Debug UART*

**Table 3-7. Pin specifications for Debug UART**

| Jumper No. | Function | Comments |
|---|---|---|
| JP1207 | UART_TX to RS232 | Alternative, just one head can be shorten to active the function. |
| JP1209 | UART_TX to RS485 | |
| JP1211 | UART_TX_TTL | |
| JP1208 | UART_TX_RS232 | Alternative, just one head can be shorten to active the function |
| JP1210 | UART_TX_RS485 | |
| JP1212 | UART_TX_TTL | |

To realize the above function, you can configure the debug UART as the general UART by tying the jumper wires.

## 3.2.15. Main battery
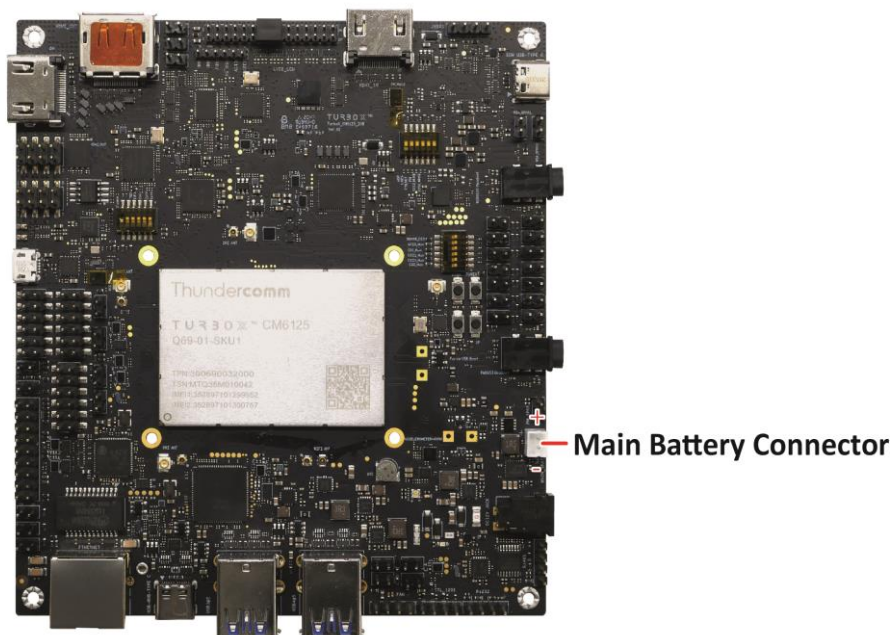


*Figure 3-18. Locate Main Battery*

The connector supports to connect general lithium battery up to 4.4V according to the software settings.

### 3.2.16. Rs485 connector (J1201)

The UART signals can be converted to Rs485 by tying jumpers to pins for UART. Refer to Figure 3-19 to tie jumpers.
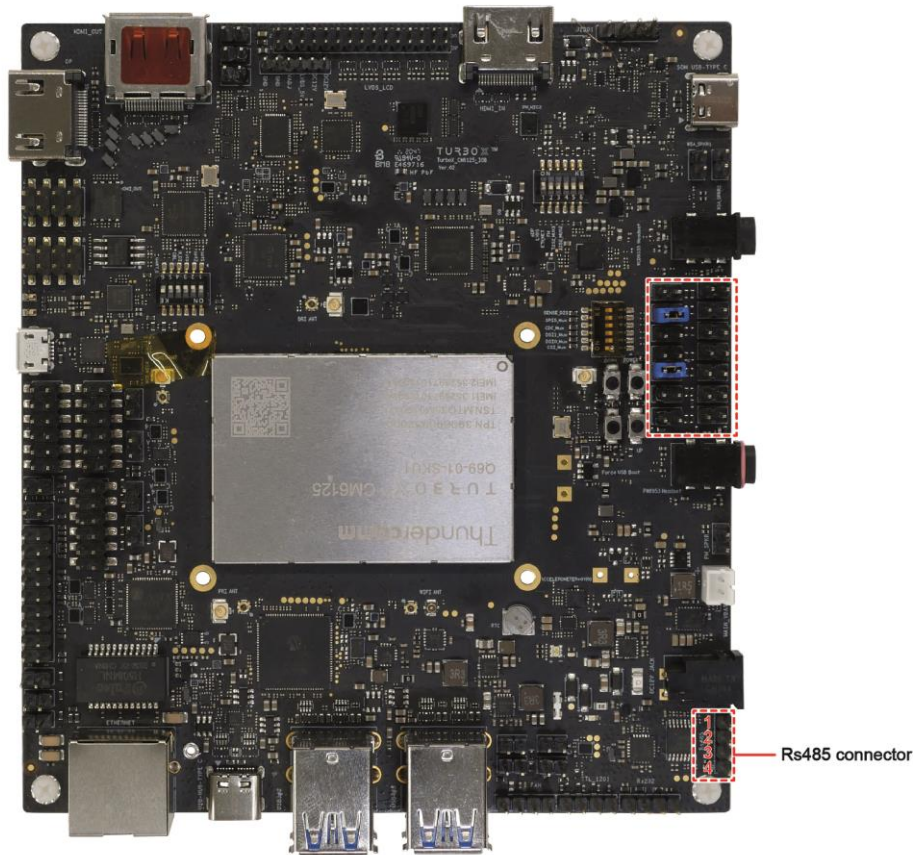


*Figure 3-19. Locate Rs485 Connector*

**Table 3-8. Pin specifications for Rs485 connector**

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | VDC_3V3 | |
| 2 | RS485_A | - |
| 3 | RS485_B | |
| 4 | GND | |

### 3.2.17. Rs232 connector (J1200)

The UART signals can be converted to Rs485 by tying jumpers to pins for UART. Refer to Figure 3-20 to tie jumpers.

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*Figure 3-20. Locate Rs232 Connector*

**Table 3-9. Pin specifications for Rs232 connector**

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | VDC_3V3 | |
| 2 | RS232_TX | |
| 3 | RS232_RX | - |
| 4 | GND | |

## 3.2.18. UART connector (TTL_120 J1201)
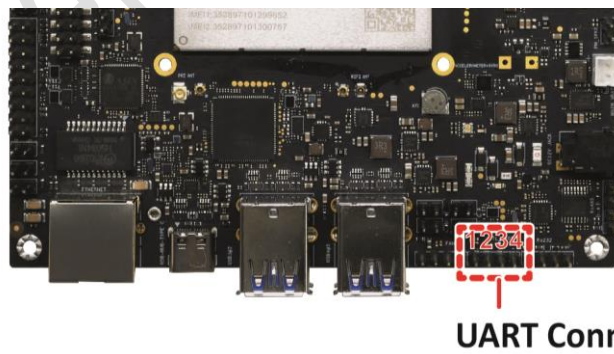


*Figure 3-21. Locate UART Connector*

**Table 3-10. Pin specifications for TTL_120 connector**

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | VDC_3V3 | |
| 2 | TTL_3V3_TX | - |
| 3 | TTL_3V3_RX | |

| Pin | Function | Comments |
|-----|----------|----------|
| 4 | GND | |

### 3.2.19. Fan connector (J2703)
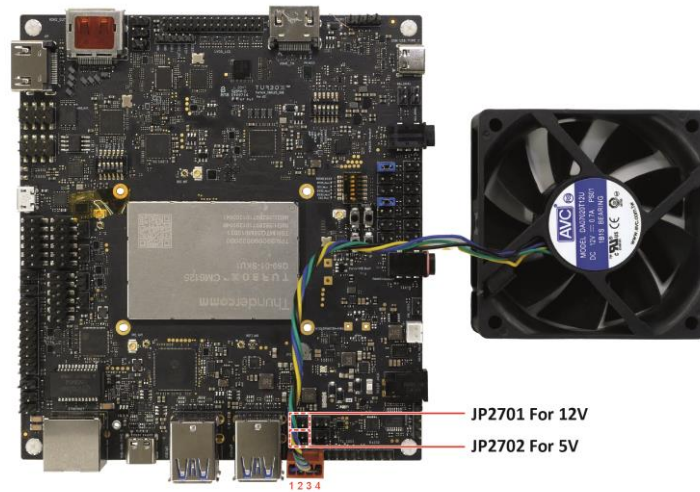


*Figure 3-22. Locate Fan Connector*

**Table 3-11. Pin specifications for fan connector**

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | GND | |
| 2 | DC12V/VDC_5V | DC12V current rate: 50mA; |
| 3 | FAN_SENSE | VDC_5V current rate: 100mA |
| 4 | FAN_PWM | |

JP2701 and JP2702 are alternative jumpers tied to respectively supply 5V or 12V power supply for Fan. JP2701 is tied for connecting fan of 12V, while JP2702 is tied for connecting fan of 5V.

### 3.2.20. External CODEC connector (J3511)
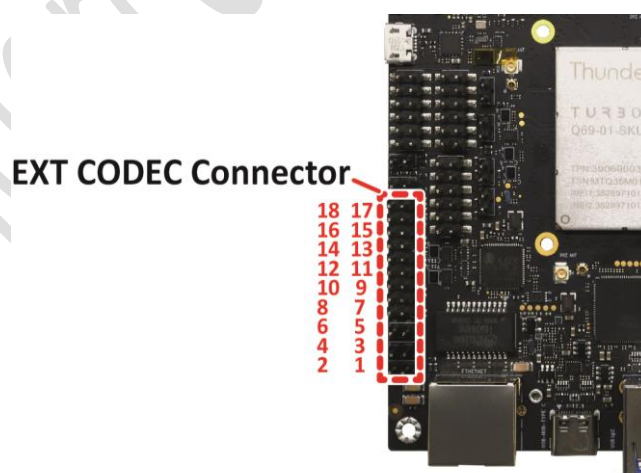


*Figure 3-23. Locate EXT CODEC Connector*

**Table 3-12. Pin specifications for external codec connector**

| Pin | Function | Comments |
|---|---|---|
| 1 | GND | - |
| 2 | CON_EXT_CDC_PWR | The voltage of power supply can be adjusted by tying jumper to different pins. |
| 3 | EXT_CDC_RST_N | RESET |
| 4 | CON_EXT_CDC_PWR | - |
| 5 | CON_EXT_CDC_PWR divided | Half voltage of CON_EXT_CDC_PWR. |
| 6 | NC | - |
| 7 | MI2S_1_SCK_EXT_LS | I2S |
| 8 | MI2S_1_WS_EXT_LS | I2S |
| 9 | MI2S_1_D0_EXT_LS | I2S |
| 10 | MI2S_1_D1_EXT_LS | I2S |
| 11 | EXT_CDC_I2C_SCL | I2C |
| 12 | EXT_CDC_I2C_SDA | I2C |
| 13 | GND | - |
| 14 | GND | - |
| 15 | DC12V | - |
| 16 | DC12V | - |
| 17 | MI2S_1_MCLK_EXT_LS | MCLK |
| 18 | CON_EXT_CDC_PWR | - |

The power domain of IO is dependent on CON_EXT_CDC_PWR setting.

### 3.2.21. CON_EXT_CDC_PWR pins
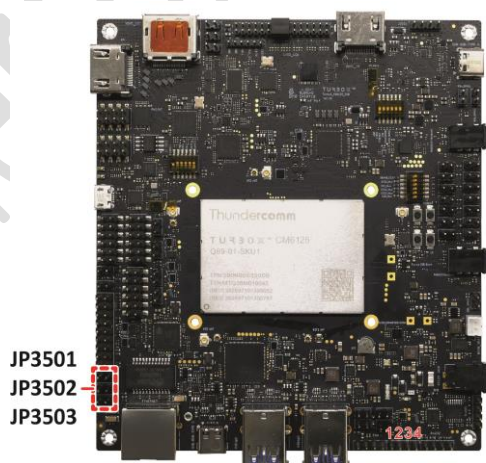


*Figure 3-24. Locate Pins for CON_EXT_CDC_PWR*

*Table 3-13. Pin specifications for CON_EXT_CDC_PWR*

| Jumper No. | Function | Comments |
|---|---|---|
| JP3501 | VDC_1V8 (output) | Alternative power selection |

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| Jumper No. | Function | Comments |
|------------|----------|----------|
| JP3502 | VDC_3V3 (output) | |
| JP3503 | VDC_5V (output) | |

## 3.2.22. External sensor connector (J3512)
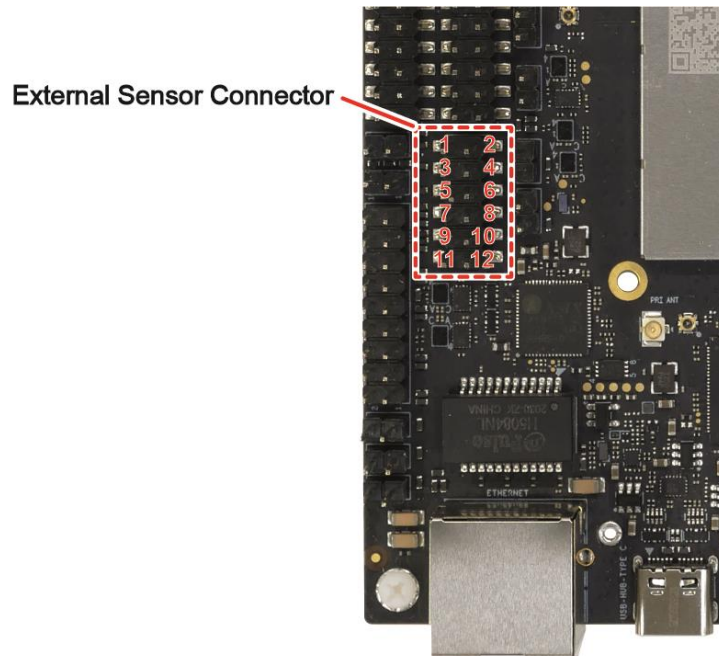


*Figure 3-25. Locate EXT Sensor Connector*

*Table 3-14. Pin specifications for EXT sensor connector*

| Pin | Function | Comments |
|-----|----------|----------|
| 1 | SENSOR_CON_LS_PWR | The voltage of power supply can be adjusted by tying jumper to different |
| 2 | SENSOR_SPI_CS0_N_CON | - |
| 3 | SENSOR_SPI_MISO_CON | - |
| 4 | SENSOR_SPI_MOSI_CON | - |
| 5 | SENSOR_SPI_CLK_CON | - |
| 6 | GND | - |
| 7 | ACCL_INT_CON | - |
| 8 | ALSP_INT_N_CON | - |
| 9 | SENSOR_I2C_SDA_CON | - |
| 10 | SENSOR_I2C_SCL_CON | - |
| 11 | GND | - |
| 12 | GND | - |

The power domain of IO is dependent with SENSOR_CON_LS_PWR setting.

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## 3.2.23. SENSOR_CON_LS_PWR pins
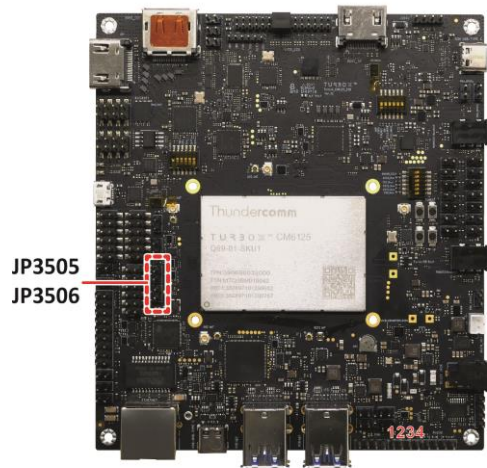


*Figure 3-26.Locate Pins of SENSOR_CON_LS_PWR*

**Table 3-15. Pin specifications for SENSOR_CON_LS_PWR**

| Jumper No. | Function | Comments |
|---|---|---|
| JP3505 | VDC_1V8 | Alternative power selection |
| JP3506 | VDC_3V3 | |

## 3.2.24. SPI&MI2S2 connector (J3513)
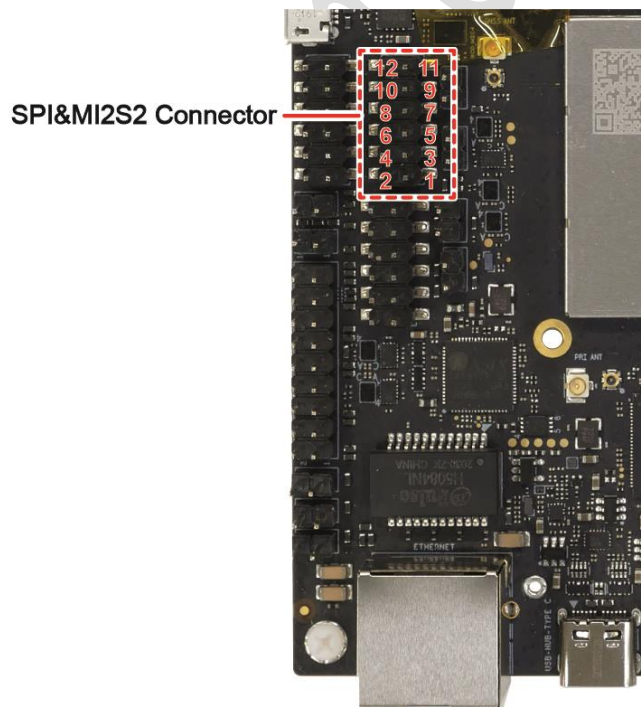


*Figure 3-27.Locate SPI&MI2S2 Connector*

**Table 3-16. Pin specifications for SPI&MI2S2 connector**

| Pin | Function | Comments |
|---|---|---|
| 1 | SPI1_LS_PWR | Power supply is dependent with Jumper selection |

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| Pin | Function | Comments |
|-----|----------|----------|
| 2 | SPI1_ESE_CLK_CON | - |
| 3 | SPI1_ESE_MOSI_CON | - |
| 4 | SPI1_CS_N_0_CON | - |
| 5 | SPI1_ESE_MISO_CON | - |
| 6 | SPI1_CS1_CON | - |
| 7 | MI2S_2_WS_CON | - |
| 8 | MI2S_2_SCK_CON | - |
| 9 | PRI_MI2S_MCLK_CON | - |
| 10 | MI2S_2_D0_CON | - |
| 11 | GND | - |
| 12 | GND | - |

The power domain of IO is dependent with SPI1_LS_PWR setting.

## 3.2.25. SPI1_LS_PWR jumpers
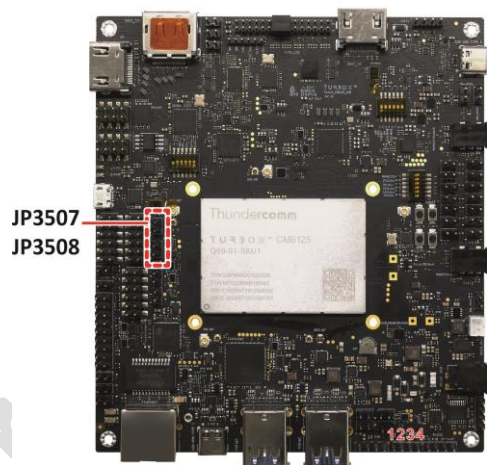


*Figure 3-28. Locate Pins for SPI1_LS_PWR*

*Table 3-17. Pin specifications for SPI1_LS_PWR*

| Jumper No. | Function | Comments |
|------------|----------|----------|
| JP3507 | VDC_1V8 | Alternative power selection |
| JP3508 | VDC_3V3 | |

## 3.2.26. SPI Interface connector (J3514)

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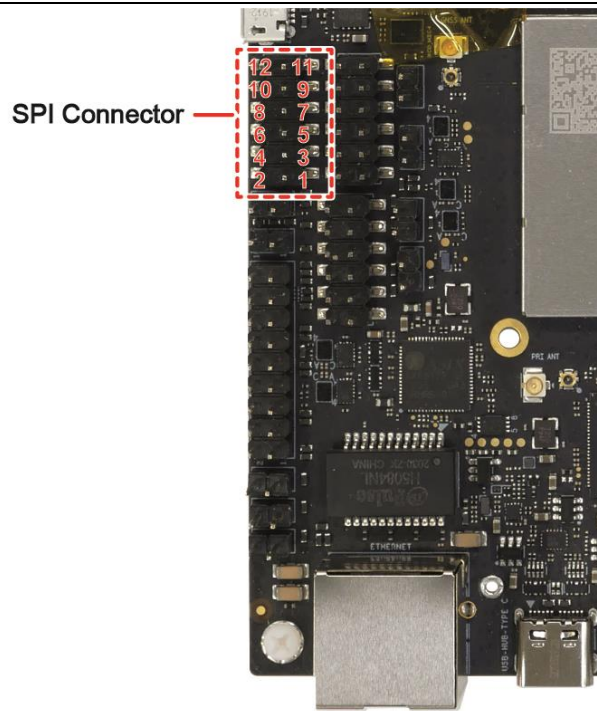
*Figure 3-29. Locate SPI Interface Connector*

**Table 3-18. Pin specifications for SPI interface connector**

| Pin | Function | Comments |
|---|---|---|
| 1 | SPI5_MOSI_CON | - |
| 2 | SPI5_MISO_CON | - |
| 3 | SPI5_CS_CON | - |
| 4 | SPI5_CLK_CON | - |
| 7,8,9 | SPI5_LS_PWR | The voltage of power supply can be adjusted by tying jumper to different pins |
| 5,6,10,11,12 | GND | - |

The power domain of IO is dependent with SPI5_LS_PWR setting.

## 3.2.27. SPI5_LS_PWR jumpers
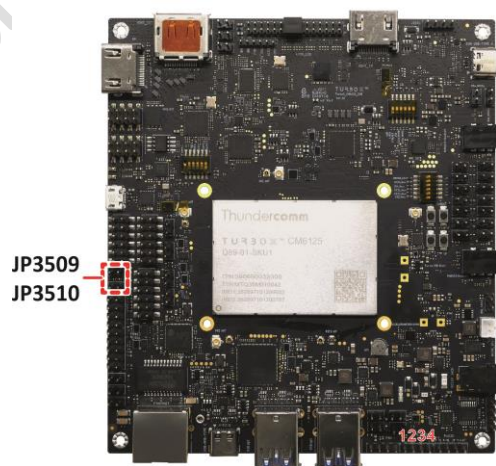


*Figure 3-30. Locate Pins for SPI5_LS_PWR*

*Table 3-19. Pin specifications for SPI5_LS_PWR*

| Jumper No. | Function | Comments |
|------------|----------|----------|
| JP3509 | VDC_1V8 | Alternative power selection |
| JP3510 | VDC_3V3 | |

## 3.2.28. SIM card slots
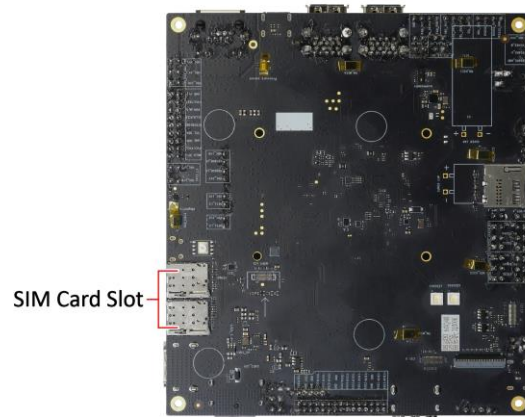


*Figure 3-31.Locate SIM Card Slot*

The board supports 2 Nano SIM card slots.

## 3.2.29. TF (Tans-Flash) card slot
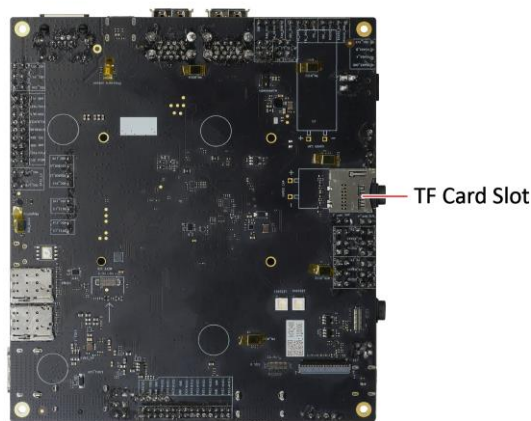


*Figure 3-32.Locate TF Card Slot*

Maximum storage capacity: 128GB.

Power supply voltage: 1.8V/2.95V.

## 3.3. Button
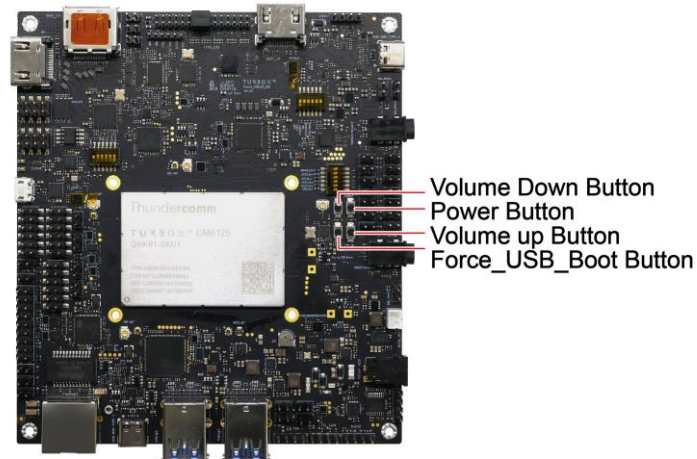


*Figure 3-33. Locate Buttons*

- **PWR_ON:** press to power on the device. When the board is running, press the button to enter sleep mode.

- **VOL_DOWN:** press for volume down.

- **VOL_UP:** press for volume up.

- **USBBOOT:** when this button is pressed, the board will be forced to enter the downloading mode and boot from the **USB_HS** port during development or factory production

## 3.4. LED power status indicator
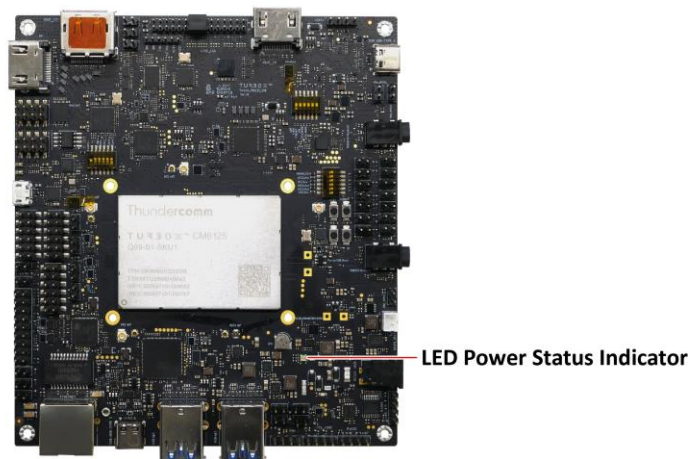


*Figure 3-34. Locate LED Power Status Indicator*

Blue light: valid 12V DC power.

Yellow light: valid battery power on the SOM.

# Appendix 1. Compliance and Certificate Information

**FCC Statements:**

<div align="center">

**OEM/Integrators Installation Manual**

</div>

**Important Notice to OEM integrators**

1. This module is limited to OEM installation ONLY.

2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).

3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations

4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part

15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

**Important Note**

Notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to XXXX that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.


**End Product Labeling**

When the module is installed in the host device, the FCC label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: XXXXXXX"

The FCC ID can be used only when all FCC compliance requirements are met.


**Antenna Installation**

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

| Antenna type | 2.4GHz band<br><br>Peak Gain (dBi) | 5.2GHz band<br><br>Peak Gain (dBi) | 5.3GHz band<br><br>Peak Gain (dBi) | 5.5GHz band<br><br>Peak Gain (dBi) | 5.8GHz band<br><br>Peak Gain (dBi) |
|---|---|---|---|---|---|
| Dipole | 3.2 | 4.2 | 4.25 | 4 | 4 |

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/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/IC authorization.

**Manual Information to the End User**

The OEM integrator has to 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 shall include all required regulatory information/warning as show in this manual.

**Federal Communication Commission Interference Statement**

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.

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 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

TURBO X

**List of applicable FCC rules**

This module has been tested and found to comply with 15.247 and 15.407 requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

**This device is intended only for OEM integrators under the following conditions: (For module device use)**

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

**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 minimum distance 20 cm between the radiator & your body.

**EU Regulatory Conformance**

Hereby, Thundercomm Technology Co., Ltd declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

$C\epsilon$

The device for operation in the band 5150–5350 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

| | 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 | CH |
| | IS | LI | NO | TR | UK(NI) | | |

The device could be used with a separation distance of 20 cm to the human body.

The device is operated with the following RF bands power in different operation modes:

| Operating Mode | Operating Frequency Range | | Maximum Transmit Power (EIRP) dBm |
| --- | --- | --- | --- |
| | TX(MHz) | RX(MHz) | |
| Bluetooth | 2402 - 2480 | | 15.70 |
| WLAN 2.4GHz | 2412 - 2472 | | 19.00 |
| WLAN 5GHz Band 1 | 5150 - 5250 | | 19.79 |
| WLAN 5GHz Band 2 | 5250 - 5350 | | 19.61 |
| WLAN 5GHz Band 3 | 5470 - 5725 | | 19.57 |
| WLAN 5GHz Band 4 | 5725 - 5850 | | 13.56 |

TURBOX

# Appendix 2. Contact Information of EU Local Agency

**Company:**        Thundercomm Europe GmbH

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# Appendix 3. Contact Information of US Local Agency

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- +86-18618401680

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