**Version：** V1.0

**Date：** 2023-08-23

# C2-M2X EVB
# User Manual

bynav 湖南北云科技有限公司
HUNAN BYNAV TECHNOLOGY CO.,LTD

# Revision History

| Edition | Content | Revised by | Release date |
|---|---|---|---|
| V1.0 | Initial | Y.ZHOU | 2023-08-23 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# CONTENT

# 1 Overview

For the convenience of users in testing M2 series modules, Bynav Technology can provide a complete C2-M2X EVB evaluation kit to facilitate the testing and use of M2 modules. This document provides a detailed introduction to the basic information of the C2-M2X EVB (evaluation board) and guides users on its proper use.

## 1.1 Product introduction

The C2-M2X EVB primarily consists of M20/M21/M22 modules, a 3.3V step-down circuit, a 5V boost circuit, RTC circuit, UTAR to USB circuit, RMII circuit, RF reception circuit, low-noise amplification circuit, and external interfaces. It is primarily used for testing various functions of the M20/M21/M22 modules and provides power and various interfaces for these modules. The C2-M2X EVB can be connected to a computer using a Type-C data cable and can also be used in conjunction with the BY6Vx carrier boards.

## 1.2 EVB Architecture

The C2-M2X EVB architecture block diagram is as follows:

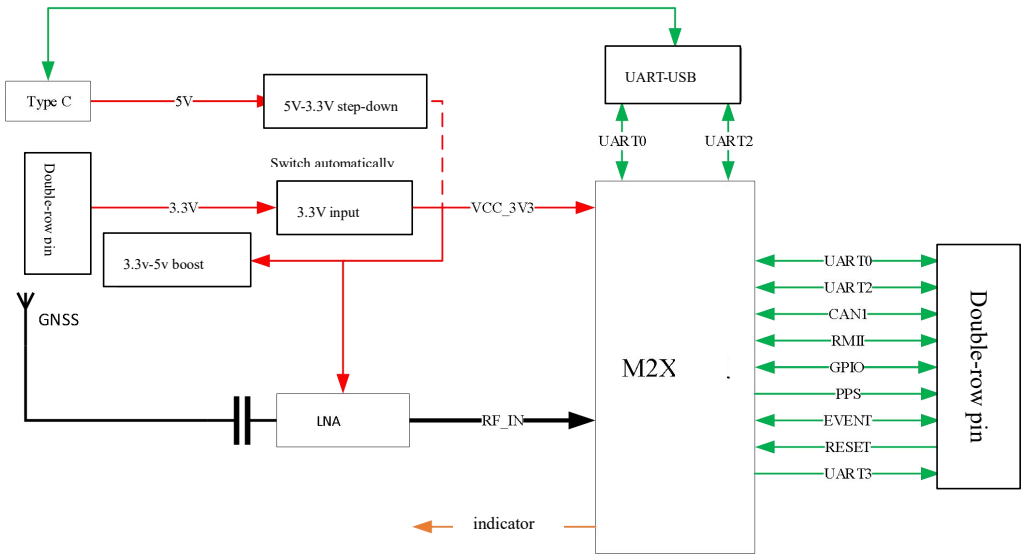



**Figure1-1 C2-M2X diagram**

## 1.3 Function

The functional module layout of C2-M2X EVB is as follows:

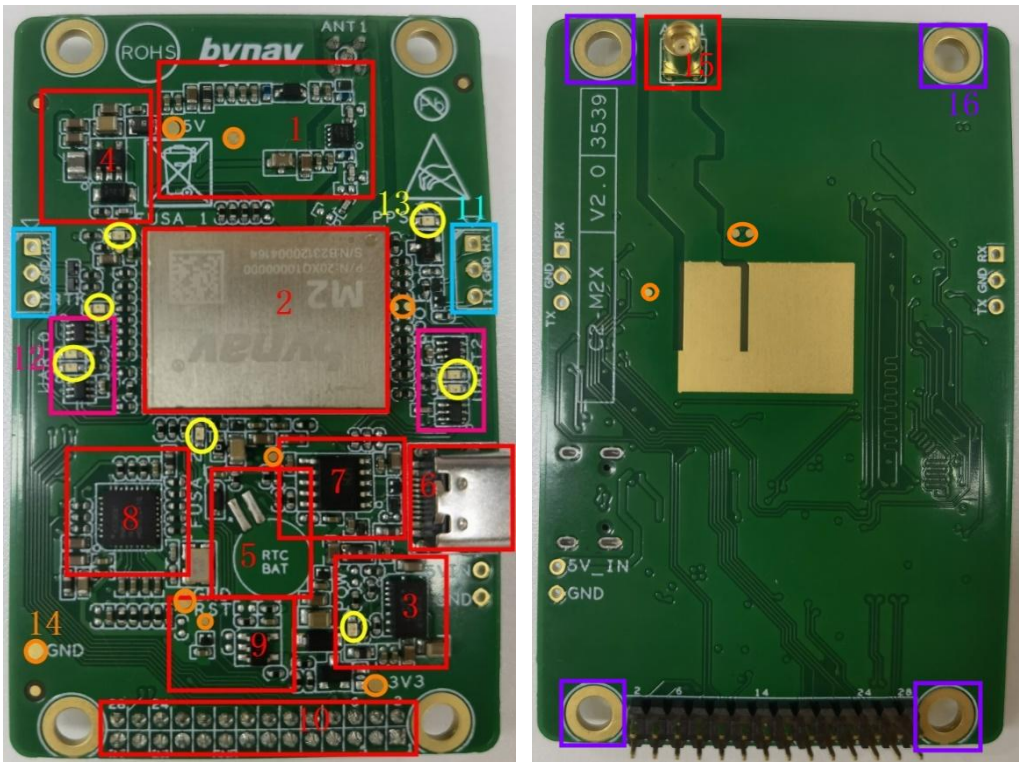



**Figure1-2 C2-M2X EVB**

1. RF Reception Circuit

2. M2X Module
3. 3.3V Step-Down Circuit
4. 5V Boost Circuit
5. RTC Circuit
6. Type-C Interface
7. UART to USB Circuit
8. RMII PHY Circuit
9. Reset Circuit
10. Dual Row Header Pins
11. Three-hole Pins
12. Analog Switch Circuit
13. LED Indicator Lights
14. Test Points
15. RF Connectors
16. Mounting Holes

## 1.4 EVB package

C2-M2X EVB mainly includes the following items:

- C2-M2X EVB
- Certificate of conformity
- RF converter cable

# 2 Hardware Introduction

## 2.1 C2-M2X EVB

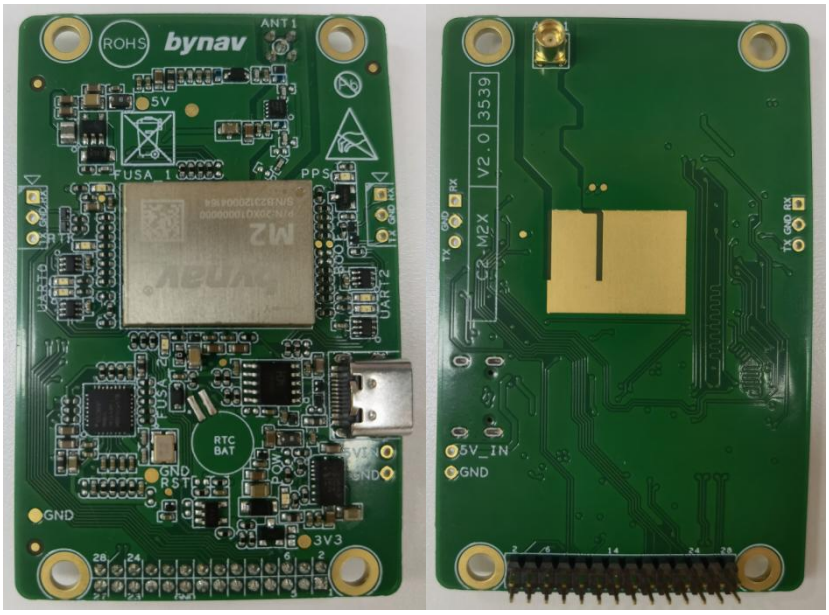



**Figure2-1 C2-M2X**

## 2.2 Power diagram

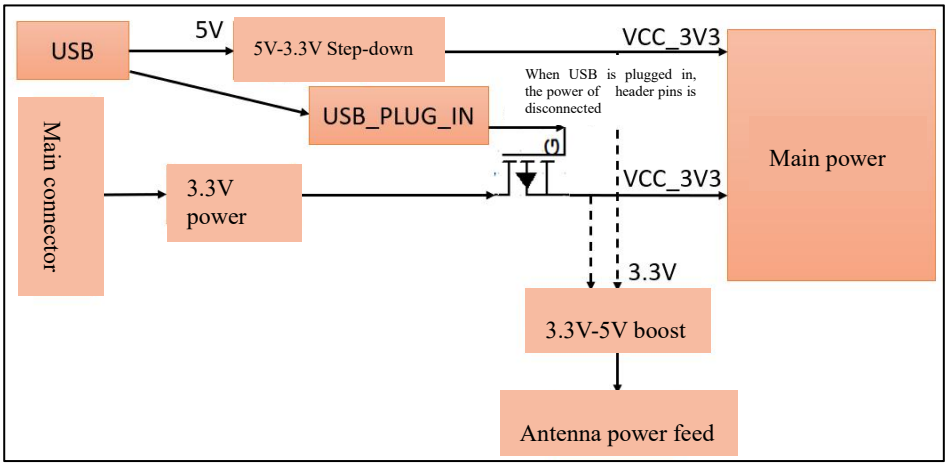



**Figure2-2 Power diagram**

# 3 Module Introduction

## 3.1 28pin connector

The C2-M2X external interface is led out through a 28-pin double row of pin header, with a pin spacing of 2mm.

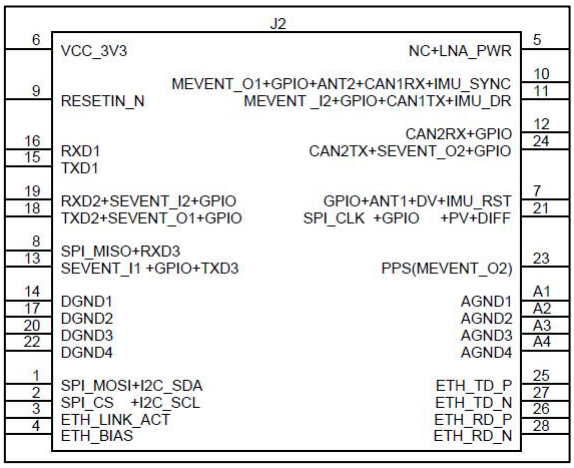




**Figure3-1 C2-M2X pin header**

**Table 3-1 C2-M2X Pin definition**

| No. | Pin | Type | Description | Comment |
|---|---|---|---|---|
| 1 | SPI_MOSI/I2C_SDA | I/O | SPI interface data output<br>I2C interface data | 3.3V LVTTL, leave it unconnected if not in use |
| 2 | SPI_CS/I2C_SCL | O | SPI interface chip select<br>I2C interface clock | 3.3V LVTTL, leave it unconnected if not in use |
| 3 | ETH_LINK_ACT | O | Ethernet connection indicator signal | 3.3V LVTTL, leave it unconnected if not in use |
| 4 | ETH_BIAS | O | Ethernet signal bias voltage | 3.3V LVTTL, leave it unconnected if not in use |
| 5 | - | / | | Not connected |
| 6 | VCC_3V3 | PWR | Power feed | +3.25V~+3.45V，Ripple＜50mV Vpp |
| 7 | GPIO/ANT1/DV/IMU_RST | I/O | ANT1: ANT1 indicator<br>GPIO：other<br>DV：heading success indicator, active high<br>IMU_RST：external IMU reset signal | 3.3V LVTTL, leave it unconnected if not in use |
| 8 | SPI_MISO/RXD3 | I | RXD3：COM3 serial input<br>SPI_MSIO：SPI input | 3.3V LVTTL, leave it unconnected if not in use |
| 9 | RESETIN_N | I | Reset input | Reset software, low-level active, reset signal width >10ms, leave it unconnected if not in use |
| 10 | MEVENT_O1/GPIO/CAN1RX/IMU_SYNC | I/O | IMU_SYNC：external IMU sync signal<br>MEVENT_O1：output pulse signal<br>GPIO：other<br>CAN1RX：CAN1 input | 3.3V LVTTL, leave it unconnected if not in use |
| 11 | MEVENT_I2/GPIO/CAN1TX/IMU_DR | I/O | MEVENT_I2：input external pulse signal<br>GPIO：other<br>CAN1TX：CAN1 output<br>IMU_DR：external IMU DR | 3.3V LVTTL, leave it unconnected if not in use |
| 12 | CAN2RX/GPIO | I/O | CAN2RX：CAN2 input<br>GPIO：other | 3.3V LVTTL, leave it unconnected if not in use |
| 13 | SEVENT_I1/GPIO / TXD3 | I/O | TXD3：COM3 serial output<br>SEVENT_I1：input external pulse signal<br>GPIO：other | 3.3V LVTTL, leave it unconnected if not in use |
| 14 | GND | PWR | signal and power ground | |
| 15 | TXD1 | O | COM1 serial output | 3.3V LVTTL, leave it unconnected if not in use |

| | | | | |
|---|---|---|---|---|
| 16 | RXD1 | I | COM1 serial input | 3.3V LVTTL, leave it unconnected if not in use |
| 17 | GND | PWR | signal and power ground | |
| 18 | TXD2/SEVENT_O1/GPIO | I/O | TXD2：COM2 serial output<br>SEVENT_O1：output pulse signal<br>GPIO：other | 3.3V LVTTL, leave it unconnected if not in use |
| 19 | RXD2/SEVENT_I2/GPIO | I/O | RXD2：COM2 serial input<br>SEVENT_I2：input external pulse signal<br>GPIO：other | 3.3V LVTTL, leave it unconnected if not in use |
| 20 | GND | PWR | signal and power ground | |
| 21 | SPI_CLK/GPIO/PV/DIFF | I/O | DIFF：differential data indicator<br>SPI_CLK：clock<br>GPIO：other<br>PV：position success indicator, active high | 3.3V LVTTL, leave it unconnected if not in use |
| 22 | GND | PWR | signal and power ground | |
| 23 | PPS | O | 1pps output | 3.3V LVTTL, by default width 1ms, leave it unconnected if not in use |
| 24 | CAN2TX/SEVENT_O2/GPIO | I/O | CAN2TX：CAN output<br>SEVENT_O2：output pulse signal<br>GPIO：other | 3.3V LVTTL, leave it unconnected if not in use |
| 25 | ETH_TD_P | I/O | 10M/100M Ethernet TX+ | Analog, connect to TD+, leave it unconnected if not in use |
| 26 | ETH_RD_P | I/O | 10M/100M Ethernet RX+ | Analog, connect to RD+, leave it unconnected if not in use |
| 27 | ETH_TD_N | I/O | 10M/100M Ethernet TX- | Analog, connect to TD-, leave it unconnected if not in use |
| 28 | ETH_RD_N | I/O | 10M/100M Ethernet RX- | Analog, connect to RD-, leave it unconnected if not in use |

Note 1：IO pin level is 3.3V LVTTL, drive capacity is 12mA, leave unconnected if not in use.

Note 2：TXD and RXD direction are defined for the dev board.

Note 3: "-"is reserved pin.

Note 4: "MEVENT_I2", "SEVENT_I1" and "SEVENT_I2" are EVENT_IN trigger, rising edge trigger, high level hold time must be more than 500ns, recommend to use "MEVENT_I2" with priority.

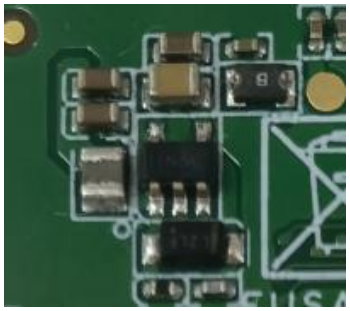
Note 5: "MEVENT_O1", "SEVENT_O1" and "SEVENT_O2" are EVENT_OUT trigger, recommend to use "MEVENT_O1" with priority.

## 3.2 Power input

After applying input power to C2-M2X EVB and passing through power filtering, it can supply power to the M20/M21/M22 modules and their peripheral circuits. Additionally, the 3.3V to 5V boost circuit provides power to external antennas.

### 3.2.1 5V DCDC boost circuit

The 3.3V power input goes through a DC-DC boost chip to output 5V voltage, providing power to the antenna.



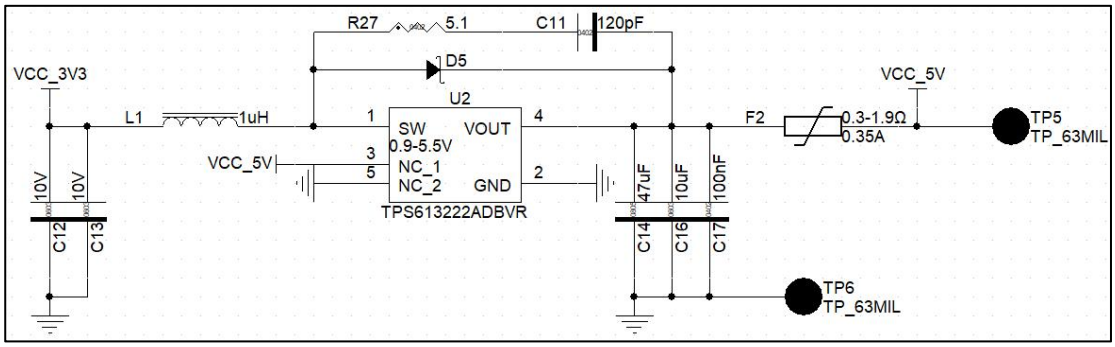



**Figure3-2 5V boost circuit**

### 3.2.2 3.3V step-down circuit

The Type-C interface inputs 5V voltage to power the C2-M2X EVB through a 3.3V step-down circuit.

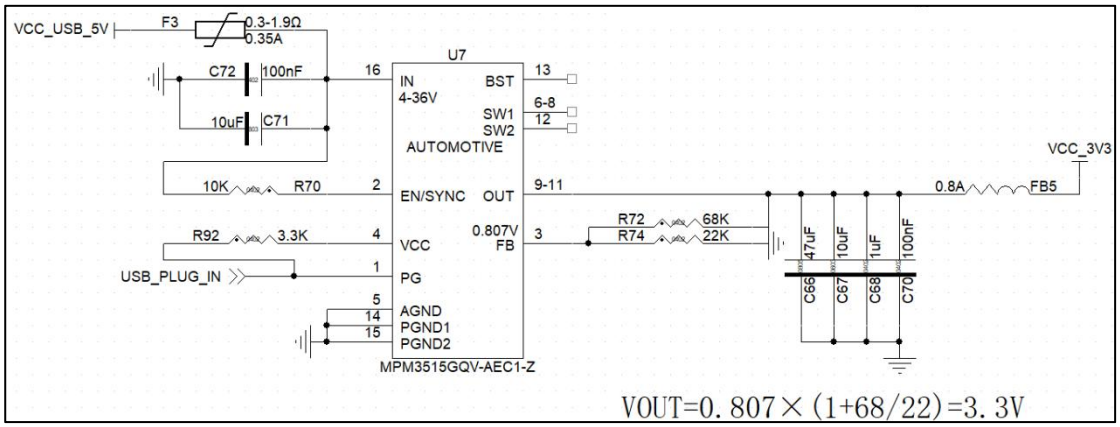



**Figure3-3 3.3V step-down circuit**

### 3.2.3 RTC circuit

When using C2-M2X EVB for a hot start, backup power needs to be supplied to the module.

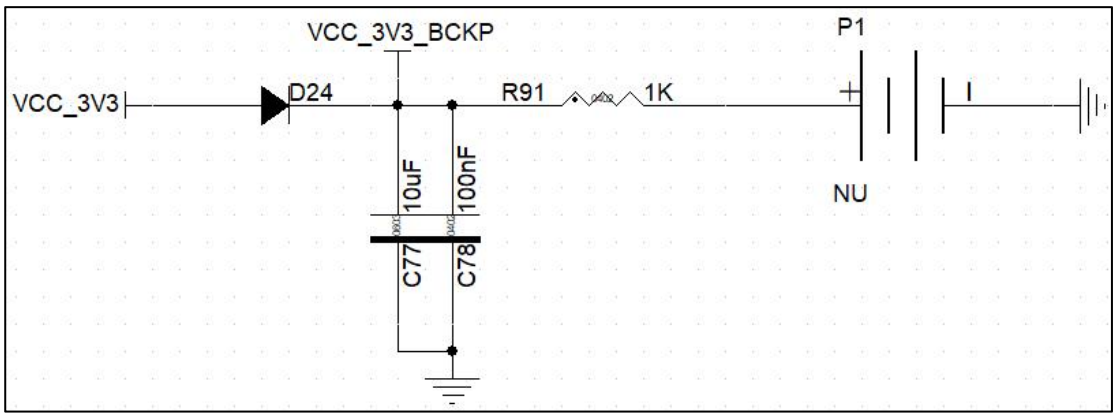



**Figure3-4 RTC circuit**

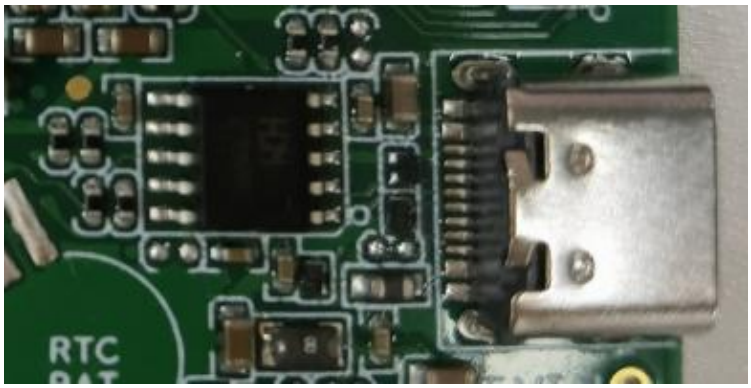
Important Notes:

The V_3V3_BCKP power supply is typically provided by a battery.

The battery charging circuit should be designed with reverse protection to ensure that the battery only powers VCC_3V3_BCKP and does not backflow into the 3.3V power domain, as shown in Figure D24.

## 3.3 UART-USB circuit

The evaluation board features a Type-C interface as the power and communication interface, enabling communication through a UART to USB circuit.



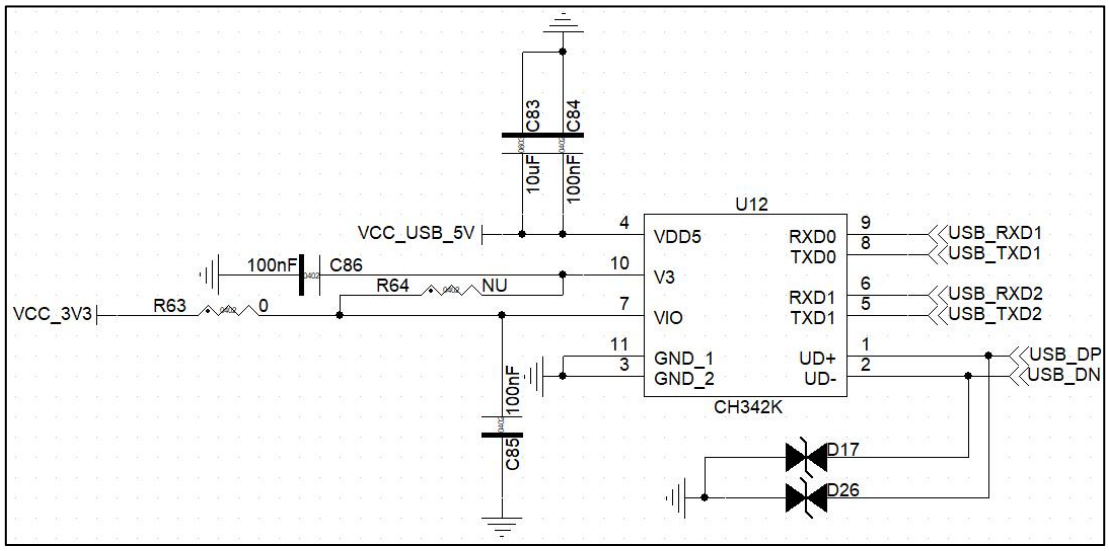
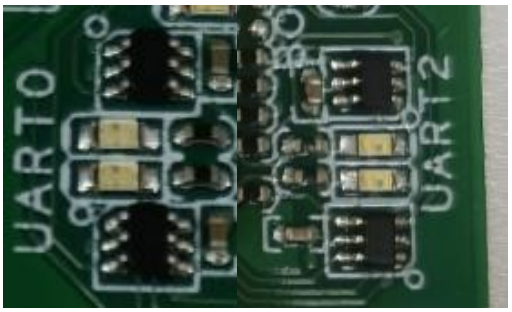



**Figure3-5 UART-USB module**

## 3.4 Analog switch

C2-M2X EVB is equipped with four analog switches. When USB is disconnected, the M2X module's serial port is connected to the header pins. When USB is connected, the M2X module's serial port switches to USB, disconnecting from the header pins.



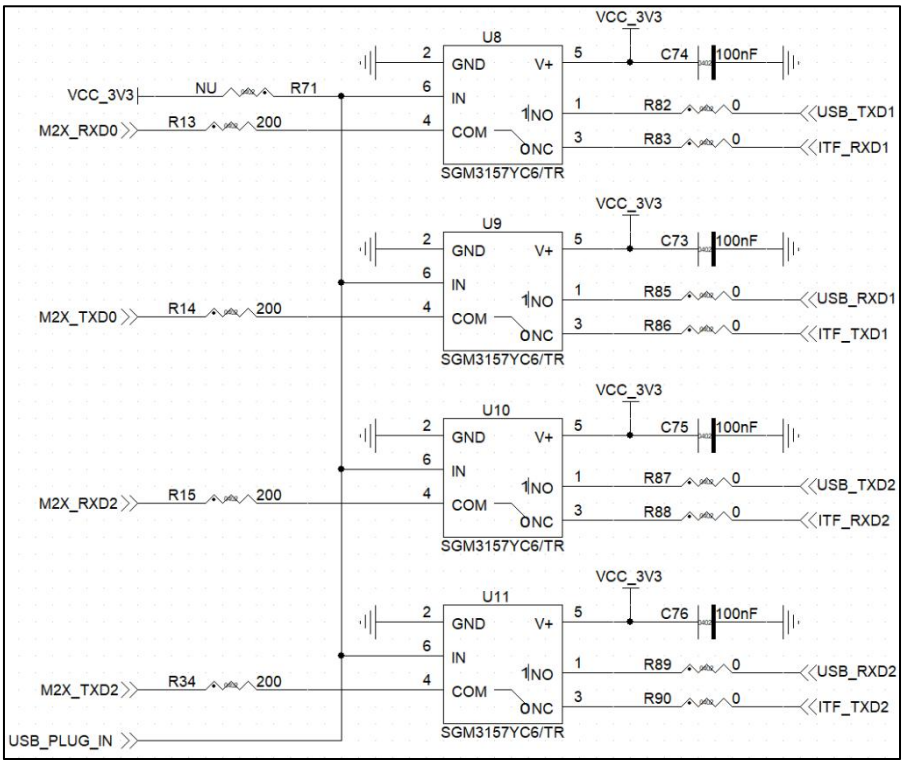



**Figure3-6 analog switch circuit**

## 3.5 M20/M21/M22 module

The evaluation board uses M20/M21/M22 modules with the following characteristics:

- 22nm process GNSS SOC chip Alice
- Deeply coupled integrated navigation (DR accuracy up to 0.2%)
- Full-system, full-frequency GNSS (1507 channels)
- L-BAND satellite-based enhancement
- Support NRTK/PPP/PPP-RTK/CLAS
- Anti-interference and anti-spoofing
- AEC-Q104


**Figure3-7 M20/M21/M22 module**

## 3.6 RMII PHY

C2-M2X EVB features an Ethernet PHY circuit, which can be used for network interface interactions.

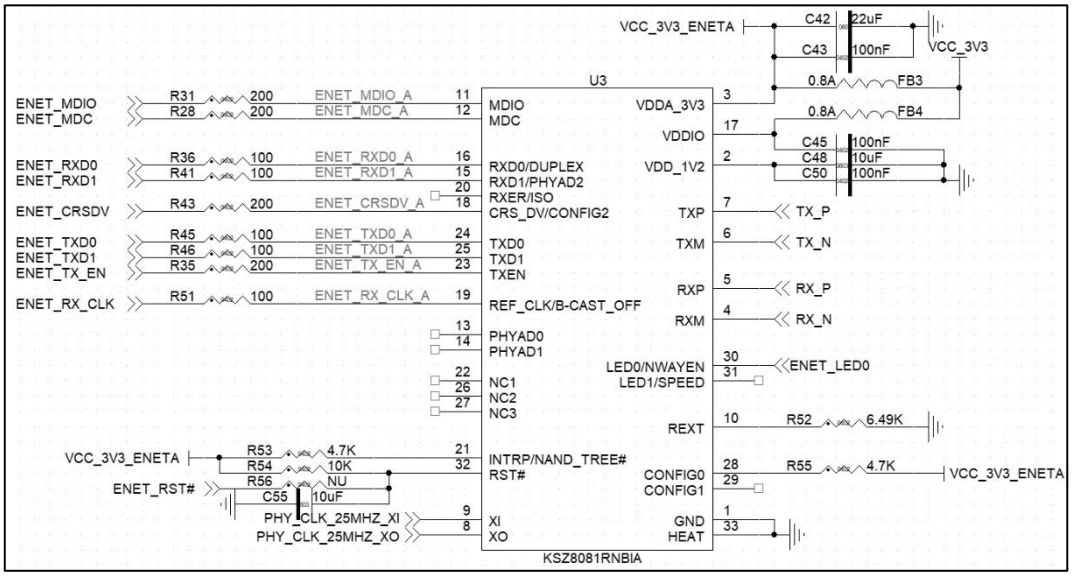



**Figure3-8 RMII PHY circuit**

## 3.7 RF reception circuit

### 3.7.1 Antenna feeding Circuit

3.7.1 Antenna Feeding Circuit

After the power supply input goes through reverse protection and a secondary LC filter circuit, it provides power to the antenna. The RF signal, after passing through a DC-blocking capacitor, is then input into the M20/M21/M22 modules.

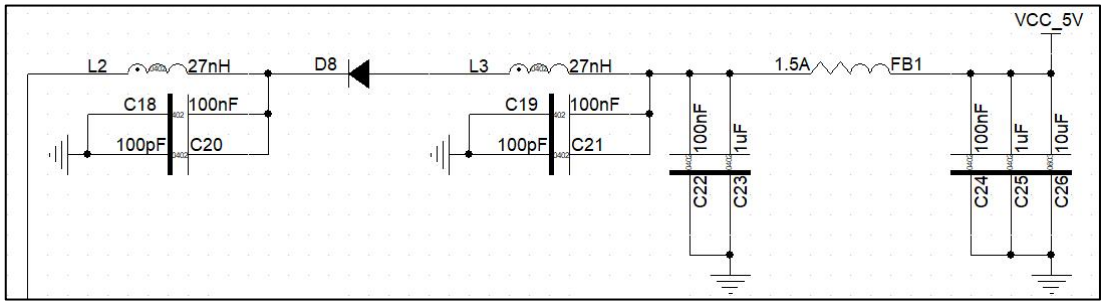



**Figure3-9 Antenna Feeding Circuit**

### 3.7.2 Low-noise amplification circuit

C2-M2X EVB has a low-noise amplification circuit that can amplify the input RF signal.

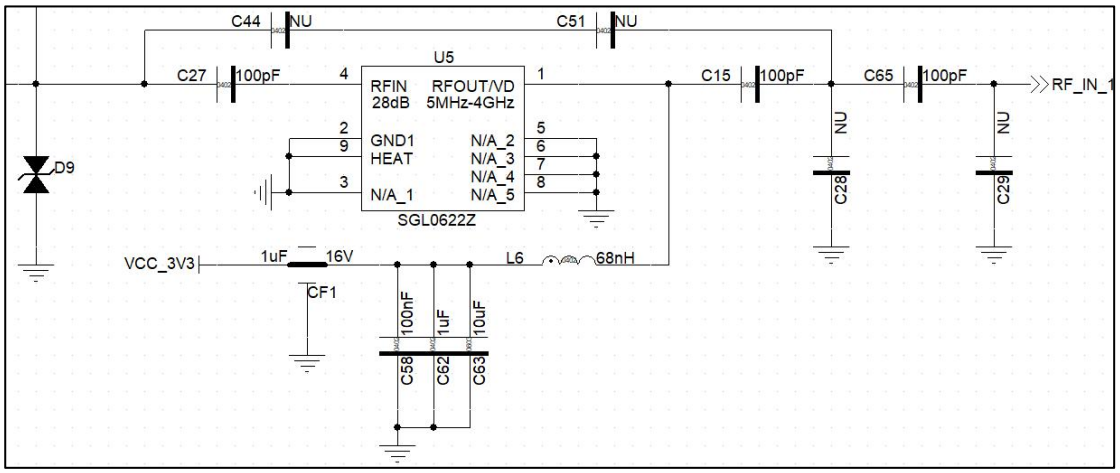
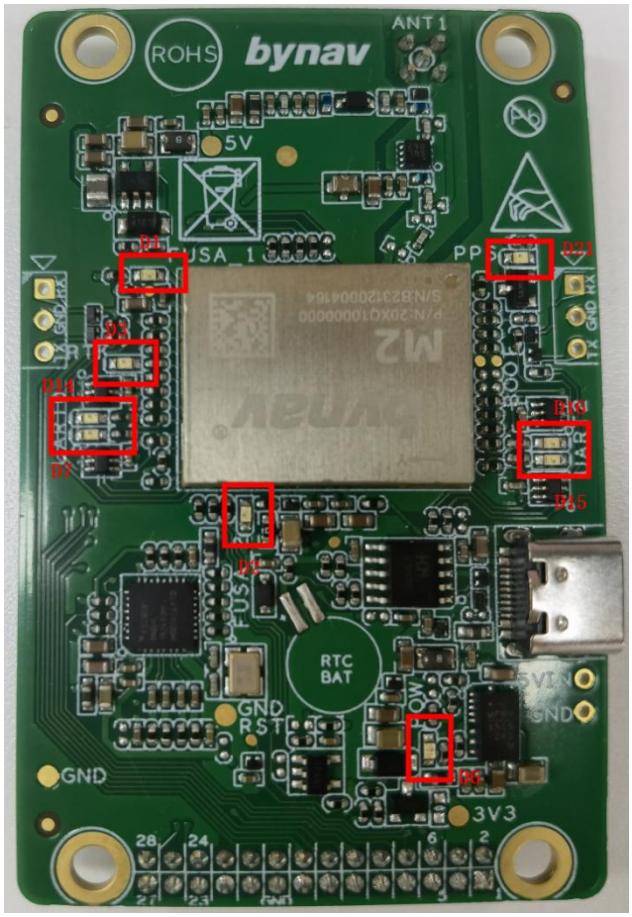



**Figure3-10 low-noise amplification circuit**

## 3.8 LED indicators

C2-M2X EVB is equipped with LED indicator lights to indicate the

operational status of various functional units.



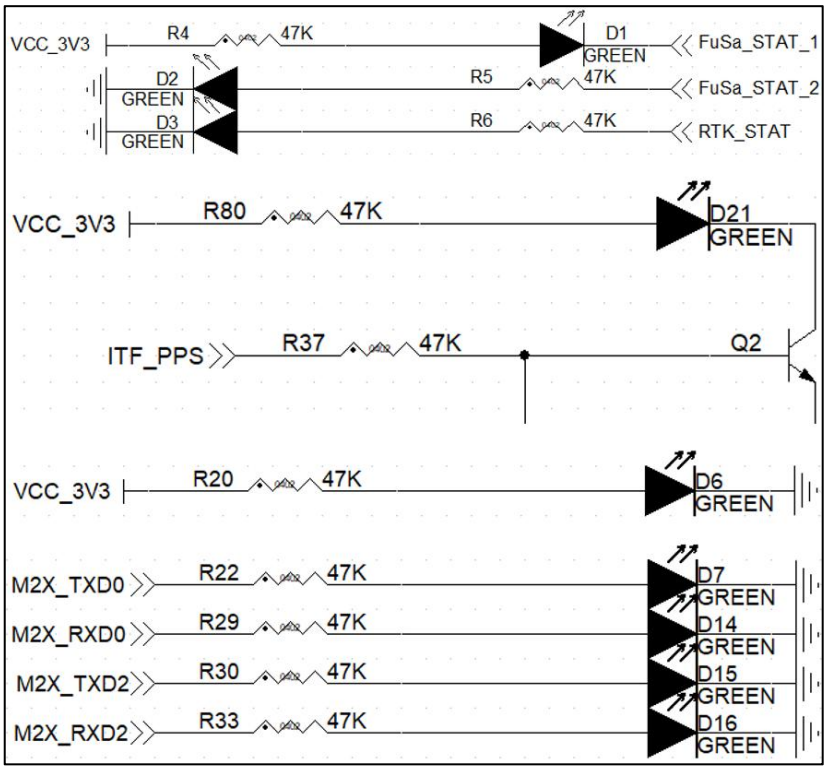



**Figure3-11 LED indicator**

**Table 3-2 Indicator description**

| Indicator | Color | Description |
|---|---|---|
| Power indicator（3.3V） | Green | When the power supply is normal, the indicator remains on. |
| UART indicator | Green | When the serial port is in operation, the indicator remains on. |
| PPS indicator | Green | During normal operation, the indicator blinks. |
| FuSa indicator | Green | If D1 is constantly on and D2 is constantly off--abnormality in operation.<br>If D1 is constantly off and D2 is constantly on--abnormality in operation.<br>If both D1 and D2 are constantly off, it enters a safe state.<br>If both D1 and D2 are constantly on, it is operating normally. |
| RTK indicator | Green | The module blinks when it enters RTK fixed solution. |

# 4 Operation guide

## 4.1 Powering On

(1) The C2-M2X EVB can be powered directly via Type-C. The Type-C interface on the board serves both power supply and serial communication functions. Simply connect the Type-C port on the module to your computer using a Type-C USB cable to power it on.

(2) The C2-M2X EVB can be connected to the BY6Vx carrier board through a 28-pin header. Power the BY6Vx carrier board with a 12V DC power supply and turn on the 3.3V switch to power it on.

## 4.2 USB Driver Installation

Before starting to use, it's necessary to install the USB driver program CH340/341 (please download it online, recommended link: https://www.wch.cn/download/CH341SER_EXE.html ). Make sure to install or update the driver tool to the latest version.

Once the installation is completed, you'll be able to see two COM ports recognized in the Device Manager, as shown in the following image:

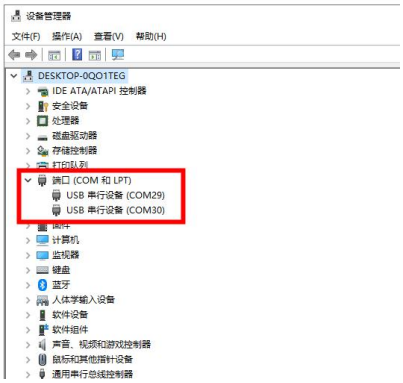



**Figure4-1 Two COM ports recognized in Device Manager**

## 4.3 Connection and Use

The GNSS antenna should be installed in a stable, unobstructed area. If using it indoors, ensure that the antenna's RF signal can penetrate indoors. Connect the antenna to the C2-M2X development board using RF coaxial cable and use a Type-C data cable to connect the C2-M2X to external communication devices. If powered through the BY6Vx carrier board, provide DC 12V power to the BY6Vx carrier board, press the 3.3V switch, and connect the serial and Ethernet ports on the carrier board to external communication devices.

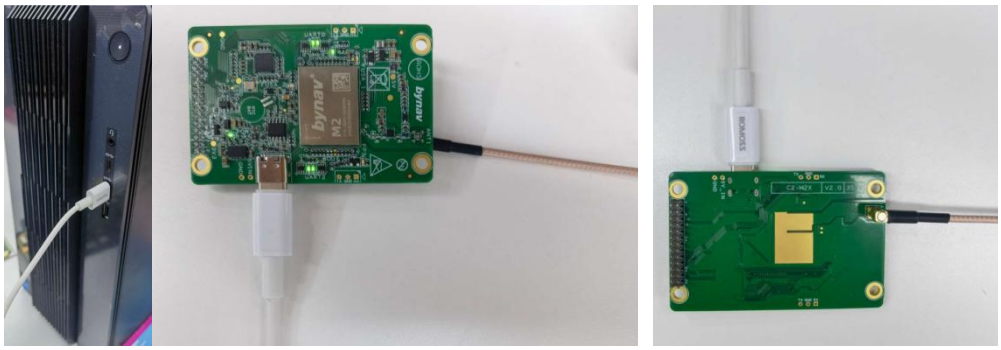


**Figure4-2 Device connection**

# 5 Precautions

## 5.1 Precautions

C2-M2X EVB is suitable for laboratory or engineering development environments. Before starting any operations, please read the following precautions:

1. Under no circumstances should performing the hot-plugging on the development board's interfaces or the carrier boards.
2. To prevent electrostatic discharge (ESD) from damaging the development board hardware, take necessary anti-static measures before unpacking and installing the development board.
3. When handling the development board, hold it by the edges and avoid touching exposed metal parts to prevent ESD damage to the board components.
4. Place the C2-M2X development board on a dry, flat surface to keep it away from heat sources, electromagnetic interference sources, radiation sources, and electromagnetic radiation-sensitive equipment (e.g., medical devices).

## 5.2 Common Troubleshooting

1. Serial Communication Issues: Check if the power supply voltage is correct. Verify that the USB cable or the serial cable of the L-shaped carrier board is properly connected. Ensure that the USB driver is installed and up to date. Verify if the serial indicator lights on the development board are functioning correctly.Check the software for the correct serial port selection and baud rate.
2. No Satellite Reception:Confirm if the antenna selection is correct. Check for excessive attenuation before the development board. Verify the correctness of the firmware version.