HARDWARE

USER MANUAL

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UM68X Series Modules Evaluation Board

Revision History

Version	Revision History	Date
R1.0	First Release.	Nov., 2025

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Foreword

This manual provides information on the hardware composition and design of Unicore UM68X series EB (Evaluation Board).

Target Readers

This document is written for technicians who are familiar with GNSS modules.

Contents

1 Introduction

This manual introduces Unicore UM68X series EB (Evaluation Board) and applies to:

- UM681A-12-EB
- UM680A-12-EB
- UM680A-13-EB
- UM681-12-EB
- UM680-12-EB

For the information of each module, refer to the corresponding user manual.

The EB consists of the following parts:

- positioning module
- a 3.3V LDO (Low Dropout Regulator)
- a 5V DC/DC boost circuit
- an antenna detection circuit
- peripheral interfaces

1.1 Block Diagram

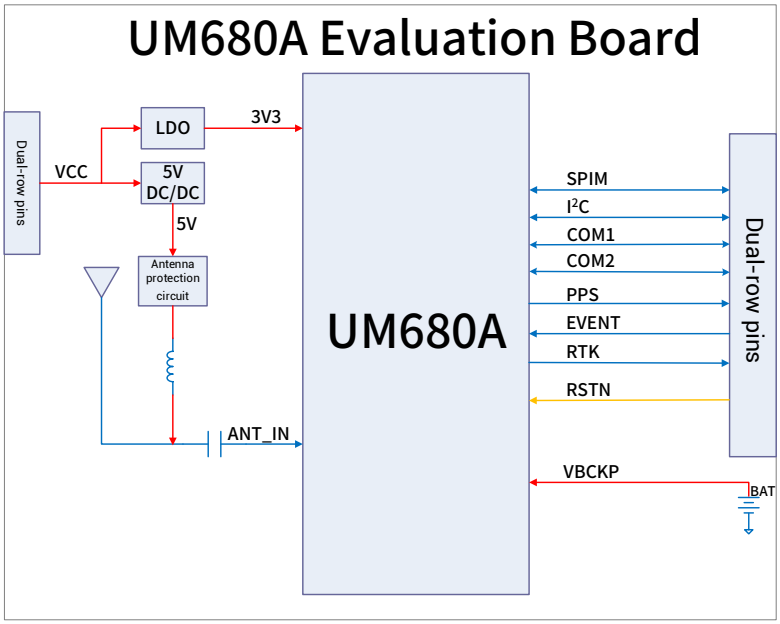


Figure 1-1 UM680A EB Block Diagram[1]

[1] UM680A, hardware version V1.1 and above, supports antenna detection and SPIM. I²C and EVENT

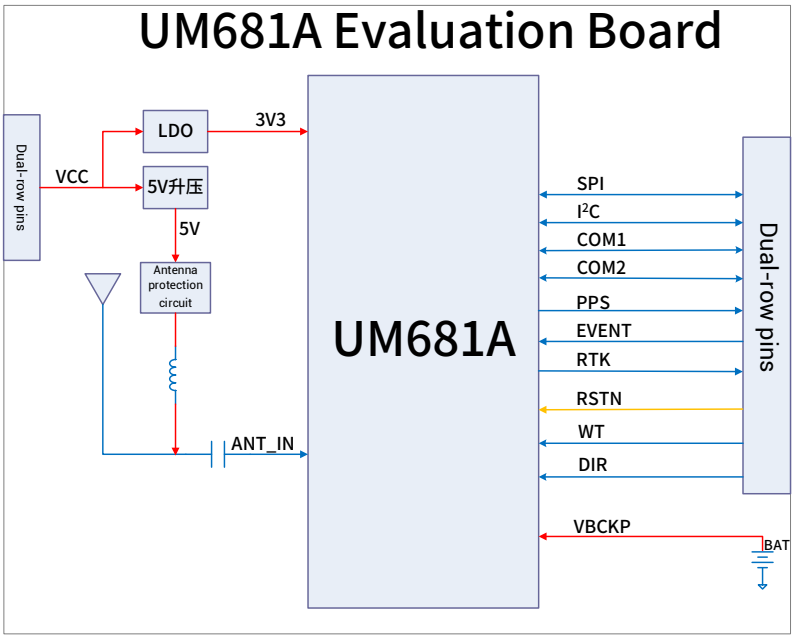


Figure 1-2 UM681A EB Block Diagram[2]

interfaces are not supported.

[2] UM681A, hardware version V1.1 and later, supports antenna detection. I²C and EVENT interfaces are not supported.

1.2 Appearance

The appearance of the EB is shown as the figure below.

Figure 1-3 Top View

(1) Silkscreen: It marks the signals of the pins. The smaller holes around are used to mount the module socket. The printing adopts exposed copper to ensure the flatness of the surface.

(2) Positioning module: The pin pads are designed long, which is convenient for soldering, testing and debugging. For detailed packaging information, please refer to the PCB document.

(3) PPS connector: To measure the PPS signal, solder an MMCX connector here.

(4) LED indicators: Indicating the status of the power supply, reset, antenna short circuit, the positioning status and UART.

☞ To facilitate testing, the dimensions of the module's functional pin pads on the EB are extended outside the module package boundary.

☞ This design applies only to testing scenarios and is not recommended to be directly used in mass production or formal product design.

☞ For formal product design, the dimensions and layout of the pin pads need to be optimized in accordance with SMT process requirements to ensure optimal manufacturability and reliability.

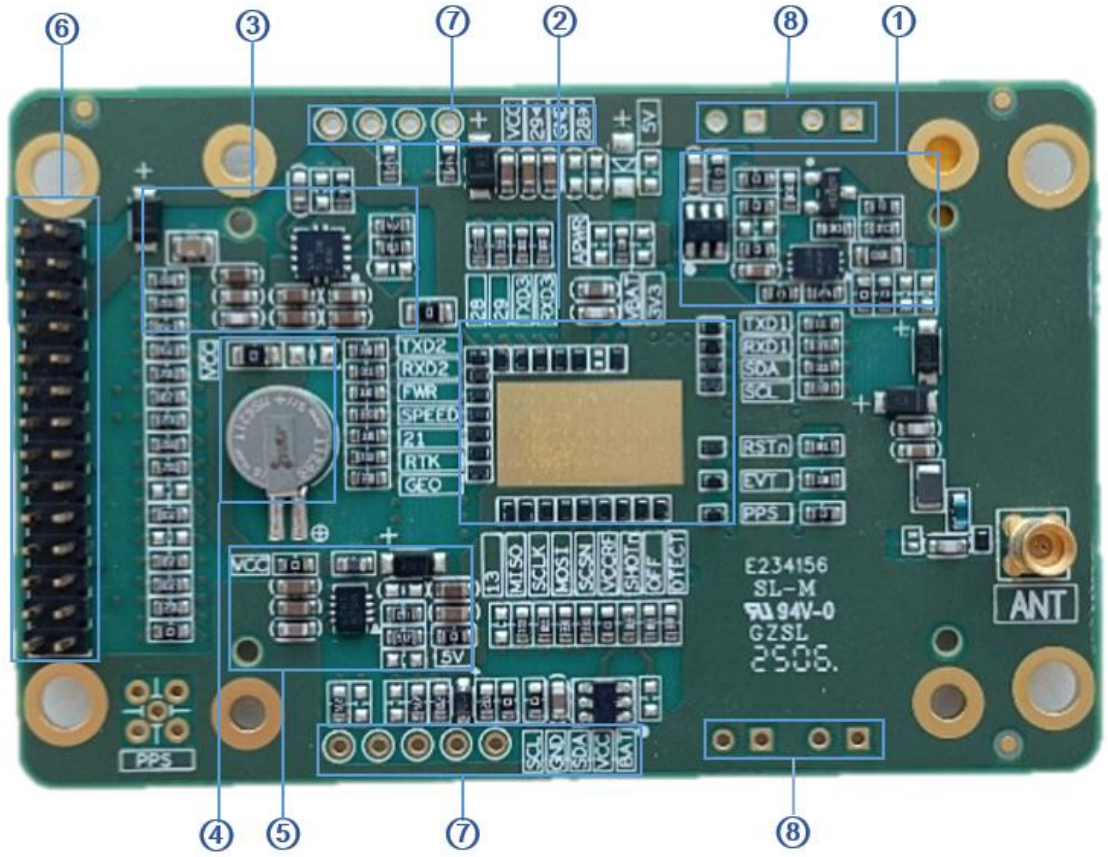


Figure 1-4 Bottom View

(1) External antenna detection circuit [3]

(2) ESD protection and exposed copper thermal dissipation

(3) VCC power supply and LDO voltage regulator circuit

(4) Backup battery

(5) 5 V antenna feed DCDC boost circuit

(6) Dual-row pins as external interfaces

(7) Debug ports

(8) Ports used to connect jumpers

[3] Supported by hardware version V1.1 and above.

2 Interfaces

The dual-row 28 pins serve as the external interfaces of the EB, and the pin pitch is 2 mm.

The interfaces can be directly connected to the J18 on Unicore HPL EVK-V5.0 board.

☞ The availability of the ports depends on the model of the module and its firmware. Refer to 1.1Block Diagram and the corresponding user manuals for more information about the supported ports.

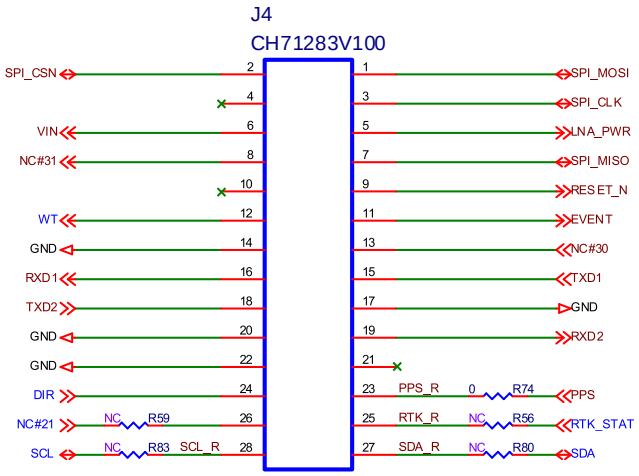


Figure 2-1 Interfaces

Table 2-1 Interfaces Description

No.	Pin Name	I/O	Description
1	SPIM_MOSI	O	Master out/slave in.
2	SPIM_CSN	O	SPI master chip select.
3	SPIM_CLK	O	SPI master clock.
4	NC	—	No connection inside.
5	LNA_PWR	I	Antenna feed voltage for LNA.
6	VIN	I	Main power supply.
7	SPIM_MISO	I	Master in/slave out.
8	RSV	—	Reserved. Leave floating.
9	RESET_N	I	System reset, active low. The active time should be no less than 5 ms.
10	NC	—	No connection inside. Leave floating.
11	EVENT[4]	I	Event input with adjustable frequency and polarity.
12	WT	I	The odometer speed pulse input pin on the UM681A/UM681 supports a maximum pulse frequency of 5 kHz, with a minimum pulse width greater than 100 μs. On the UM680A/UM680, this pin is left floating.

[4] Reserved interface and not supported.

No.	Pin Name	I/O	Description
13	RSV	—	Reserved. Leave floating.
14	GND	—	Ground.
15	TXD1	O	UART1 output; LVTTL.
16	RXD1	I	UART1 input; LVTTL.
17	GND	—	Ground.
18	TXD2	O	UART2 output; LVTTL.
19	RXD2	I	UART2 input; LVTTL.
20	GND	—	Ground.
21	RSV	—	Reserved. Leave floating.
22	GND	—	Ground.
23	PPS	O	Pulse per second with adjustable pulse width and polarity.
24	DIR	I	The odometer direction input pin on the UM681A/UM681: High level = forward; Low level = reverse. On UM680A/UM680, this pin is left floating.
25	RTK_STAT[5]	O	RTK Positioning Indicator (active-high): high when RTK fixed solution is valid; low otherwise (including other positioning modes or no fix).
26	RSV	—	Reserved. Leave floating.
27	SDA[6]	I/O	I²C Data.
28	SCL[6]	I/O	I²C Clock.

[5] Reserved interface and not supported.

[6] I²C is a reserved interface and not supported.

3 Power Supply

The power supply of the EB is input from the VIN pin, passing through a circuit with surge protection and filter capacitors, to provide power for the 3.3 V LDO circuit and 5 V DC/DC boost circuit.

The input range of VIN is 3.2 V to 5 V.

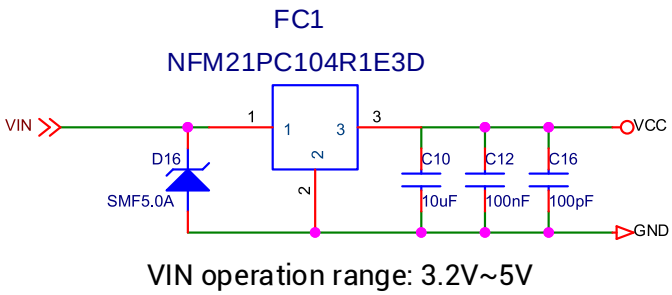


Figure 3-1 Power Filter Circuit

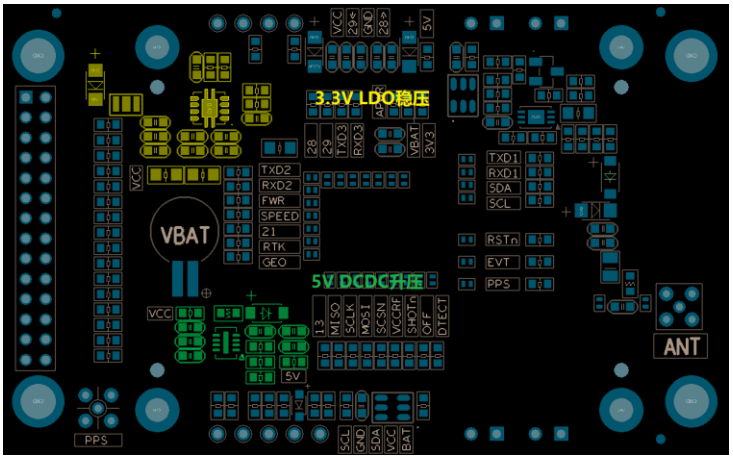


Figure 3-2 3.3 V LDO and 5 V DC/DC on the Bottom

3.1 3.3 V LDO Power Supply

VCC outputs 3.3 V voltage after passing through the LDO circuit to provide power to the EB.

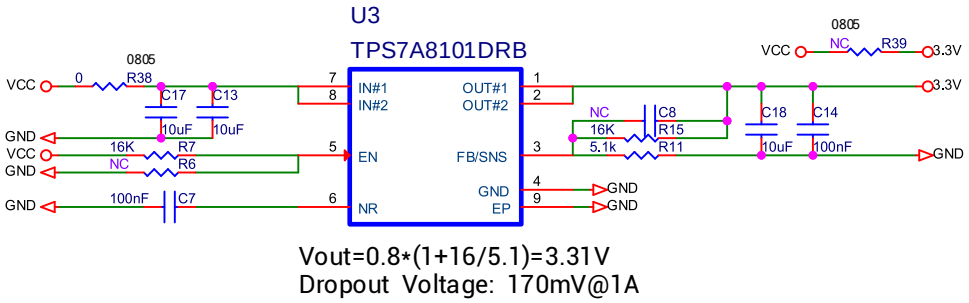


Figure 3-3 3.3 V LDO Power Supply

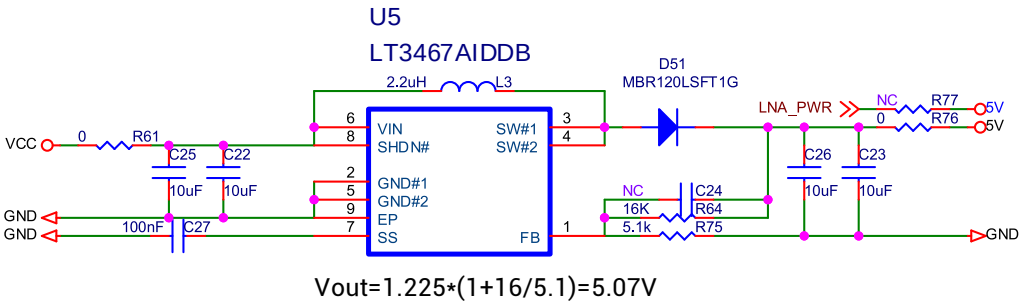
Design and usage guidelines for the LDO circuit are as follows:

- The rated output current of LDO should be more than twice the current of the module.
- R38 is a series resistor placed at the input of the LDO, which is used for debugging. When selecting the resistor, choose one with high rated power to ensure the current capability. Here, a 0805 0-ohm resistor is selected.
- R39 is a resistor connected in parallel with LDO. After removing R38 and soldering R39, you can use VCC to power the module.

☞ When using the LDO to power the module, you should consider the power dissipation of the LDO.

3.2 5 V DCDC Power Supply

VCC outputs 5 V voltage after passing through the DC/DC boost circuit to feed the antenna.



Vout=1.225*(1+16/5.1)=5.07V

Figure 3-4 5 V DCDC Boost Circuit

Antenna feed power configuration and debugging guidelines are as follows:

- You can choose whether to use the 5 V power on the board to feed the antenna according to the antenna type.
- R61 and R76 are series resistors connected to the DC/DC circuit at the input and output, which are used for debugging. When selecting the resistors, choose those with suitable rated power according to the power consumption of the antenna load. Here, a 0603 0-ohm resistor is selected.
- R77: After removing R61/R76 and soldering R77, you can use the external LNA_PWR to feed the antenna.

3.3 Backup Power Supply

When using the hot start function of the EB, you need to provide backup power for the module.

The input range of V_BCKP is 2.0 V to 3.6 V.

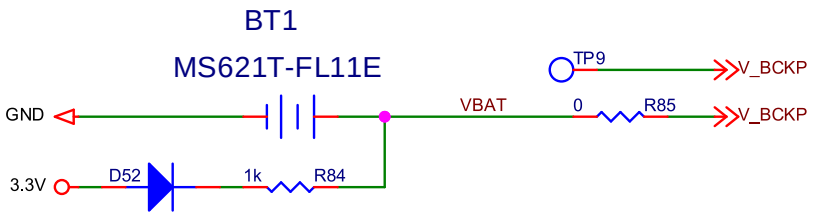


Figure 3-5 Backup Power Supply

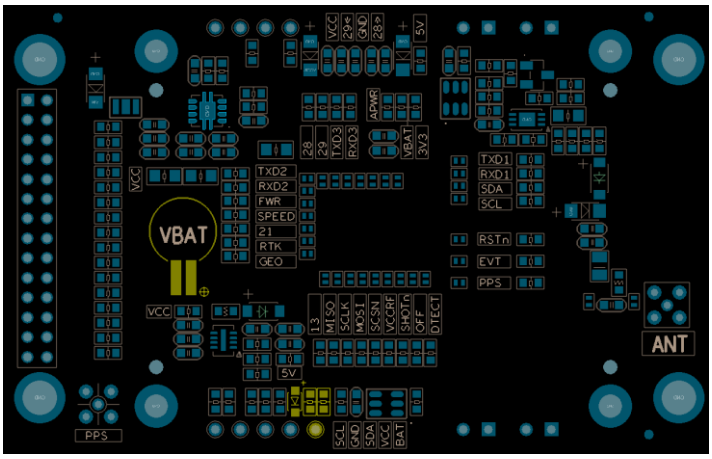


Figure 3-6 Backup Power Circuit on the Bottom

Design and test guidelines for the V_BCKP backup power supply are as follows:

- When the backup battery supplies power to V_BCKP, the battery charging circuit should be designed to prevent reverse current to ensure that the battery only supplies power to V_BCKP and the current does not flow back into the 3.3 V power domain, as the D52 shows in Figure 3-5.
- According to the maximum charging current of the battery, a current-limiting resistor should be added, as the R84 shows in Figure 3-5.
- V_BCKP can also be powered through the test point TP9. Removing R85, connecting a power supply wire at TP9 and a ground wire at TP6, you can use an external power to supply V_BCKP. This method can be used to measure the supply voltage and current of V_BCKP.

- In the case of normal power supply to the EB, the micro battery charging circuit on the board will automatically charge the micro battery.
- If the EB has been placed for a long time, the power of the battery may be low and the hot start test may fail. Therefore, it is recommended to charge the board as long as possible before testing the hot start function. Battery status assessment and charging characteristics are as follows:
    - Use a multimeter to measure the voltage of the micro battery. If the voltage is above 2.6 V and is stable, it indicates that the power of the micro battery is sufficient.
    - Use a multimeter to measure the voltage of the micro battery. If the voltage drops rapidly, it indicates that the power of the micro battery is insufficient.
    - When the micro battery runs out of power, it will take more than 96 hours to fully charge the battery.
    - Under normal circumstances, after powering the EB for one night, the hot start test can be done normally the next day.

4 Antenna Circuit

4.1 Antenna Detection Circuit [7]

The antenna detection circuit consists of a MOS switch, a current detection chip and two buffers.

The antenna feed supply can be selected from the 5 V DC/DC circuit output or VCC_RF (supplied by the module). VCC_RF provides 3.3 V voltage, but the circuit has less protective design; therefore, it is not recommended to use VCC_RF to supply power to the antenna.

U6 and U2 are two buffers with open-drain output. ANT_OFF1 needs to be pulled up through ANT_BIAS1 to make sure that MOS can be turned off.

The current threshold can be adjusted by changing the resistance value of R24/R13/R14. Since the feed current flowing through R24 will generate a voltage drop, this solution is not suitable for antennas with high power consumption.

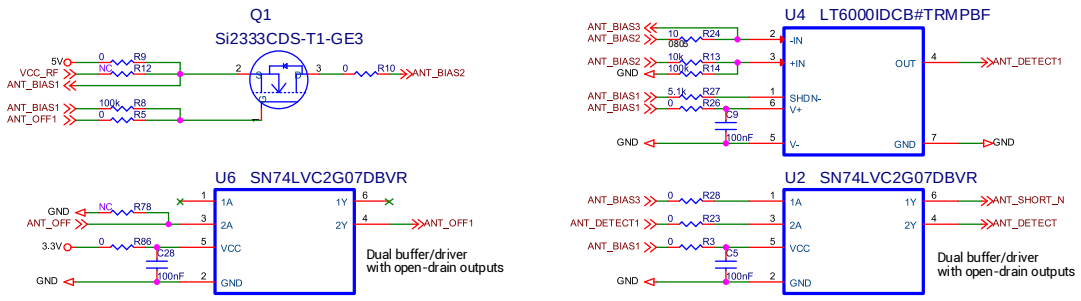


Figure 4-1 Antenna Detection Circuit

Table 4-1 Truth Table of the Antenna Detection Circuit

ANT-OFF	ANT-DETECT	ANT-SHORT-N	
1	X	X	The antenna feed supply is turned off
0	0	0	An error occurred in the circuit
0	0	1	No antenna detected
0	1	0	The antenna feed circuit is shorted to ground

[7] Supported by hardware version V1.1 and above.

ANT-OFF	ANT-DETECT	ANT-SHORT-N	
0	1	1	The antenna status is normal

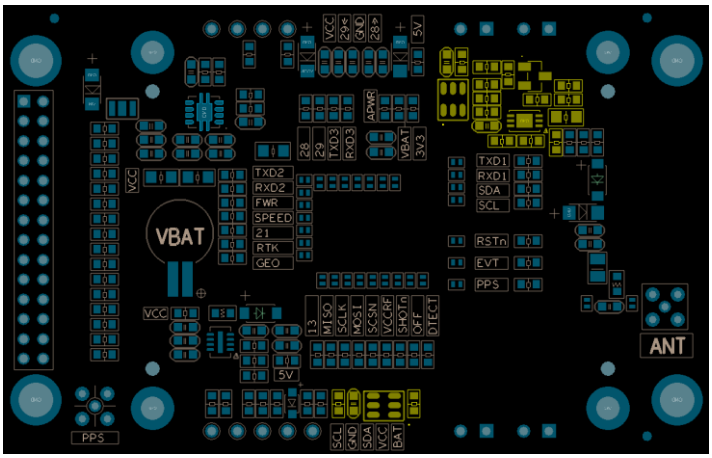


Figure 4-2 Antenna Detection Circuit on the Bottom

4.2 Antenna Feed Circuit

The antenna feed circuit consists of the anti-reverse current design, anti-surge design, filter inductors, and ESD protection.

The supply voltage can be selected from 5 V, VCC_RF or ANT_BIAS3 through R31/R29/R30. When using the 5 V voltage or VCC_RF, the antenna detection circuit on the EB will be bypassed.

The ESD protection diode should support high-frequency signal (above 2000 MHz). Nexperia PESD5V0F1BL is recommended here.

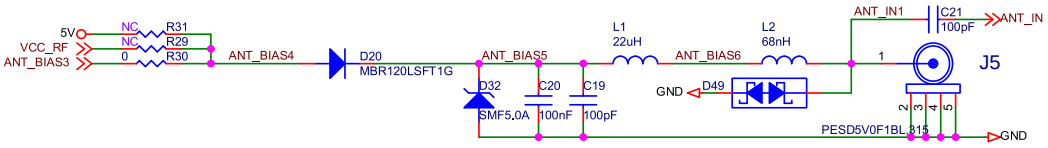


Figure 4-3 Antenna Feed Circuit

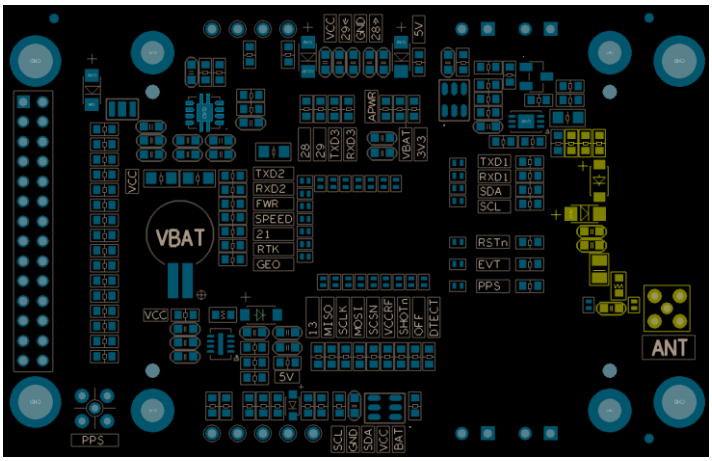


Figure 4-4 Antenna Feed Circuit on the Bottom

5 LED Indicators

There are LED indicators on the EB to indicate the working status of each functional unit.

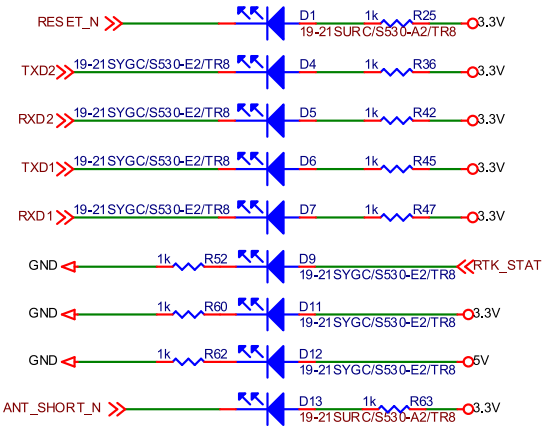


Figure 5-1 LED Indicators

Table 5-1 Description of the LED Status

LED Indicator	Color	Description
Power (5V or 3.3V)	Green	Light on when the power is normal
Reset	Red	Light on when pressing the reset button
Antenna[8]	Red	Light on when antenna is shorted
RTK[9]	Green	Light on when RTK is fixed
UART	Green	Blinking when UART is working

The silkscreen markings on the right of the LED indicators identify the corresponding functions, as shown in Figure 5-2 Markings on the Right of the LED Indicators.

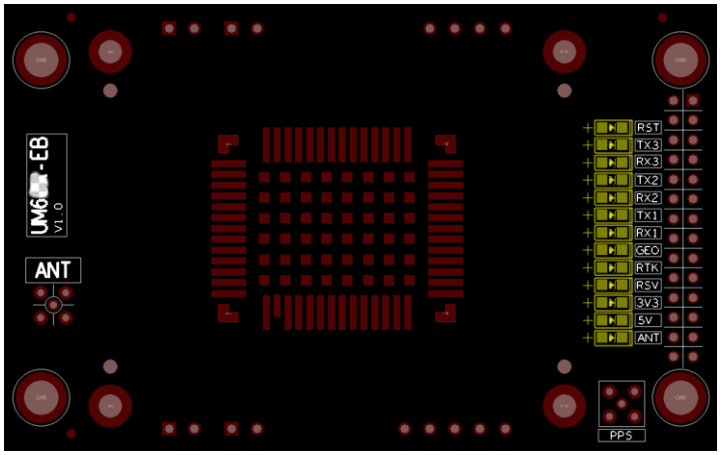


Figure 5-2 Markings on the Right of the LED Indicators

[8] Supported by hardware version V1.1 and above.

[9] RTK indicator is not supported.

6 Peripheral Design

Recommended hardware design practices are as follows:

- Add TVS anti-surge protection at the input of the module. Add ESD protection at all pins.
- Use large and small VCC filter capacitors together. A combination of 10 μF, 0.1 μF, and 100 pF is recommended.
- Add series resistors at the IO pins for the convenience of debugging.
- VCCIN powers the module only. R33 is a large-size resistor (with high rated power) to ensure the current capability. A 0805 resistor is used for the design in this chapter.
- Removing R33, connecting a power supply wire at TP1 and a ground wire at TP3 (as shown in 7 Debug Support), you can use an external power to supply the module. This method can be used to measure the input voltage and current of the module.

> ☞ R33, TP1, and TP3 refer to the resistor and test points on the evaluation board, respectively. Their exact locations are shown in Appendix.

The figures below show the peripheral circuit design for the UM68X series modules.

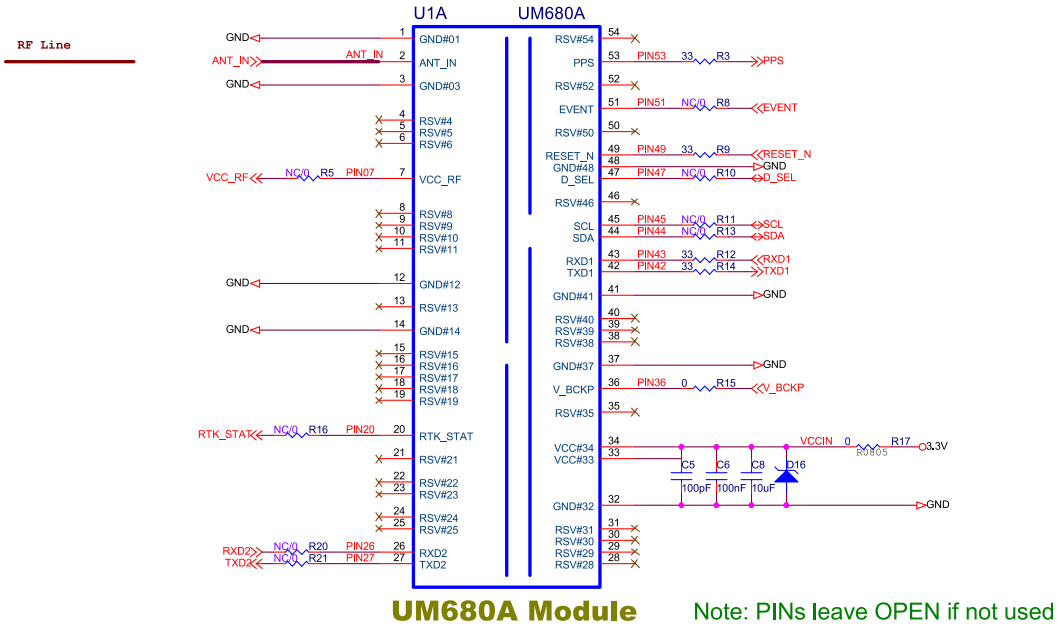


Figure 6-1 UM680A Peripheral Design (V1.0)

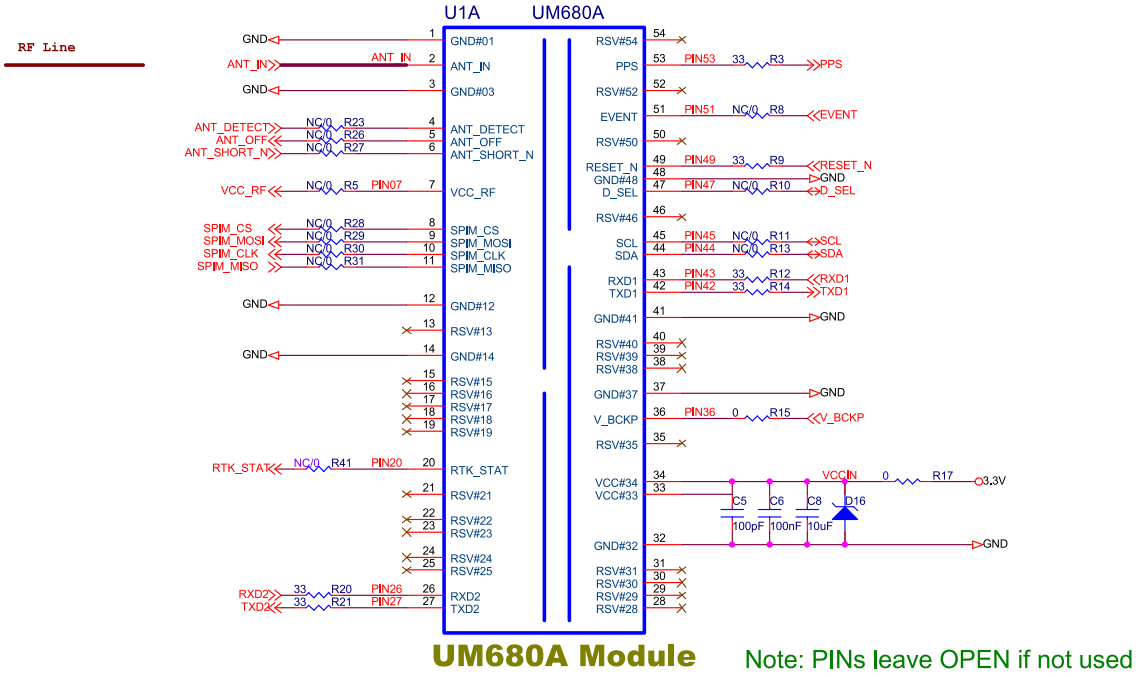


Figure 6-2 UM680A Peripheral Design (V1.3)

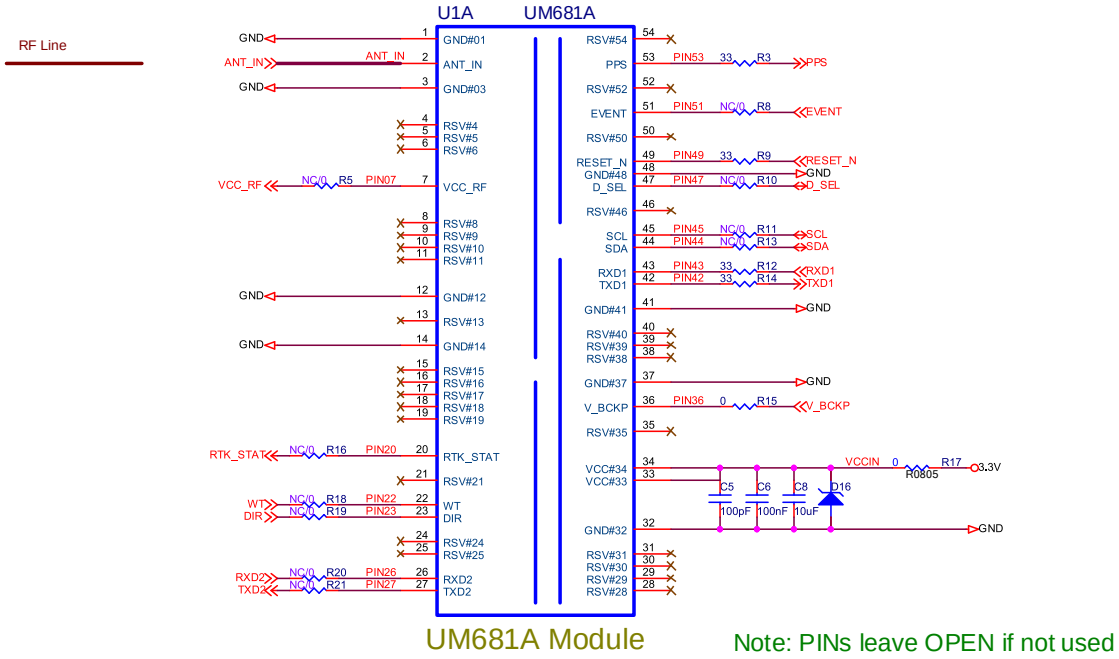


Figure 6-3 UM681A Peripheral Design (V1.0)

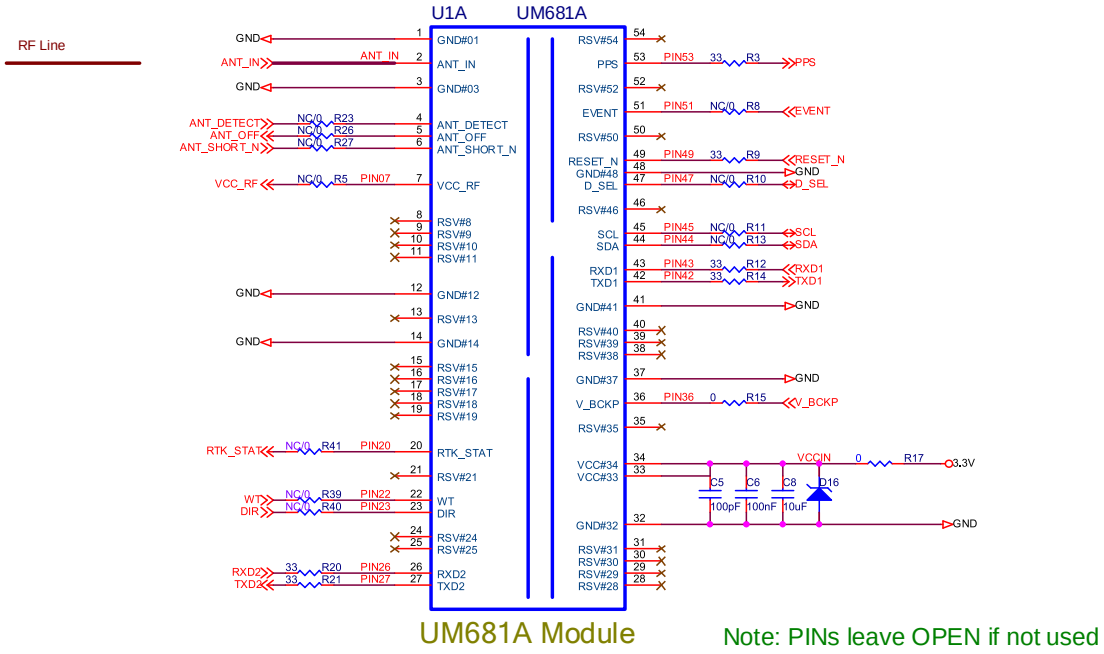


Figure 6-4 UM681A Peripheral Design (V1.3)

The availability of the ports depends on the model of the module and its firmware. Refer to 1.1Block Diagram and the corresponding user manual for more information about the supported ports.

Silkscreen markings are printed around the module to identify the resistors, which is convenient for measurement.

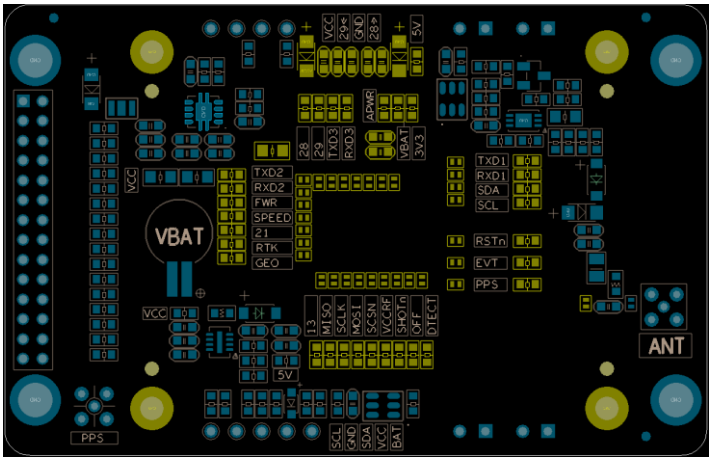


Figure 6-5 Peripheral Circuit

The GND pads at the bottom of the module should be grounded to ensure heat dissipation. The EB has copper exposed on the bottom of the module, which not only enhances heat dissipation, but also provides a large area for grounding and is convenient to test.

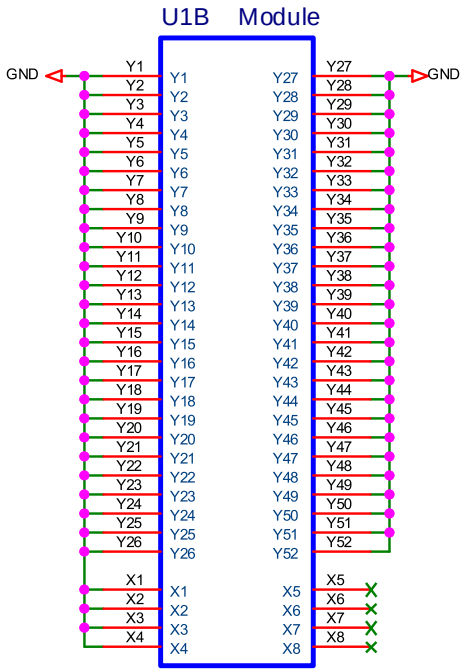


Figure 6-6 Pads (Y1-Y52) and Socket Mounting Holes (X1-X8)

7 Debug Support

As mentioned above, TP1 and TP9 can be used to connect an external power to supply VCCIN and V_BCKP and to measure the supply voltage and current.

TP2, TP3, TP5 and TP7 are used for internal debugging, of which TP5 and TP7 can be used to debug I^2C.

J1 is used for MMCX connection. After soldering the MMCX connector, it can be used to measure the PPS signals.

J2, J3, J6 and J7 are debug ports. Connect the signal that needs to be tested to the square hole and test the round hole, or connect the round hole to a measuring instrument. Using these debug ports can avoid damage to the PCB pads and traces, which is convenient for debugging.

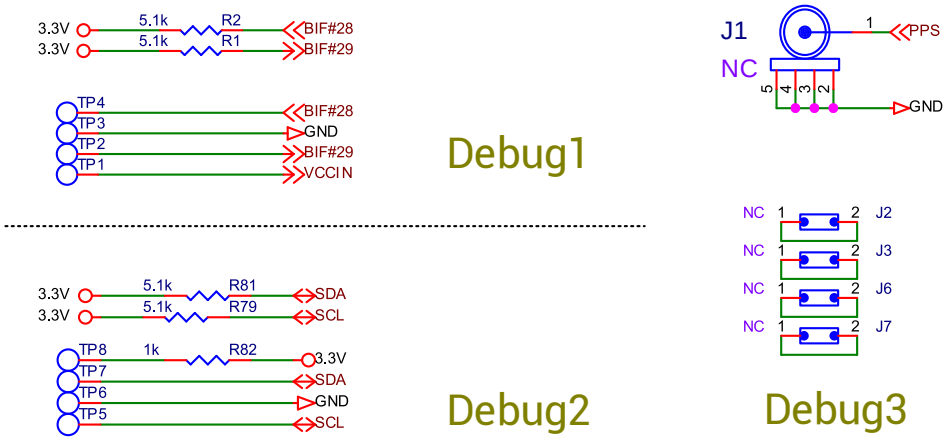


Figure 7-1 Debug Ports for the Module

The silkscreen markings on the right of the test points are arranged in order to identify the function of each port.

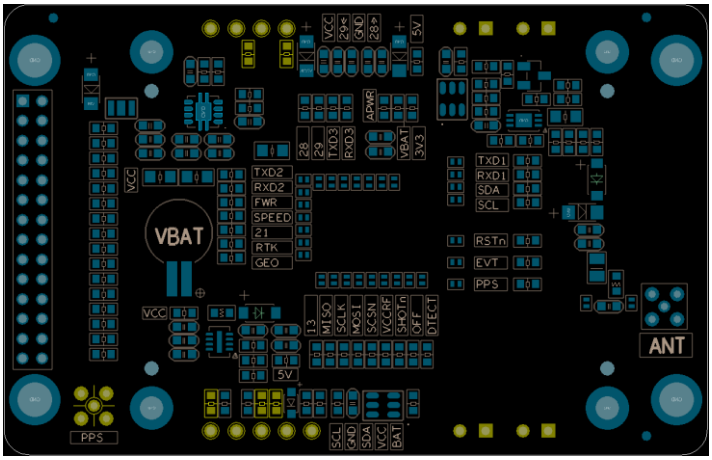
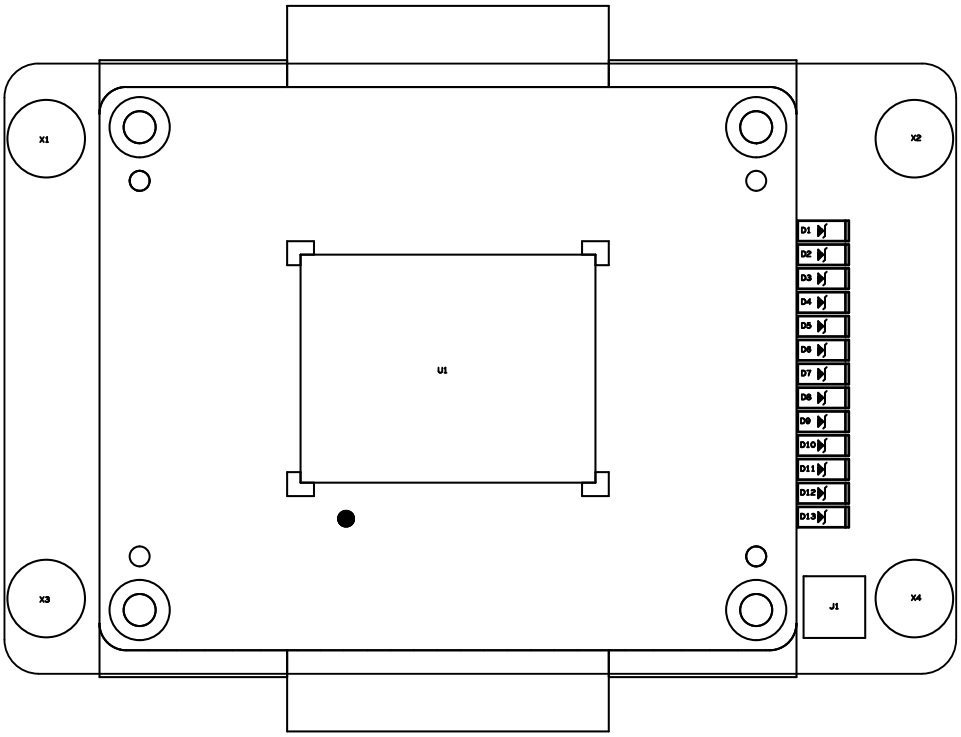


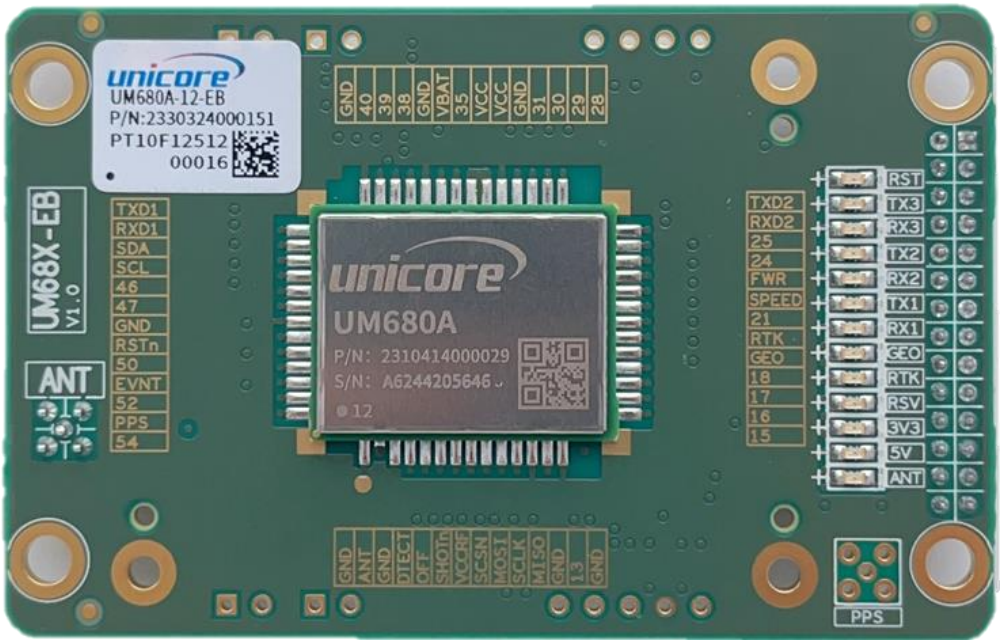
Figure 7-2 Through-Hole Test Points

Appendix

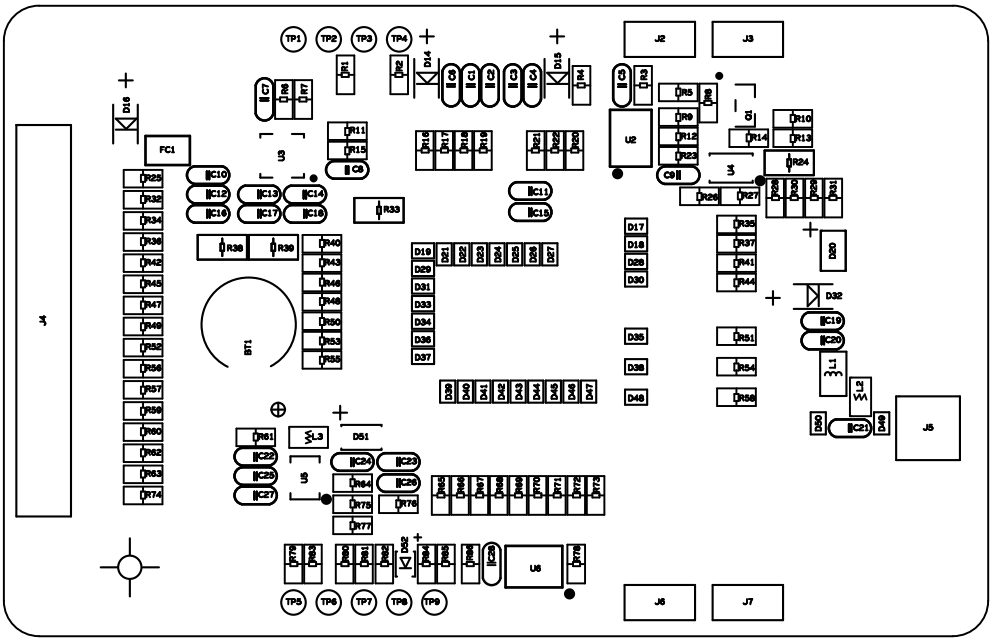
Schematic of the EB:

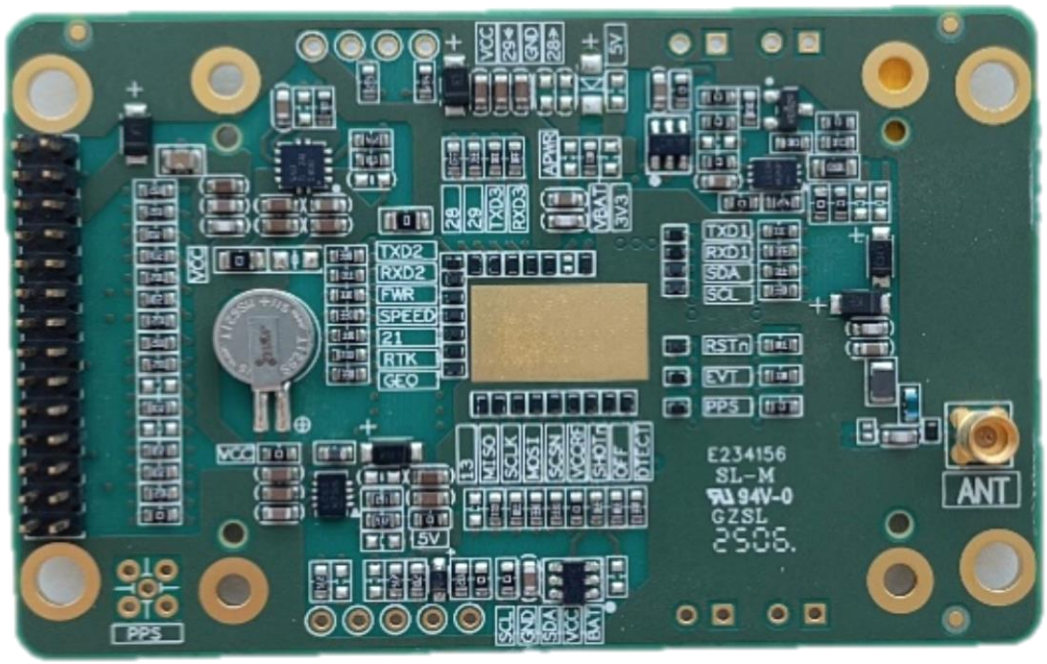
Assembly Top of the EB





Assembly Bottom of the EB





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