# EC200x&EC2x Series

# Compatible Design

**LTE Standard Module Series**

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# About the Document

## Revision History

| Version | Date | Author | Description |
|---|---|---|---|
| - | 2021-09-27 | Kyle CHEN/ Brant WAN/ Dylan LIU | Creation of the document |
| 1.0 | 2021-11-23 | Kyle CHEN/ Brant WAN/ Dylan LIU | First official release |

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# 1 Introduction

Quectel LTE Standard EC200x series modules (EC200U series, EC200T series and EC200S series) are compatible with EC2x series modules (EC25 series, EC21 series, EC20-CE). This document briefly describes the compatible design among EC200x series and EC2x series modules, which can help customers easily migrate from one design to either of the others.

## 1.1. Special Mark

**Table 1: Special Mark**

| Mark | Definition |
|---|---|
| * | Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, AT command, or argument, it indicates that the function, feature, interface, pin, AT command, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the sample of such model is currently unavailable. |

# 2 General Descriptions

## 2.1. Product Description

The general information and frequency bands of EC200x and EC2x series modules are presented in the tables below.

### 2.1.1. General Information

**Table 2: General Information**

| Module Name | Appearance | Packaging | Dimensions (mm) |
|---|---|---|---|
| EC200U Series |  | 80 LCC pins + 64 LGA pins | 28.0 × 31.0 × 2.4 |
| EC200T Series |  | 80 LCC pins + 64 LGA pins | 29.0 × 32.0 × 2.4 |
| EC200S Series |  | 80 LCC pins + 64 LGA pins | 29.0 × 32.0 × 2.4 |
| EC25 Series |  | 80 LCC pins + 64 LGA pins | 29.0 × 32.0 × 2.4 |

| | | | |
|---|---|---|---|
| EC21 Series |  | 80 LCC pins + 64 LGA pins | 29.0 × 32.0 × 2.4 |
| EC20-CE |  | 80 LCC pins + 64 LGA pins | 29.0 × 32.0 × 2.4 |

### 2.1.2. Frequency Bands

**Table 3: Frequency Bands**

| Module | LTE | UMTS | EVDO/CDMA | GSM [1] | Rx-diversity [2] | GNSS |
|---|---|---|---|---|---|---|
| **EC200U Series** | | | | | | |
| **EC200U-CN** | FDD: B1/B3/B5/B8<br>TDD: B34/B38/B39/B40/B41 | - | - | EGSM900/DCS1800 | - | GPS, GLONASS, BeiDou, Galileo, QZSS (Optional) |
| **EC200U-EU** | FDD: B1/B3/B5/B7/B8/B20/B28<br>TDD: B38/B40/B41 | - | - | GSM850/EGSM900/DCS1800/PCS1900 | - | GPS, GLONASS, BeiDou, Galileo, QZSS (Optional) |
| **EC200T Series** | | | | | | |
| **EC200T-CN** | FDD: B1/B3/B5/B8<br>TDD: B34/B38/B39/B40/B41 | WCDMA: B1/B5/B8 | - | EGSM900/DCS1800 | √ | - |
| **EC200T-EU** | FDD: B1/B3/B7/B8/B20/B28<br>TDD: B38/B40/B41 | WCDMA: B1/B8 | | EGSM900/DCS1800 | √ | - |
| **EC200T-AU** | FDD: B1/B2/B3/B4/B5/B7/B8/B28/B66<br>TDD: B40 | WCDMA: B1/B2/B4/B5/B8 | - | GSM850/EGSM900/DCS1800/PCS1900 | √ | - |
| **EC200S Series** | | | | | | |
| **EC200S-CN** [3] | FDD: B1/B3/B5/B8<br>TDD: B34/B38/B39/B40/B41 | - | - | EGSM900/DCS1800 (Optional) | - | GPS, BeiDou (COMPASS) (Optional) |
| **EC200S-EU** | FDD: B1/B3/B5/B7/B8/B20/B28<br>TDD: B38/B40/B41 | - | - | GSM850/EGSM900/DCS1800/PCS1900 | - | - |
| **EC200S-EN** | FDD: B1/B3/B5/B7/B8/B20/B28/B31/B72 | - | - | EGSM900/DCS1800 | - | - |
| **EC200S-AU** | FDD: B1/B2/B3/B4/B5/B7/B8/B28/B66<br>TDD: B40 | - | - | GSM850/EGSM900/DCS1800/PCS1900 | - | - |
| **EC25 Series** | | | | | | |
| **EC25-E** | FDD: B1/B3/B5/B7/B8/B20<br>TDD: B38/B40/B41 | WCDMA: B1/B5/B8 | - | EGSM900/DCS1800 | √ | GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS (Optional) |
| **EC25-A** | FDD: B2/B4/B12 | WCDMA: B2/B4/B5 | - | - | √ | |
| **EC25-V** | FDD: B4/B13 | - | - | - | √ | |
| **EC25-J** | FDD: B1/B3/B8/B18/B19/B26<br>TDD: B41 | WCDMA: B1/B6/B8/B19 | - | - | - | |

[1] GSM network on EC200U-CN and EC200S-CN is optional.
[2] Rx-diversity on EC200T series is optional. TD-SCDMA on EC20-CE does not support Rx-diversity.
[3] For EC200S series, only EC200S-CN supports GNSS function.

| | | | | | | |
|---|---|---|---|---|---|---|
| **EC25-AU** | FDD: B1/B2 [4]/B3/B4/B5/B7/B8/B28<br>TDD: B40 | WCDMA: B1/B2/B5/B8 | - | GSM850/EGSM900/DCS1800/PCS1900 | - | |
| **EC25-AUX** | FDD: B1/B2 [4]/B3/B4/B5/B7/B8/B28<br>TDD: B40 | WCDMA: B1/B2/B5/B8/B4 | - | GSM850/EGSM900/DCS1800/PCS1900 | - | |
| **EC25-AF** | FDD: B2/B4/B5/B12/B13/B14/B66/B71 | WCDMA: B2/B4/B5 | - | - | - | |
| **EC25-AFX** | FDD: B2/B4/B5/B12/B13/B14/B66/B71 | WCDMA: B2/B4/B5 | - | - | - | |
| **EC25-EU** | FDD: B1/B3/B7/B8/B20/B28A<br>TDD: B38/B40/B41 | WCDMA: B1/B8 | - | EGSM900/DCS1800 | √ | |
| **EC25-EUX** | FDD: B1/B3/B7/B8/B20/B28A<br>TDD: B38/B40/B41 | WCDMA: B1/B8 | - | EGSM900/DCS1800 | √ | |
| **EC25-MX** | FDD: B2/B4/B5/B7/B28/B66 | WCDMA: B2/B4/B5 | - | - | √ | - |
| **EC21 Series** | | | | | | |
| **EC21-E** | FDD: B1/B3/B5/B7/B8/B20 | WCDMA: B1/B5/B8 | - | GSM900/DCS1800 | √ | |
| **EC21-A** | FDD: B2/B4/B12 | WCDMA: B2/B4/B5 | - | - | | |
| **EC21-V** | FDD: B4/B13 | - | - | - | | |
| **EC21-AU** | FDD: B1/B2 [4]/B3/B4/B5/B7/B8/B28<br>TDD: B40 | WCDMA: B1/B2/B5/B8 | - | GSM850/EGSM900/DCS1800/PCS1900 | | GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS (Optional) |
| **EC21-EU** | FDD: B1/B3/B7/B8/B20/B28A | WCDMA: B1/B8 | - | EGSM900/DCS1800 | √ | |
| **EC21-AUT** | FDD: B1/B3/B5/B7/B28 | WCDMA: B1/B5 | - | - | √ | |
| **EC21-EUX** | FDD: B1/B3/B7/B8/B20/B28A | WCDMA: B1/B8 | - | EGSM900/DCS1800 | √ | |
| **EC21-J** | FDD: B1/B3/B8/B18/B19/B26 | - | - | - | √ | - |
| **EC21-AUX** | FDD: B1/B2 [4]/B3/B4/B5/B7/B8/B28<br>TDD: B40 | WCDMA: B1/B2/B5/B8/B4 | - | GSM850/EGSM900/DCS1800/PCS1900 | √ | - |
| **EC21-KL** | FDD: B1/B3/B5/B7/B8 | - | - | - | √ | - |
| **EC20-CE** | | | | | | |
| **EC20-CE** | FDD: B1/B3/B5/B8<br>TDD: B34/B38/B39/B40/B41 | WCDMA: B1/B8<br>TD-SCDMA: B34/B39 | BC0 | EGSM900/DCS1800 | √ | GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS (Optional) |

[4] B2 on EC25-AU/-AUX and EC21-AU/-AUX modules does not support Rx-diversity.

**NOTE**

"√" means supported.

## 2.2. Feature Overview

The general features of EC200x and EC2x series modules are compared in the table below.

**Table 4: Feature Overview**

| Feature | EC200U Series | EC200T Series | EC200S Series | EC25 Series/EC21 Series/EC20-CE |
|---|---|---|---|---|
| Power Supply | Supply voltage: 3.3–4.3 V, Typ. 3.8 V | Supply voltage: 3.4–4.5 V, Typ. 3.8 V | Supply voltage: 3.4–4.5 V, Typ. 3.8 V | Supply voltage: 3.3–4.3 V, Typ. 3.8 V |
| Sleep Current (USB Suspend) | < 4 mA.<br>For more information, see ***document [1]***. | < 4.1 mA.<br>For more information, see ***document [2]***. | < 4 mA.<br>For more information, see ***document [3]***. | < 4 mA.<br>For more information, see ***documents [4] & [5] & [6]***. |
| LTE Features | Supports LTE Cat 1:<br>FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL)<br>TDD: Max. 8.96 Mbps (DL), Max. 3.1 Mbps (UL) | Supports non-CA LTE Cat 4:<br>FDD: Max. 150 Mbps (DL), Max. 50 Mbps (UL)<br>TDD: Max. 130 Mbps (DL), Max. 30 Mbps (UL) | Supports LTE Cat 1:<br>FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL)<br>TDD: Max. 7.5 Mbps (DL), Max. 1 Mbps (UL) | **EC25 Series/EC20-CE:**<br>Supports LTE Cat 4:<br>FDD: Max. 150 Mbps (DL), Max. 50 Mbps (UL)<br>TDD: Max. 130 Mbps (DL), Max. 30 Mbps (UL)<br>**EC21 Series:**<br>Supports LTE Cat 1:<br>FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL)<br>TDD: Max. 8.96 Mbps (DL), Max. 3.1 Mbps (UL) |
| Temperature Ranges | Operating temperature range: -35 to +75 °C [5]<br>Extended temperature range: -40 to +85 °C [6]<br>Storage temperature range: -40 to +90 °C | Operating temperature range: -35 to +75 °C [5]<br>Extended temperature range: -40 to +85 °C [6]<br>Storage temperature range: -40 to +90 °C | Operating temperature range: -35 to +75 °C [5]<br>Extended temperature range: -40 to +85 °C [6]<br>Storage temperature range: -40 to +90 °C | Operating temperature range: -35 to +75 °C [5]<br>Extended temperature range: -40 to +85 °C [6]<br>Storage temperature range: -40 to +90 °C |
| UART Interfaces | **Main UART:**<br>● Used for AT command communication and data transmission<br>● Baud rates: up to 921600 bps, 115200 bps by default<br>● RTS and CTS hardware flow control<br>**Debug UART:**<br>● Used for outputting partial logs<br>● 921600 bps baud rate<br>● Used for debug UART interface only<br>**Auxiliary UART** | **Main UART:**<br>● Used for AT command communication and data transmission<br>● Baud rates: up to 1 Mbps, 115200 bps by default<br>● RTS and CTS hardware flow control<br>**Debug UART:**<br>● Used for outputting partial logs<br>● 115200 bps baud rate | **Main UART:**<br>● Used for AT command communication and data transmission<br>● Baud rates: up to 1 Mbps, 115200 bps by default<br>● RTS and CTS hardware flow control<br>**Debug UART:**<br>● Used for outputting partial logs<br>● 115200 bps baud rate | **Main UART:**<br>● Used for AT command communication and data transmission<br>● Baud rates: up to 921600 bps, 115200 bps by default<br>● RTS and CTS hardware flow control<br>**Debug UART:**<br>● Used for Linux console and log output<br>● 115200 bps baud rate |

[5] Within the operating temperature range, the module meets 3GPP specifications.
[6] Within the extended temperature range, the module retains the functionalities such as voice, SMS, data transmission, etc., without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specification, such as $P_{out}$, may exceed the specified 3GPP tolerances. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

| | | | | |
|---|---|---|---|---|
| USB Interface | USB 2.0 high-speed and full-speed (slave only) supported | USB 2.0 high-speed and full-speed (slave only) supported | USB 2.0 high-speed and full-speed (slave only) supported | USB 2.0 high-speed (slave only) supported |
| Digital Audio | PCM interface (slave only) | PCM interface | PCM interface | PCM interface |
| I2C Interfaces | Supported | Supported | Supported | Supported |
| SD Card Interface | SD 2.0 protocol | SD 3.0 protocol | SD 3.0 protocol * | SD 3.0 protocol |
| WLAN/Bluetooth Interface | SDIO 2.0 interface for WLAN* (Wi-Fi-scan and Bluetooth share the same antenna interface) | SDIO 3.0 interface for WLAN* (Bluetooth function is not supported) | SDIO 3.0 interface for WLAN* (Bluetooth function is not supported) | Low-power SDIO 3.0 interface for WLAN;<br>UART & PCM interfaces for Bluetooth |
| SGMII Interface | - | - | - | 10 Mbps/100 Mbps/1000 Mbps Ethernet work modes<br>**EC25 Series/EC20-CE:**<br>Max. 150 Mbps (DL)/50 Mbps (UL) for 4G network<br>**EC21 Series:**<br>Max. 10 Mbps (DL)/Max. 5 Mbps (UL) for 4G network |
| (U)SIM Card Detection | Supported | Supported | Supported | Supported |
| GNSS [7] | GPS, GLONASS, BeiDou, Galileo, QZSS (Optional) | - | GPS, BeiDou (COMPASS) (Optional) | GPS, GLONASS, BeiDou (COMPASS), Galileo, QZSS (Optional) |
| Firmware Upgrade | Via USB interface or FOTA | USB interface or FOTA | USB interface or DFOTA | USB interface or DFOTA |

[7] For EC200S series, only EC200S-CN supports GNSS function.

## 2.3. Pin Assignment

Pin assignments of EC200x and EC2x series modules are presented in the figures below.

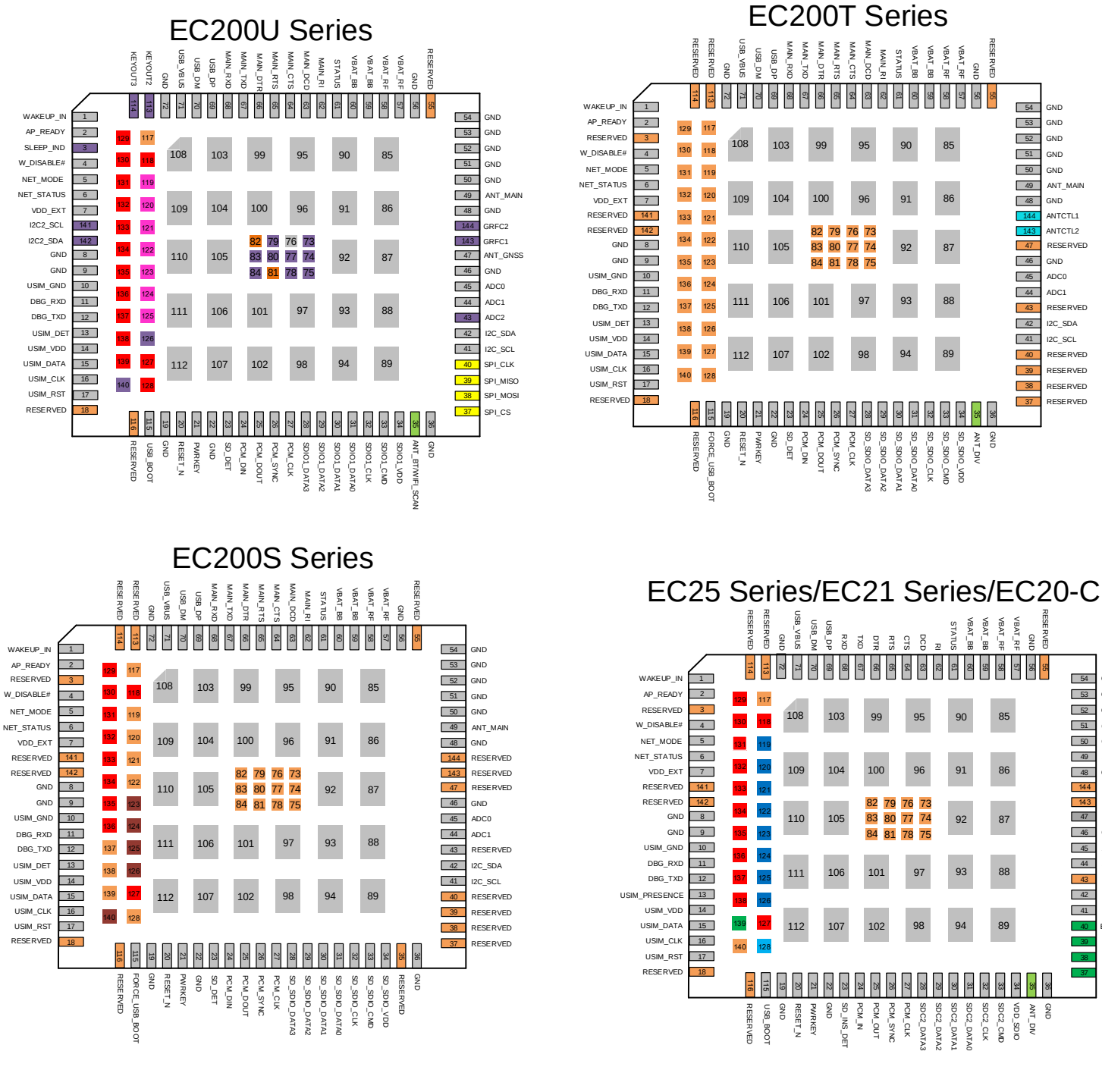


**Figure 1: EC200x & EC2x Series Pin Assignment**

**NOTE**

1. The USB_BOOT/FORCE_USB_BOOT pin on the EC200U/EC200T series cannot be pulled up before the module is successfully powered on. In addition, the KEYIN1 pin on EC200U series cannot be pulled up before startup. There are no restrictions on other pins.
2. WAKEUP_IN (pin 1), NET_STATUS (pin 6) and FORCE_USB_BOOT (pin 115) should not be pulled up high before the module is successfully started up. Pin 47 is the ANT_GNSS pin on EC200S-CN with built-in GNSS function and the RESERVED pin on other variants of EC200S series.
3. WAKEUP_IN, NET_MODE, WLAN_EN, COEX_UART_RX, COEX_UART_TX, USB_BOOT, BT_CTS pins on EC25 series/EC21 series/EC20-CE cannot be pulled up before startup.

# 3 Pin Description

The pins on EC200x and EC2x series modules are described in this chapter.

**Table 5: I/O Parameter Definition**

| Symbol | Description |
|---|---|
| AI | Analog Input |
| AO | Analog Output |
| AIO | Analog Input/Output |
| DI | Digital Input |
| DO | Digital Output |
| DIO | Digital Input/Output |
| OD | Open Drain |
| PI | Power Input |
| PO | Power Output |

## 3.1. Pin Description

Pin definition of EC200x and EC2x series modules is presented in the following table.

**Table 6: Pin Definition**

| EC200U Series | | | | EC200T Series | | | | EC200S Series | | | | EC25 Series/EC21 Series/EC20-CE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pin No. | Pin Name | I/O | Power Domain | Pin No. | Pin Name | I/O | Power Domain | Pin No. | Pin Name | I/O | Power Domain | Pin No. | Pin Name | I/O | Power Domain |
| 1 | WAKEUP_IN | DI | 1.8 V | 1 | WAKEUP_IN* | DI | 1.8 V | 1 | WAKEUP_IN | DI | 1.8 V | 1 | WAKEUP_IN | DI | 1.8 V |
| 2 | AP_READY | DI | 1.8 V | 2 | AP_READY | DI | 1.8 V | 2 | AP_READY | DI | 1.8 V | 2 | AP_READY | DI | 1.8 V |
| 3 | SLEEP_IND | DO | 1.8 V | 3 | RESERVED | - | - | 3 | RESERVED | - | - | 3 | RESERVED | - | - |
| 4 | W_DISABLE# | DI | 1.8 V | 4 | W_DISABLE# | DI | 1.8 V | 4 | W_DISABLE# | DI | 1.8 V | 4 | W_DISABLE# | DI | 1.8 V |
| 5 | NET_MODE | DO | 1.8 V | 5 | NET_MODE | DO | 1.8 V | 5 | NET_MODE | DO | 1.8 V | 5 | NET_MODE | DO | 1.8 V |
| 6 | NET_STATUS | DO | 1.8 V | 6 | NET_STATUS | DO | 1.8 V | 6 | NET_STATUS | DO | 1.8 V | 6 | NET_STATUS | DO | 1.8 V |
| 7 | VDD_EXT | PO | 1.8 V | 7 | VDD_EXT | PO | 1.8 V | 7 | VDD_EXT | PO | 1.8 V | 7 | VDD_EXT | PO | 1.8 V |
| 8 | GND | - | GND | 8 | GND | - | GND | 8 | GND | - | GND | 8 | GND | - | GND |
| 9 | GND | - | GND | 9 | GND | - | GND | 9 | GND | - | GND | 9 | GND | - | GND |
| 10 | USIM_GND | - | GND | 10 | USIM_GND | - | GND | 10 | USIM_GND | - | GND | 10 | USIM_GND | - | GND |
| 11 | DBG_RXD | DI | 1.8 V | 11 | DBG_RXD | DI | 1.8 V | 11 | DBG_RXD | DI | 1.8 V | 11 | DBG_RXD | DI | 1.8 V |
| 12 | DBG_TXD | DO | 1.8 V | 12 | DBG_TXD | DO | 1.8 V | 12 | DBG_TXD | DO | 1.8 V | 12 | DBG_TXD | DO | 1.8 V |
| 13 | USIM_DET | DI | 1.8 V | 13 | USIM_DET | DI | 1.8 V | 13 | USIM_DET | DI | 1.8 V | 13 | USIM_PRESENCE | DI | 1.8 V |
| 14 | USIM_VDD | PO | 1.8/3.0 V | 14 | USIM_VDD | PO | 1.8/3.0 V | 14 | USIM_VDD | PO | 1.8/3.0 V | 14 | USIM_VDD | PO | 1.8/3.0 V |
| 15 | USIM_DATA | DIO | 1.8/3.0 V | 15 | USIM_DATA | DIO | 1.8/3.0 V | 15 | USIM_DATA | DIO | 1.8/3.0 V | 15 | USIM_DATA | DIO | 1.8/3.0 V |
| 16 | USIM_CLK | DO | 1.8/3.0 V | 16 | USIM_CLK | DO | 1.8/3.0 V | 16 | USIM_CLK | DO | 1.8/3.0 V | 16 | USIM_CLK | DO | 1.8/3.0 V |
| 17 | USIM_RST | DO | 1.8/3.0 V | 17 | USIM_RST | DO | 1.8/3.0 V | 17 | USIM_RST | DO | 1.8/3.0 V | 17 | USIM_RST | DO | 1.8/3.0 V |
| 19 | GND | - | GND | 19 | GND | - | GND | 19 | GND | - | GND | 19 | GND | - | GND |
| 20 | RESET_N | DI | VBAT Voltage domain | 20 | RESET_N | DI | 1.8 V | 20 | RESET_N | DI | 1.8 V | 20 | RESET_N | DI | 1.8 V |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | PWRKEY | DI | VBAT Voltage domain | 21 | PWRKEY | DI | VBAT | 21 | PWRKEY | DI | VBAT | 21 | PWRKEY | DI | The output voltage is 0.8 V when the module is powered on. |
| 22 | GND | - | GND | 22 | GND | - | GND | 22 | GND | - | GND | 22 | GND | - | GND |
| 23 | SD_DET | DI | 1.8 V | 23 | SD_DET* | DI | 1.8/2.8 V | 23 | SD_DET* | DI | 1.8/2.8 V | 23 | SD_INS_DET | DI | 1.8 V |
| 24 | PCM_DIN | DI | 1.8 V | 24 | PCM_DIN | DI | 1.8 V | 24 | PCM_DIN | DI | 1.8 V | 24 | PCM_IN | DI | 1.8 V |
| 25 | PCM_DOUT | DO | 1.8 V | 25 | PCM_DOUT | DO | 1.8 V | 25 | PCM_DOUT | DO | 1.8 V | 25 | PCM_OUT | DO | 1.8 V |
| 26 | PCM_SYNC | DI | 1.8 V | 26 | PCM_SYNC | DIO | 1.8 V | 26 | PCM_SYNC | DIO | 1.8 V | 26 | PCM_SYNC | DIO | 1.8 V |
| 27 | PCM_CLK | DI | 1.8 V | 27 | PCM_CLK | DIO | 1.8 V | 27 | PCM_CLK | DIO | 1.8 V | 27 | PCM_CLK | DIO | 1.8 V |
| 28 | SDIO1_DATA3 | DIO | 1.8/3.2 V | 28 | SD_SDIO_DATA3 | DIO | 1.8/2.8 V | 28 | SD_SDIO_DATA3* | DIO | 1.8/2.8 V | 28 | SDC2_DATA3 | DIO | 1.8/2.85 V |
| 29 | SDIO1_DATA2 | DIO | 1.8/3.2 V | 29 | SD_SDIO_DATA2 | DIO | 1.8/2.8 V | 29 | SD_SDIO_DATA2* | DIO | 1.8/2.8 V | 29 | SDC2_DATA2 | DIO | 1.8/2.85 V |
| 30 | SDIO1_DATA1 | DIO | 1.8/3.2 V | 30 | SD_SDIO_DATA1 | DIO | 1.8/2.8 V | 30 | SD_SDIO_DATA1* | DIO | 1.8/2.8 V | 30 | SDC2_DATA1 | DIO | 1.8/2.85 V |
| 31 | SDIO1_DATA0 | DIO | 1.8/3.2 V | 31 | SD_SDIO_DATA0 | DIO | 1.8/2.8 V | 31 | SD_SDIO_DATA0* | DIO | 1.8/2.8 V | 31 | SDC2_DATA0 | DIO | 1.8/2.85 V |
| 32 | SDIO1_CLK | DO | 1.8/3.2 V | 32 | SD_SDIO_CLK | DO | 1.8/2.8 V | 32 | SD_SDIO_CLK* | DO | 1.8/2.8 V | 32 | SDC2_CLK | DO | 1.8/2.85 V |
| 33 | SDIO1_CMD | DIO | 1.8/3.2 V | 33 | SD_SDIO_CMD | DIO | 1.8/2.8 V | 33 | SD_SDIO_CMD* | DIO | 1.8/2.8 V | 33 | SDC2_CMD | DIO | 1.8/2.85 V |
| 34 | SDIO1_VDD | PO | 1.8/3.2 V | 34 | SD_SDIO_VDD | PO | 1.8/2.8 V | 34 | SD_SDIO_VDD* | PO | 1.8/2.8 V | 34 | VDD_SDIO | PO | 1.8/2.85 V |
| 35 | ANT_BT/ WIFI_SCAN | AIO | - | 35 | ANT_DIV | AI | - | 35 | RESERVED | - | - | 35 | ANT_DIV | AI | - |
| 36 | GND | - | GND | 36 | GND | - | GND | 36 | GND | - | GND | 36 | GND | - | GND |
| 37 | SPI_CS | DO | - | 37 | RESERVED | - | - | 37 | RESERVED | - | - | 37 | BT_RTS | DI | 1.8 V |
| 38 | SPI_MOSI | DO | - | 38 | RESERVED | - | - | 38 | RESERVED | - | - | 38 | BT_TXD | DO | 1.8 V |
| 39 | SPI_MISO | DI | - | 39 | RESERVED | - | - | 39 | RESERVED | - | - | 39 | BT_RXD | DI | 1.8 V |
| 40 | SPI_CLK | DO | - | 40 | RESERVED | - | - | 40 | RESERVED | - | - | 40 | BT_CTS | DO | 1.8 V |
| 41 | I2C_SCL | OD | An external 1.8 V pull-up resistor is required. | 41 | I2C_SCL | OD | An external 1.8 V pull-up resistor is required. | 41 | I2C_SCL | OD | An external 1.8 V pull-up resistor is required. | 41 | I2C_SCL | OD | An external 1.8 V pull-up resistor is required. |
| 42 | I2C_SDA | OD | An external 1.8 V pull-up resistor is required. | 42 | I2C_SDA | OD | An external 1.8 V pull-up resistor is required. | 42 | I2C_SDA | OD | An external 1.8 V pull-up resistor is required. | 42 | I2C_SDA | OD | An external 1.8 V pull-up resistor is required. |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | ADC2 | AI | 0–VBAT_BB | 43 | RESERVED | - | - | 43 | RESERVED | - | - | 43 | RESERVED | - | - |
| 44 | ADC1 | AI | 0–VBAT_BB | 44 | ADC1 | AI | 0–VBAT_BB | 44 | ADC1 | AI | 0–VBAT_BB | 44 | ADC1 | AI | 0.3 V–VBAT_BB |
| 45 | ADC0 | AI | 0–VBAT_BB | 45 | ADC0 | AI | 0–VBAT_BB | 45 | ADC0 | AI | 0–VBAT_BB | 45 | ADC0 | AI | 0.3 V–VBAT_BB |
| 46 | GND | - | GND | 46 | GND | - | GND | 46 | GND | - | GND | 46 | GND | - | GND |
| 47 | ANT_GNSS | AI | - | 47 | RESERVED | - | - | 47 | RESERVED [8] | - | - | 47 | ANT_GNSS | AI | - |
| 48 | GND | - | GND | 48 | GND | - | GND | 48 | GND | - | GND | 48 | GND | - | GND |
| 49 | ANT_MAIN | AIO | - | 49 | ANT_MAIN | AIO | - | 49 | ANT_MAIN | AIO | - | 49 | ANT_MAIN | AIO | - |
| 50–54 | GND | - | GND | 50–54 | GND | - | GND | 50–54 | GND | - | GND | 50–54 | GND | - | GND |
| 56 | GND | - | GND | 56 | GND | - | GND | 56 | GND | - | GND | 56 | GND | - | GND |
| 57 | VBAT_RF | PI | 3.3–4.3 V | 57 | VBAT_RF | PI | 3.4–4.5 V | 57 | VBAT_RF | PI | 3.4–4.5 V | 57 | VBAT_RF | PI | 3.3–4.3 V |
| 58 | VBAT_RF | PI | 3.3–4.3 V | 58 | VBAT_RF | PI | 3.4–4.5 V | 58 | VBAT_RF | PI | 3.4–4.5 V | 58 | VBAT_RF | PI | 3.3–4.3 V |
| 59 | VBAT_BB | PI | 3.3–4.3 V | 59 | VBAT_BB | PI | 3.4–4.5 V | 59 | VBAT_BB | PI | 3.4–4.5 V | 59 | VBAT_BB | PI | 3.3–4.3 V |
| 60 | VBAT_BB | PI | 3.3–4.3 V | 60 | VBAT_BB | PI | 3.4–4.5 V | 60 | VBAT_BB | PI | 3.4–4.5 V | 60 | VBAT_BB | PI | 3.3–4.3 V |
| 61 | STATUS | DO | 1.8 V | 61 | STATUS | OD | - | 61 | STATUS | OD | - | 61 | STATUS | OD | - |
| 62 | MAIN_RI | DO | 1.8 V | 62 | MAIN_RI | DO | 1.8 V | 62 | MAIN_RI | DO | 1.8 V | 62 | RI | DO | 1.8 V |
| 63 | MAIN_DCD | DO | 1.8 V | 63 | MAIN_DCD | DO | 1.8 V | 63 | MAIN_DCD | DO | 1.8 V | 63 | DCD | DO | 1.8 V |
| 64 | MAIN_CTS | DO | 1.8 V | 64 | MAIN_CTS | DO | 1.8 V | 64 | MAIN_CTS | DO | 1.8 V | 64 | CTS | DO | 1.8 V |
| 65 | MAIN_RTS | DI | 1.8 V | 65 | MAIN_RTS | DI | 1.8 V | 65 | MAIN_RTS | DI | 1.8 V | 65 | RTS | DI | 1.8 V |
| 66 | MAIN_DTR | DI | 1.8 V | 66 | MAIN_DTR | DI | 1.8 V | 66 | MAIN_DTR | DI | 1.8 V | 66 | DTR | DI | 1.8 V |
| 67 | MAIN_TXD | DO | 1.8 V | 67 | MAIN_TXD | DO | 1.8 V | 67 | MAIN_TXD | DO | 1.8 V | 67 | TXD | DO | 1.8 V |
| 68 | MAIN_RXD | DI | 1.8 V | 68 | MAIN_RXD | DI | 1.8 V | 68 | MAIN_RXD | DI | 1.8 V | 68 | RXD | DI | 1.8 V |
| 69 | USB_DP | AIO | - | 69 | USB_DP | AIO | - | 69 | USB_DP | AIO | - | 69 | USB_DP | AIO | - |
| 70 | USB_DM | AIO | - | 70 | USB_DM | AIO | - | 70 | USB_DM | AIO | - | 70 | USB_DM | AIO | - |
| 71 | USB_VBUS | AI | 3.5–5.25 V | 71 | USB_VBUS | AI | 3.0–5.25 V | 71 | USB_VBUS | AI | 3.0–5.25 V | 71 | USB_VBUS | AI | 3.0–5.25 V |
| 72 | GND | - | GND | 72 | GND | - | GND | 72 | GND | - | GND | 72 | GND | - | GND |
| 73 | LOUDSPK_P | AO | - | 73 | RESERVED | - | - | 73 | RESERVED | - | - | 73 | RESERVED | - | - |

[8] Pin 47 is the ANT_GNSS pin on EC200S-CN with built-in GNSS function and it is the RESERVED pin on other variants of EC200S series.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74 | LOUDSPK_N | AO | - | 74 | RESERVED | - | - | 74 | RESERVED | - | - | 74 | RESERVED | - | - |
| 75 | MIC_P | AI | - | 75 | RESERVED | - | - | 75 | RESERVED | - | - | 75 | RESERVED | - | - |
| 76 | GND | - | GND | 76 | RESERVED | - | - | 76 | RESERVED | - | - | 76 | RESERVED | - | - |
| 77 | MIC_N | AI | - | 77 | RESERVED | - | - | 77 | RESERVED | - | - | 77 | RESERVED | - | - |
| 78 | KEYIN1 | DI | 1.8 V | 78 | RESERVED | - | - | 78 | RESERVED | - | - | 78 | RESERVED | - | - |
| 79 | KEYIN2 | DI | 1.8 V | 79 | RESERVED | - | - | 79 | RESERVED | - | - | 79 | RESERVED | - | - |
| 80 | KEYIN3 | DI | 1.8 V | 80 | RESERVED | - | - | 80 | RESERVED | - | - | 80 | RESERVED | - | - |
| 83 | KEYOUT0 | DO | 1.8 V | 83 | RESERVED | - | - | 83 | RESERVED | - | - | 83 | RESERVED | - | - |
| 84 | KEYOUT1 | DO | 1.8 V | 84 | RESERVED | - | - | 84 | RESERVED | - | - | 84 | RESERVED | - | - |
| 85–112 | GND | - | GND | 85–112 | GND | - | GND | 85–112 | GND | - | GND | 85–112 | GND | - | GND |
| 113 | KEYOUT2 | DO | 1.8 V | 113 | RESERVED | - | - | 113 | RESERVED | - | - | 113 | RESERVED | - | - |
| 114 | KEYOUT3 | DO | 1.8 V | 114 | RESERVED | - | - | 114 | RESERVED | - | - | 114 | RESERVED | - | - |
| 115 | USB_BOOT | DI | 1.8 V | 115 | FORCE_USB_BOOT | DI | 1.8 V | 115 | FORCE_USB_BOOT | DI | 1.8 V | 115 | USB_BOOT | DI | 1.8 V |
| 118 | WLAN_SLP_CLK* | DO | 1.8 V | 118 | RESERVED | DO | 1.8 V | 118 | WLAN_SLP_CLK* | DO | 1.8 V | 118 | WLAN_SLP_CLK | DO | 1.8 V |
| 119 | LCD_FMARK | DI | 1.8 V | 119 | RESERVED | - | - | 119 | RESERVED | - | - | 119 | EPHY_RST_N | DO | 1.8/2.85 V |
| 120 | LCD_RSTB | DO | 1.8 V | 120 | RESERVED | - | - | 120 | RESERVED | - | - | 120 | EPHY_INT_N | DI | 1.8 V |
| 121 | LCD_SEL | - | 1.8 V | 121 | RESERVED | - | - | 121 | RESERVED | - | - | 121 | SGMII_MDATA | DIO | 1.8/2.85 V |
| 122 | LCD_CS | DO | 1.8 V | 122 | RESERVED | - | - | 122 | RESERVED | - | - | 122 | SGMII_MCLK | DO | 1.8/2.85 V |
| 123 | LCD_CLK | DO | 1.8 V | 123 | RESERVED | - | - | 123 | SPK_N | AO | - | 123 | SGMII_TX_M | AO | - |
| 124 | LCD_SDC | DO | 1.8 V | 124 | RESERVED | - | - | 124 | SPK_P | AO | - | 124 | SGMII_TX_P | AO | - |
| 125 | LCD_SI/O | DIO | - | 125 | RESERVED | - | - | 125 | MIC_P | AI | - | 125 | SGMII_RX_P | AI | - |
| 126 | GPIO1 | DO | - | 126 | RESERVED | - | - | 126 | MIC_N | AI | - | 126 | SGMII_RX_M | AI | - |
| 127 | WLAN_PWR_EN* | DO | 1.8 V | 127 | RESERVED | DO | 1.8 V | 127 | WLAN_PWR_EN* | DO | 1.8 V | 127 | PM_ENABLE | DO | 1.8 V |
| 128 | USIM2_VDD | PO | 1.8/3.0 V | 128 | RESERVED | - | - | 128 | RESERVED | - | - | 128 | USIM2_VDD | PO | 1.8/2.85 V |
| 129 | SDIO2_DATA3* | DIO | 1.8 V | 129 | RESERVED | DIO | 1.8 V | 129 | WLAN_SDIO_DATA3* | DIO | 1.8 V | 129 | SDC1_DATA3 | DIO | 1.8 V |
| 130 | SDIO2_DATA2* | DIO | 1.8 V | 130 | RESERVED | DIO | 1.8 V | 130 | WLAN_SDIO_DATA2* | DIO | 1.8 V | 130 | SDC1_DATA2 | DIO | 1.8 V |
| 131 | SDIO2_DATA1* | DIO | 1.8 V | 131 | RESERVED | DIO | 1.8 V | 131 | WLAN_SDIO_DATA1* | DIO | 1.8 V | 131 | SDC1_DATA1 | DIO | 1.8 V |
| 132 | SDIO2_DATA0* | DIO | 1.8 V | 132 | RESERVED | DIO | 1.8 V | 132 | WLAN_SDIO_DATA0* | DIO | 1.8 V | 132 | SDC1_DATA0 | DIO | 1.8 V |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 133 | SDIO2_CLK* | DO | 1.8 V | 133 | RESERVED | DO | 1.8 V | 133 | WLAN_SDIO_CLK* | DO | 1.8 V | 133 | SDC1_CLK | DO | 1.8 V |
| 134 | SDIO2_CMD* | DO | 1.8 V | 134 | RESERVED | DO | 1.8 V | 134 | WLAN_SDIO_CMD* | DO | 1.8 V | 134 | SDC1_CMD | DO | 1.8 V |
| 135 | WLAN_WAKE* | DI | 1.8 V | 135 | RESERVED | DI | 1.8 V | 135 | WLAN_WAKE* | DI | 1.8 V | 135 | WAKE_ON_WIRELESS | DI | 1.8 V |
| 136 | WLAN_EN* | DO | 1.8 V | 136 | RESERVED | DO | 1.8 V | 136 | WLAN_EN* | DO | 1.8 V | 136 | WLAN_EN | DO | 1.8 V |
| 137 | AUX_RXD | DI | 1.8 V | 137 | RESERVED | - | - | 137 | RESERVED | - | - | 137 | COEX_UART_RX | DI | 1.8 V |
| 138 | AUX_TXD | DO | 1.8 V | 138 | RESERVED | - | - | 138 | RESERVED | - | - | 138 | COEX_UART_TX | DO | 1.8 V |
| 139 | BT_EN | DO | 1.8 V | 139 | RESERVED | - | - | 139 | RESERVED | - | - | 139 | BT_EN | DO | 1.8 V |
| 140 | ISINK | PI | - | 140 | RESERVED | - | - | 140 | MICBIAS | PO | - | 140 | RESERVED | - | - |
| 141 | I2C2_SCL | OD | An external 1.8 V pull-up resistor is required. | 141 | RESERVED | - | - | 141 | RESERVED | - | - | 141 | RESERVED | - | - |
| 142 | I2C2_SDA | OD | An external 1.8 V pull-up resistor is required. | 142 | RESERVED | - | - | 142 | RESERVED | - | - | 142 | RESERVED | - | - |
| 143 | GRFC1 | DO | 1.8 V | 143 | ANTCTL2 | DO | - | 143 | RESERVED | - | - | 143 | RESERVED | - | - |
| 144 | GRFC2 | DO | 1.8 V | 144 | ANTCTL1 | DO | - | 144 | RESERVED | - | - | 144 | RESERVED | - | - |
| 18, 55, 81, 82, 116, 117 | RESERVED | - | - | 18, 55, 81, 82, 116, 117 | RESERVED | - | - | 18, 55, 81, 82, 116, 117 | RESERVED | - | - | 18, 55, 81, 82, 116, 117 | RESERVED | - | - |

**NOTE**

1. Keep all reserved and unused pins unconnected.
2. All GND pins should be connected to ground.
3. For comprehensive and detailed definitions of Wi-Fi & Bluetooth and SGMII functions on pins 118–139, see ***document [1]*** & ***[2]*** & ***[3]*** & ***[4]*** & ***[5]*** & ***[6]***.
4. Pins in blue are pins with different functions or voltage domain, but the module footprint is compatible.

# 4 Hardware Reference Design

The following sub-chapters describe the compatible design among EC200x and EC2x series modules in terms of main functionalities.

## 4.1. Power Supply

Use a TVS diode with low reverse stand-off voltage $V_{RWM}$, low clamping voltage $V_C$ and high reverse peak pulse current $I_{PP}$ to ensure power source stability. A reference design for +5.0 V input power source and the power supply in star-shaped pattern are presented in the figure below.

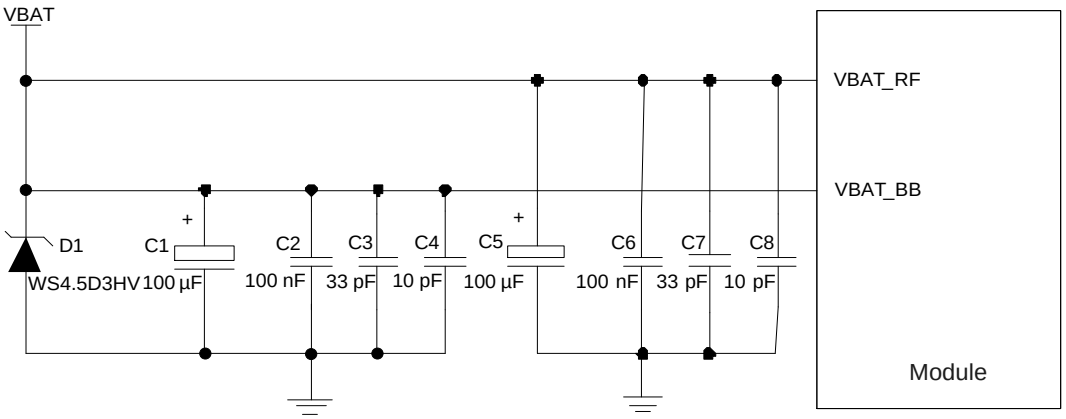


**Figure 2: Power Supply in Star-Shaped Pattern**

The performance of the module largely depends on the power source. The power supply for EC200x series and EC2x series should be able to provide sufficient current up to 2.0 A. For EC200U-CN and EC200S-CN, on which GSM is an option, the power supply should provide up to 2.0 A to the variant that supports only LTE network, while 3.0 A should be provided for the variant that supports GSM network, as well.

A reference design for + 5.0 V input power source is presented in the figure below. The typical output of the power supply is about 3.8 V and the maximum load current is 3.0 A.

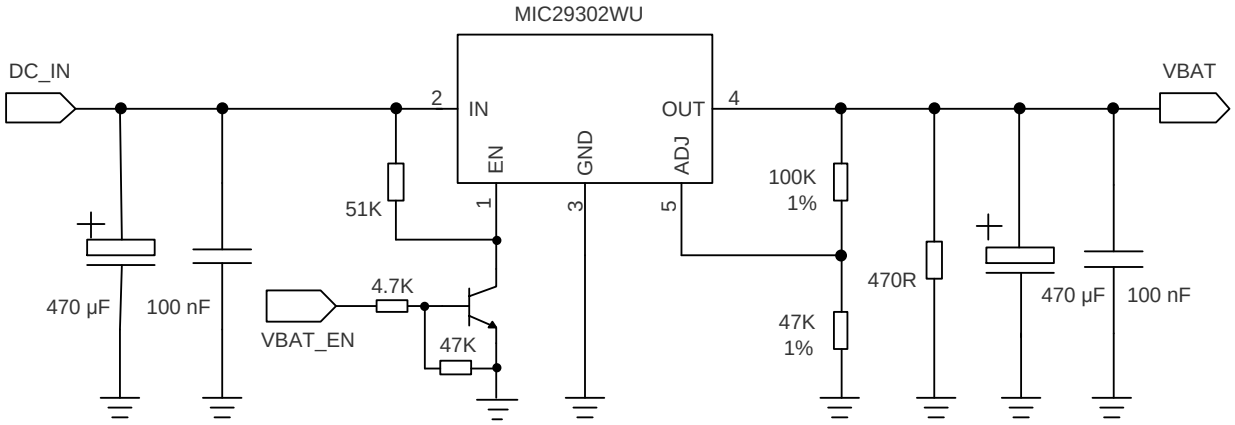


**Figure 3: Power Supply Reference Design**

## 4.2. Turn-on/off

### 4.2.1. Turn-on

A reference design for the turn-on circuits of EC200x and EC2x series modules is presented in the figure below.

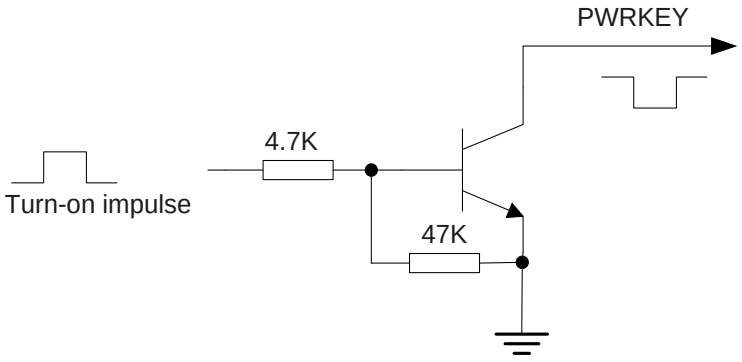


**Figure 4: Turn-on Circuit**

The power-up scenario of EC200U series modules is illustrated in the figure below.

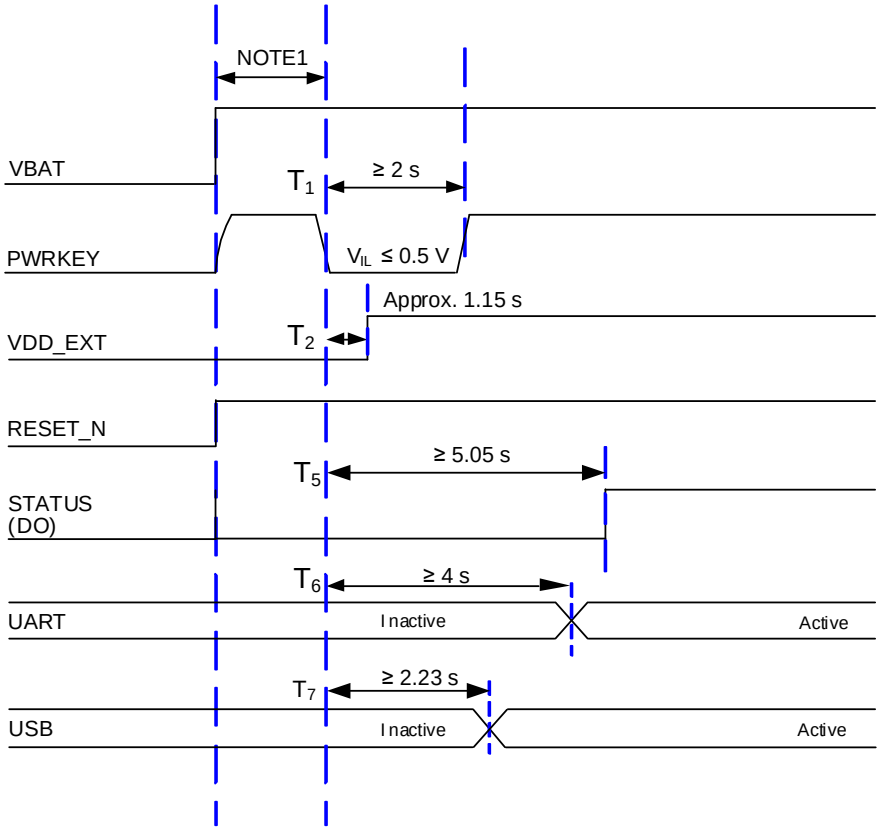


**Figure 5: Power-up Timing (EC200U Series)**

The power-up scenario of EC200T series, EC200S series modules is illustrated in the figure below.

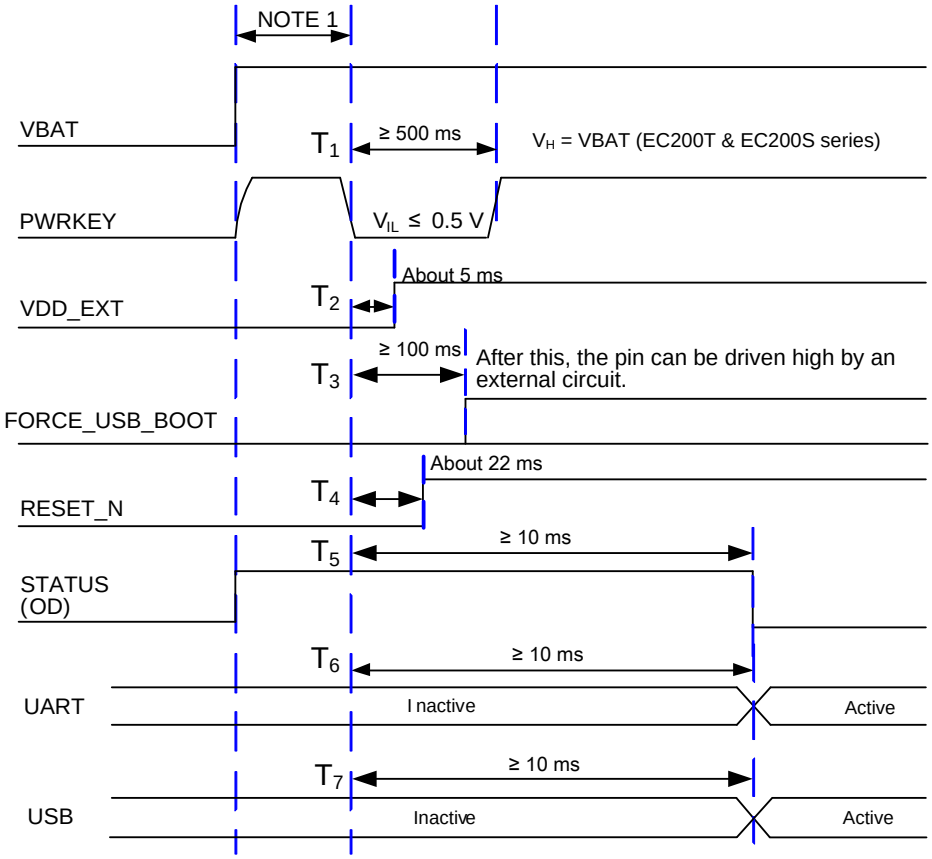


**Figure 6: Power-up Timing (EC200T & EC200S Series)**

The power-up scenario of EC2x series modules is illustrated in the figure below.

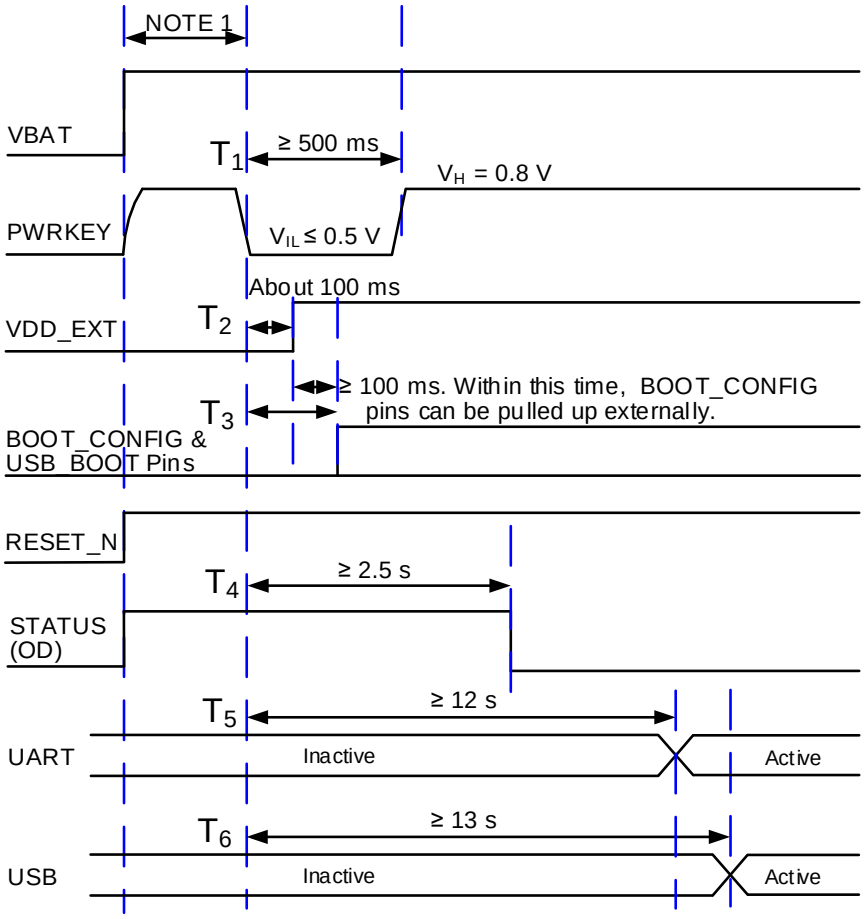


**Figure 7: Power-up Timing (EC2x Series)**

The power-up timing of EC200x and EC2x series modules is illustrated in the table below.

**Table 7: Power-up Timing of EC200x and EC2x Series**

| Module | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ |
|---|---|---|---|---|---|---|---|
| EC200U Series | ≥ 2 s | Approx. 1.15 s | - | - | ≥ 5.05 s | ≥ 4 s | ≥ 2.23 s |
| EC200T Series | ≥ 500 ms | Typ. 5 ms | ≥ 100 ms | Typ. 22 ms | ≥ 10 s | ≥ 10 s | ≥ 10 s |
| EC200S Series | ≥ 500 ms | Typ. 5 ms | ≥ 100 ms | Typ. 22 ms | ≥ 10 s | ≥ 10 s | ≥ 10 s |
| EC25 Series/ EC21 Series/ EC20-CE | ≥ 500 ms | Typ. 100 ms | ≥ 200 ms | - | ≥ 2.5 s | ≥ 12 s | ≥ 13 s |

**NOTE**

1. Make sure that VBAT is stable and wait at least 30 ms before pulling down PWRKEY pin.
2. PWRKEY can be pulled down directly to GND with a recommended resistor if the module needs to be powered on automatically and shutdown is not needed. EC200T & EC200S series pull-down resistors should be 4.7 kΩ; EC2x series pull-down resistor should be 10 kΩ, and EC200U series pull-down resistor should be 1 kΩ.
3. EC200U series STATUS pin is not OD pin but DO pin, and outputs high-level after $T_5$ (5.05 s).
4. EC200T/EC200S series RESET_N pin should be pulled up after pulling down the PWRKEY pin, and EC200U series & EC2x series RESET_N pin should be pulled up after the VBAT pin is powered on.

### 4.2.2. Turn-off

The following is a reference design of the turn-off circuits for EC200x and EC2x series modules.

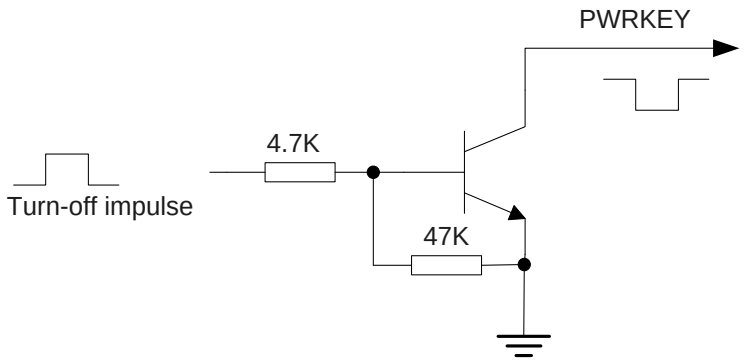


**Figure 8: Turn-off Circuit**

#### 4.2.2.1.Turn off with PWRKEY

The power-off scenario of EC200T series, EC200S series and EC2x series modules is illustrated in the figure below.

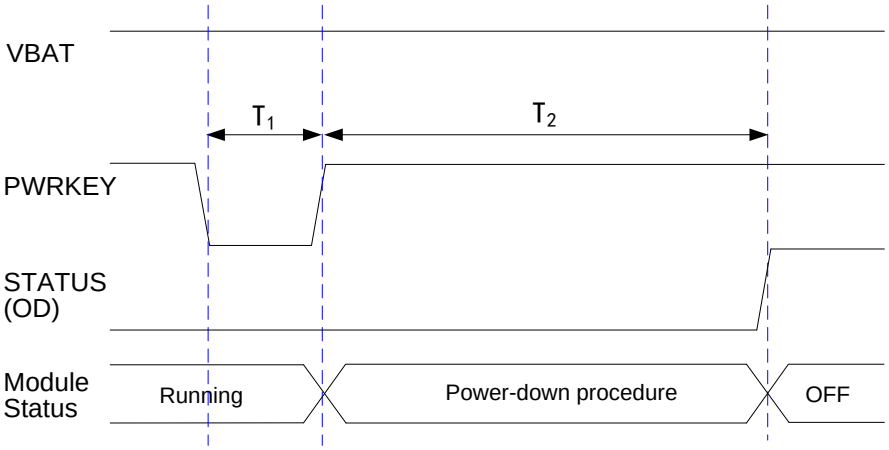


**Figure 9: Power-off Timing (EC200T & EC200S & EC2x Series)**

The power-off scenario of EC200U series module is illustrated in the figure below.

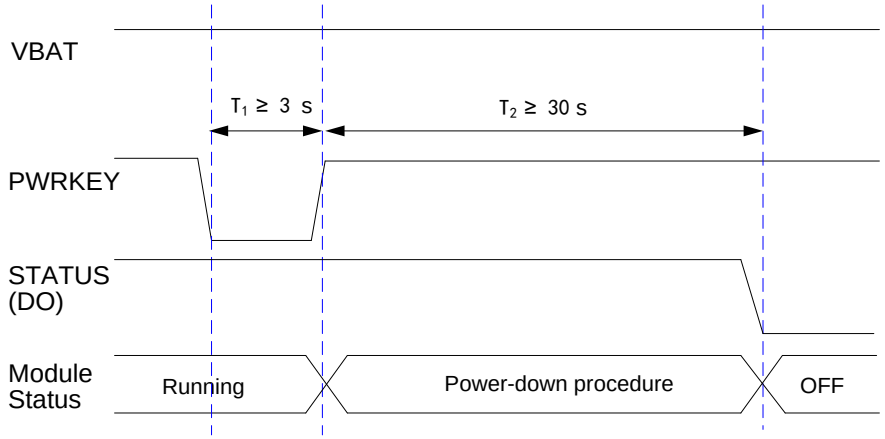


**Figure 10: Power-off Timing (EC200U Series)**

The power-off timing with PWRKEY of EC200x and EC2x series modules is illustrated in the table below.

**Table 8: Power-off Timing by PWRKEY on EC200x and EC2x Series**

| Module | $T_1$ | $T_2$ |
|---|---|---|
| EC200U Series | ≥ 3 s | ≥ 30 s |
| EC200T Series | ≥ 650 ms | ≥ 2 s |
| EC200S Series | ≥ 650 ms | ≥ 2 s |
| EC25 Series/EC21 Series/EC20-CE | ≥ 650 ms | ≥ 29.5 s |

#### 4.2.2.2.Turn off with AT Command

The module can also be safely turned off with **AT+QPOWD**, which is similar to turning off the module via PWRKEY pin. See ***documents [7]*** & ***[8]*** & ***[9]*** or more information about **AT+QPOWD**.

**NOTE**

1. To avoid damaging the internal flash, do not switch off the power supply when the module is working normally. Only after the module is shut down with PWRKEY or AT command, the power supply can be cut off.
2. When turning off module with the AT command, keep PWRKEY at high level after executing the command. Otherwise, the module will turn on again after being turned off.

## 4.3. Reset

Use RESET_N only in case of failure to turn off the module with **AT+QPOWD** or PWRKEY pin. A reference design for EC200x and EC2x series module reset signal circuit is presented in the figures below.

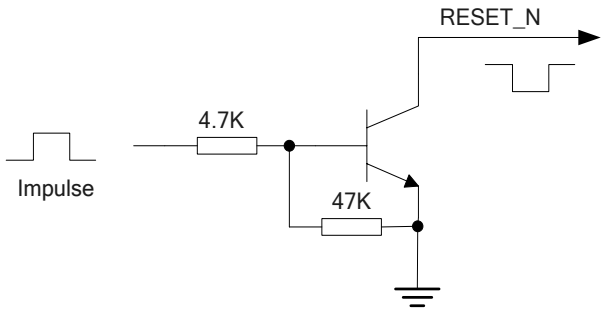


**Figure 11: Reset Signal Circuit**

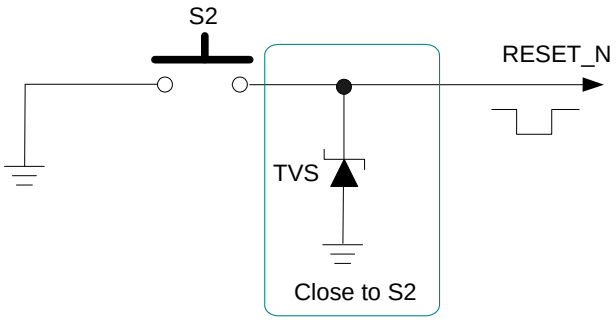


**Figure 12: Reset Signal Circuit with Push Button**

The reset scenario of EC200x and EC2x series modules are illustrated in the figures below.

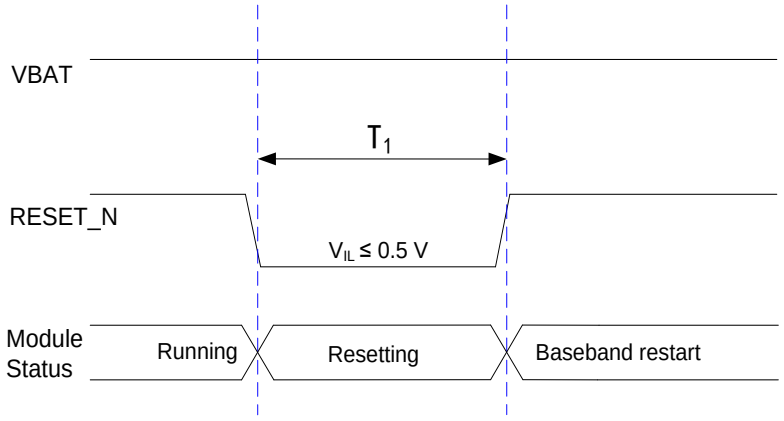


**Figure 13: Reset Timing (EC200x Series)**

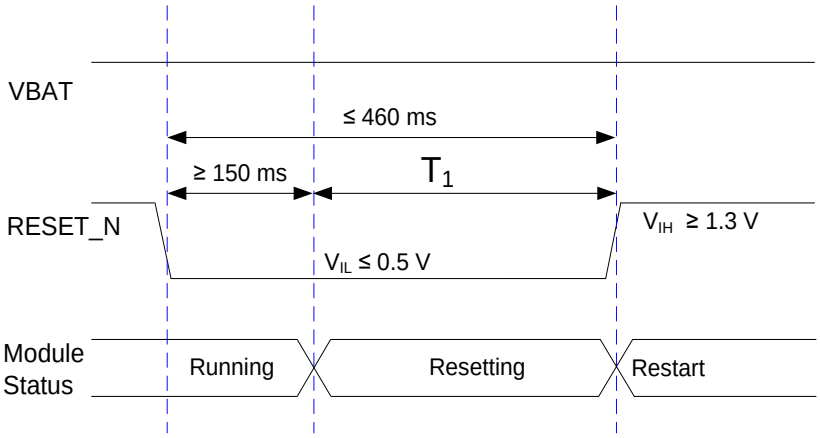


**Figure 14: Reset Timing (EC2x Series)**

The reset timing of EC200x and EC2x series modules is presented in the table below.

**Table 9: Reset Timing of EC200x and EC2x Series**

| Module | $T_1$ |
|---|---|
| EC200U Series | ≥ 100 ms |
| EC200T Series | ≥ 300 ms |
| EC200S Series | ≥ 300 ms |
| EC25 Series/EC21 Series/EC20-CE | 150 ms ≤ $T_1$ ≤ 460 ms |

**NOTE**

1. EC200x series RESET_N pin only resets the baseband chip inside the module, and does not reset the power management chip. EC20-CE series RESET_N pin can reset the power management chip.
2. When the RESET_N pin on EC200S series and EC200T series modules is pulled down, the baseband chip is in the reset state, and the chip system restarts after the pin is released.
3. Ensure that the load capacitance does not exceed 10 nF on PWRKEY and RESET_N pins.

## 4.4. (U)SIM Interface

(U)SIM interface of EC200x and EC2x series module meets ETSI and IMT-2000 requirements. Both 1.8 V and 3.0 V (U)SIM cards are supported. The reference design of the (U)SIM interface with an 8-pin (U)SIM card connector is presented in the figure below.

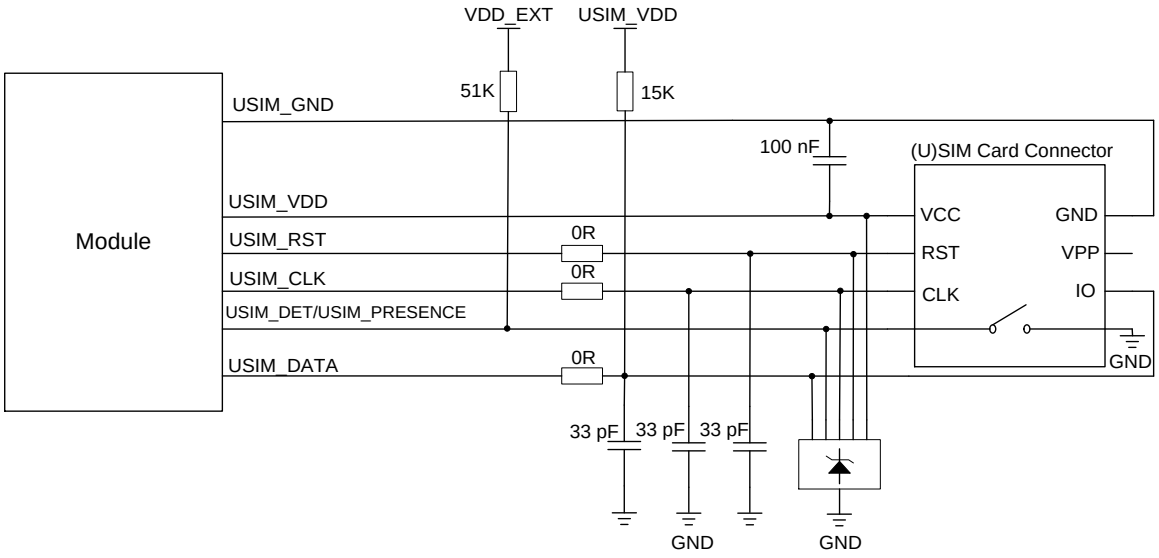


**Figure 15: Reference Design of (U)SIM Interface with an 8-Pin (U)SIM Card Connector**

If (U)SIM card detection function is not needed, please keep USIM_DET/USIM_PRESENCE unconnected. The reference design of (U)SIM interface with a 6-pin (U)SIM card connector is presented in the figure below.

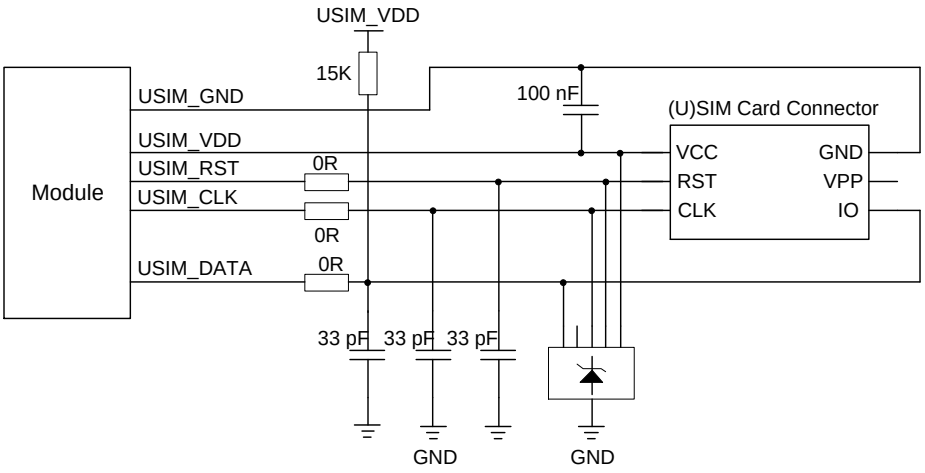


**Figure 16: Reference Design of (U)SIM Interface with a 6-Pin (U)SIM Card Connector**

## 4.5. USB Interface

EC200x and EC2x series modules contain one integrated Universal Serial Bus (USB) interface that complies with USB 2.0 specification, supports high-speed (480 Mbps) and full-speed (12 Mbps) modes.

The USB interface of these modules can only be a slave device and is used for AT command communication, data transmission, GNSS NMEA sentence output [9], software debugging and firmware upgrading.

The USB interface should be reserved for firmware upgrading in customers' design. The reference design of USB interface is presented in the figure below.

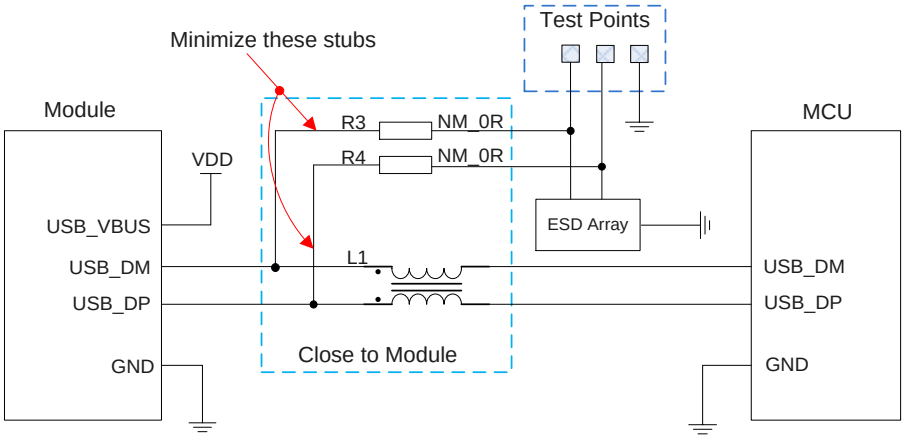


**Figure 17: USB Interface Implementation**

[9] The USB interface does not support GNSS NMEA sentence output for EC200x series modules.

A common mode choke L1 should be added in series between the module and your MCU to suppress EMI spurious emission. 0 Ω resistors (R3 and R4) should be added in series between the module and the test points to facilitate debugging, since the resistors are not mounted by default. To ensure USB data signal integrity, L1, R3 and R4 components must be placed close to the module, and R3 and R4 resistors should be placed close to each other, as well. Stubs should be avoided on all traces if possible, if not, they must be as short as possible.

## 4.6. PCM and I2C Interfaces

EC200x and EC2x series modules support one PCM interface for audio applications and one I2C interface.

Reference design of EC200T series, EC200S series and EC2x series PCM and I2C interfaces with external codec IC is presented below.

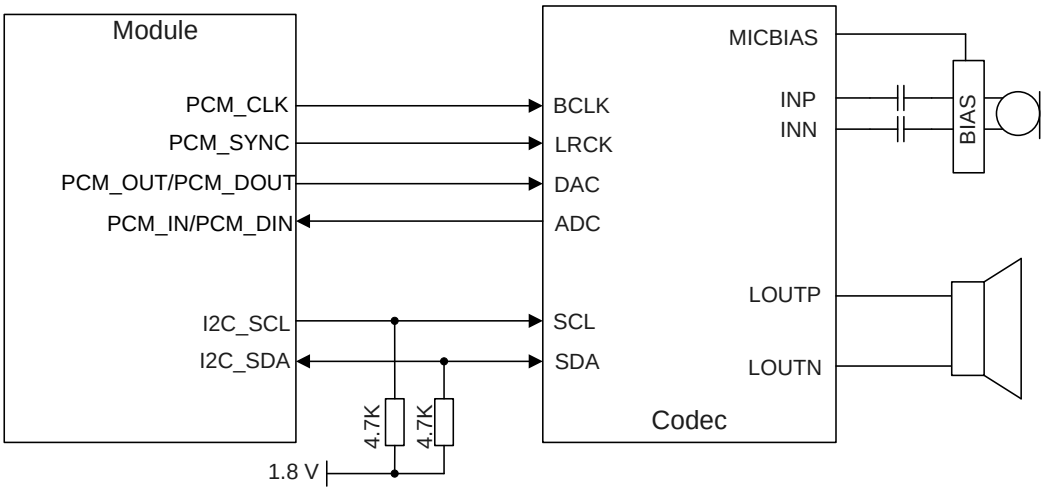


**Figure 18: Reference Design of PCM and I2C Application with Audio Codec**

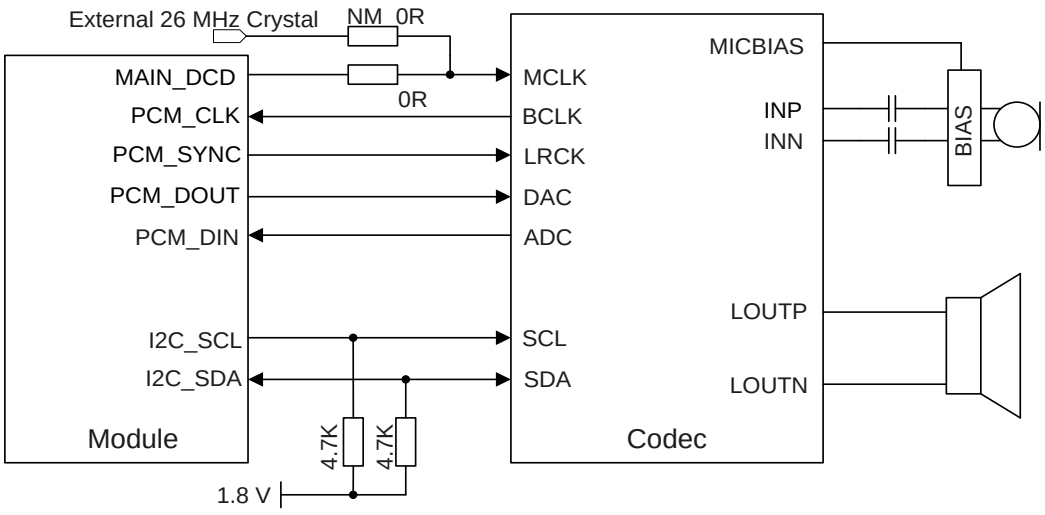


**Figure 19: Reference Design of PCM and I2C Application with Audio Codec (EC200U Series)**

**NOTE**

1. Reserve RC (R = 22 Ω, C = 22 pF) circuits on PCM traces, especially for PCM_CLK, and close to codec.
2. EC200T series, EC200S series and EC2x series modules are I2C master devices. EC200U series can only be used as master devices, not slave devices.

## 4.7. UART Interfaces

EC200x and EC2x series modules support one main UART and one debug UART interface. (EC200U series also supports an auxiliary UART interface.)

The main UART interface can be used for data transmission and AT command communication. In addition, it supports RTS and CTS hardware flow control.

For EC200T and EC200S series module, the debug UART interface supports 115200 bps baud rate. (EC200U series only supports 921600 bps baud rate.) It is used for partial log output. For EC2x series, the debug UART interface can also be used for Linux console and log output.

EC200x and EC2x series modules have a 1.8 V UART interface. A voltage-level translator should be used if a customers' application has a 3.3 V UART interface. Voltage-level translator TXS0108EPWR provided by *Texas Instrument* is recommended. The voltage-level translator reference design with IC is presented below.

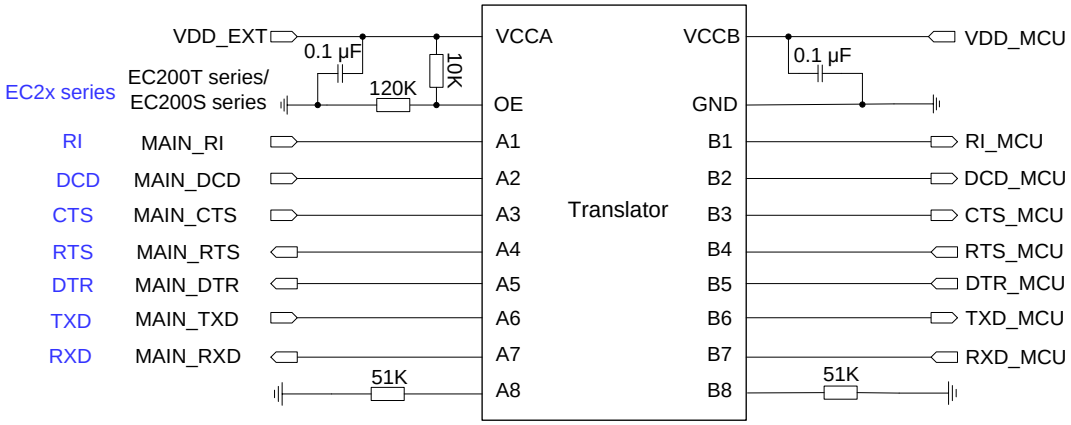


**Figure 20: Voltage-level Translator Reference Design with IC (EC200T/EC200S Series)**

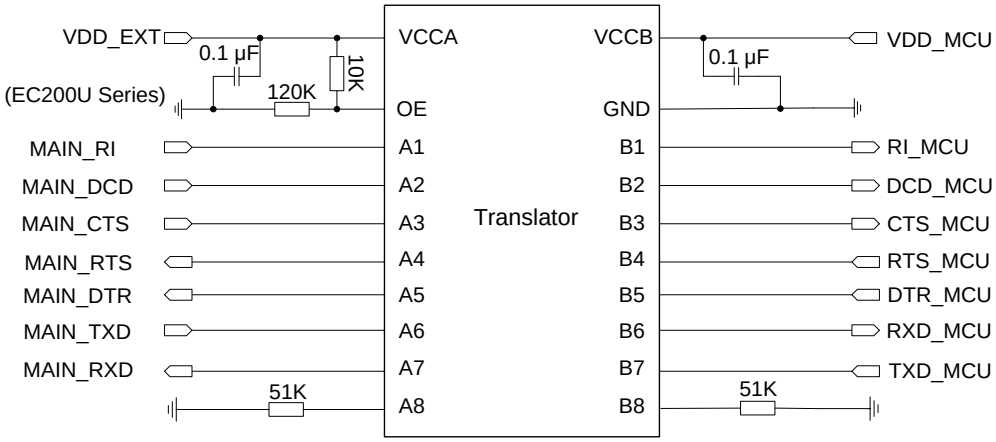


**Figure 21: Voltage-level Translator Reference Design with IC (EC200U Series)**

Visit http://www.ti.com for more information.

Another example of a voltage-level translator reference design with transistor is shown below. The reference design of the two signals presented in solid lines also applies to the other signals presented in dotted lines (the signals are presented in dotted lines to simplify the illustration). Please pay attention to signal directions.

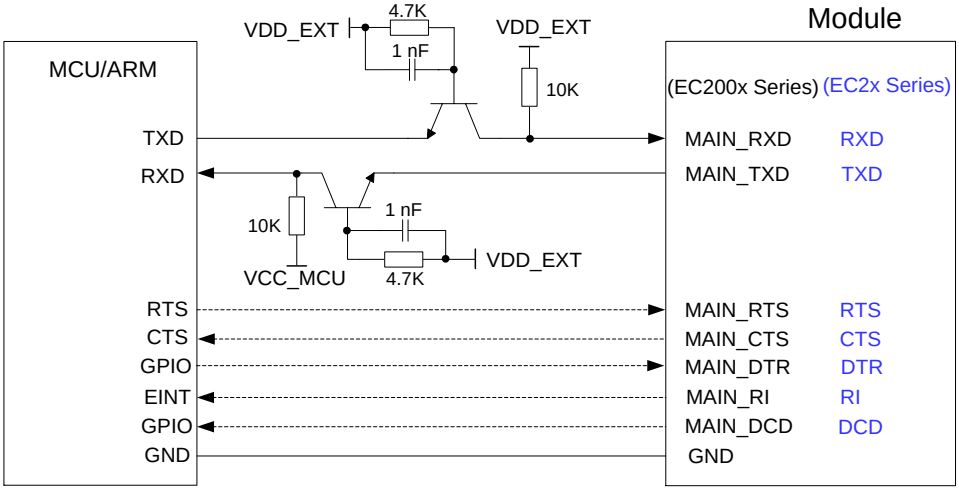


**Figure 22: Voltage-level Translator Reference Design with Transistors**

**NOTE**

1. The solution implementing transistor circuit is not suitable for applications with high baud rate exceeding 460 kbps.
2. Please note that the module CTS is connected to the host CTS, and the module RTS is connected to the host RTS.

## 4.8. Antenna Interfaces

### 4.8.1. RF Antenna Interface

The ANT_MAIN pins on EC200x and EC2x series modules are compatible. The impedance of RF antenna interface is 50 Ω. For better RF performance, a π-type matching circuit should be reserved, and the π-type matching components should be placed as close to the antenna as possible.

In addition to supporting the main antenna, EC200U series also supports the Wi-Fi Scan & Bluetooth antenna. The two functions cannot be used simultaneously because they share the same antenna interface. And Wi-Fi scan only supports reception. A reference design of ANT_MAIN and ANT_BT/WIFI_SCAN is shown below. A π-type matching circuit should be reserved for better RF performance. The capacitors are not mounted by default.

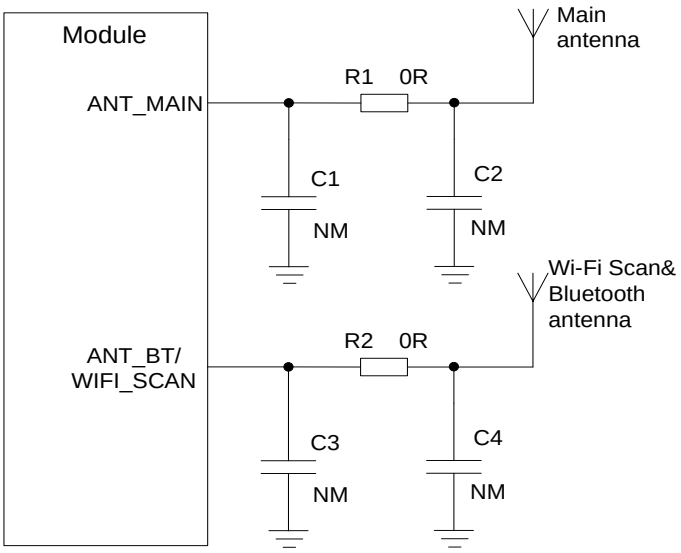


**Figure 23: Reference Design of RF Antenna Interface (EC200U Series)**

EC200T series and EC2x series modules support Rx-diversity function via ANT_DIV interface. A reference design for ANT_DIV antenna interface of EC200T series and EC2x series modules is shown below.

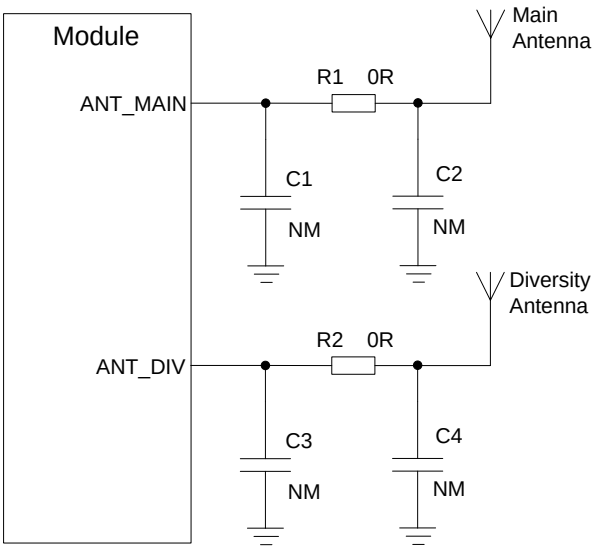


**Figure 24: Reference Design of RF Antenna Interface (EC200T & EC2x Series)**

EC200S series supports main antenna and Wi-Fi scan antennas. They share the same antenna interface (except for EC200S-EN, which does not support Wi-Fi scan antenna. A reference design of ANT_MAIN is shown below.

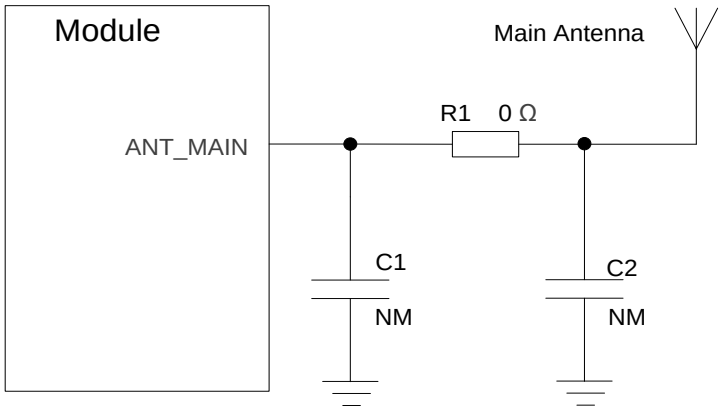


**Figure 25: Reference Design of RF Antenna Interface (EC200S Series)**

**NOTE**

1. To improve receiving sensitivity, it is necessary to ensure the proper distance between the main antenna and the Bluetooth receiving antenna/Rx-diversity antenna.
2. Place the π-type matching components (R1 & C1 & C2 and R2 & C3 & C4) as close to the antenna as possible.

### 4.8.2. GNSS Antenna Interface

EC200U series, EC25 series, EC21 series, and EC20-CE modules support GNSS antenna, with ANT_GNSS pin provided. A reference design of ANT_GNSS antenna interface of EC2x series is shown below.

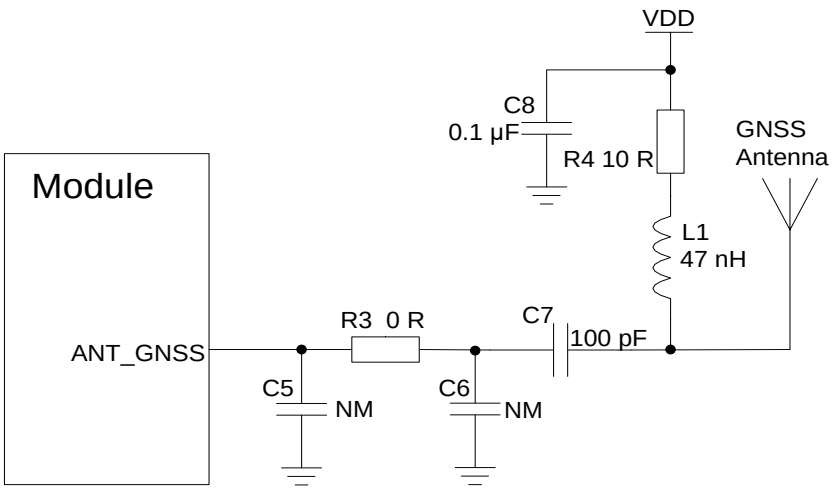


**Figure 26: Reference Design of GNSS Antenna Interface (EC200U & EC2x Series)**

EC200S-CN with built-in GNSS function can support the active GNSS antenna and passive GNSS antenna. The power supply voltage range of the external active antenna is 2.8–4.3 V, and the typical value is 3.3 V.

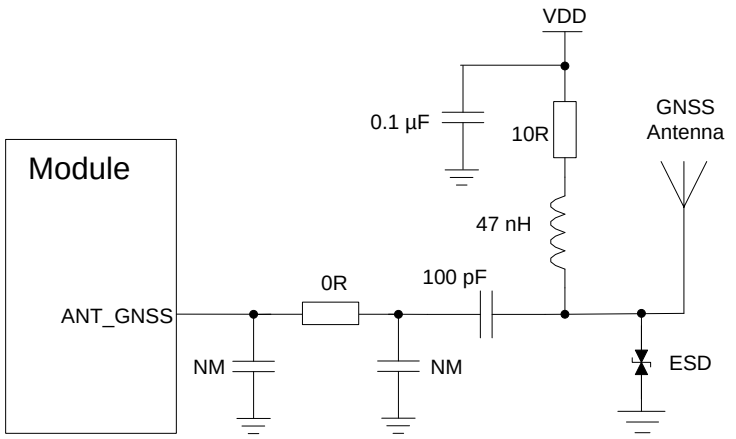


**Figure 27: Active GNSS Antenna Reference Design**

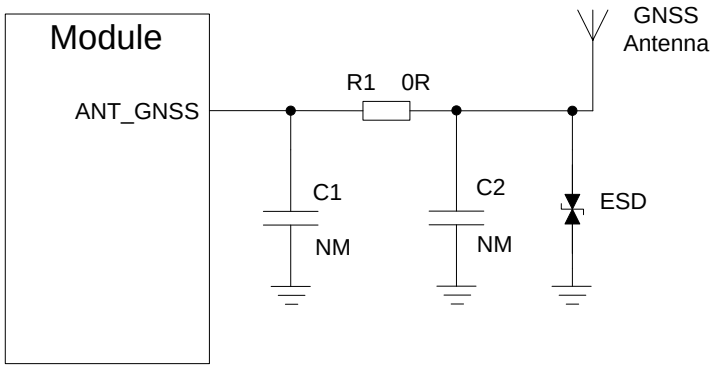


**Figure 28: Passive GNSS Antenna Reference Design**

It is recommended to reserve C1, R1 and C2 for adjusting antenna impedance. C1 and C2 are not mounted by default, and R1 is only mounted with a 0 Ω resistor. The impedance of the RF trace should be controlled at about 50 Ω, and the trace should be as short as possible.

**NOTE**

1. An external LDO can be selected to supply power according to the active antenna requirement.
2. If the module is designed with a passive antenna, then the VDD circuit is not needed.
3. For EC200S series, the junction capacitance of antenna interface ESD device should be less than 0.05 pF.

# 5 Recommended Footprints

The recommended compatible footprint of EC200x and EC2x series modules is shown in the following figure. All dimensions are in mm, and the dimensional tolerances are ±0.2 mm unless otherwise specified.

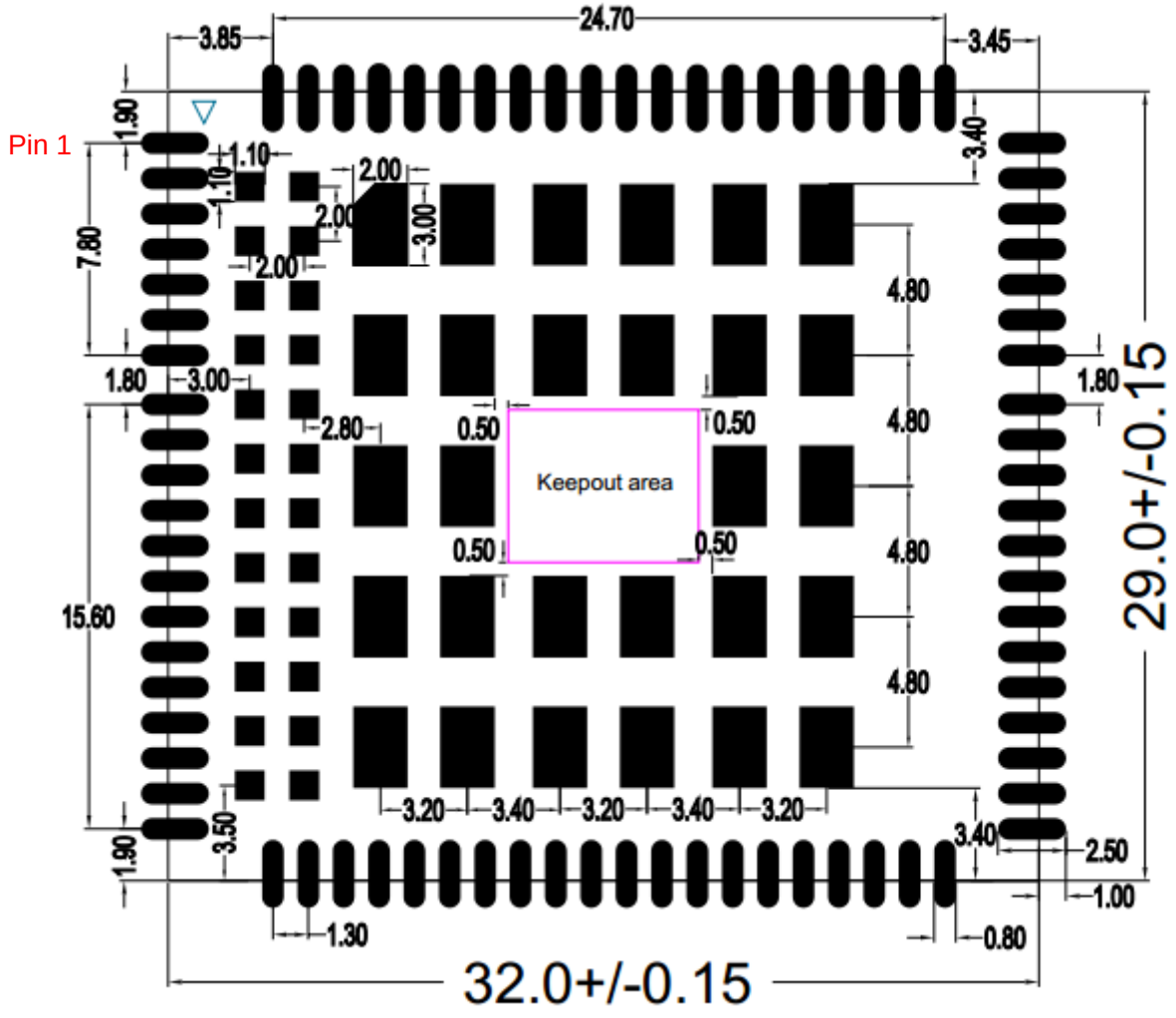


**Figure 29: Recommended Compatible Footprint (EC200T & EC200S & EC2x Series)**

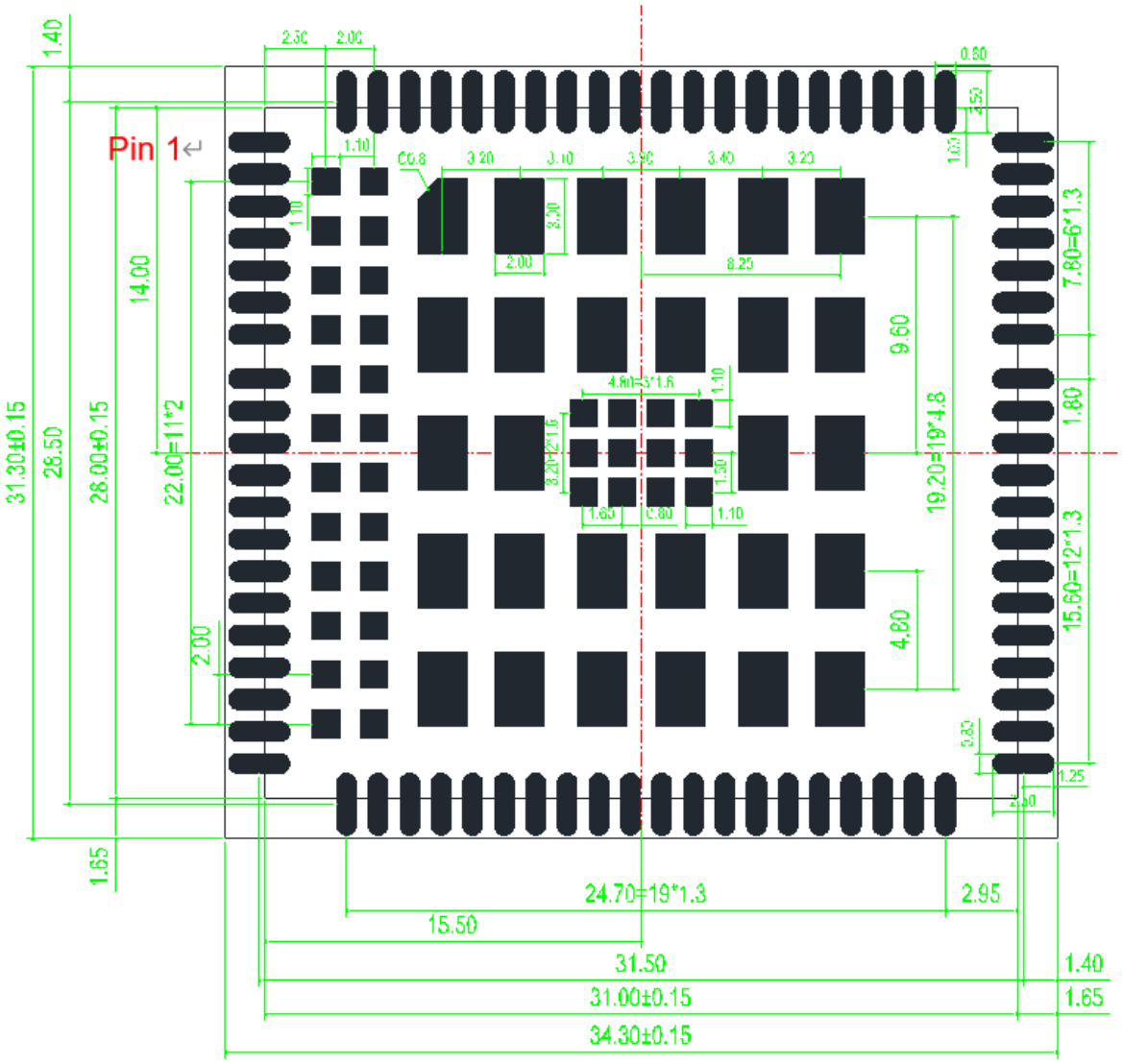


**Figure 30: Recommended Compatible Footprint (EC200U Series)**

If SGMII or Wi-Fi function (supported by EC2x series) is not needed, clear the keepout area for pins 117–140 in the compatible design. The recommended compatible footprint without SGMII or Wi-Fi function is presented in the figure below.

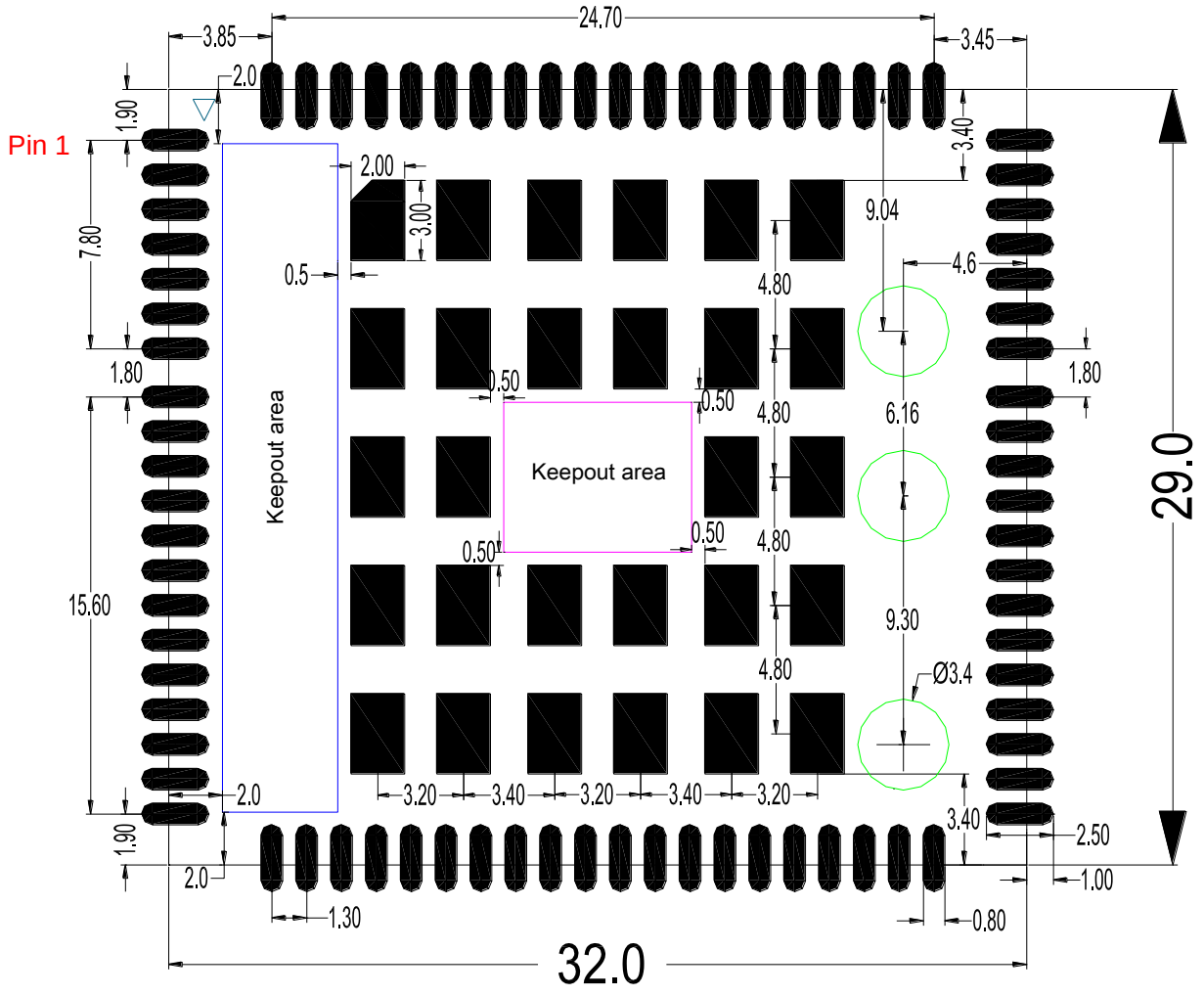


**Figure 31: Recommended Compatible Footprint Without SGMII or Wi-Fi Function**

**NOTE**

1. Do not design the keepout area marked in purple. In addition, clear the keepout area marked in blue for pins 117–140 if SGMII or Wi-Fi function is not needed.
2. For convenient module maintenance, keep about 3 mm between the module and other components in the motherboard.

# 6 Appendix References

**Table 10: Related Documents**

| Document Name |
|---|
| [1] Quectel_EC200U_Series_Hardware_Design |
| [2] Quectel_EC200T_Series_Hardware_Design |
| [3] Quectel_EC200S_Series_Hardware_Design |
| [4] Quectel_EC25_Series_Hardware_Design |
| [5] Quectel_EC21_Series_Hardware_Design |
| [6] Quectel_EC20_R2.1_Hardware_Design |
| [7] Quectel_ECx00U&EGx00U_Series_AT_Commands_Manual |
| [8] Quectel_EC200x&EG912Y&EC600S_Series_AT_Commands_Manual |
| [9] Quectel_EC2x&EG9x&EG2x-G&EM05_Series_AT_Commands_Manual |
| [10] Quectel_EC200U_Series_Reference_Design |
| [11] Quectel_EC200T_Series_Reference_Design |
| [12] Quectel_EC200S_Series_Reference_Design |
| [13] Quectel_EC25_Reference_Design |
| [14] Quectel_EC21_Reference_Design |
| [15] Quectel_EC20_R2.1_Reference_Design |

**Table 11: Terms and Abbreviations**

| Abbreviation | Description |
|---|---|
| bps | Bits Per Second |
| CDMA | Code-Division Multiple Access |
| CTS | Clear to Send |
| DCS | Data Coding Scheme |
| DFOTA | Delta Firmware Upgrade Over-The-Air |
| DL | Downlink |
| DTR | Data Terminal Ready |
| EGSM | Enhanced GSM |
| EMI | Electromagnetic Interference |
| ESD | Electrostatic Discharge |
| EVDO | Evolution-Data Optimized |
| FDD | Frequency Division Duplex |
| Galileo | Galileo Satellite Navigation System (EU) |
| GLONASS | Russian Global Navigation Satellite System |
| GND | Ground |
| GNSS | Global Navigation Satellite System |
| GPIO | General Purpose Input/Output Pin |
| GPS | Global Positioning System |
| GRFC | Generic RF Control |
| GSM | Global System for Mobile Communications |
| HSPA | High Speed Packet Access |
| I2C | Inter-Integrated Circuit |
| IC | Integrated Circuit |

| | |
|---|---|
| I/O | Input/Output |
| LCC | Leadless Chip Carrier |
| LCD | Liquid Crystal Display |
| LDO | Low-dropout Regulator |
| LGA | Land Grid Array |
| LTE | Long Term Evolution |
| MCU | Microcontroller Unit/Microprogrammed Control Unit |
| NMEA | NMEA (National Marine Electronics Association) 0183 Interface Standard |
| QZSS | Quasi-Zenith Satellite System |
| RF | Radio Frequency |
| RTS | Real-Time Clock |
| SDIO | Secure Digital Input/Output |
| SGMII | Serial Gigabit Media Independent Interface |
| SMS | Short Message Service |
| SPI | Serial Peripheral Interface |
| TDD | Time Division Duplexing |
| TD-SCDMA | Time Division-Synchronous Code Division Multiple Access |
| TVS | Transient Voltage Suppressor |
| UART | Universal Asynchronous Receiver/Transmitter |
| UL | Uplink |
| UMTS | Universal Mobile Telecommunications System |
| USB | Universal Serial Bus |
| (U)SIM | (Universal) Subscriber Identity Module |
| VDD | Drain Voltage |
| $V_{rwm}$ | Reverse Working Maximum Voltage |

| | |
|---|---|
| WCDMA | Wideband Code Division Multiple Access |
| Wi-Fi | Wireless Fidelity |
| WLAN | Wireless Local Area Network |