HARDWARE

USER MANUAL

WWW.UNICORECOMM.COM

UM960 Series Evaluation Board (UM960eb and UM960Leb)

Revision History

Version	Revision History	Date
P1.0.0	Draft	2022-11-08

Legal right notice

This manual provides information and details on the products of Unicore Communication, Inc. ("Unicore") referred to herein.

All rights, title and interest to this document and the information such as data, designs, layouts contained in this manual are fully reserved, including but not limited to the copyrights, patents, trademarks and other proprietary rights as relevant governing laws may grant, and such rights may evolve and be approved, registered or granted from the whole information aforesaid or any part(s) of it or any combination of those parts.

Unicore holds the trademarks of "和芯星通", "UNICORECOMM" and other trade name, trademark, icon, logo, brand name and/or service mark of Unicore products or their product serial referred to in this manual (collectively "Unicore Trademarks").

This manual or any part of it, shall not be deemed as, either expressly, implied, by estoppel or any other form, the granting or transferring of Unicore rights and/or interests (including but not limited to the aforementioned trademark rights), in whole or in part.

Disclaimer

The information contained in this manual is provided "as is" and is believed to be true and correct at the time of its publication or revision. This manual does not represent, and in any case, shall not be construed as a commitments or warranty on the part of Unicore with respect to the fitness for a particular purpose/use, the accuracy, reliability and correctness of the information contained herein.

Information, such as product specifications, descriptions, features and user guide in this manual, are subject to change by Unicore at any time without prior notice, which may not be completely consistent with such information of the specific product you purchase.

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.

Foreword

This manual provides information on the hardware composition and design of the UM960 series evaluation board (UM960eb and UM960Leb).

Target Readers

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

Contents

1 Product Overview

UM960 series evaluation board (EB) includes two types: UM960eb and UM960Leb. The board consists of the module (UM960 or UM960L), 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 UM960 and UM960L. Figure 1-1 to Figure 1-3 take UM960 as an example of the module to introduce.

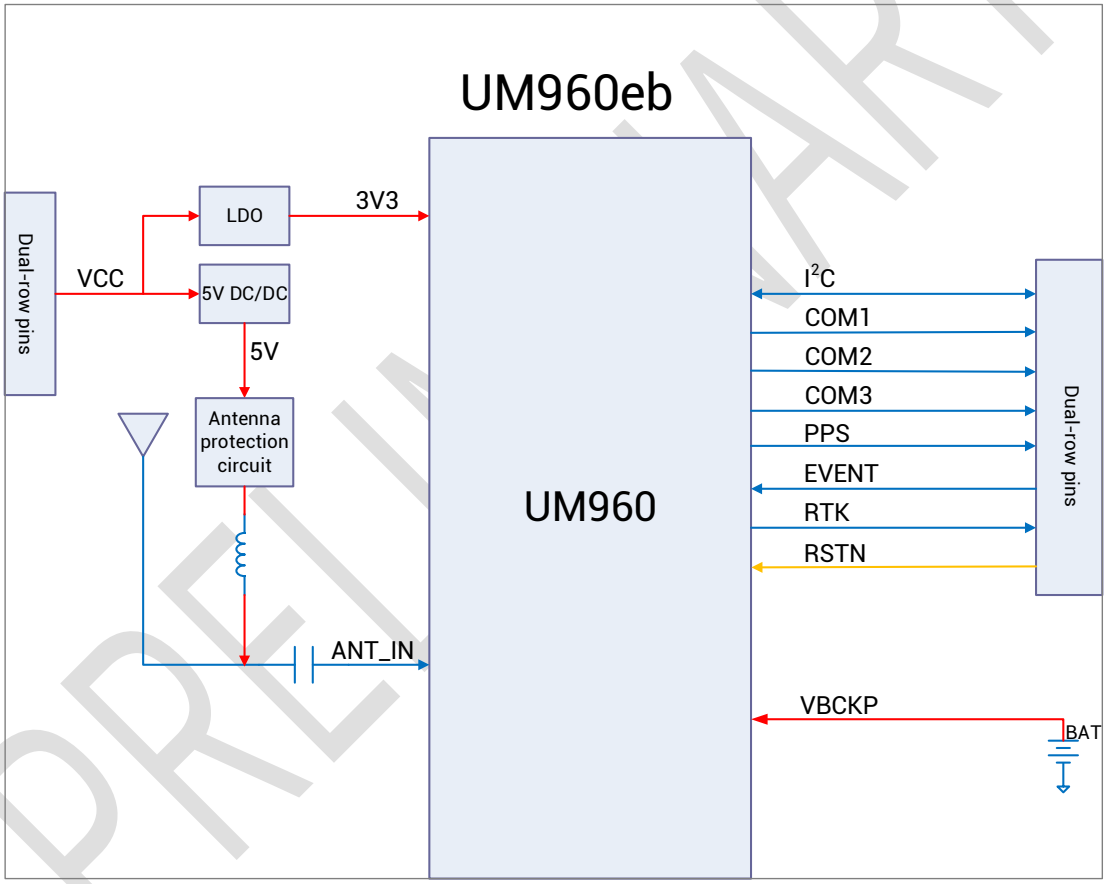


Figure 1-1 UM960eb Block Diagram[1]

[1] I²C is the reserved interface, not supported currently.

☞ Figure 1-2 is UM960eb and it has UM960 on it. If you order UM960Leb, the module is UM960L.

The appearance of UM960eb is as follows:

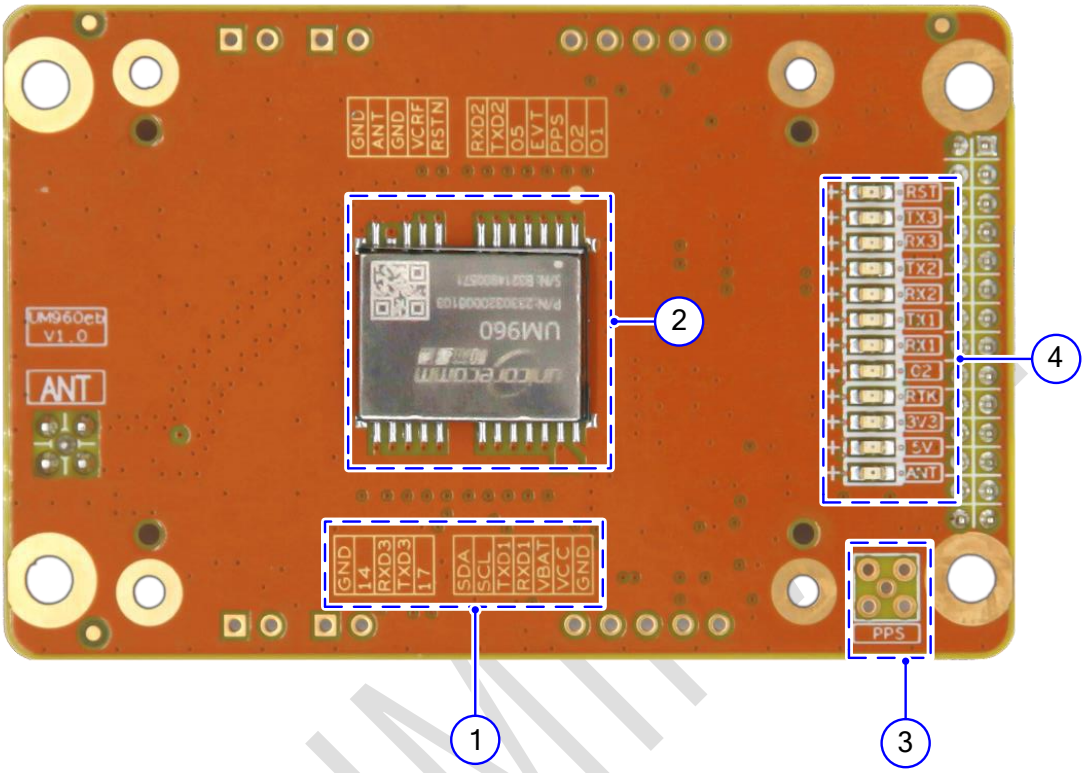


Figure 1-2 Top View of UM960eb

(1) Silkscreen: It marks the signals of the pins. The smaller holes around are used to mount the UM960 socket. The printing adopts exposed copper to ensure the flatness of the surface.

(2) UM960 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, the positioning status and UART.

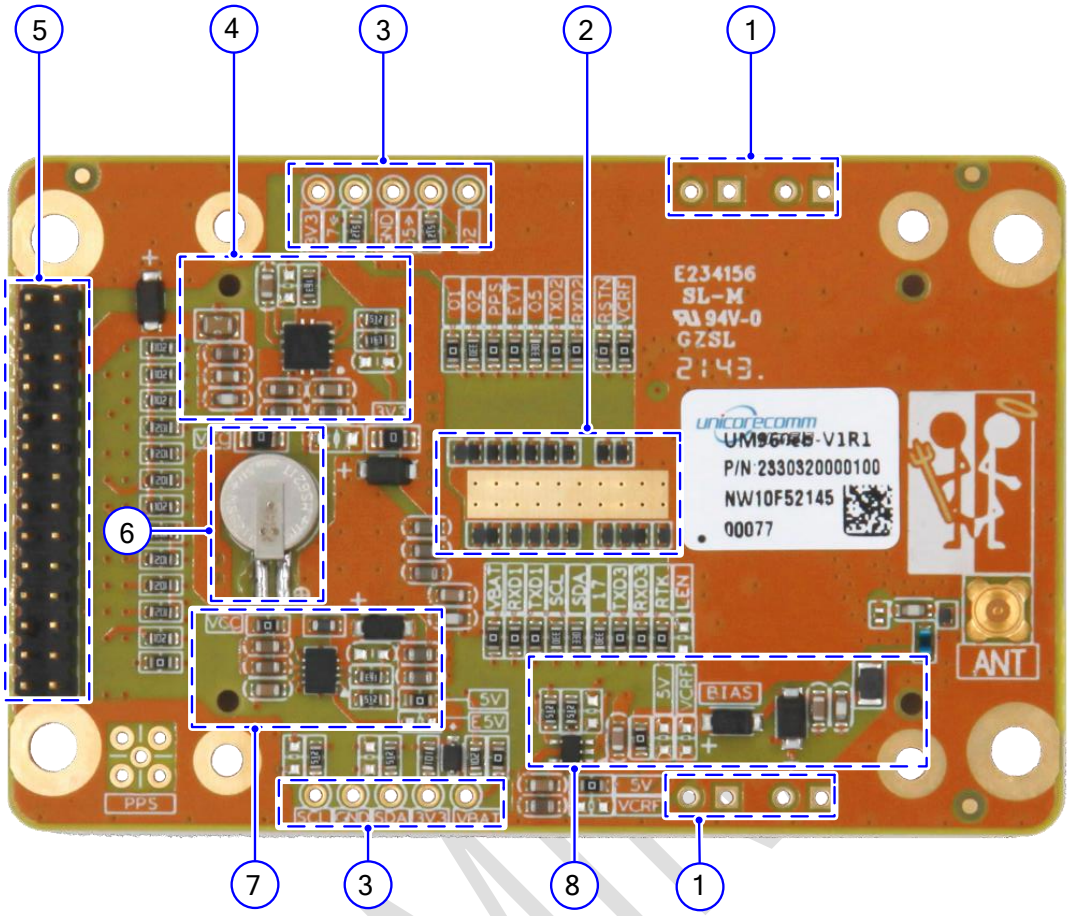


Figure 1-3 Bottom View of UM960eb

(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.

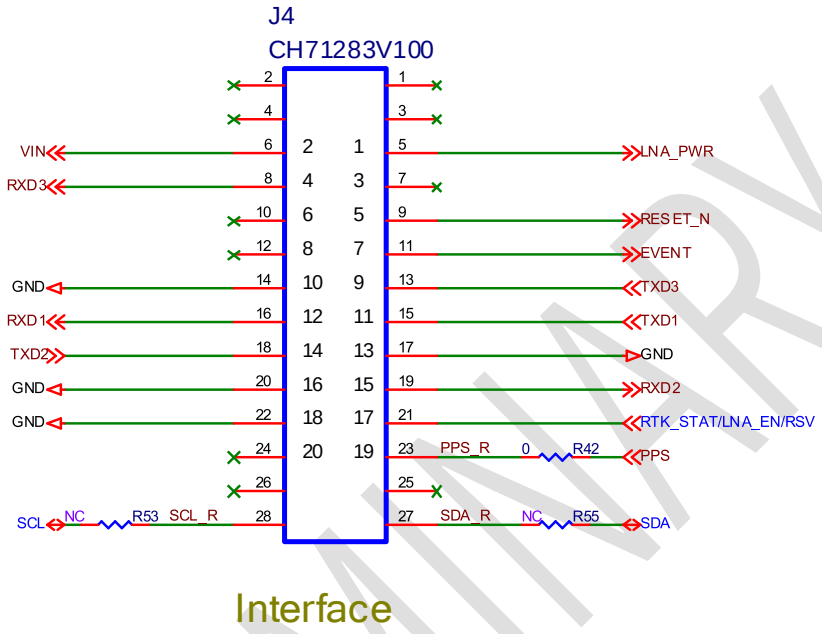


Figure 2-1 UM960eb/UM960Leb Interface

Table 2-1 UM960eb/UM960Leb 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	RXD3	I	COM3 input, LVTTL
9	RESET_N	I	System reset; active low
10	NC	-	No connection inside
11	EVENT	I	Event input
12	NC	-	No connection inside
13	TXD3	O	COM3 output, LVTTL
14	GND	-	Ground
15	TXD1	O	COM1 output, LVTTL
16	RXD1	I	COM1 input, LVTTL
17	GND	-	Ground

No.	Pin Name	I/O	Description
18	TXD2	O	COM2 output, LVTTL
19	RXD2	I	COM2 input, LVTTL
20	GND	-	Ground
21	RTK_STAT/LAN_EN/RSV	O	Corresponding to pin14 of UM960/UM960L; see Table 6-1 for more details
22	GND	-	Ground
23	PPS	O	PPS output
24	NC	-	No connection inside
25	NC	-	No connection inside
26	NC	-	No connection inside
27	SDA	I/O	I^2C data
28	SCL	I/O	I^2C clock

☞ The availability of the ports depends on the firmware version of the module UM960/UM960L.

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.

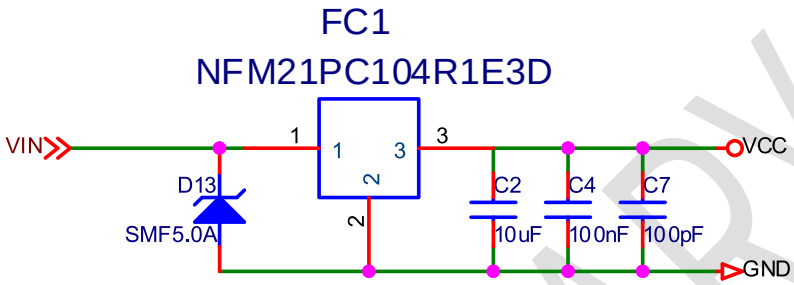


Figure 3-1 Power Filter Circuit

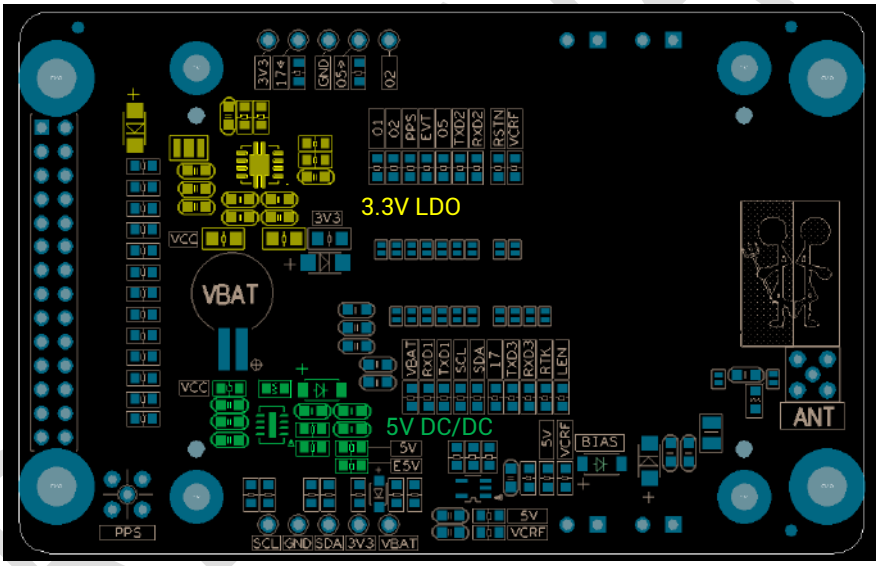


Figure 3-2 3.3 V LDO and 5 V DC/DC on the Bottom of EB

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.

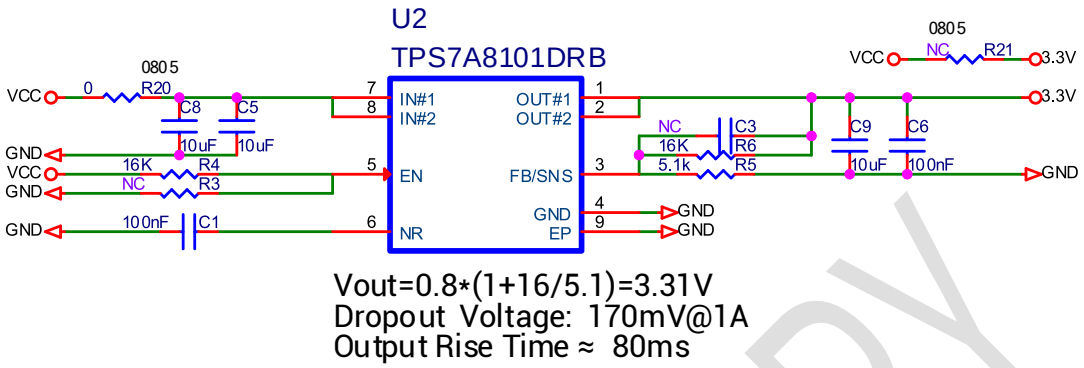


Figure 3-3 LDO Circuit

Notes:

- The rated output current of LDO should be more than twice the current of the module.
- R20 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.
- R21 is a resistor connected in parallel with LDO. After removing R20 and soldering R21, you can use external VIN to power the module.

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.

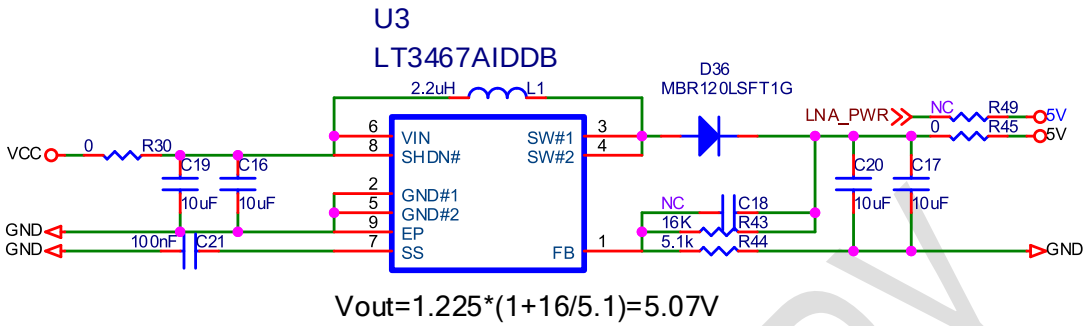


Figure 3-4 5 V DC/DC Boost Circuit

Notes:

- You can choose whether to use the 5 V power on the board to feed the antenna according to the antenna type.
- R30 and R45 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.
- R49: After removing R30/R45 and soldering R49, you can use the external LNA_PWR to feed the antenna. VCC does not supply power to DC/DC after removing R30.

3.3 Backup Power Supply[2]

☞ When you do not use the hot start function, connect V_BCKP to VCC. Do not connect it to ground or leave it floating.

When using the hot start function of the module UM960, you need to provide backup power for the module.

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

[2] UM960L does not support hot start function.

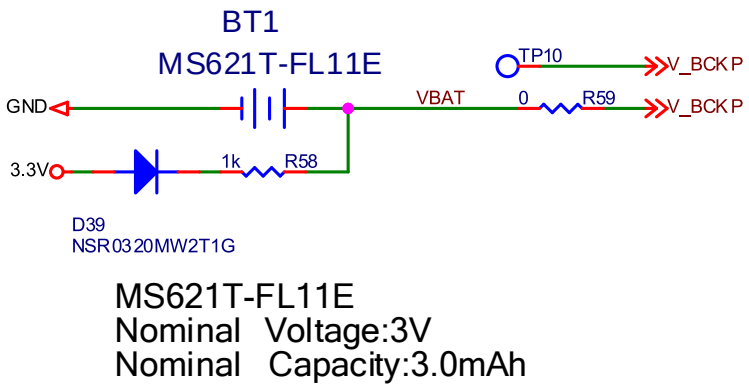


Figure 3-5 Backup Power Circuit

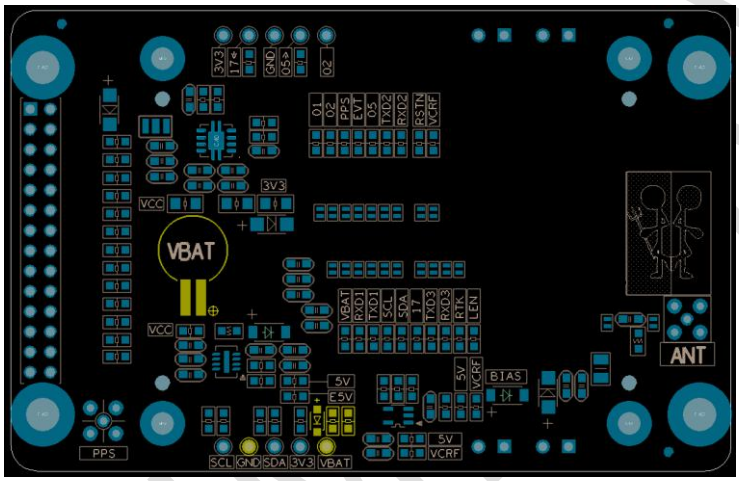


Figure 3-6 Backup Power Circuit on the Bottom of EB

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 D39 shows in Figure 3-5.
- According to the maximum charging current of the battery, a current-limiting resistor should be added, as the R58 shows in Figure 3-5.
- V_BCKP can also be powered through the test point TP10. Removing R59, connecting a power supply wire at TP10 and a ground wire at TP7, 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 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 R60 and R50, the antenna short protection circuit is bypassed. You can choose VCC_RF or 5 V DC/DC circuit output to feed the antenna by soldering R52 or R51. But it is not recommended to use VCC_RF to feed as it just provides 3.3 V voltage and it is not optimized for the anti-lightning strike and anti-surge due to the compact size of the module.

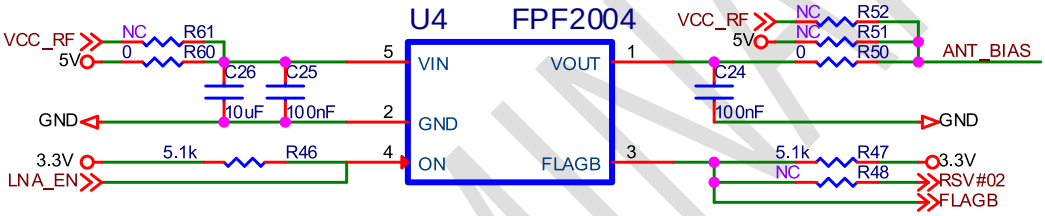


Figure 4-1 Antenna Short Protection Circuit

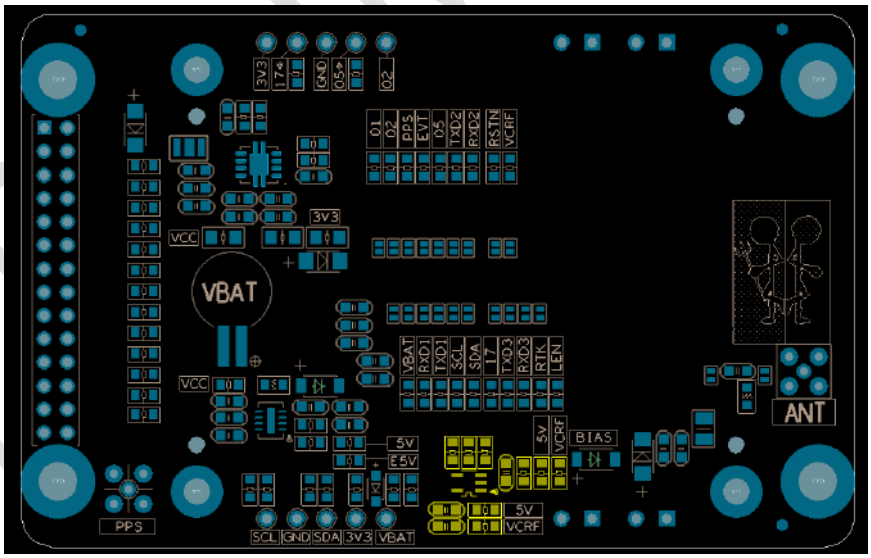


Figure 4-2 Antenna Short Protection Circuit on the Bottom of EB

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 R50 and soldering R52 or R51, the antenna short protection circuit is bypassed. Then you can choose VCC_RF or 5 V DC/DC circuit output directly to feed the antenna.

> ☞ It is not recommended to use VCC_RF to feed as it just provides 3.3 V voltage and it is not optimized for the anti-lightning strike and anti-surge due to the compact size of the module.

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

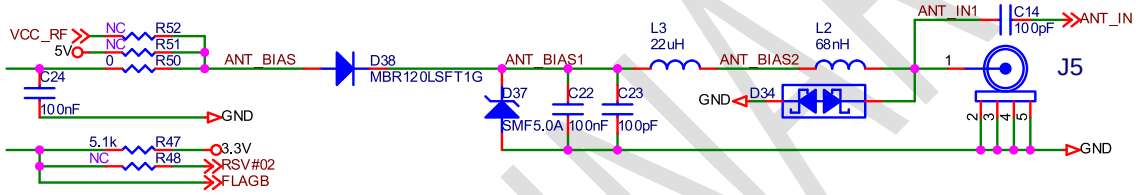


Figure 4-3 Antenna Feed Circuit

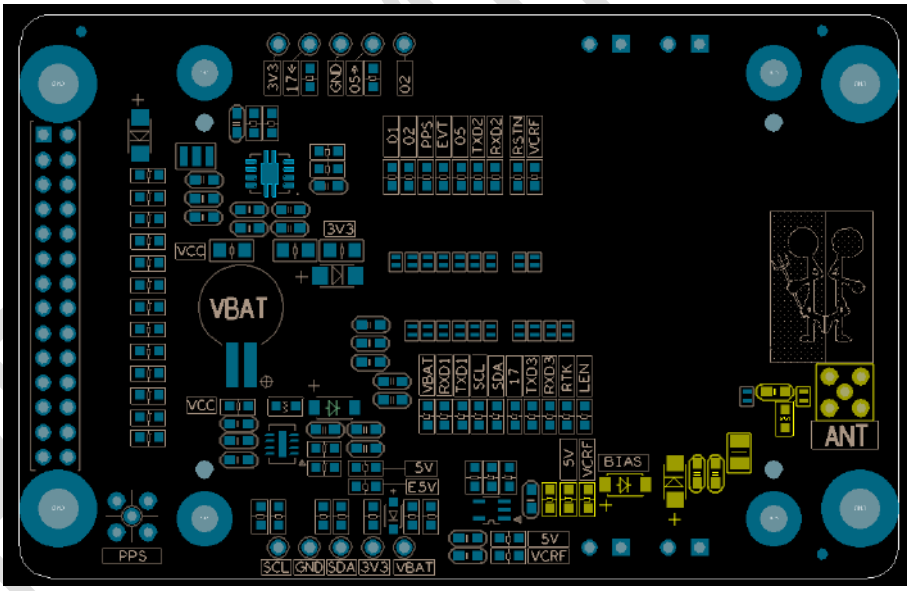


Figure 4-4 Antenna Feed Circuit on the Bottom of EB

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
RTK	Green	Light on when RTK is fixed
UART	Green	Blinking when UART is working
RSV#02	Green	Not defined

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

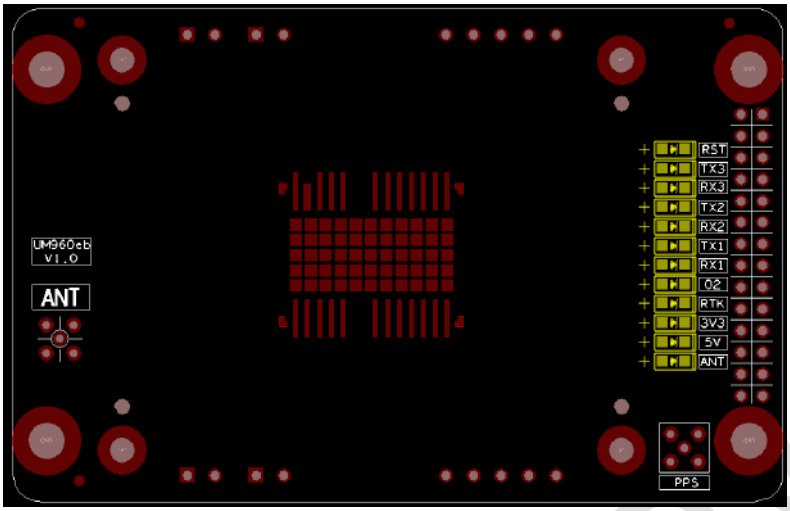


Figure 5-2 Markings on the Right of the LED Indicators

6 UM960 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. R22 is a large-size resistor (with high rated power) to ensure the current capability. In the figure below, a 0805 resistor is used.
- Removing R22, 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 UM960 series.

☞ Except pin14, the pin definitions of UM960 and UM960L are the same. Figure 6-1 shows the peripheral design of UM960, and for that of UM960L, you can keep the pin14 floating, but it cannot be connected to ground, power supply or an output interface.

Table 6-1 UM960/UM960L Pin14 Description

Module	Pin14	Description
UM960	RTK_STAT/LNA_EN	RTK_STAT: High level, RTK Fix; Low level, RTK No Fix LAN_EN: High level, enable external LNA; Low level, disable external LNA; Note: The pin function is configured by protocol. The default is RTK_STAT.
UM960L	RSV	Reserved, cannot be connected to ground, power supply or an output interface.

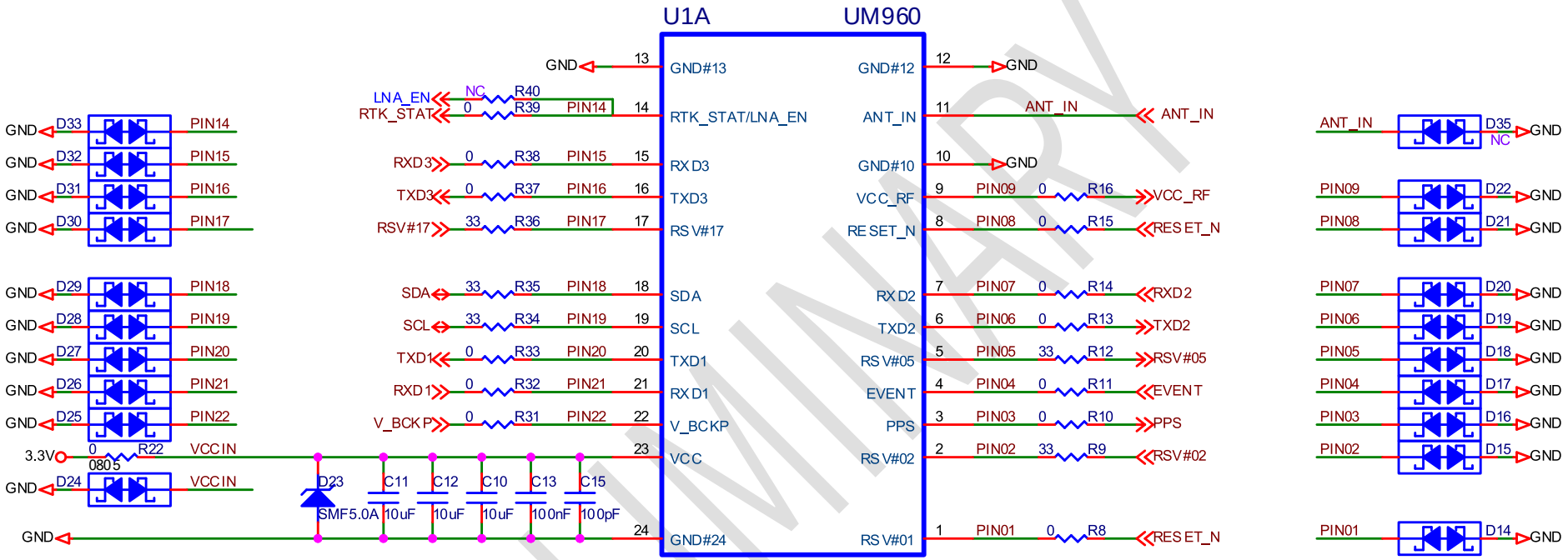


Figure 6-1 UM960 Peripheral Design

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

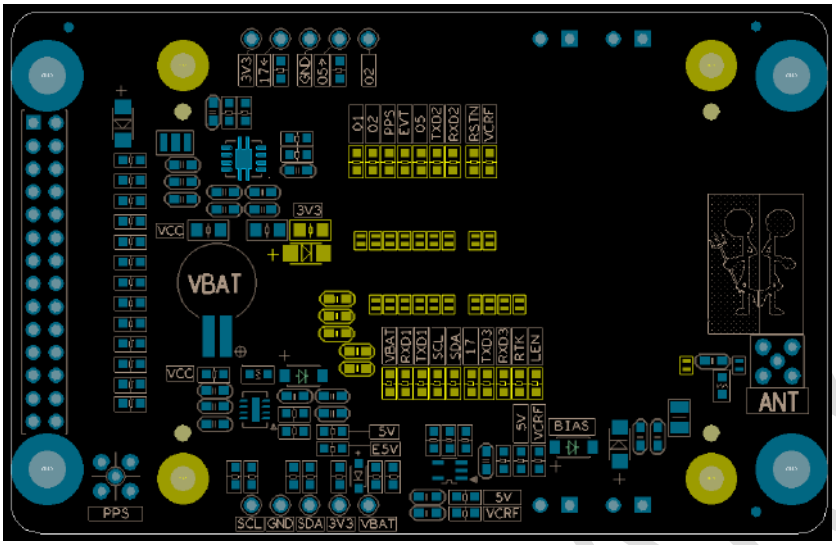


Figure 6-2 UM960 Peripheral Circuit

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.

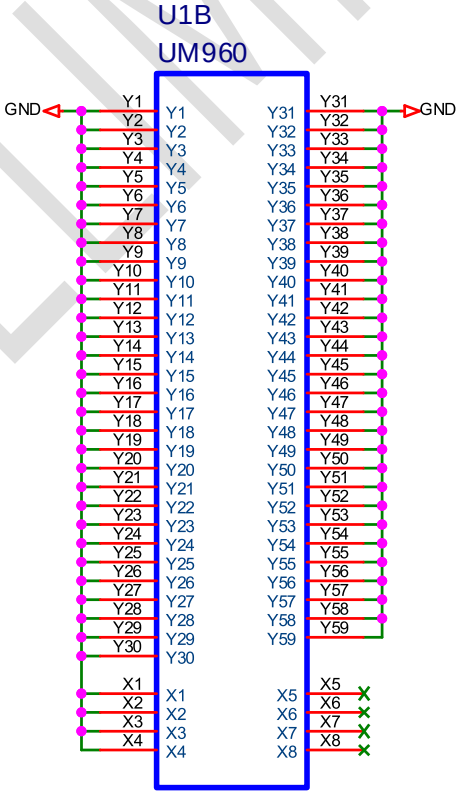


Figure 6-3 Pads (Y1-Y55) and Socket Mounting Holes (X1-X8)

7 Debug Support

- As mentioned above, TP1 and TP10 can be used to connect an external power to supply VCCIN and V_BCKP and to measure the supply voltage and current.
- TP2, TP4, TP6 and TP8 are used for internal debugging, of which TP6 and TP8 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.

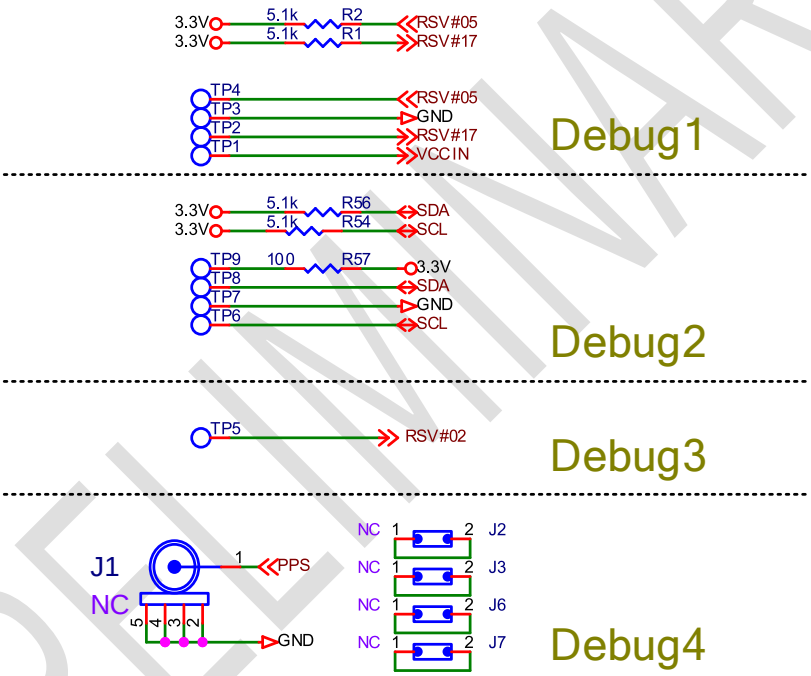


Figure 7-1 Debug Ports

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

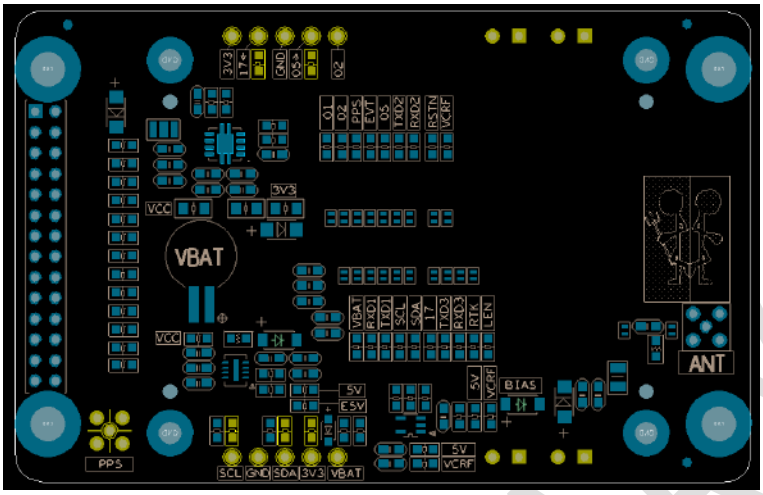
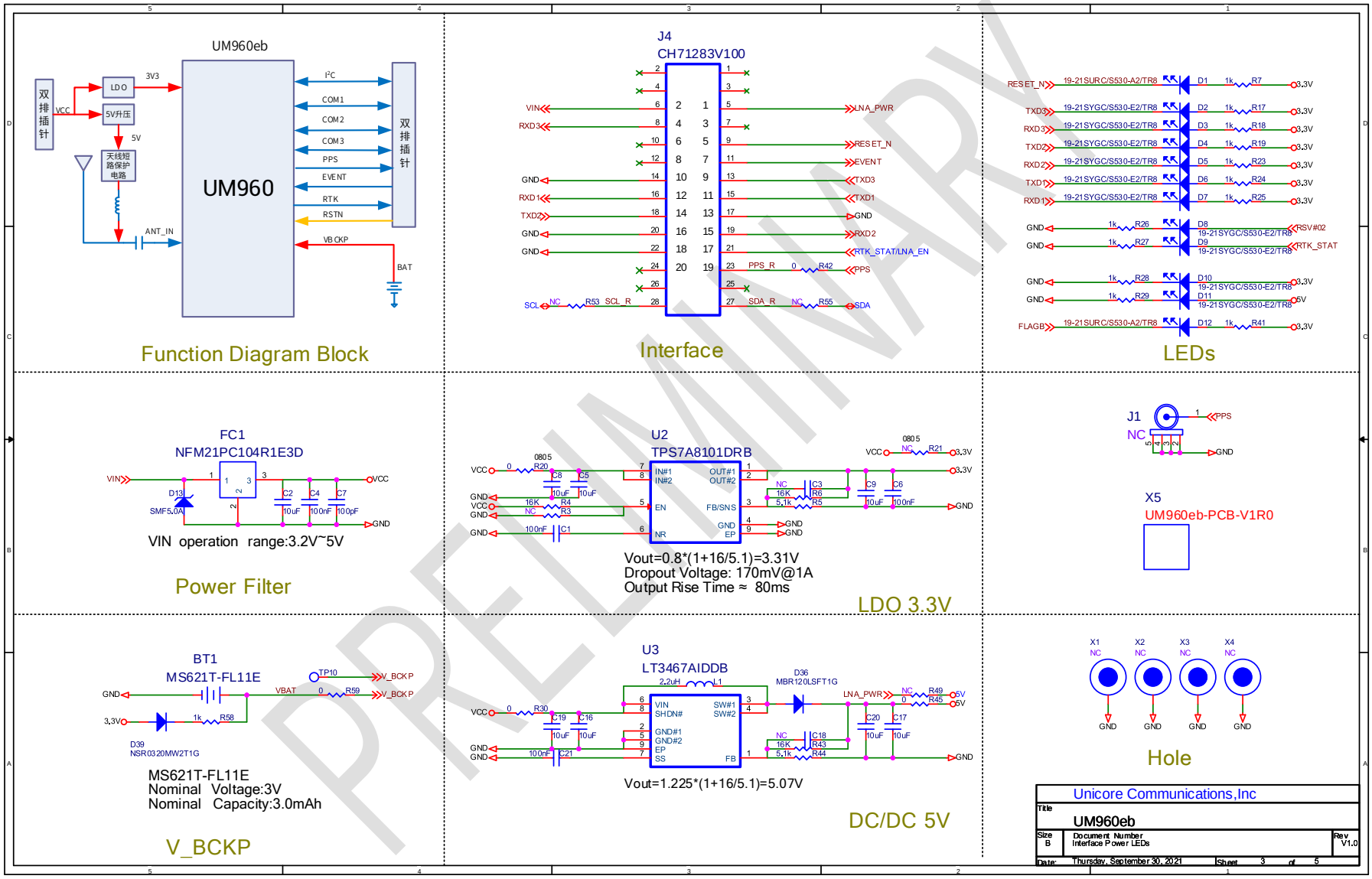
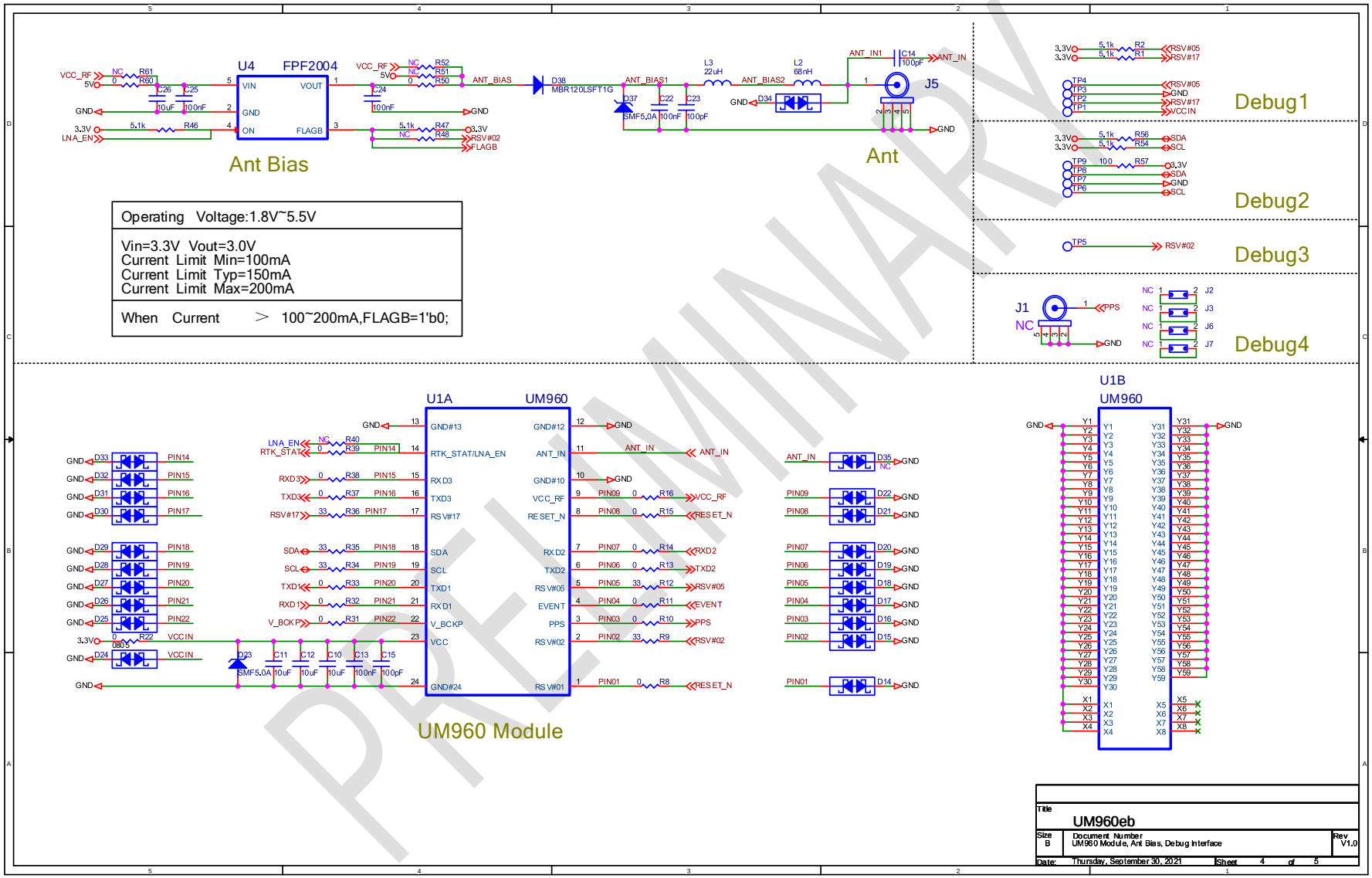


Figure 7-2 Through-Hole Test Points

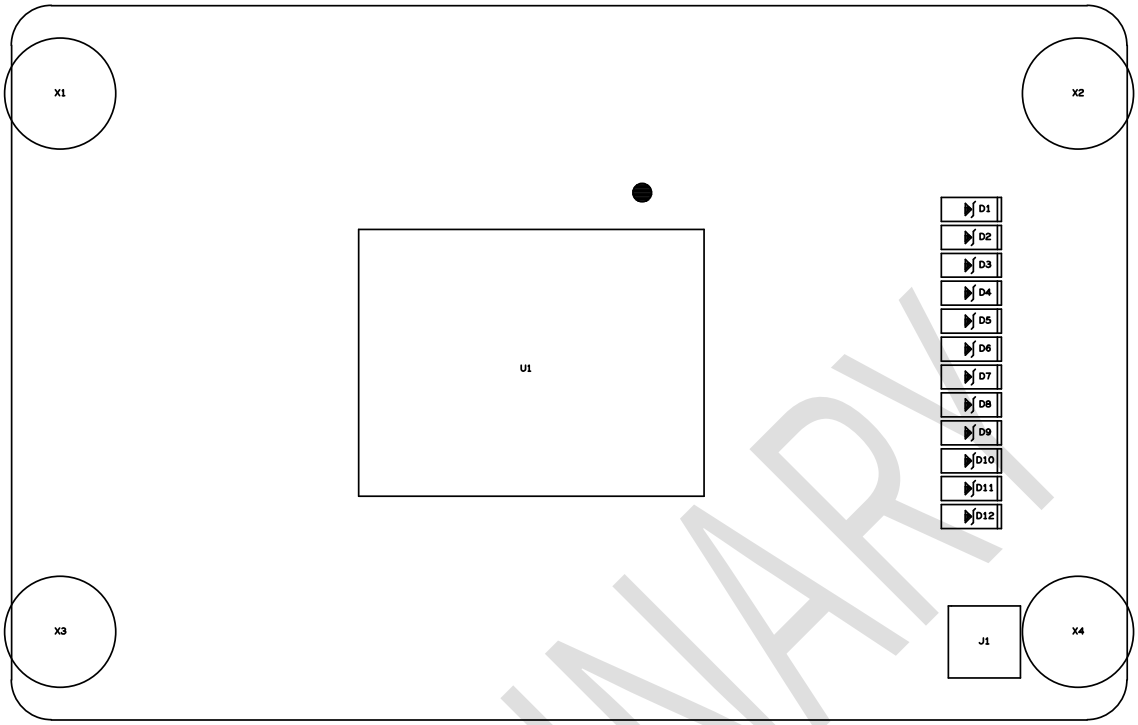
Appendix

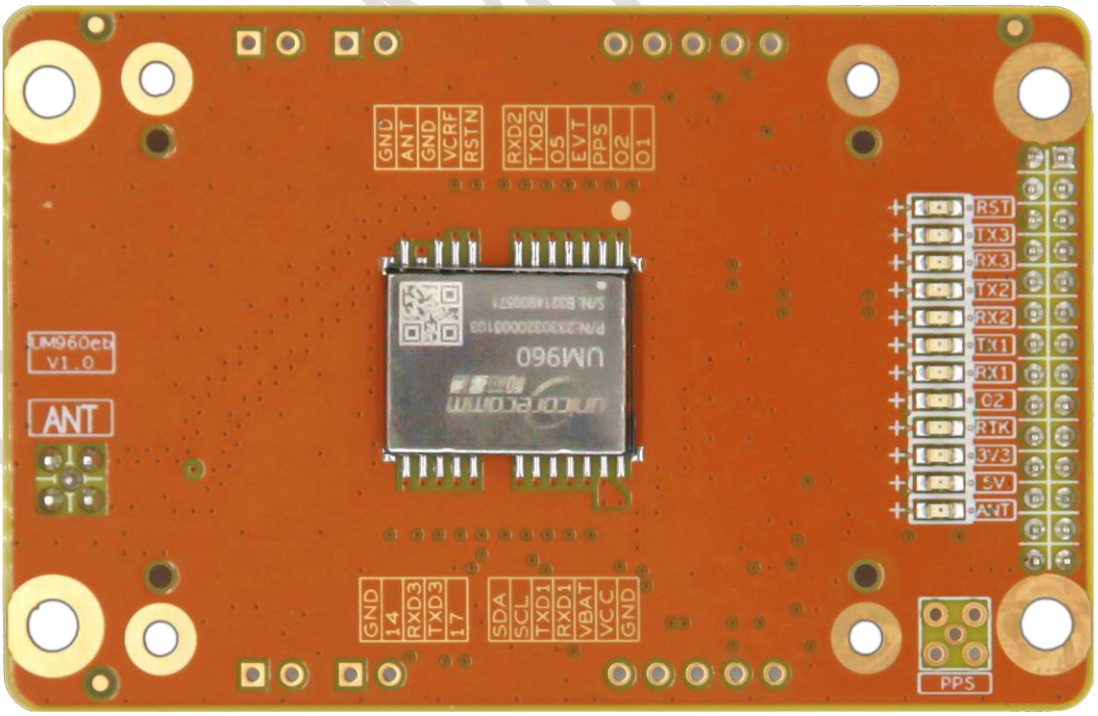
The schematics of UM960 and UM960L are almost the same except the peripheral design of pin14 (see Chapter 6) and the corresponding J4 pin21. The appendix only gives an introduction of UM960eb as a reference.


UM960eb
UM960
Function Diagram Block
J4
CH71283V100
Interface
LEDs
FC1
NFM21PC104R1E3D
VIN operation range:3.2V~5V
Power Filter
U2
TPS7A8101DRB
Vout=0.8*(1+16/5.1)=3.31V
Dropout Voltage: 170mV@1A
Output Rise Time ≈ 80ms
LDO 3.3V
J1
X5
UM960eb-PCB-V1R0
BT1
MS621T-FL11E
MS621T-FL11E
Nominal Voltage:3V
Nominal Capacity:3.0mAh
V_BCKP
U3
LT3467AIDDB
Vout=1.225*(1+16/5.1)=5.07V
DC/DC 5V
Hole
Unicore Communications,Inc
UM960eb
PRELIMINARY

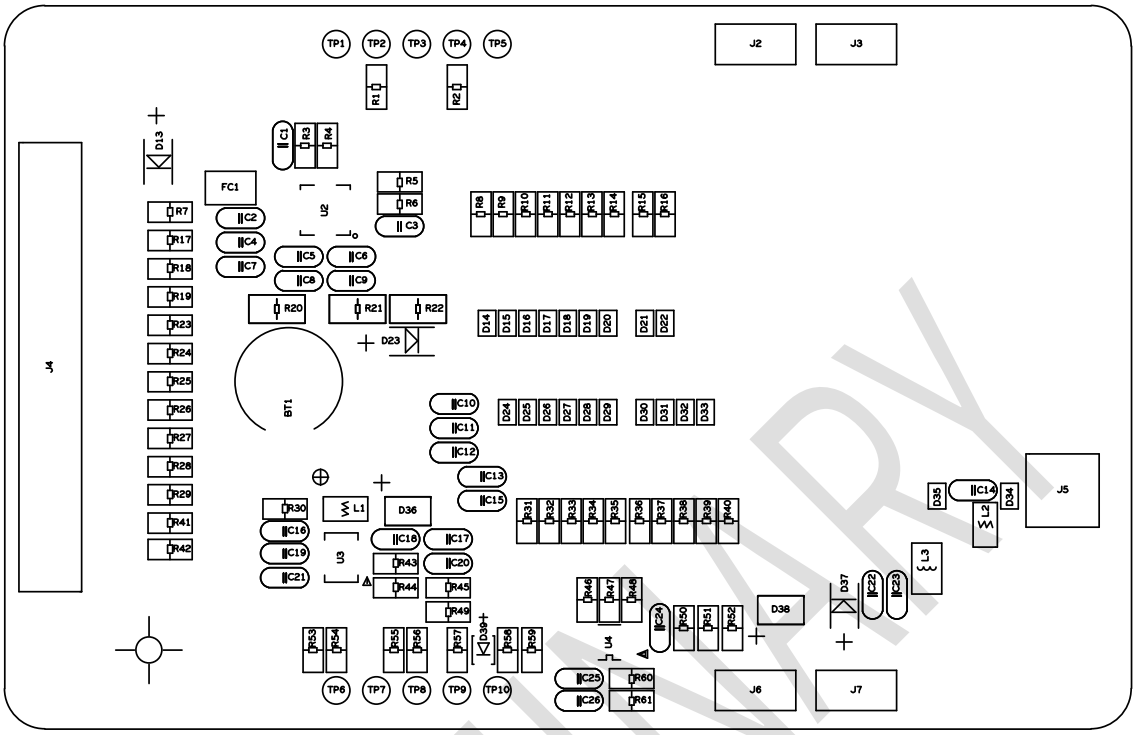

U4 FPF2004
Ant Bias
Operating Voltage:1.8V~5.5V
Vin=3.3V Vout=3.0V
Current Limit Min=100mA
Current Limit Typ=150mA
Current Limit Max=200mA
When Current > 100~200mA,FLAGB=1'b0;
Ant
Debug1
Debug2
Debug3
Debug4
U1A UM960
UM960 Module
U1B
UM960
PRELIMINARY
Title
UM960eb
Size B
Document Number
UM960 Module, Ant Bias, Debug Interface
Rev V1.0
Date: Thursday, September 30, 2021
Sheet 4 of 5

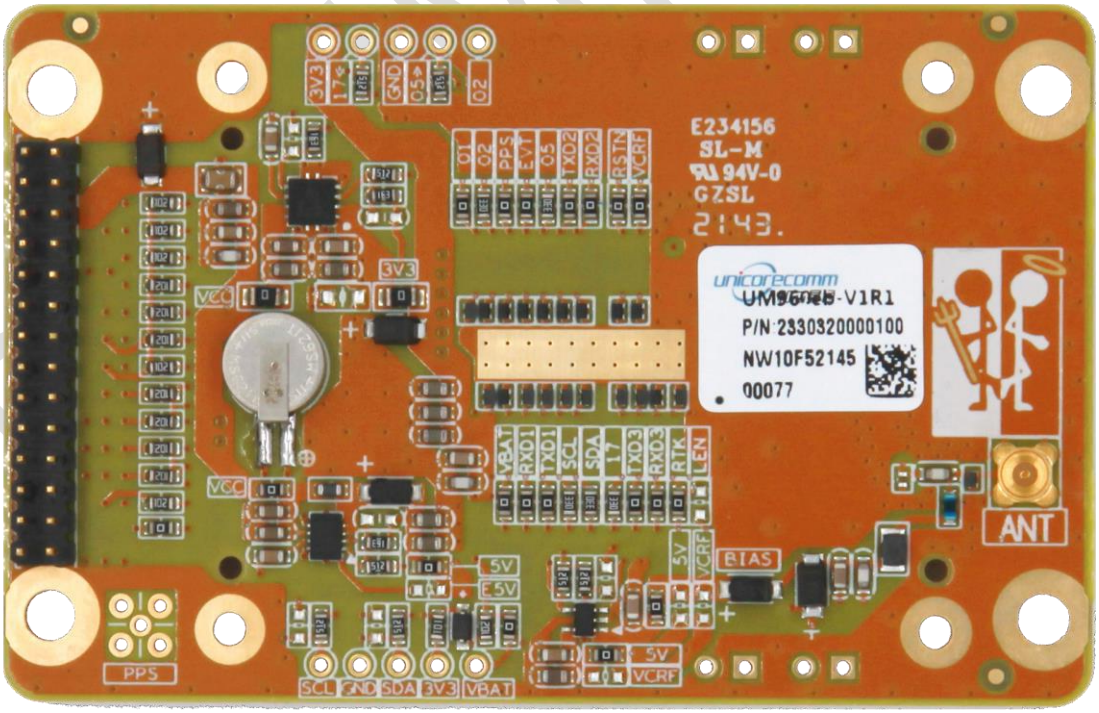
Assembly Top of UM960eb





Assembly Bottom of UM960eb





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