HARDWARE

USER MANUAL

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UT986eb

Evaluation Board

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Revision History

Version	Revision History	Date
R1.0	First release	Nov., 2023

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Foreword

This manual provides information on the hardware composition and design of the UT986 evaluation board (UT986eb).

Target Readers

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

Contents

1 Product Overview

UT986eb is the evaluation board (EB) of UT986. It consists of the module UT986, a 3.3V low dropout regulator (LDO), a 5V DC/DC boost circuit, an antenna short protection circuit and peripheral interfaces.

☞ The schematics of the evaluation board can be used as the reference design for the module UT986.

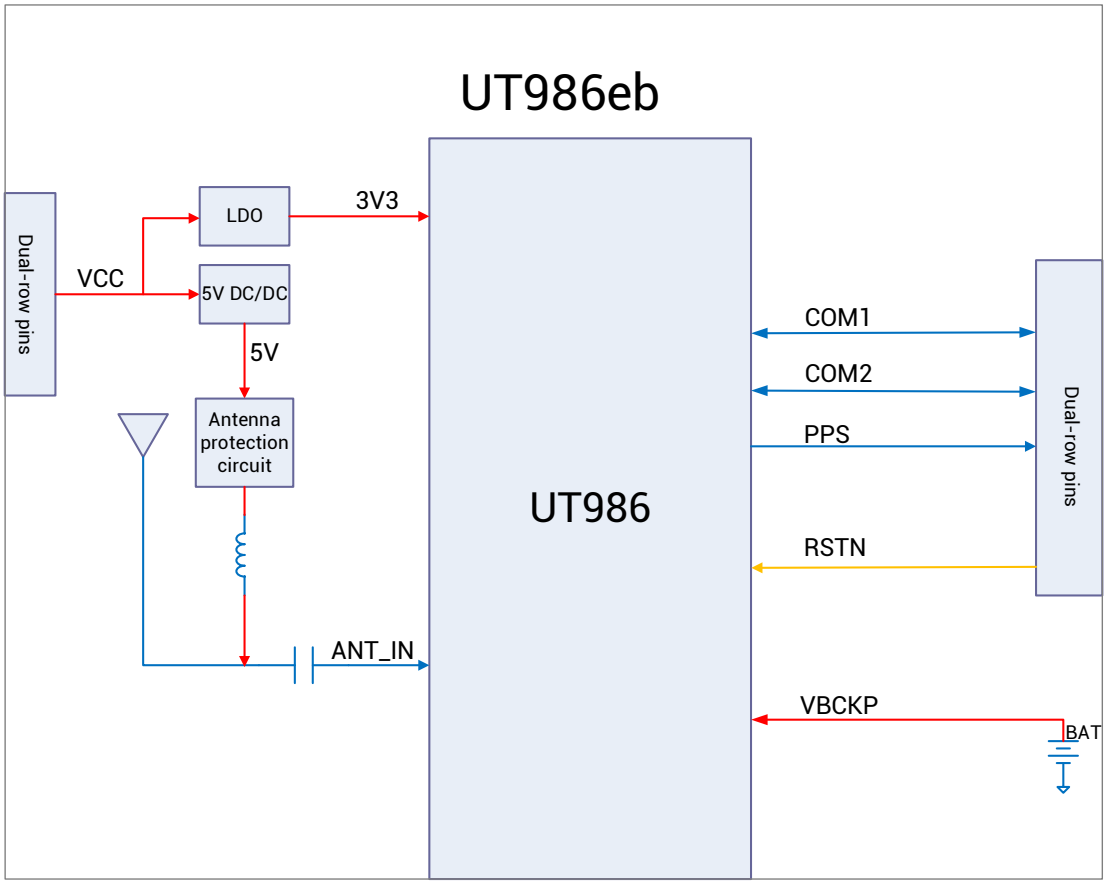


Figure 1-1 UT986eb Block Diagram

The appearance of UT986eb is as follows:

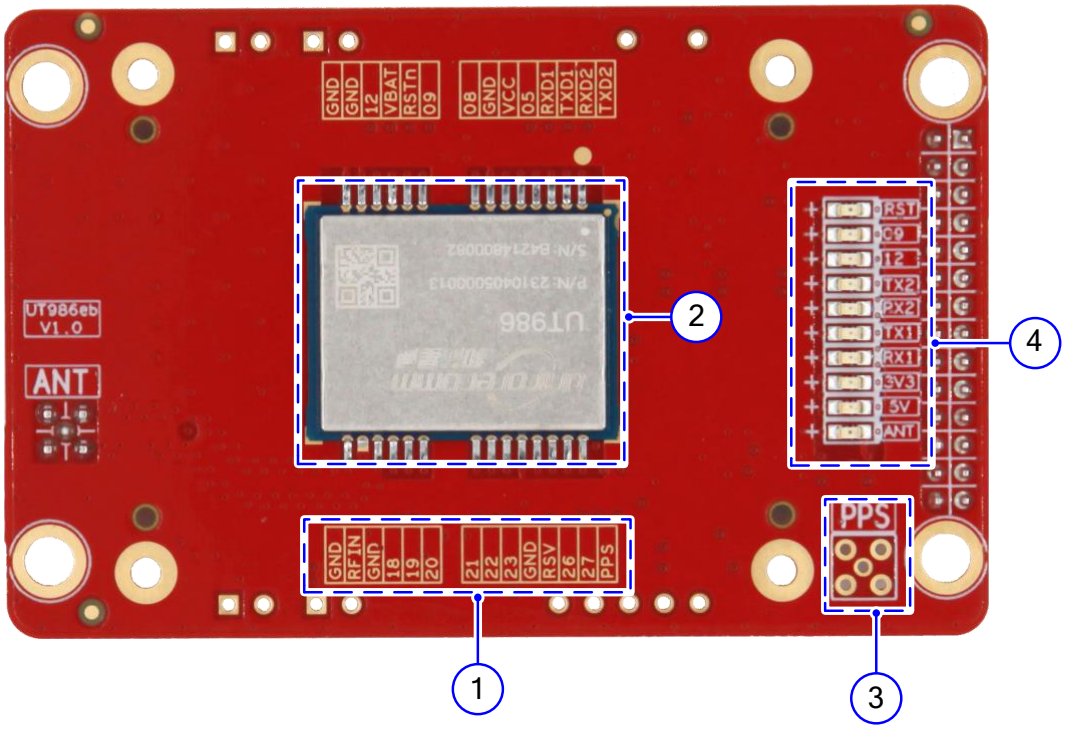


Figure 1-2 Top View of UT986eb

(1) Silkscreen: It marks the signals of the pins. The smaller holes around are used to mount the UT986 socket. The printing adopts exposed copper to ensure the flatness of the surface.

(2) UT986 module: The pin pads are designed long, which is convenient for soldering, testing and debugging. For detailed packaging information, 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, and UART.

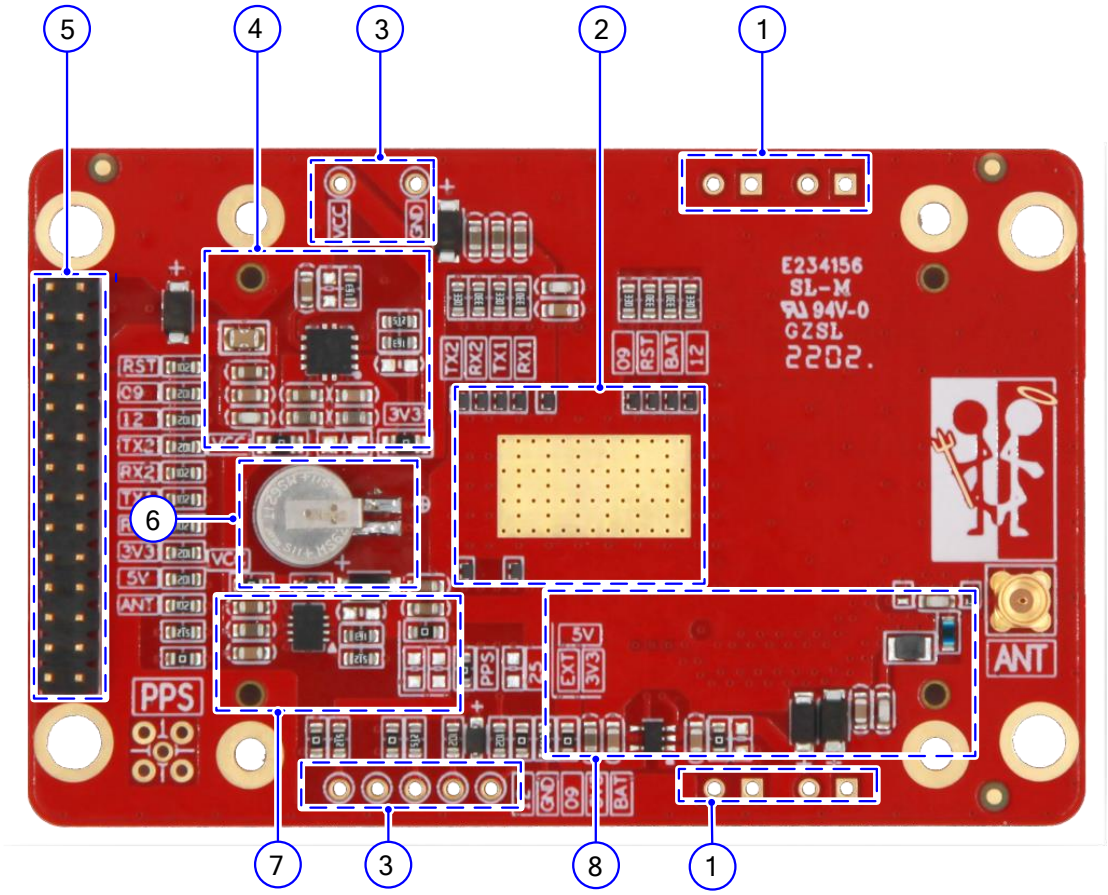


Figure 1-3 Bottom View of UT986eb

(1) Ports used to connect jumpers

(2) Anti-static design and heat dissipation with exposed copper

(3) Debug ports

(4) VCC power supply and LDO circuit

(5) Dual-row pins as external interfaces

(6) Backup battery

(7) 5 V DC/DC boost circuit for antenna feeding

(8) Antenna feed circuit

2 Interfaces

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

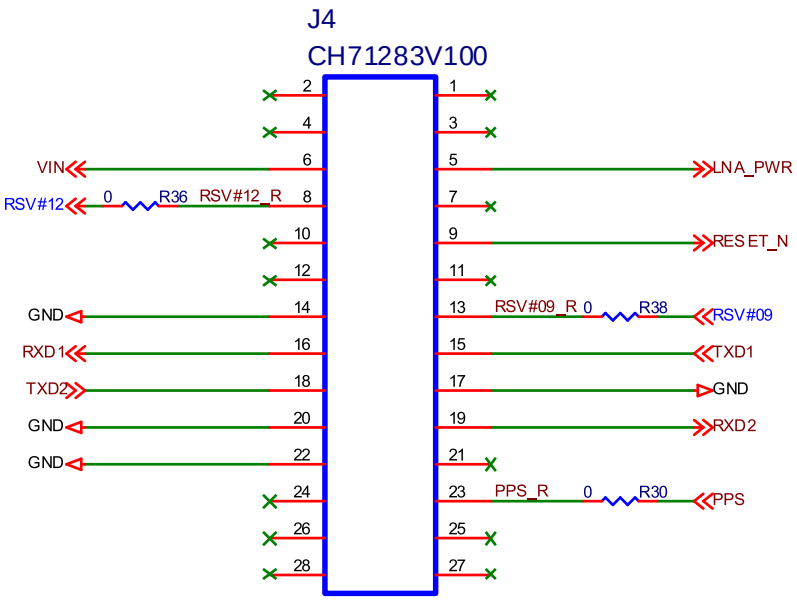


Figure 2-1 UT986 Interface

Table 2-1 UT986 Pin Description

No.	Pin Name	I/O	Description
1	NC	-	No connection inside
2	NC	-	No connection inside
3	NC	-	No connection inside
4	NC	-	No connection inside
5	LNA_PWR	I	Antenna feed voltage for LNA
6	VIN	I	Main power supply
7	NC	-	No connection inside
8	RSV	-	Reserved
9	RESET_N	I	System reset; active low
10	NC	-	No connection inside
11	NC	-	No connection inside
12	NC	-	No connection inside
13	RSV	-	Reserved
14	GND	-	Ground
15	TXD1	O	COM1 output, LVTTL
16	RXD1	I	COM1 input, LVTTL
17	GND	-	Ground
18	TXD2	O	COM2 output, LVTTL

No.	Pin Name	I/O	Description
19	RXD2	I	COM2 input, LVTTL
20	GND	-	Ground
21	NC	-	No connection inside
22	GND	-	Ground
23	PPS	O	PPS output
24	NC	-	No connection inside
25	NC	-	No connection inside
26	NC	-	No connection inside
27	NC	-	No connection inside
28	NC	-	No connection inside

☞ The availability of the ports depends on the firmware version of the module UT986.

3 Power Supply

The power supply of the evaluation board 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.

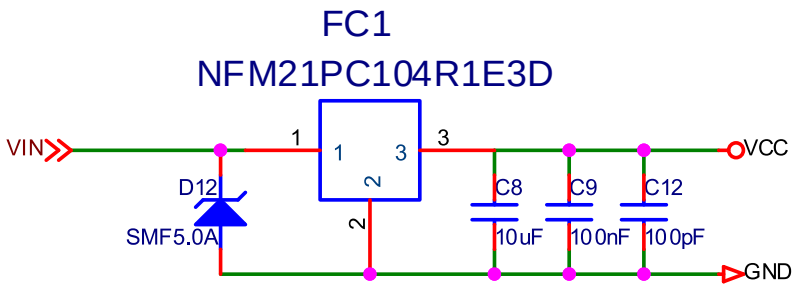


Figure 3-1 Power Filter Circuit

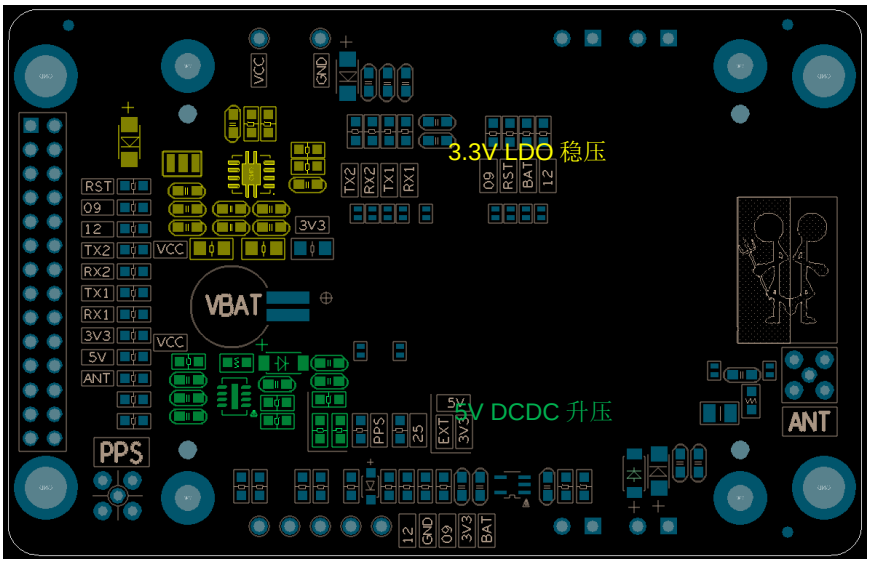


Figure 3-2 3.3 V LDO and 5 V DC/DC on the Bottom of EB

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 evaluation board.

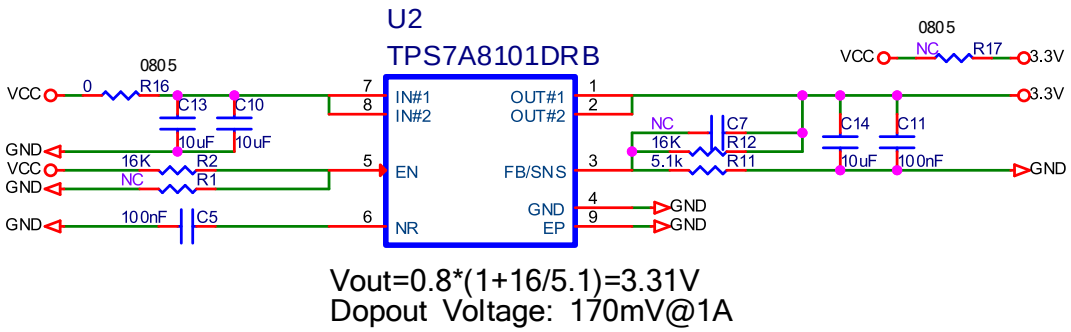


Figure 3-3 LDO Circuit

Notes:

- The rated output current of LDO should be more than twice the current of the module.
- R16 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.
- R17 is a resistor connected in parallel with LDO. After removing R16 and soldering R17, you can use an external power to supply the module.

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

3.2 5 V DC/DC Power Supply

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

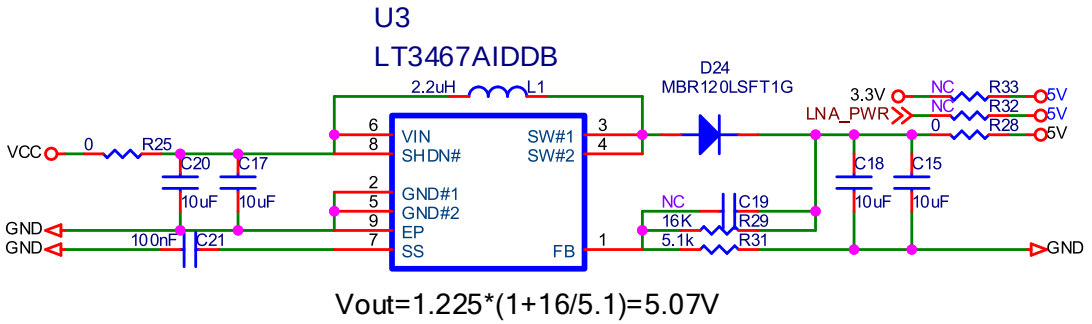


Figure 3-4 5 V DC/DC Boost Circuit

Notes:

- You can choose whether to use the 5 V power on the board to feed the antenna according to the antenna type.
- R25 and R28 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.
- R32: After removing R25/R28 and soldering R32, you can use the external LNA_PWR to feed the antenna. VCC does not supply power to DC/DC after removing R25.
- R33: After removing R25/R28 and soldering R33, you can use the 3.3 V power supply output by the LDO to feed the antenna.

3.3 Backup Power Supply

When using the hot start function of the module UT986, you need to provide backup power for the module.

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

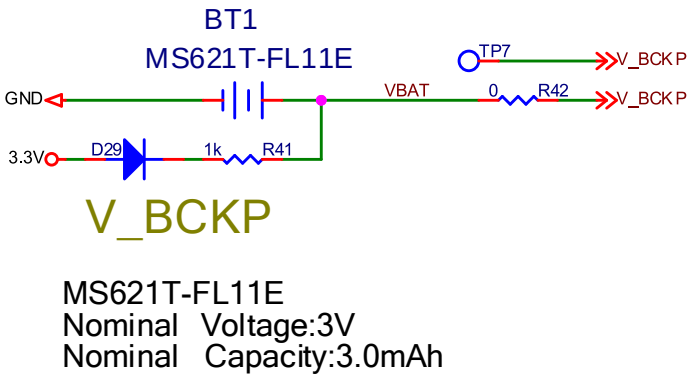


Figure 3-5 Backup Power Circuit

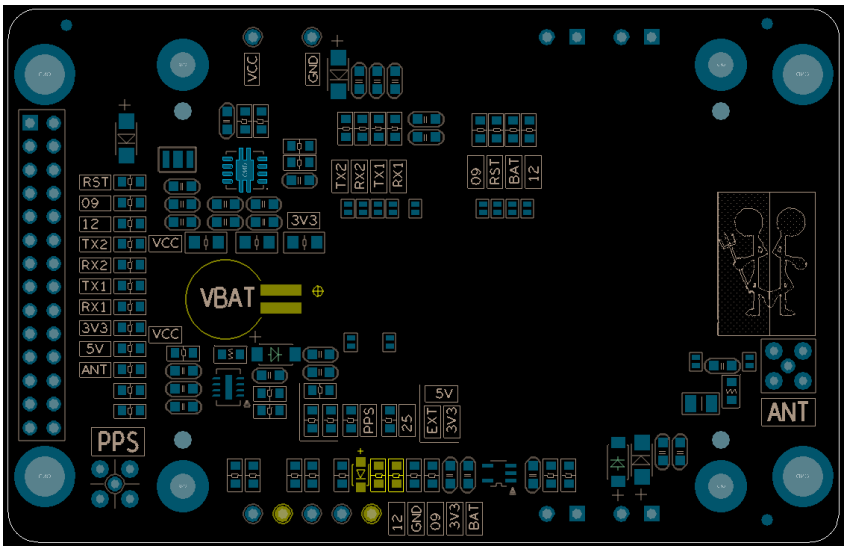


Figure 3-6 Backup Power Circuit on the Bottom of EB

Note

- 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 D29 shows in Figure 3-5.
- According to the maximum charging current of the battery, a current-limiting resistor should be added, as the R41 shows in Figure 3-5.
- V_BCKP can also be powered through the test point TP7. Removing R42, connecting a power supply wire at TP7 and a ground wire at TP4, 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 evaluation board, the micro battery charging circuit on the board will automatically charge the micro battery.

☞ If the board 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.
(1) 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.
(2) 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.
(3) When the micro battery runs out of power, it will take more than 96 hours to fully charge the battery.
(4) Under normal circumstances, after powering the board for one night, the hot start test can be done normally the next day.

4 Antenna Circuit

4.1 Antenna Short Protection Circuit

The antenna short protection circuit consists of a load management chip and peripheral circuits. 5 V DC/DC circuit output feeds the antenna via the chip. When the antenna current is larger than 100 mA, the circuit triggers a short protection and FLAGB gives a low level indication.

After removing R44 and R45, the antenna short protection circuit is bypassed. You can use the 5 V DC/DC circuit output to feed the antenna by soldering R46.

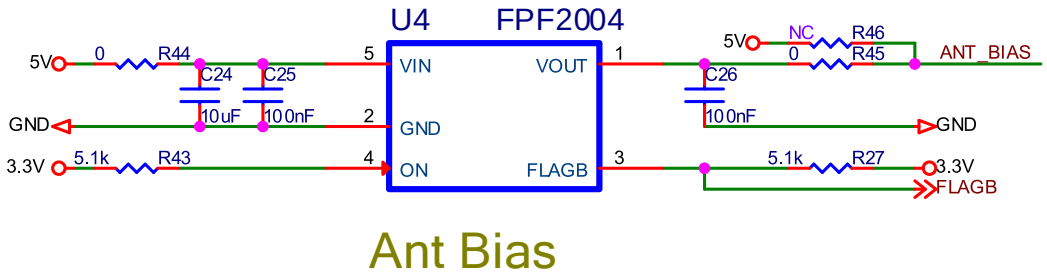


Figure 4-1 Antenna Short Protection Circuit

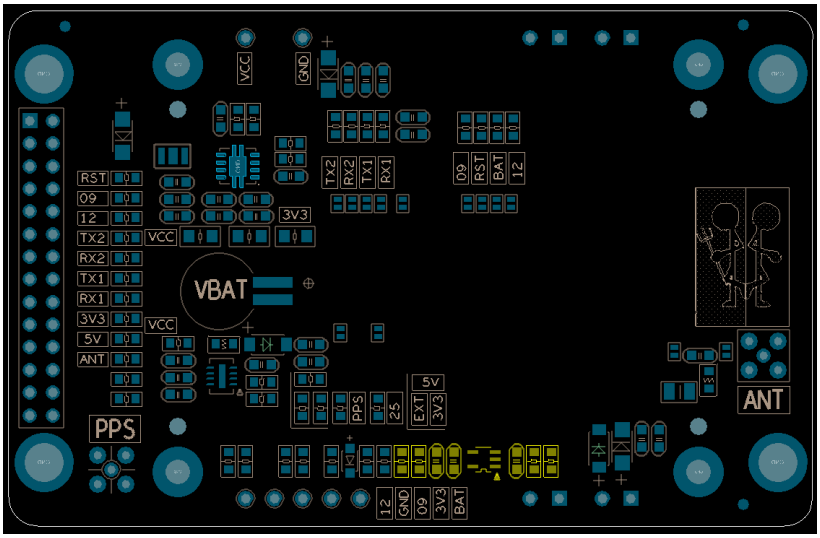


Figure 4-2 Antenna Short Protection Circuit on the Bottom of EB

4.2 Antenna Feed Circuit

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

Removing R45 and soldering R46, the antenna short protection circuit is bypassed. Then you can use the 5 V DC/DC circuit output directly to feed the antenna.

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

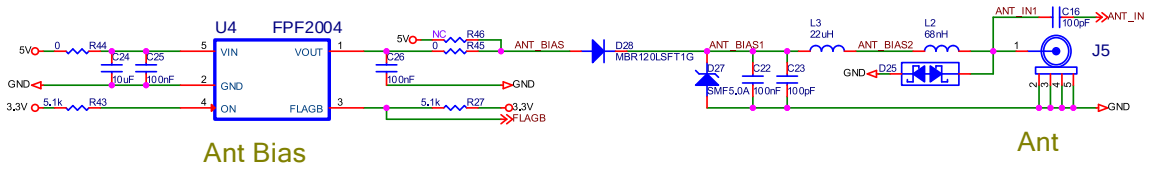


Figure 4-3 Antenna Feed Circuit

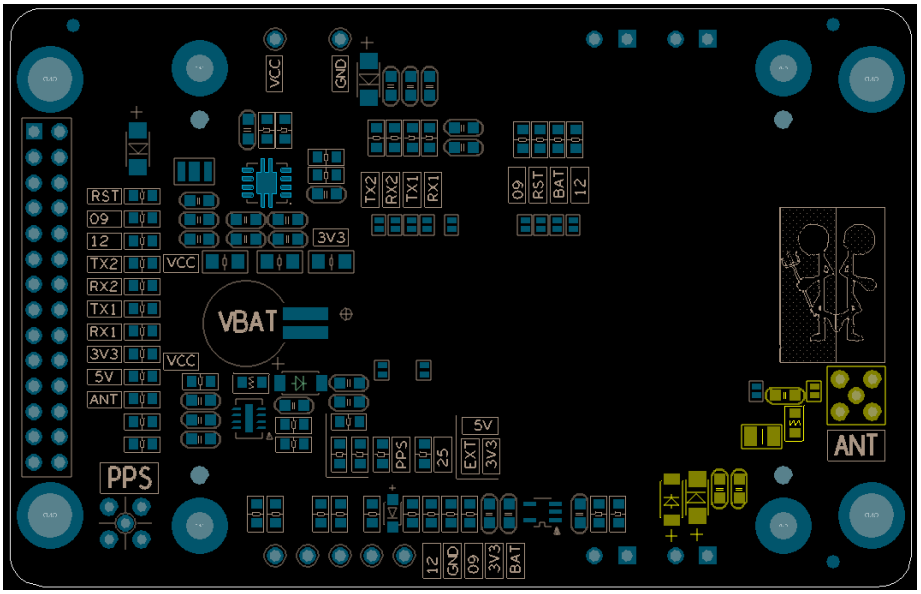


Figure 4-4 Antenna Feed Circuit on the Bottom of EB

5 LED Indicators

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

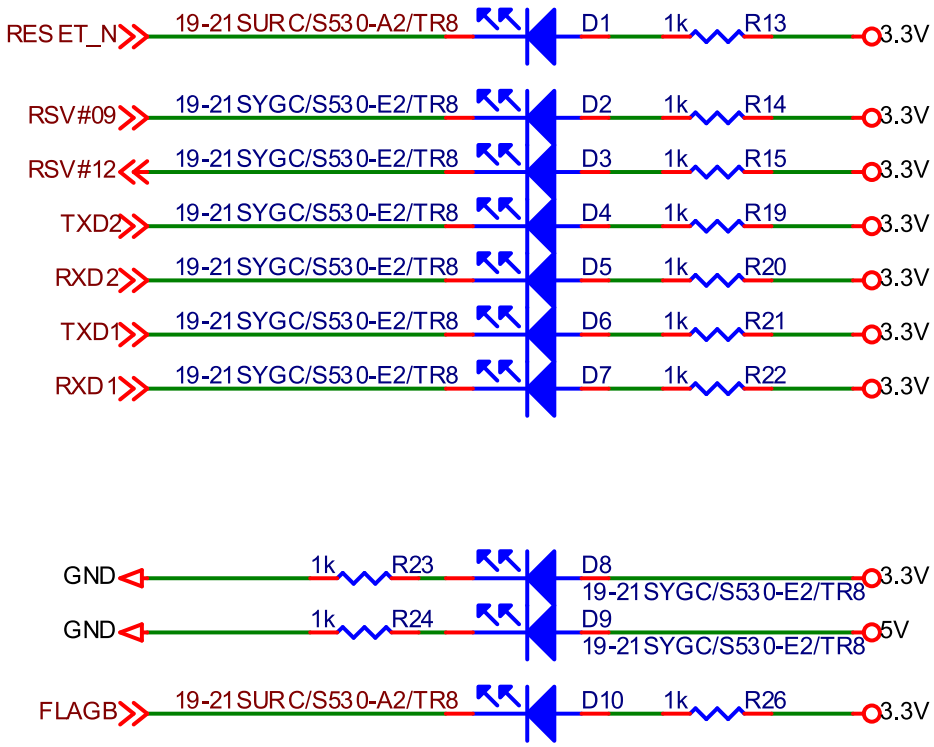


Figure 5-1 LED Indicators

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
UART	Green	Blinking when UART is working
RSV(#09, #12)	Green	Not defined

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

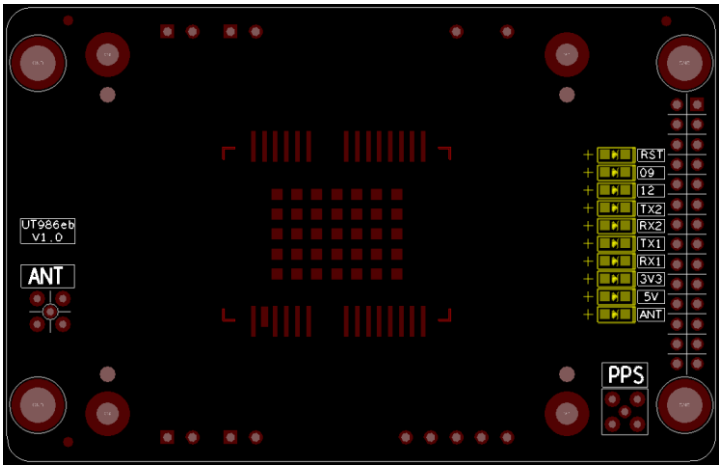


Figure 5-2 Markings on the Right of the LED Indicators

6 UT986 Series Peripheral Design

- TVS anti-surge protection is added at the input of the module. ESD protection is added at all pins.
- Use large and small VCC filter capacitors together, with a total capacitance greater than 30 μF.
- Add series resistors at the IO pins for the convenience of debugging.
- VCCIN powers the module only. R18 is a large-size resistor (with high rated power) to ensure the current capability. In the figure below, a 0805 resistor is used.
- Removing R18, connecting a power supply wire at TP1 and a ground wire at TP2 (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 the module.

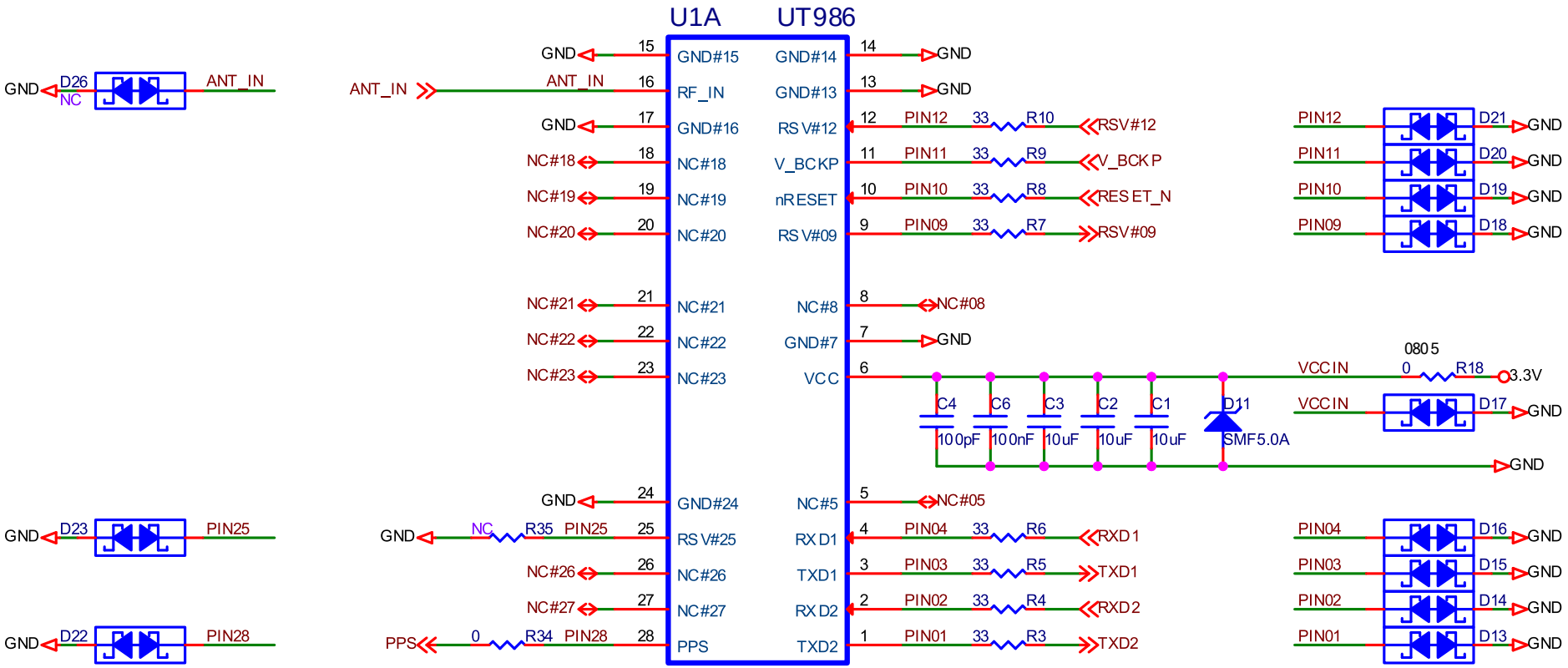


Figure 6-1 UT986 Peripheral Design

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

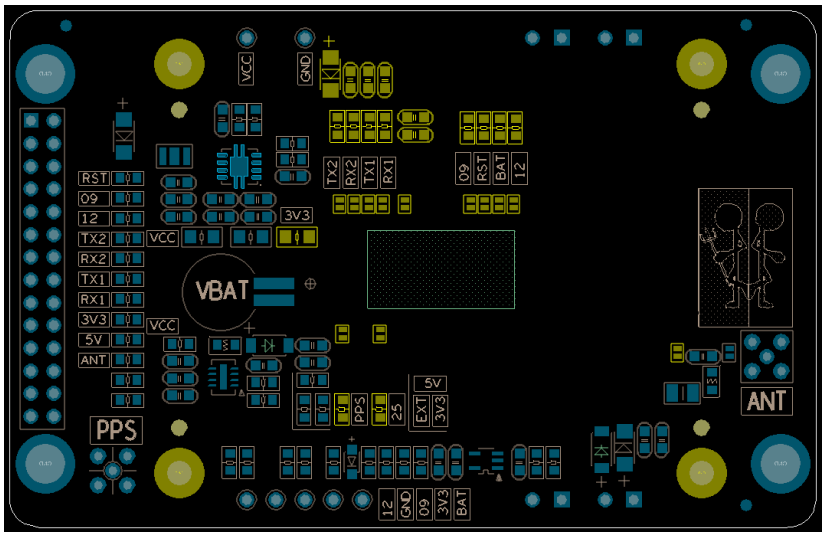


Figure 6-2 UT986 Peripheral Circuit

The GND pads at the bottom of the module should be grounded to ensure heat dissipation. The evaluation board 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

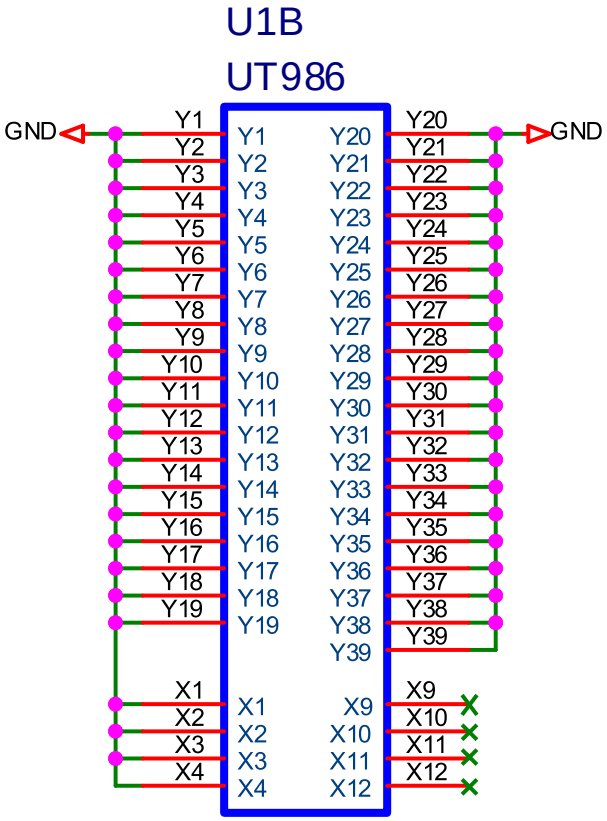


Figure 6-3 Pads (Y1-Y35) and Socket Mounting Holes (X1-X12)

7 Debug Support

- As mentioned above, TP1 and TP7 can be used to connect an external power to supply VCCIN and V_BCKP and to measure the supply voltage and current.
- TP3 and TP5 are used for internal debugging
- 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.

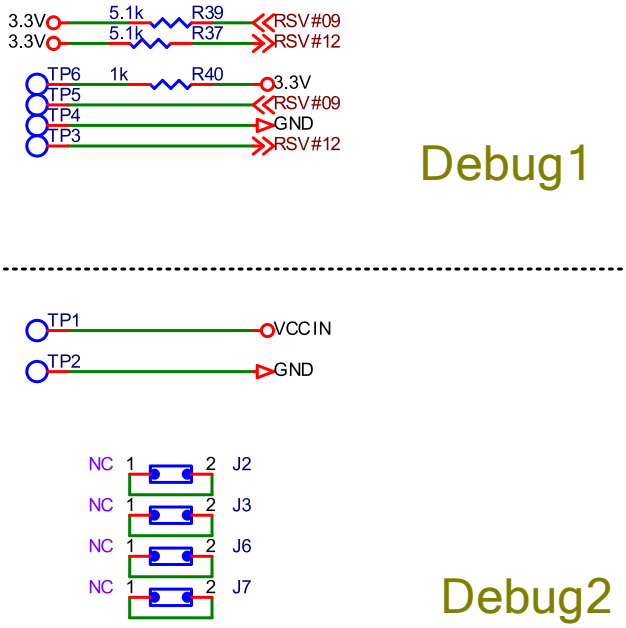


Figure 7-1 Debug Ports

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

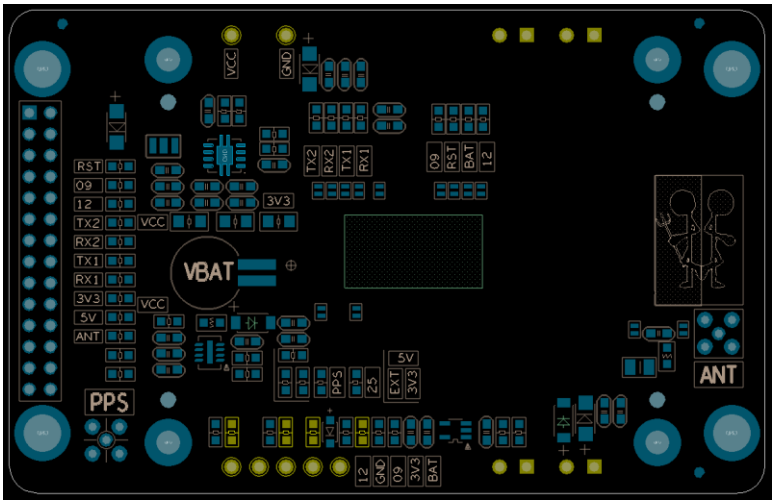
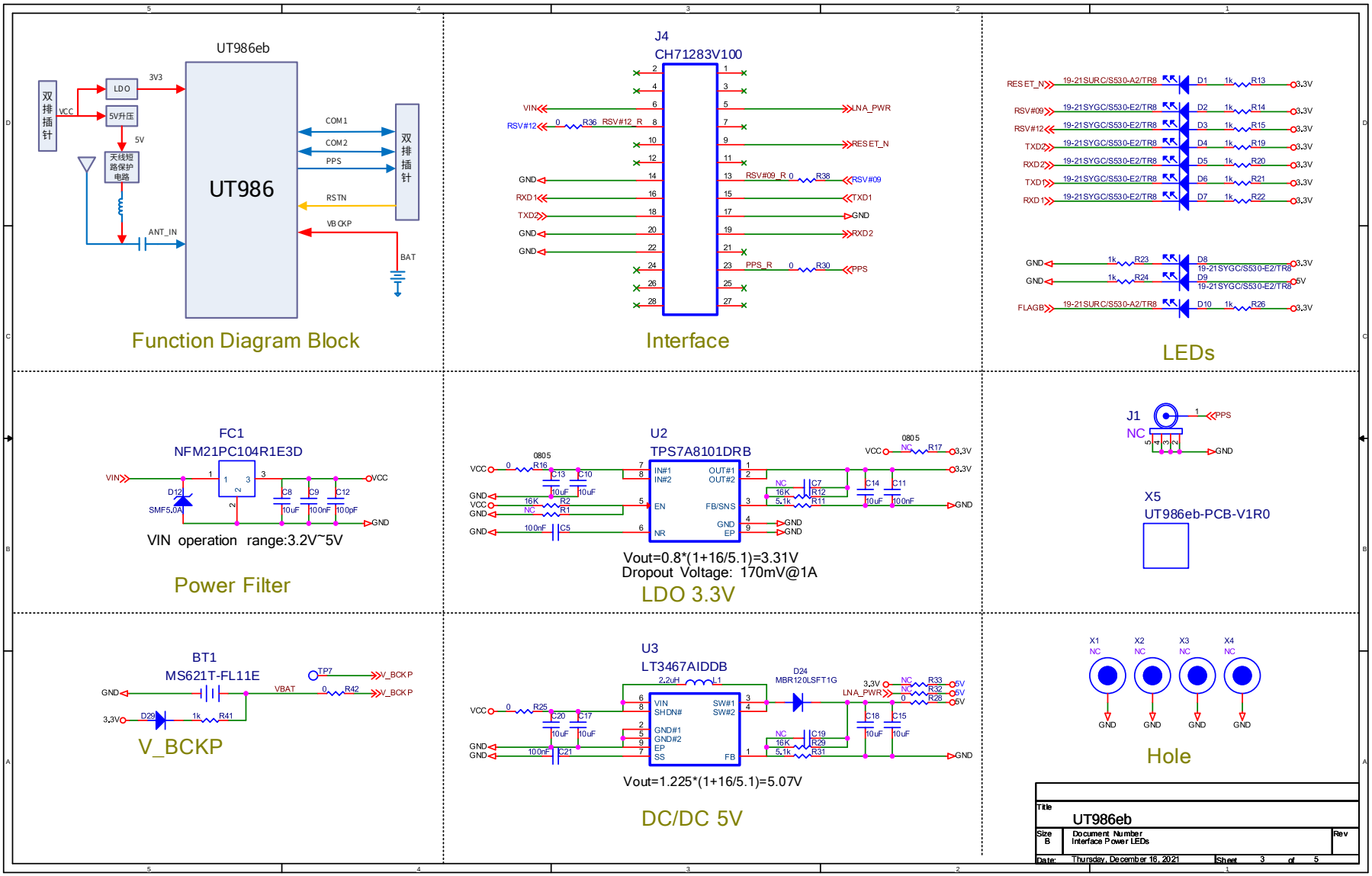


Figure 7-2 Through-Hole Test Points

Appendix

UT986eb schematics:


UT986eb
UT986
双排插针
LDO
3V3
5V升压
5V
天线短路保护电路
ANT_IN
VCC
COM1
COM2
PPS
RSTN
VBCKP
BAT
Function Diagram Block
J4
CH71283V100
VIN
RSV#12
LNA_PWR
RESET_N
RSV#09
TXD1
RXD2
PPS
GND
Interface
RESET_N
RSV#09
RSV#12
TXD2
RXD2
TXD1
RXD1
FLAGB
19-21SURC/S530-A2/TR8
19-21SYGC/S530-E2/TR8
3.3V
5V
LEDs
FC1
NFM21PC104R1E3D
SMF5.0A
VIN operation range:3.2V~5V
Power Filter
U2
TPS7A8101DRB
Vout=0.8*(1+16/5.1)=3.31V
Dropout Voltage: 170mV@1A
LDO 3.3V
J1
NC
PPS
GND
X5
UT986eb-PCB-V1R0
BT1
MS621T-FL11E
V_BCKP
U3
LT3467AIDDB
D24
MBR120LSFT1G
Vout=1.225*(1+16/5.1)=5.07V
DC/DC 5V
X1
X2
X3
X4
Hole
Title
UT986eb
Size B
Document Number
Interface Power LEDs
Rev
Date: Thursday, December 16, 2021
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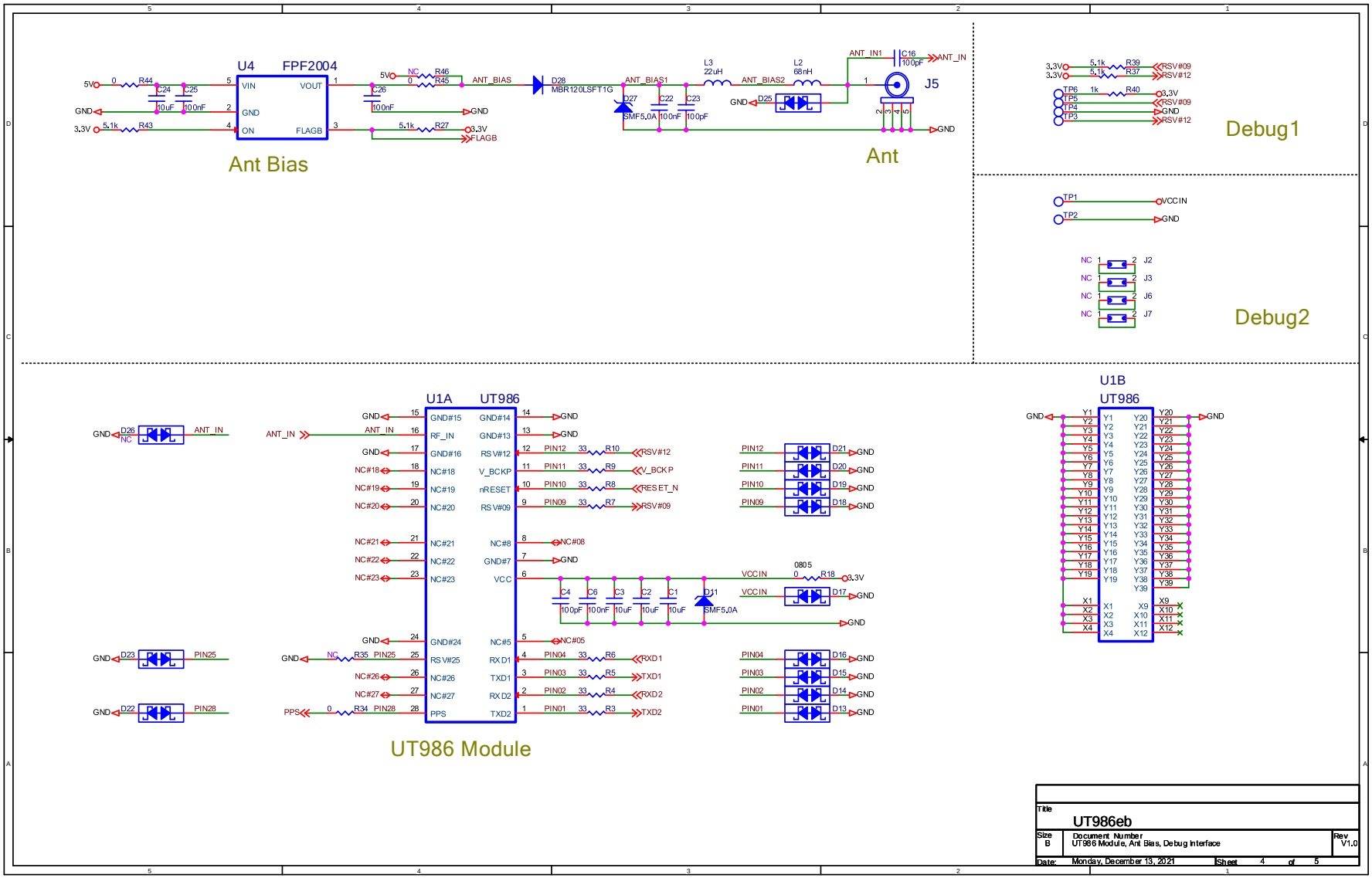
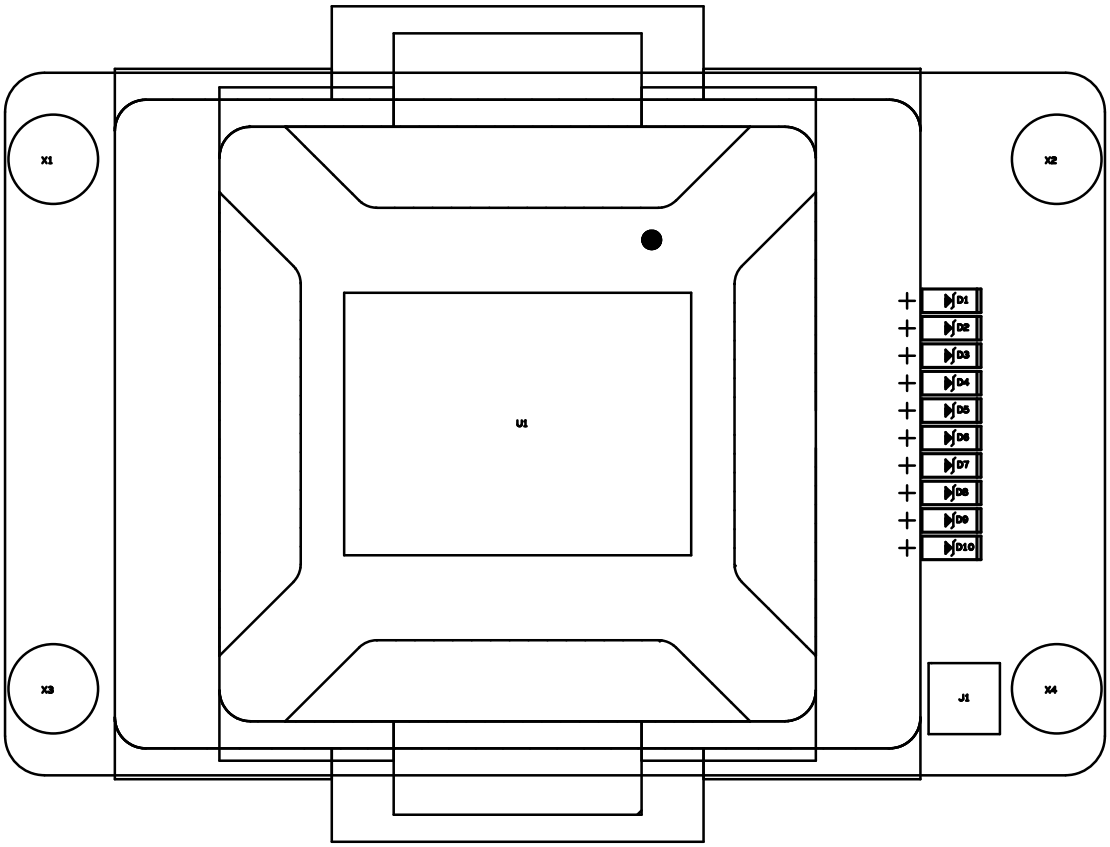
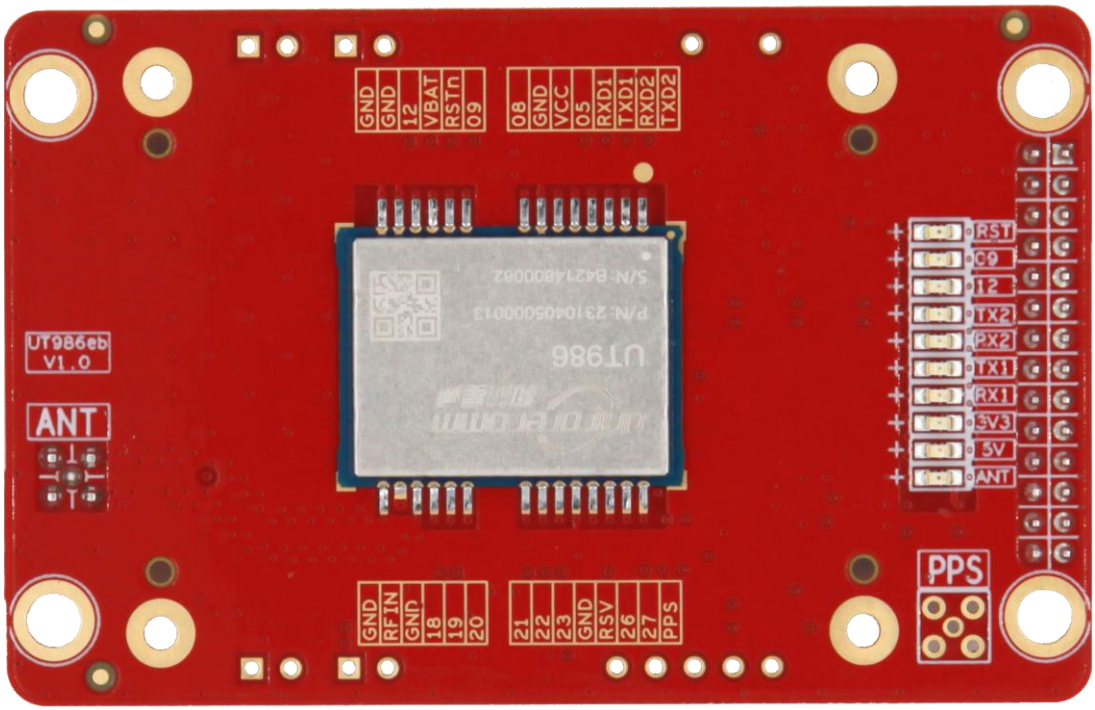
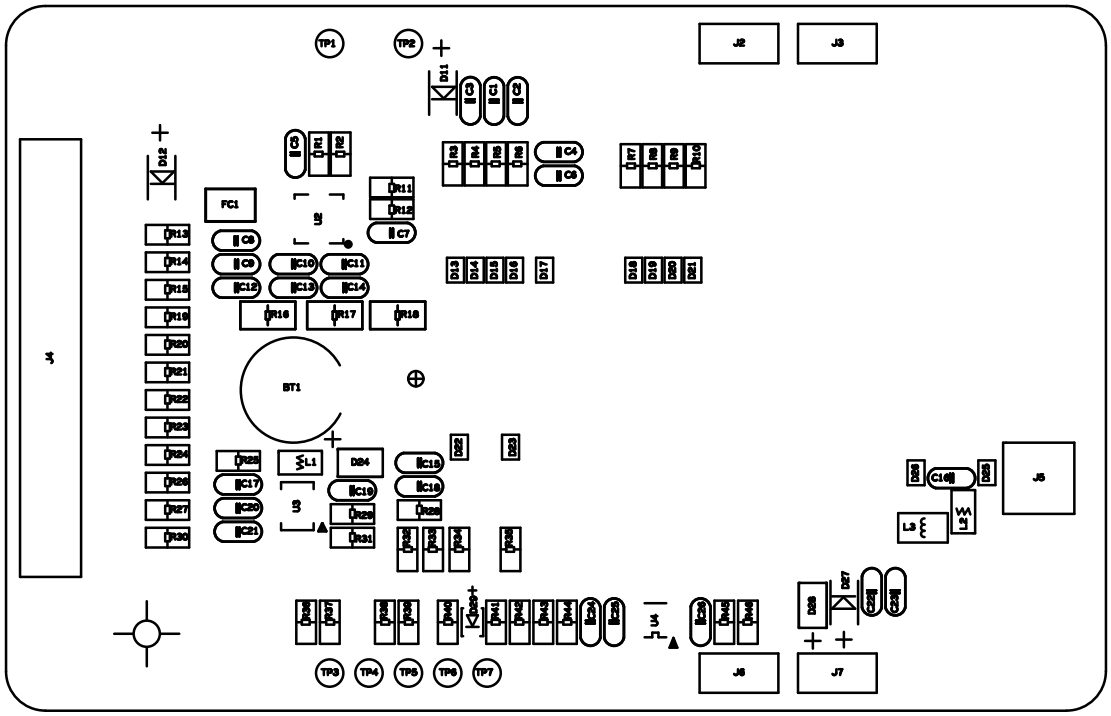

U4 FPF2004
VIN
VOUT
GND
ON
FLAGB
Ant Bias
J5
Ant
Debug1
Debug2
U1A UT986
U1B UT986
UT986 Module
Title
UT986eb
Size B
Document Number
UT986 Module, Ant Bias, Debug Interface
Rev V1.0
Date: Monday, December 13, 2021
Sheet 4 of 5

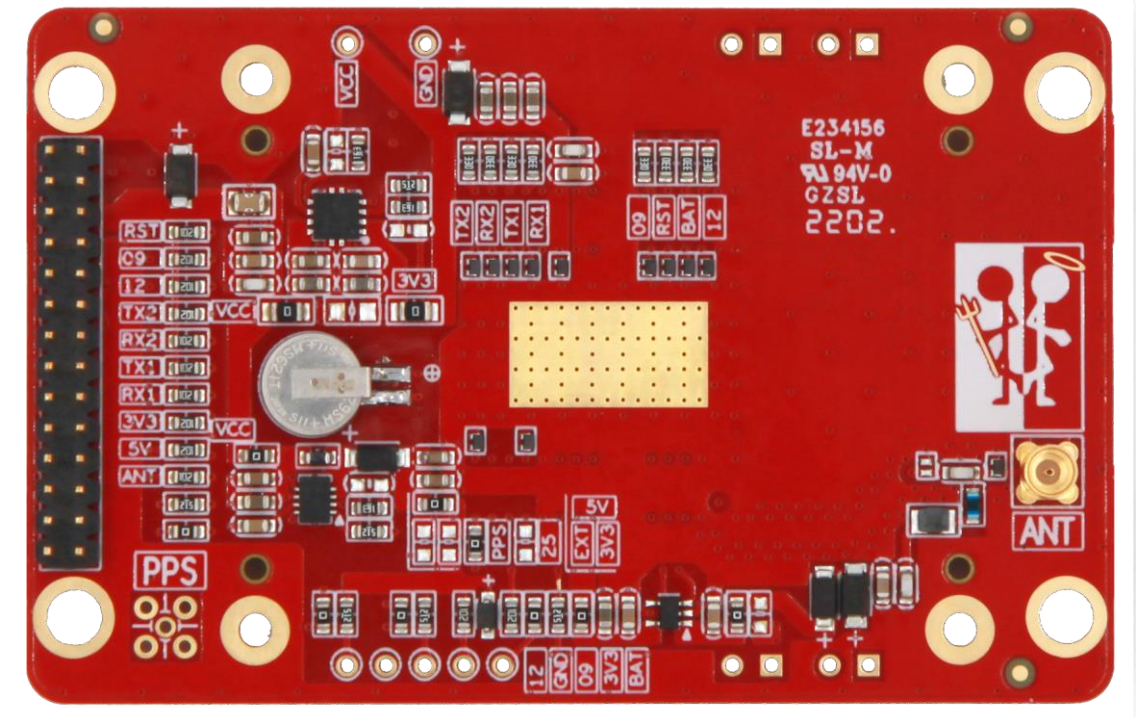
Assembly Top of UT986





Assembly Bottom of UT986





和芯星通科技（北京）有限公司

Unicore Communications, Inc.

北京市海淀区丰贤东路 7 号北斗星通大厦三层
F3, No.7, Fengxian East Road, Haidian, Beijing, P.R.China,
100094
www.unicorecomm.com

Phone: 86-10-69939800

Fax: 86-10-69939888

info@unicorecomm.com