



HARDWARE

# USER MANUAL

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# UM980-EB

## Evaluation Board

(This manual also applies to UM981-EB)

## Revision History

Version	Revision History	Date
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P1.0.A	Alpha release	2022-10-17

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## UM980-EB User Manual

Should you purchase our product and encounter any inconsistency, please contact us or our local authorized distributor for the most up-to-date version of this manual along with any addenda or corrigenda.

PRELIMINARY

## Foreword

This manual provides information on the hardware composition and design of the UM980 evaluation board (EB).

### Target Readers

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

PRELIMINARY

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# 1 Product Overview

UM980-EB is the evaluation board for UM980 and it consists of the UM980 module, a 3.3V low dropout regulator (LDO), a 5V DC/DC boost circuit, an antenna short protection circuit and peripheral interfaces.

☞ The schematic of the UM980-EB can be used as the reference design for the UM980 module.

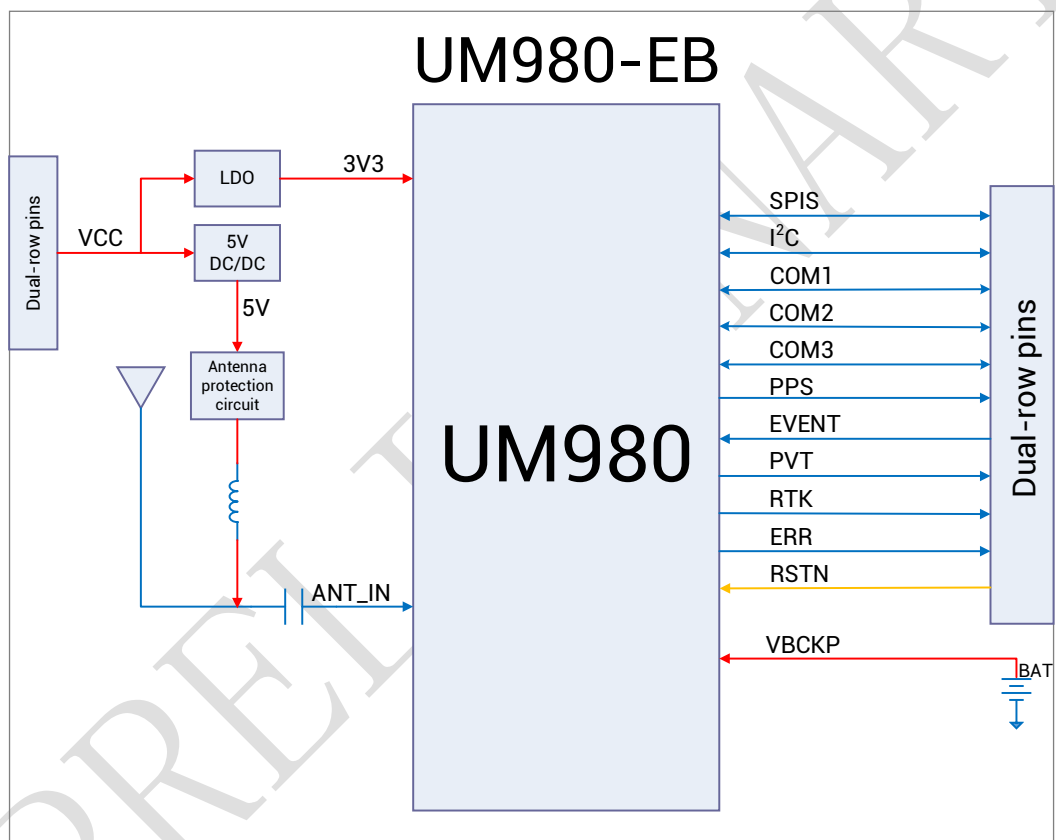


Figure 1-1 UM980-EB Block Diagram

The appearance of UM980-EB is shown as follows:

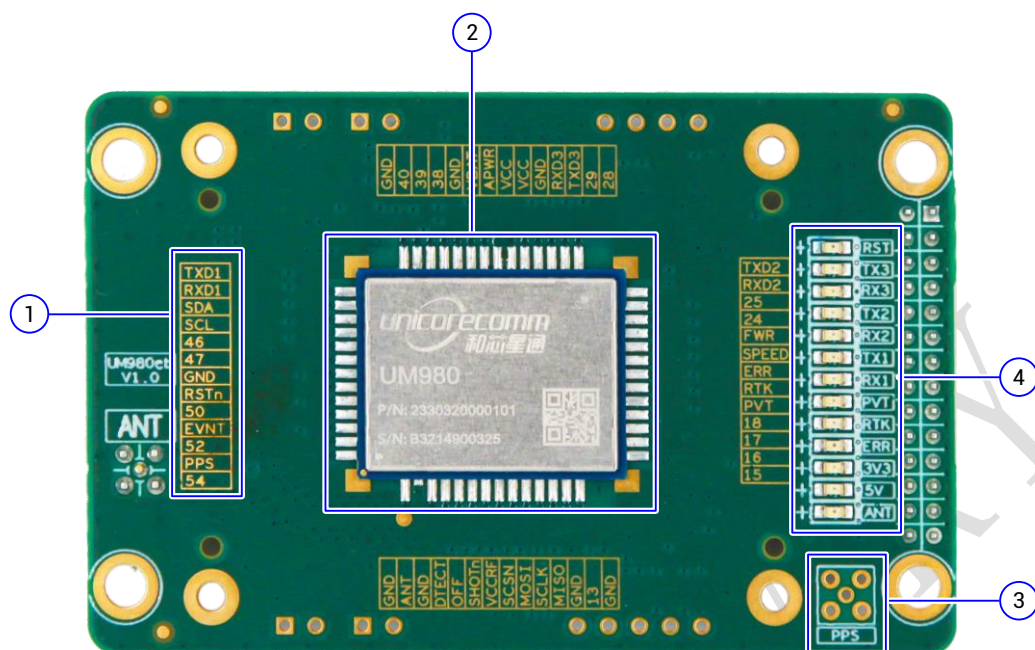


Figure 1-2 Top View of UM980-EB

- (1) Silkscreen: It marks the signals of the pins. The smaller holes around are used to mount the UM980 socket. The printing adopts exposed copper to ensure the flatness of the surface.
- (2) UM980 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.

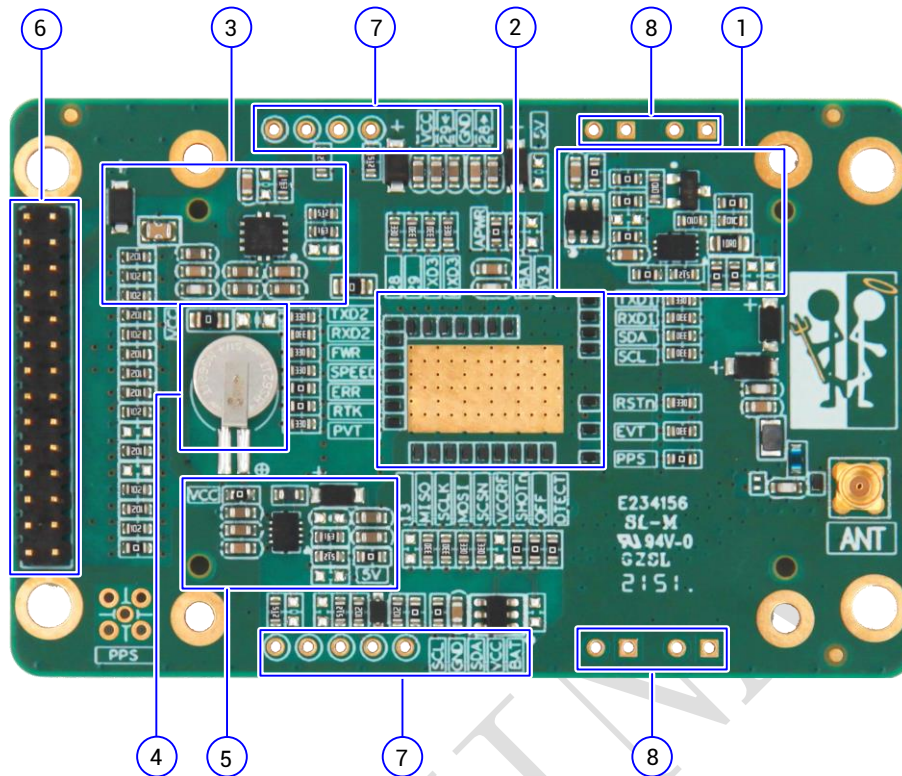


Figure 1-3 Bottom View of UM980-EB

- (1) Antenna short protection circuit
- (2) Anti-static design and heat dissipation with exposed copper
- (3) VCC power supply and LDO circuit
- (4) Backup battery
- (5) 5 V DC/DC boost circuit for antenna feeding
- (6) Dual-row pins as external interfaces
- (7) Debug ports
- (8) Ports used to connect jumpers



## 2 Interfaces

The dual-row 28 pins serve as the external interfaces of UM980-EB, and the pin pitch is 2 mm. The interfaces can be directly connected to the J18 on Unicore HPL EVK-V5.0 board.

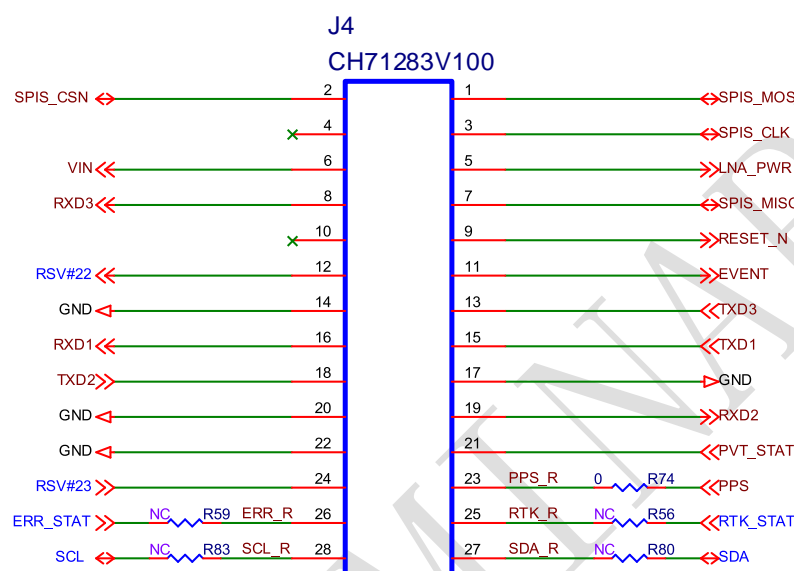


Figure 2-1 UM980-EB Interfaces

Table 2-1 UM980-EB Pin Description

No.	Pin Name	I/O	Description
1	SPIS_MOSI	I	Master Out / Slave In. This pin is used to receive data in slave mode.
2	SPIS_CSN	I	Chip select pin for SPI slave
3	SPIS_CLK	I	Clock input pin for SPI slave
4	NC	—	No connection inside
5	LNA_PWR	I	Antenna feed voltage for LNA
6	VIN	I	Main power supply

No.	Pin Name	I/O	Description
7	SPIS_MISO	O	Master In / Slave Out. This pin is used to transmit data in slave mode.
8	RXD3	I	COM3 input, can be used as CAN RXD, LVTTTL
9	RESET_N	I	System reset, active low
10	NC	—	No connection inside
11	EVENT	I	Event input
12	RSV#22	—	Reserved
13	TXD3	O	COM3 output, can be used as CAN TXD, LVTTTL
14	GND	—	Ground
15	TXD1	O	COM1 output, LVTTTL
16	RXD1	I	COM1 input, LVTTTL
17	GND	—	Ground
18	TXD2	O	COM2 output, LVTTTL
19	RXD2	I	COM2 input, LVTTTL
20	GND	—	Ground
21	PVT_STAT	O	PVT status, active high.  High level when positioning and low level when not positioning.
22	GND	—	Ground
23	PPS	O	PPS output
24	RSV#23	—	Reserved

No.	Pin Name	I/O	Description
25	RTK_STAT	O	RTK status, active high.  High level for RTK fixed solution and low level for other status.
26	ERR_STAT	O	Error status, active high.  High level when failing self-test and low level when passing self-test.
27	SDA	I/O	I <sup>2</sup> C data
28	SCL	I/O	I <sup>2</sup> C clock

☞ The availability of the ports depends on the firmware version of the UM980 module.

### 3 Power Supply

The power supply of the UM980-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 3.2V to 5V.

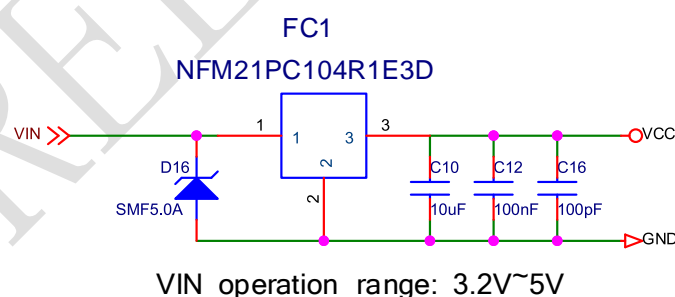


Figure 3-1 Power Filter Circuit

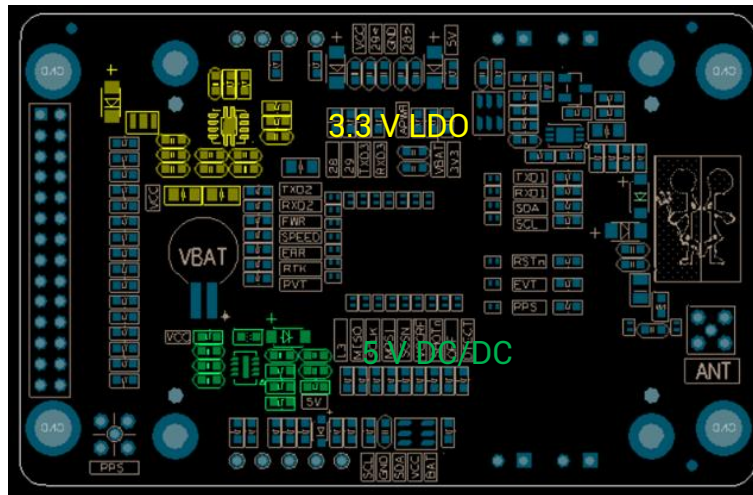


Figure 3-2 3.3 V LDO and 5 V DC/DC on the Bottom of UM980-EB

### 3.1 3.3V LDO Power Supply

VCC outputs 3.3 V voltage after passing through the LDO circuit to provide power to UM980-EB.

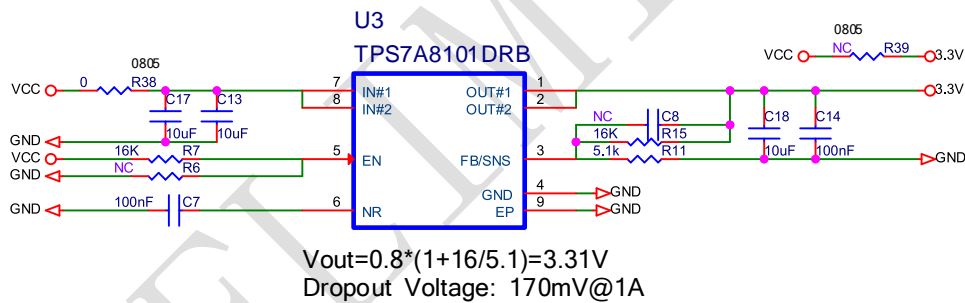


Figure 3-3 3.3V LDO Circuit

#### Notes:

The rated output current of LDO should be more than twice the current of UM980.

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.



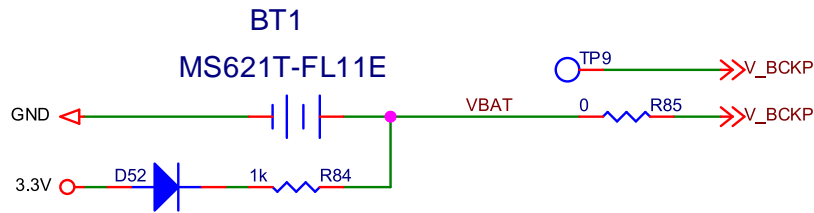


Figure 3-5 Backup Power Circuit

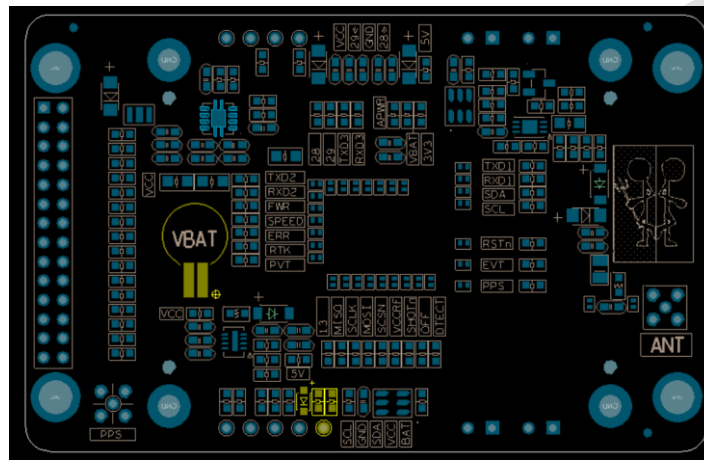


Figure 3-6 Backup Power Circuit on the Bottom of UM980-EB

#### Notes:

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.

## 4 Antenna Circuit

### 4.1 Antenna Short Protection Circuit

The antenna short protection 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.

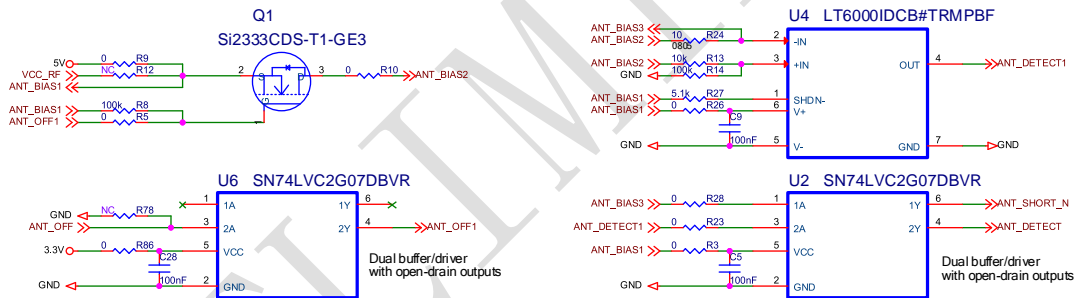


Figure 4-1 Antenna Short Protection Circuit

Table 4-1 Truth Table of the Antenna Short Protection 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	The antenna feed current < 50 mA; no antenna detected
0	1	0	The antenna feed circuit is shorted to ground

ANT-OFF	ANT-DETECT	ANT-SHORT-N	
0	1	1	The antenna feed current > 50 mA; the antenna status is normal

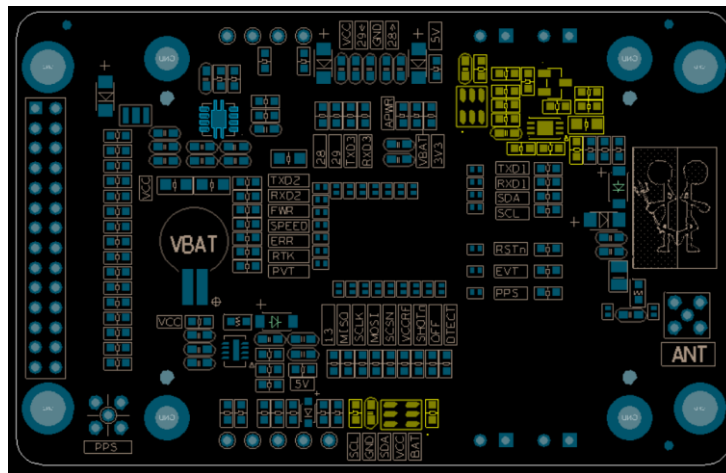


Figure 4-2 Antenna Short Protection Circuit on the Bottom of UM980-EB

## 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 short protection circuit on UM980-EB will be bypassed.

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

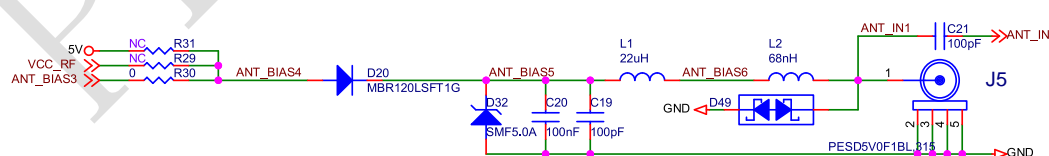


Figure 4-3 Antenna Feed Circuit



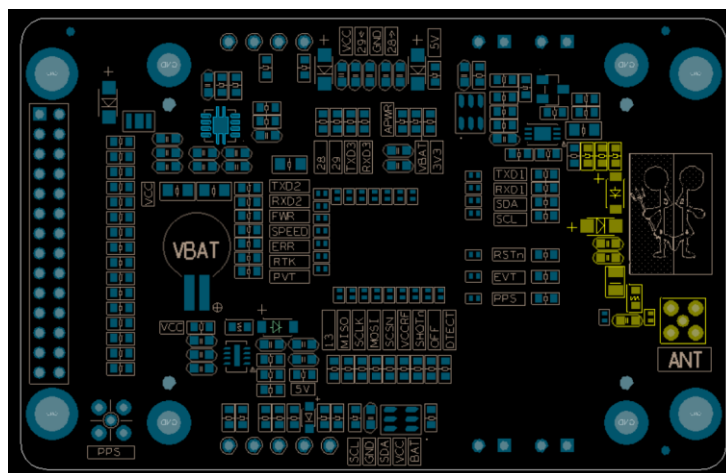


Figure 4-4 Antenna Feed Circuit on the Bottom of UM980-EB

## 5 LED Indicators

There are LED indicators on UM980-EB to indicate the working status of each functional unit.

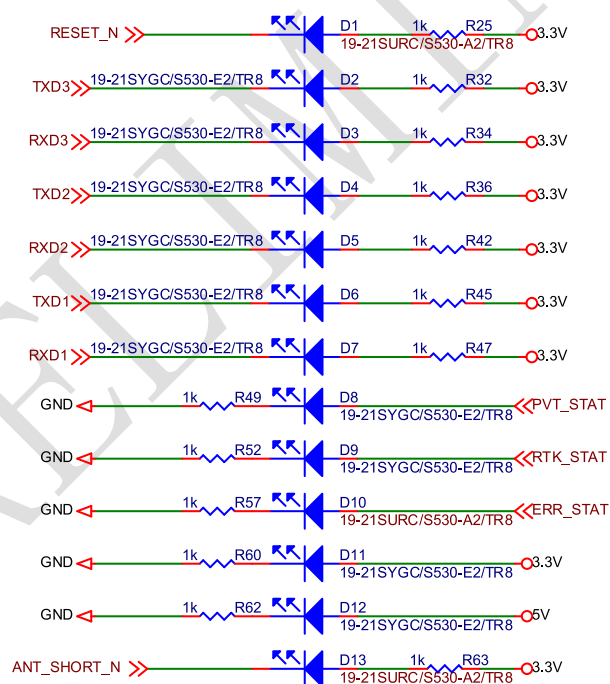


Figure 5-1 LED Indicators

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	Red	Light on when antenna is shorted
PVT	Green	Light on when position is fixed
RTK	Green	Light on when RTK is fixed
ERR	Red	Light on when failing self-test
UART	Green	Blinking when UART is working

The silkscreen markings on the right of the LED indicators identify the corresponding functions, as shown in the figure below.

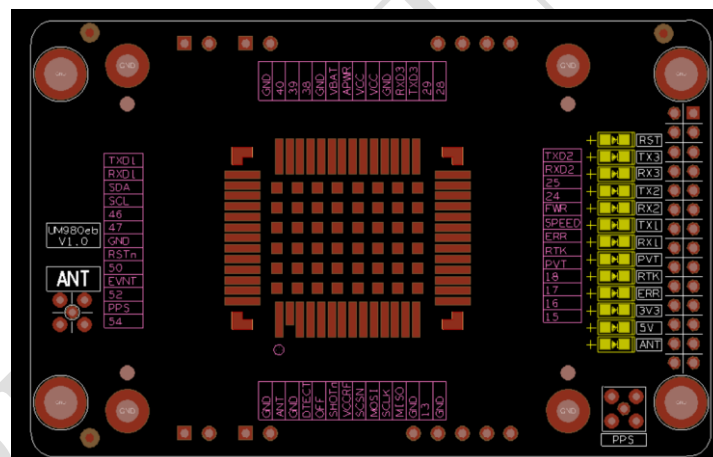


Figure 5-2 Markings on the Right of the LED Indicators

## 6 UM980 Peripheral Design

TVS anti-surge protection is added at the input of the UM980 module. ESD protection is added at all pins.

Use large and small VCC filter capacitors together, with a total capacitance greater than 30 uF.

Add series resistors at the IO pins for the convenience of debugging.

VCCIN powers the UM980 module only. R33 is a large-size resistor (with high rated

power) to ensure the current capability. In the figure below, a 0805 resistor is used.

Removing R33, connecting a power supply wire at TP1 and a ground wire at TP3 (as shown in Figure 7-1), you can use an external power to supply the module. This method can be used to measure the input voltage and current of UM980.

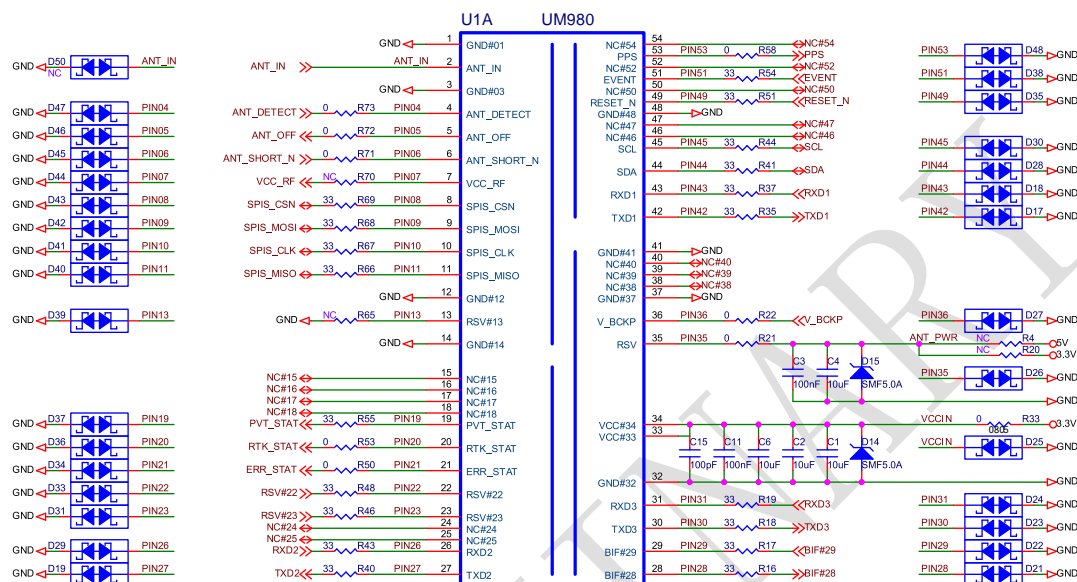


Figure 6-1 UM980 Peripheral Design

Silkscreen markings are printed around the UM980 module to identify the resistors, which is convenient for measurement.

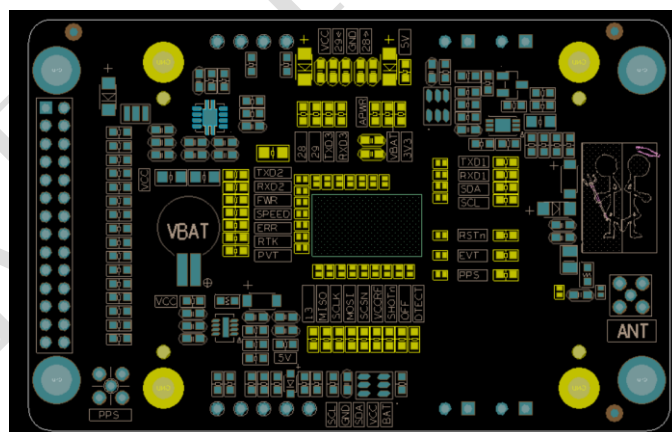


Figure 6-2 UM980 Peripheral Circuit

The GND pads at the bottom of the module should be grounded to ensure heat dissipation. The UM980-EB has copper exposed on the bottom of the UM980 module, which not only enhances heat dissipation, but also provides a large area for grounding and is convenient to test.

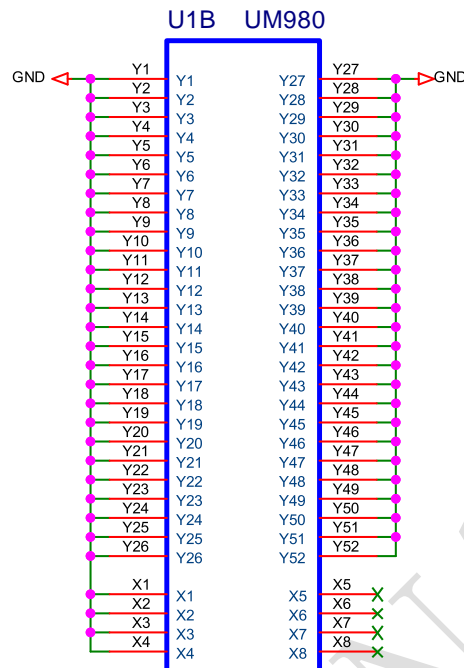


Figure 6-3 UM980 Pads (Y1-Y52) and Socket Mounting Holes (X1-X8)

## 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<sup>2</sup>C.

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.

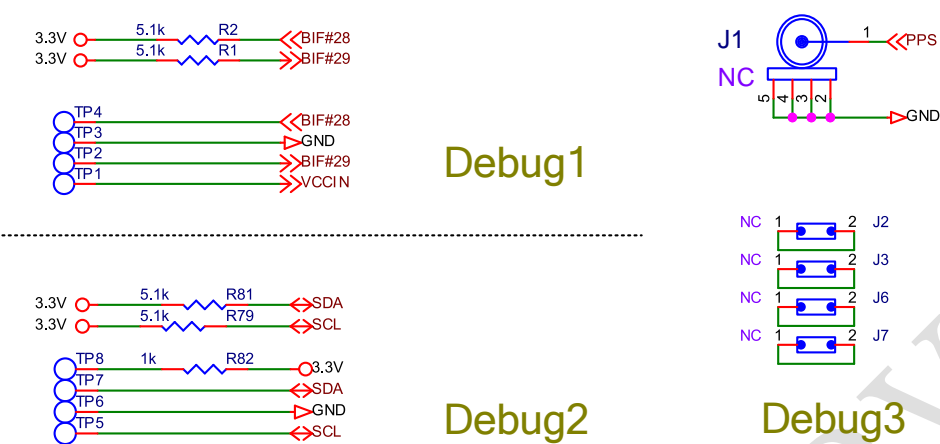


Figure 7-1 Debug Ports for the UM980 Module

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

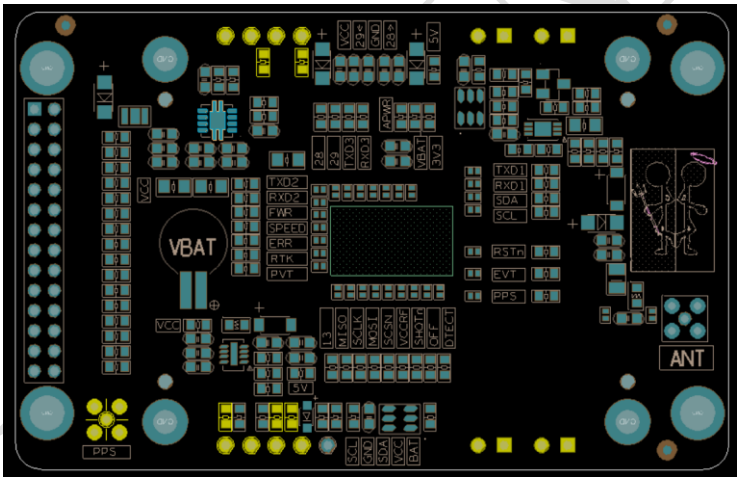
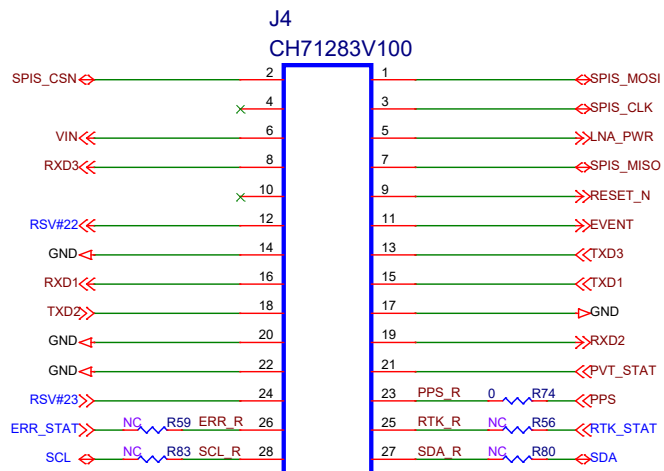


Figure 7-2 Through-Hole Test Points on UM980-EB

# Appendix

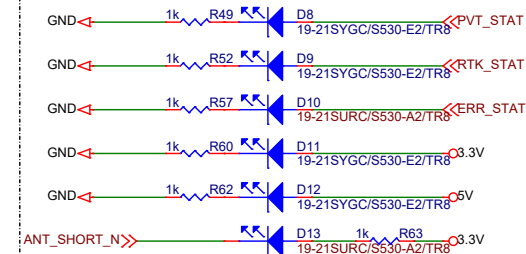
## Schematic of UM980-EB



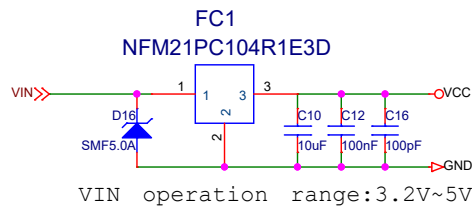
## Interface



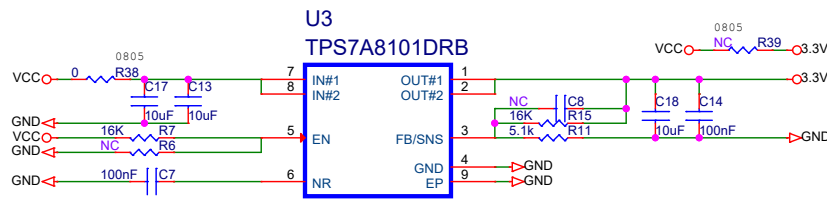
## LEDs



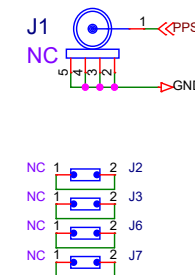
## LEDs



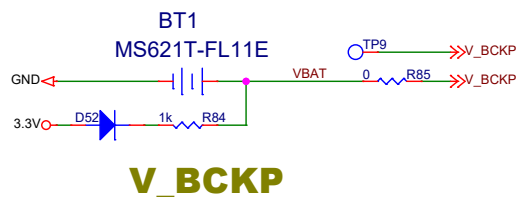
## Power Filter



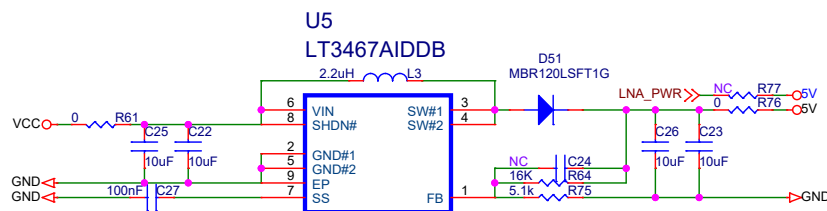
## LDO 3.3V



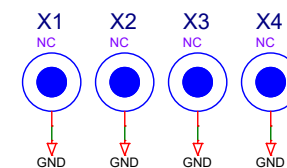
## Debug3



## V\_BCKP



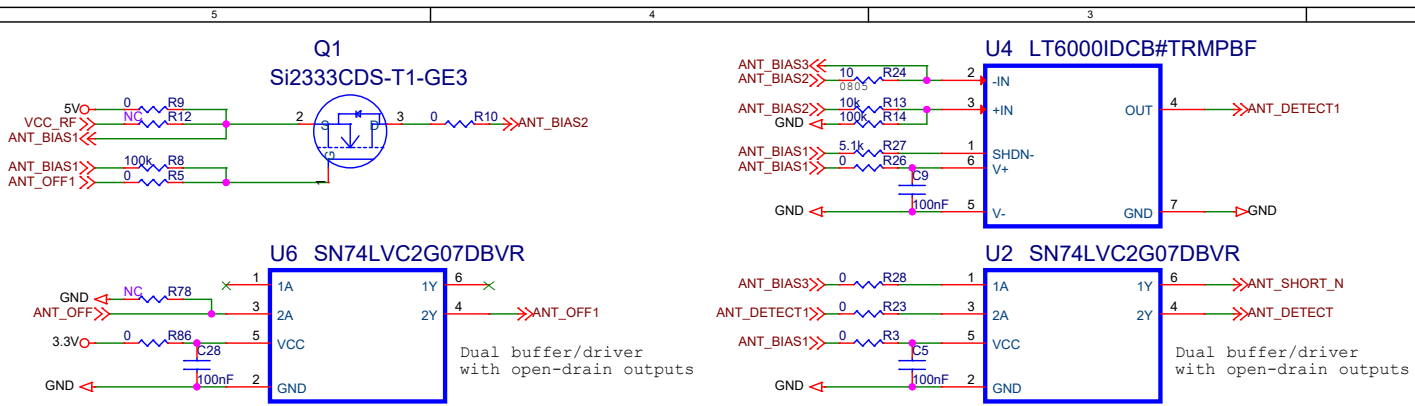
## DC/DC 5V



## Hole

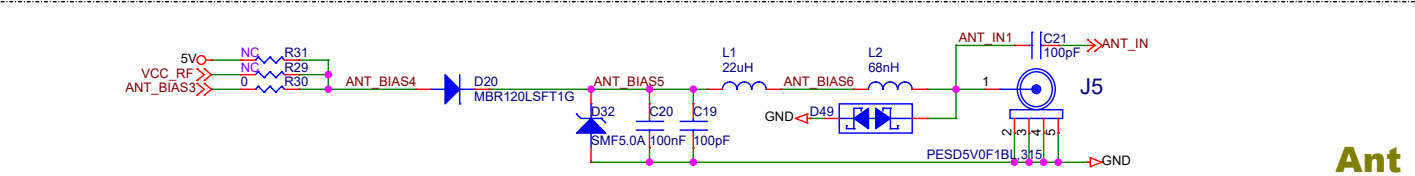
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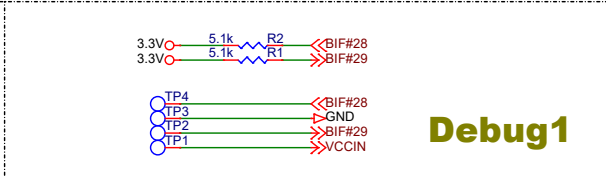


ANT-OFF	ANT-DETECT	ANT-SHORT-N	
1	X	X	Ant-Bias Turn off
0	0	0	Circuits Maybe error
0	0	1	Ant-Bias Current < 50mA
0	1	0	Ant-Bias Short to GND
0	1	1	Ant-Bias Current > 50mA

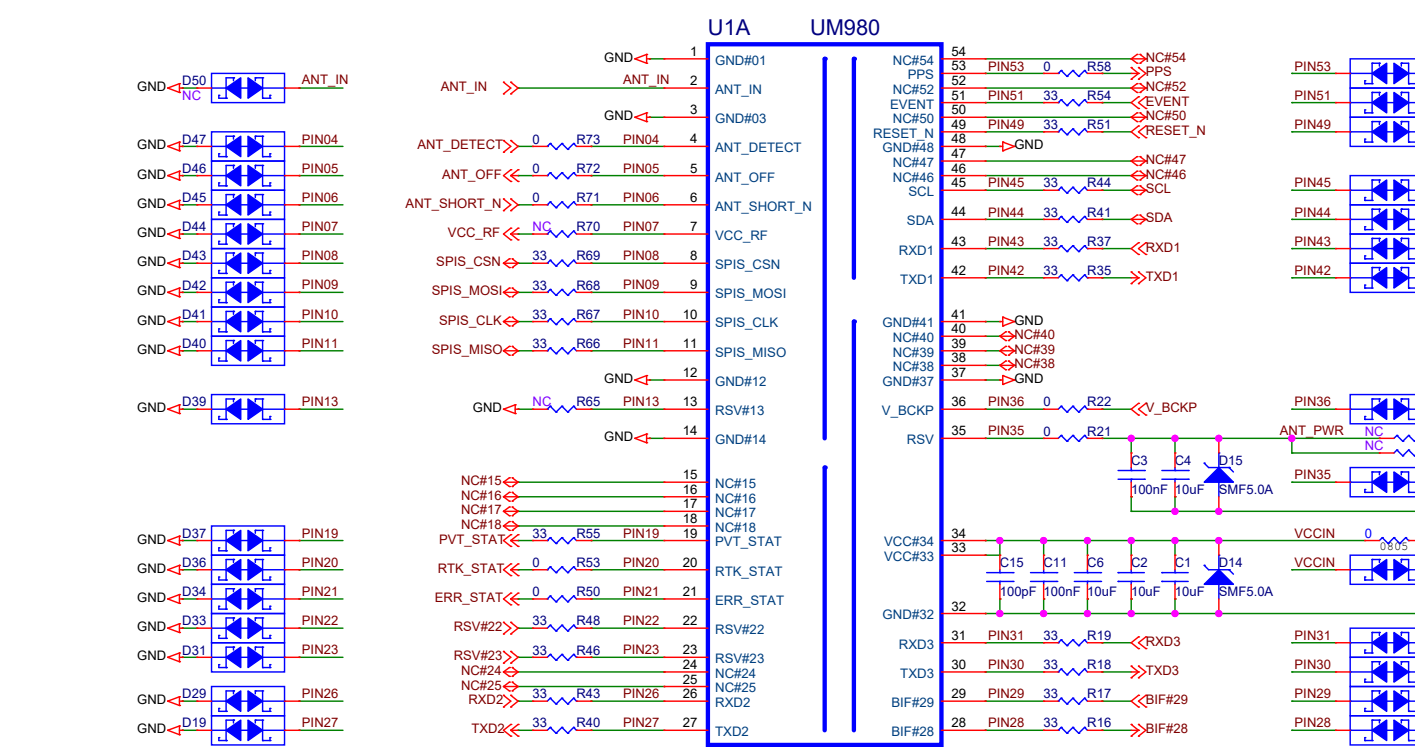
Ant Bias Status Detect



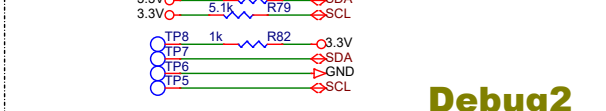
Ant Bias



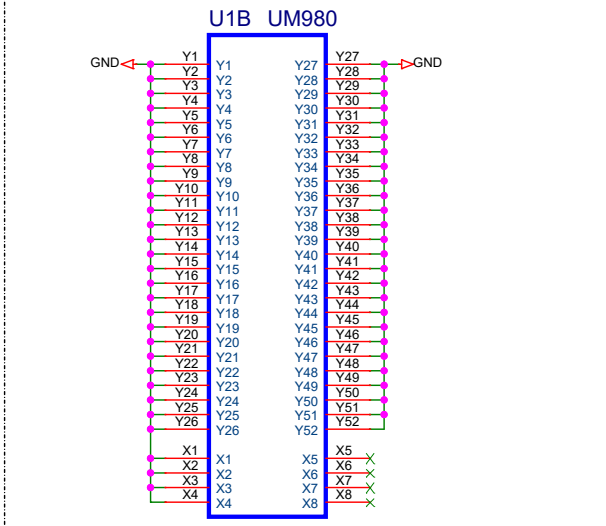
Debug1



UM980 Module



Debug2



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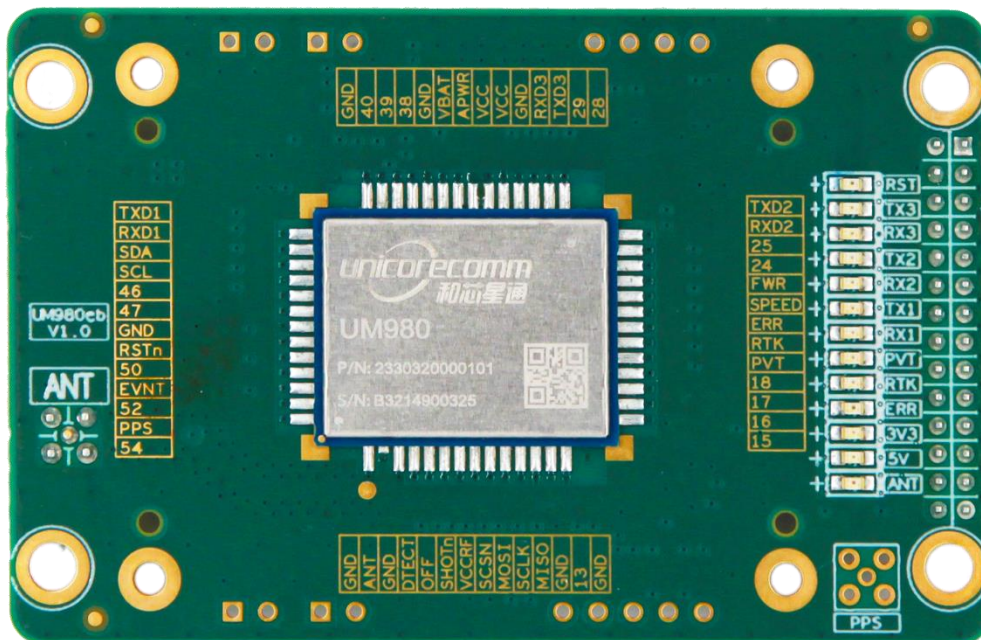
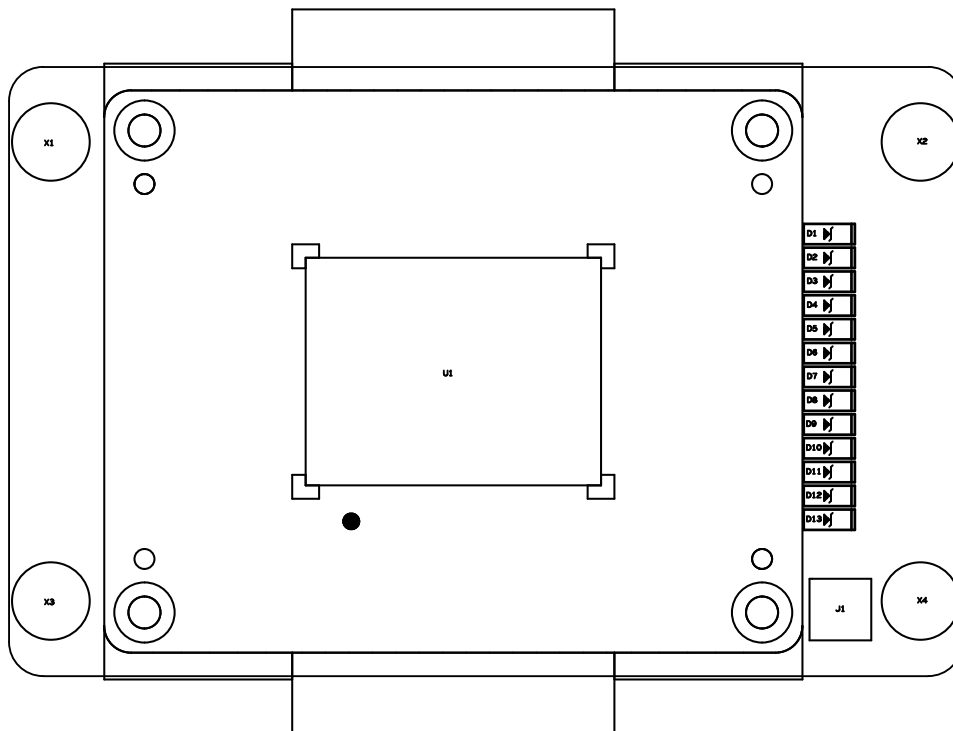
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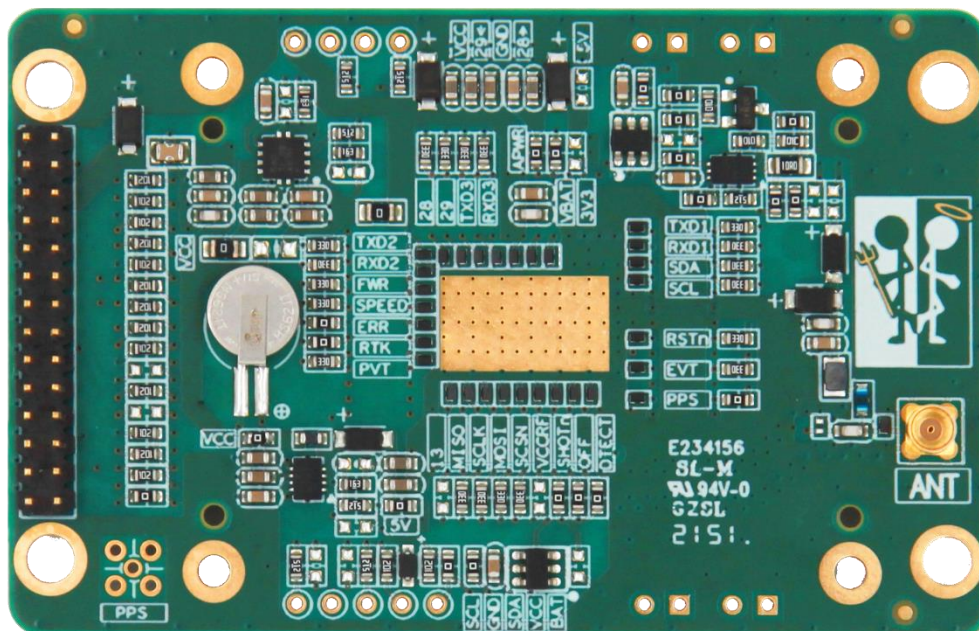
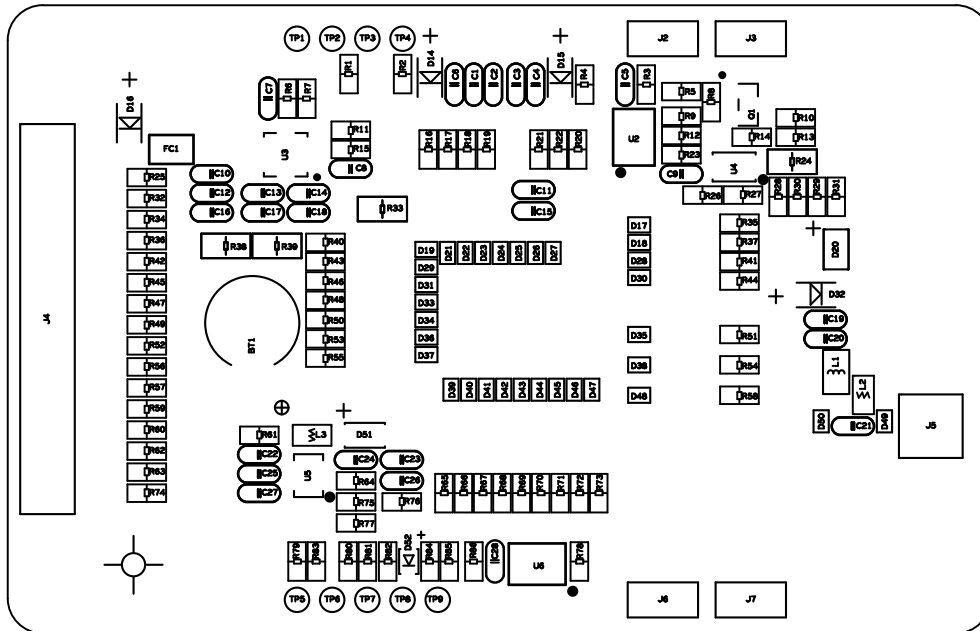


## Assembly Top of UM980-EB





## Assembly Bottom of UM980-EB



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