



# EC-01G Specification

Version V1.0

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## Formulation / Revision / Abolition of CV

Version	Date	Developed/revised content	Make	Verify
V1.0	2021.05.24	First development	Nannan Yuan	Ning Guan

## CONTENT

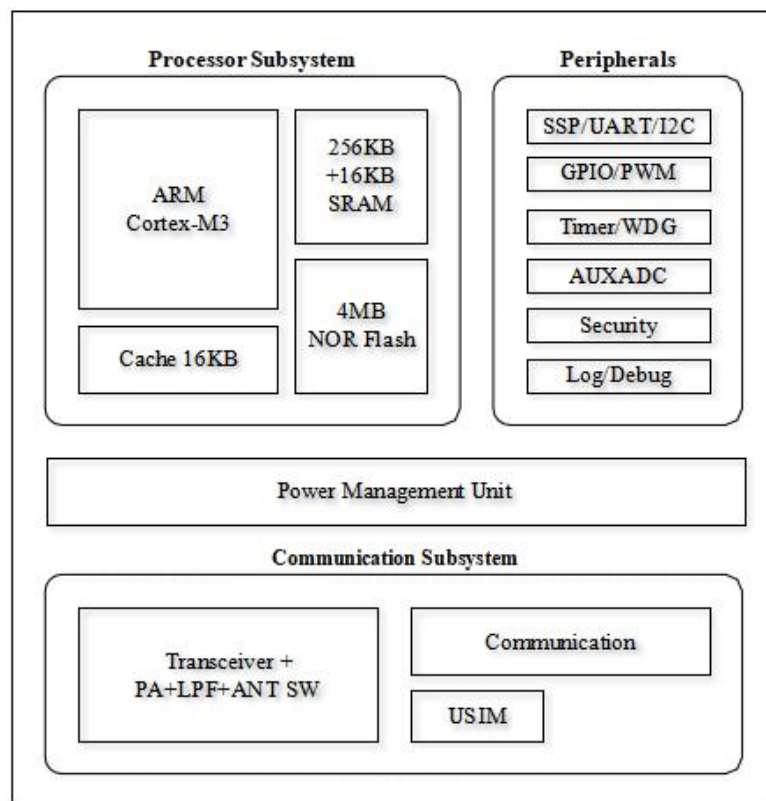
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## 1. Product overview

EC-01G is an NB+GPS module developed by Ai-Thinker. The main chip scheme adopted by the NB part is EC616S. The chip has an ultra-highly integrated NB-IoT SoC, supports ultra-low power consumption, and fully supports the 3GPP Rel14 NB-IoT standard. It is an ultra-high cost-effective NB-IoT chip.

It has the following characteristics (NB-IoT) :

- Integrated radio frequency transceiver, PA, radio frequency filter, antenna switch and power management.
- Excellent communication performance and stability in various wireless environments.
- Excellent power consumption performance in various modes (PSM, DRX, eDRX, connected state).
- Unique MCU mode, providing lower working current and shorter wake-up time.



**Figure 1 EC616S chip architecture diagram**

The main chip solution adopted by the GPS part of the EC-01G module is AT6558R. This chip is a high-performance BDS/GNSS multi-mode satellite navigation receiver SoC single chip, on-chip integrated radio frequency front end, digital baseband processor, 32-bit RISC CPU, power management function. The chip supports a variety of satellite navigation systems, including China's Beidou satellite navigation system BDS, the United States' GPS, and Russia's GLONASS, and can realize multi-system joint positioning.

It has the following characteristics (GPS) :

- Support BDS/GPS/GLONASS multi-system joint positioning and single-system independent positioning.
- With active antenna detection and protection.
- RTC and backup circuit power supply can be as low as 1.4V
- BDS/GPS dual-mode continuous operation.

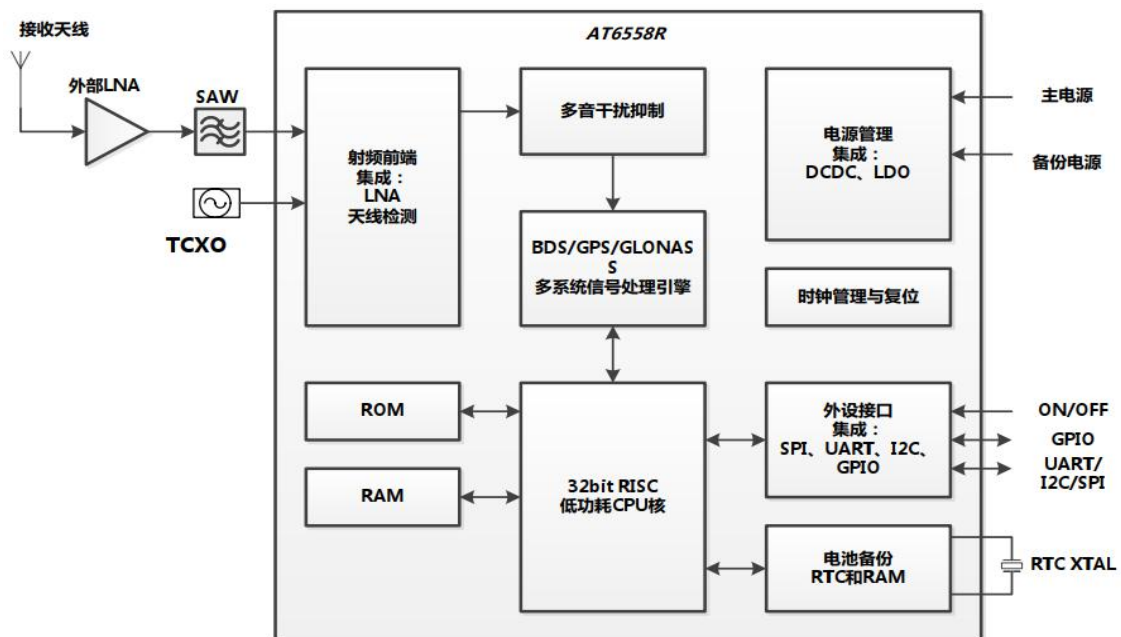


Figure 2 AT6558R chip architecture diagram

## 1.1. Features

- CPU:

- ✓ Cortex-M3, support MPU
- ✓ Configurable CPU frequency, up to 204MHz
- ✓ 8-channel DMA
- Memory:
  - ✓ 4MB on-chip NOR flash
  - ✓ 272KB on-wafer SRAM, divided into 256KB and 16KB
  - ✓ 16KB instruction cache
- System
  - ✓ Flexible configuration support 1.8/2.8/3.3V IO
  - ✓ Clock source: 26MHz TCXO or DCXO, 32.768KHz crystal oscillator
  - ✓ 1 external wake-up source (interrupt)
  - ✓ Unique MCU mode, in this mode, the internal RC oscillator is used as the clock, and the power consumption is lower
  - ✓ LOG port, UNILOG
  - ✓ Debug port, SWD
- Peripherals
  - ✓ 16 GPIO
  - ✓ 3 UART, 2 SSP, 2 I2C
  - ✓ 6 PWM, 6 Timers, 6 GPIO counter, 1 WDG
  - ✓ 32KHz RTC timer
  - ✓ USIM, support Esim
  - ✓ LPUART
  - ✓ 4-channel 12-bit AUXADC
  - ✓ Temperature sensor
  - ✓ Battery voltage monitoring
- Low power consumption:
  - ✓ Unique low-power architecture, 4-level sleep mode
  - ✓ PSM: 800nA
  - ✓ DRX (2.56s): typical value 110uA

- ✓ RX: typical value 10mA
- ✓ TX: typical value 24mA
- Communication:
  - ✓ Totally support 3GPP R14 NB-IoT
  - ✓ Category NB2, 2-HARQ
  - ✓ Multi-tone NPUSCH
  - ✓ Anchor and non-anchor carrier
  - ✓ In-band same/different PCI, guardband, standalone
  - ✓ Multi-carrier paging, NPRACH
  - ✓ Positioning: OTDOA & ECID
  - ✓ ROHC, RAI, multiple-DRB, RRC connection re-establish
  - ✓ SC-PTM (need SW upgrade)
- RF:
  - ✓ Support frequency band: 3, 5, 8
  - ✓ Chip integrated PA, support APT function
  - ✓ Chip integrated RF transceiver filter and antenna switch
  - ✓ Power rating 3
- Safety:
  - ✓ Hardware encryption and decryption module (AES, SHA)
  - ✓ Secure boot
  - ✓ flash encryption
  - ✓ True random number generator
- Application:
  - ✓ Support open-CPU
  - ✓ The software complies with the CMSIS architecture
  - ✓ Support main cloud services
  - ✓ IPv4, IPv6 and non-IP
  - ✓ UDP, TCP
  - ✓ DTLS, TLS, SSL



- ✓ MQTT, CoAP, HTTP(S)
- ✓ LWM2M
- ✓ Support FOTA
- Voltage range:
- ✓ 3.3V to 4.5V

## 2. Main parameters

**List 1 Main parameter description**

<b>Model</b>	EC-01G
<b>Package</b>	SMD-54
<b>Size</b>	19.2*18.8*2.8(±0.2)MM
<b>Antenna</b>	External antenna
<b>Spectrum range</b>	Band3,Band5,Band8
<b>Operating temperature</b>	-40 °C ~ 85 °C
<b>Storage environment</b>	-40 °C ~ 125 °C , < 90%RH
<b>Power supply range</b>	Supply voltage 3.3V ~ 4.5V, current >500mA
<b>Support interface</b>	SSP/UART/I2C/PWM/ADC/GPIO
<b>Serial port</b>	Support 110 ~ 4608000 bps , default 9600 bps

<b>rate</b>	
<b>Safety</b>	AES/SHA
<b>Flash</b>	4MB NOR flash

## 2.1. Electrical parameters

The EC-01G module is an electrostatic sensitive device, and special precautions must be taken when handling it.



Figure 3 ESD anti-static

## 2.2. Electrical characteristics

List 2 Electrical characteristics table

Parameter		Condition	Min	Typical	Max	Unit
Voltage		VDD	3.3	3.3	4.5	V
I/O	$V_{IL}/V_{IH}$	-	-0.3/0.75V <sub>IO</sub>	-	0.25V <sub>IO</sub> /4.5	V
	$V_{OL}/V_{OH}$	-	N/0.8V <sub>IO</sub>	-	0.1V <sub>IO</sub> /N	V
	$I_{MAX}$	-	-	-	24	mA

## 2.3. NB RF performance

List 3 NB RF performance

Band	Channel	1 Tone@11(15KHz)				12 Tone(15KHz)			
		Pout (dBm)	EVM RMS (%)	SEM Margin (dB)	ACLR Max (dBc)	Pout (dBm)	EVM RMS (%)	SEM Margin (dB)	ACLR Max (dBc)
3	1201	22.5	0.9	4.9	-39.5	20.5	7	6	-40.8

	1575	22.5	0.9	3.8	-39	20.5	7	6	-41
	1949	22.5	0.9	4	-39	20.5	7	5	-40.5
5	2401	22.6	0.9	8	-42	20.4	7	7	-43
	2525	22.6	0.9	9	-42	20.4	6	6	-42.5
	2649	22.6	0.9	8	-42	20.4	7	7	-42.8
8	3451	22.5	0.9	7.5	-42.5	20.5	6	4	-42.5
	3625	22.5	0.9	8.5	-42	20.4	6	3.5	-41
	3799	22.5	0.9	5	-42	20.4	7	4.5	-40.5

## 2.4. Power consumption

The following power consumption data is based on a 3.3V power supply, an ambient temperature of 25°C, and measured using an internal voltage regulator.

**List 4 Power consumption table**

Mode	Min	Average	Max	Unit
Connect_Tx_23dBm_1Tone(Band3 Channel 1575 1842.5MHz)	-	120	240	mA
Connect_Tx_23dBm_1Tone(Band5 Channel 2525 881.5MHz)	-	110	226	mA
Connect_Tx_23dBm_1Tone(Band8 Channel 2625 942.5MHz)	-	108	215	mA
Connect_Rx_Band3	-	10	40	mA
Connect_Rx_Band5	-	16	46	mA
Connect_Rx_Band8	-	10	40	mA

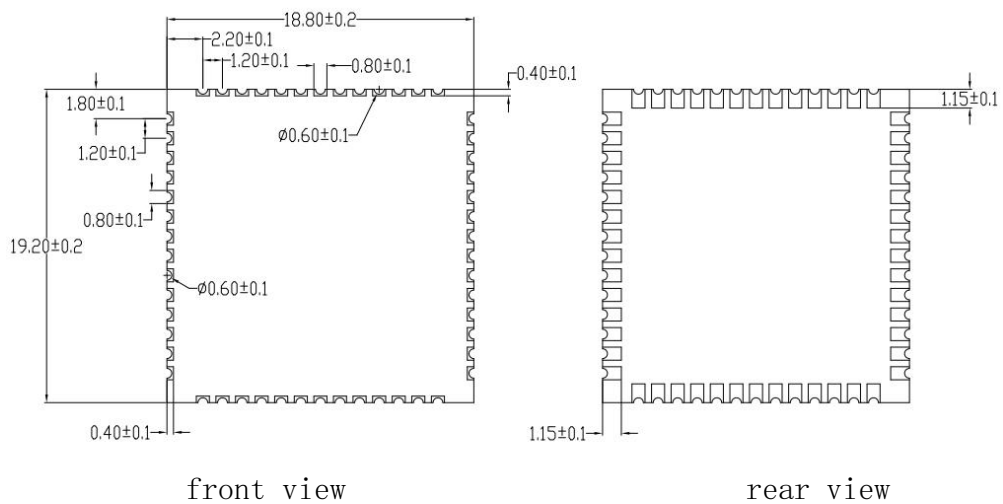
DRX (2.56s)	-		110	μA
PSM	-		<1	μA

### 3. Dimensions



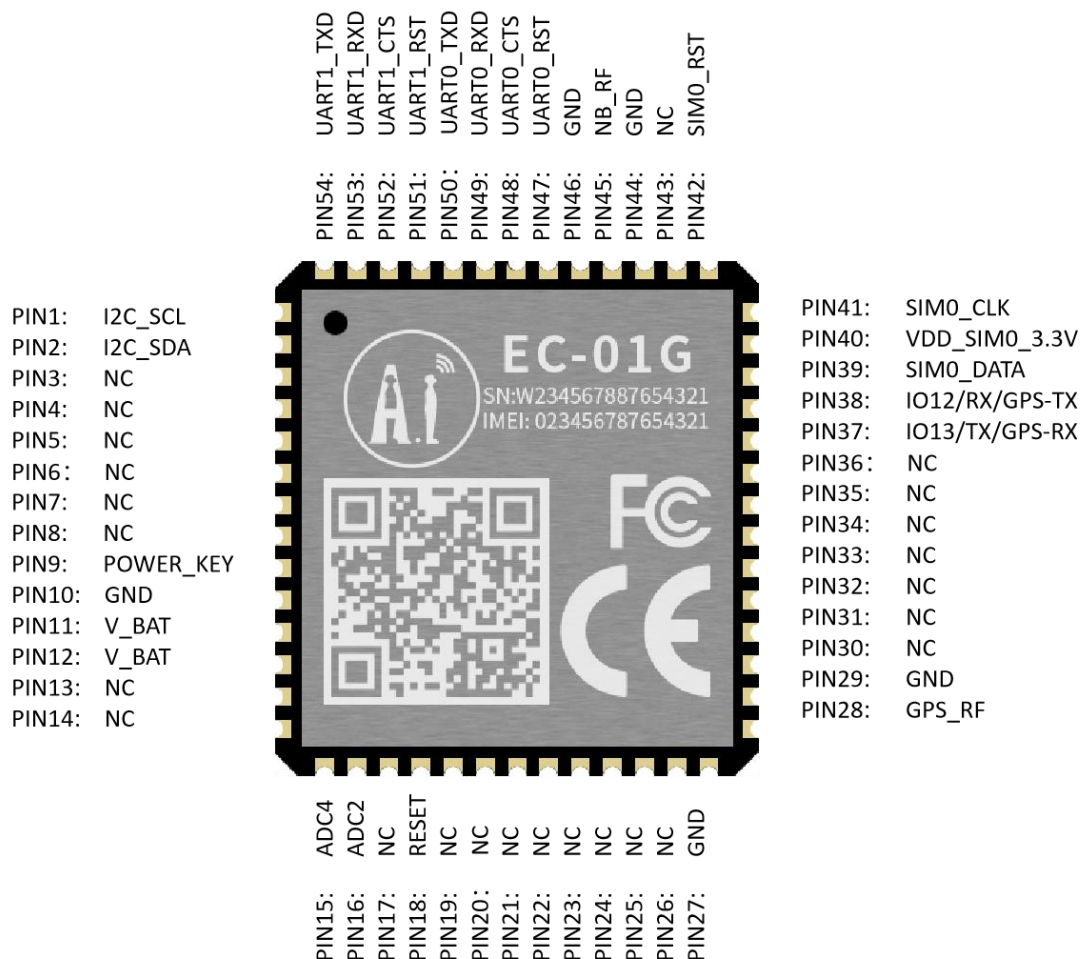
Figure 4 EC-01G appearance(The picture and silk screen are for reference only, the actual product shall prevail)

**Note: The two-dimensional code of the shielding cover is the SN/IMEI number of the product**



**Figure 5 Module size**

## 4. PIN definition



**Figure 6 EC-01G PIN definition diagram(The picture and silk screen are for reference only, the actual product shall prevail)**

The EC-01G module has a total of 54 interfaces. As shown in the pin diagram, the pin function definition table is the interface definition.

**List 5 Pin function definition table**

No.	Name	Function description
1	I2C_SCL	GPIO3
2	I2C_SDA	GPIO2

3-8	NC	Empty
9	POWER_KEY	WAKEUP
10	GND	Grounded
11	V_BAT	Power input
12	V_BAT	Power input
13-14	NC	Empty
15	ADC4	ADC Channel AIO4
16	ADC2	ADC Channel AIO2
17	NC	Empty
18	RESET	RESETn
19-26	NC	Empty
27	GND	Grounded
28	GPS_RF	GPS RF port
29	GND	Grounded
30-36	NC	Empty
37	IO13/TX	UART1_TXD
38	IO12/RX	UART1_RXD
39	SIM0_DATA	USIM_UIO/SIM card IO
40	VDD_SIM0_3. 3V	VO_LDOSIM Output of LDO SIM 1.8V/3.3V
41	SIM0_CLK	USIM_UCLK/SIM card clock
42	SIM0_RST	USIM_URSTn/SIM card reset
43	NC	Empty
44	GND	Grounded

45	NB_RF	NB RF port
46	GND	Grounded
47	UART0_RST	GPIO6/UART0_RSTn
48	UART0_CTS	GPIO7/UART0_CTSn
49	UART0_RXD	GPIO8/UART0_RXD
50	UART0_TXD	GPIO9/UART0_TXD
51	UART1_RST	GPIO10/UART1_RSTn
52	UART1_CTS	GPIO11/UART1_CTSn
53	UART1_RXD	GPIO14/UART1_RXD
54	UART1_TXD	GPIO15/UART1_TXD

## 5. Schematic diagram

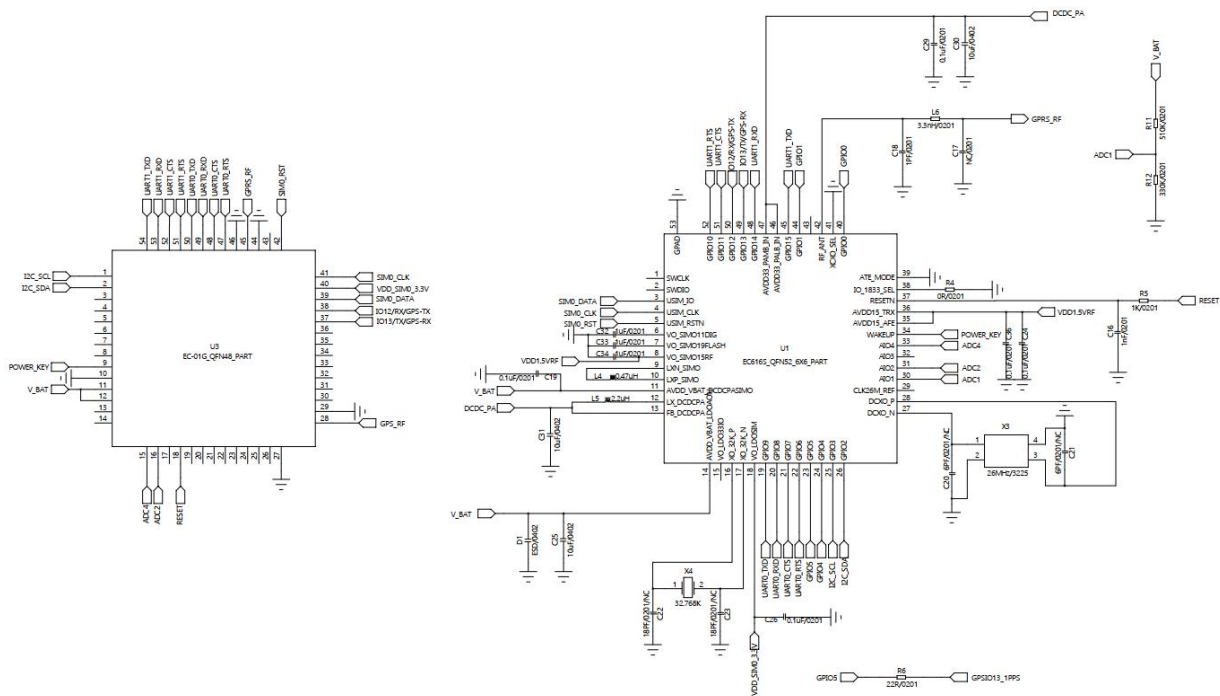
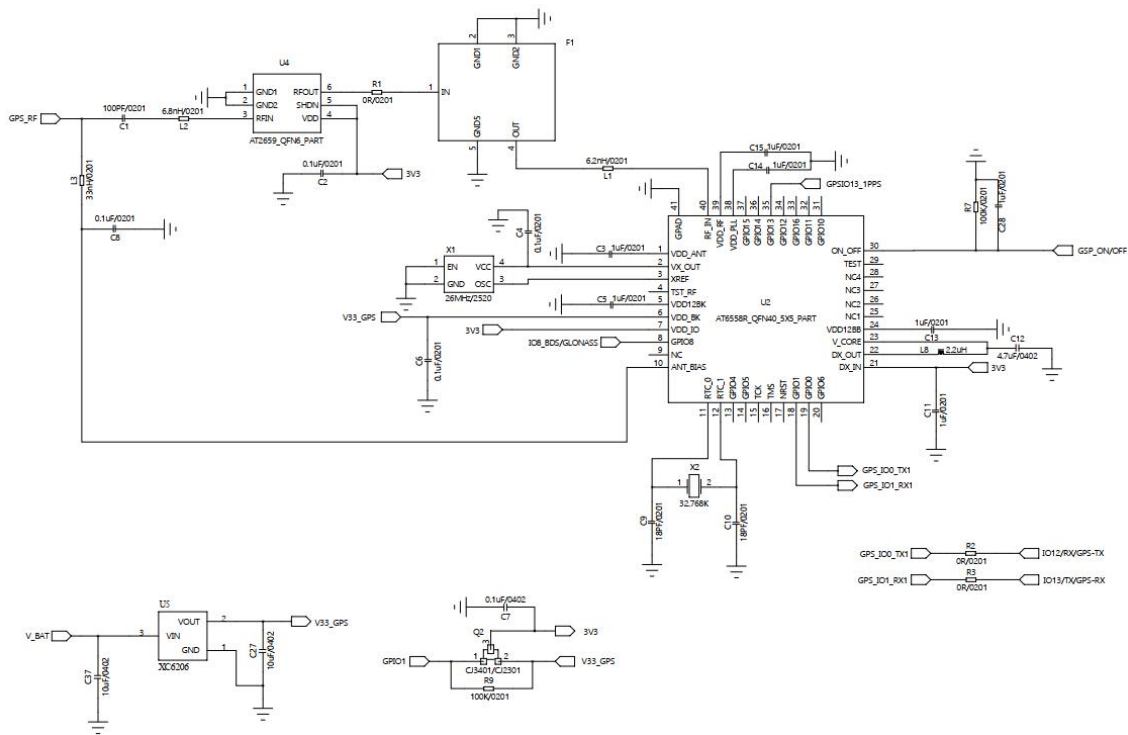


Figure 7 Module schematic diagram NB part



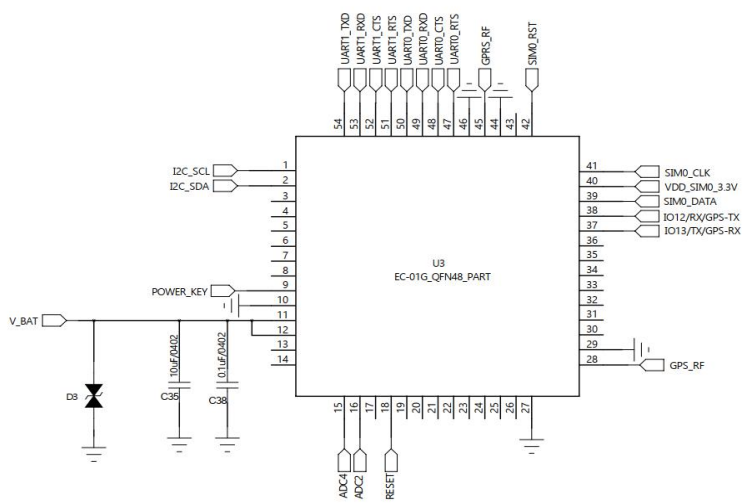


**Figure 8 Module schematic diagram GPS part**

## 6. Design guide

### 6.1. Application circuit

It is recommended to add an anti-static protection IC to the power input.



**Figure 9 Application circuit schematic**

## 6.2. Power supply

- Recommended 3.3V-4.5V voltage, peak current above 500mA.
- It is recommended to use LDO for power supply; if using DC-DC, it is recommended that the ripple be controlled within 50mV.
- For the DC-DC power supply circuit, it is recommended to reserve a place for the dynamic response capacitor to optimize the output ripple when the load changes greatly.
- It is recommended to add ESD devices for the 3.3V-4.5V power interface.

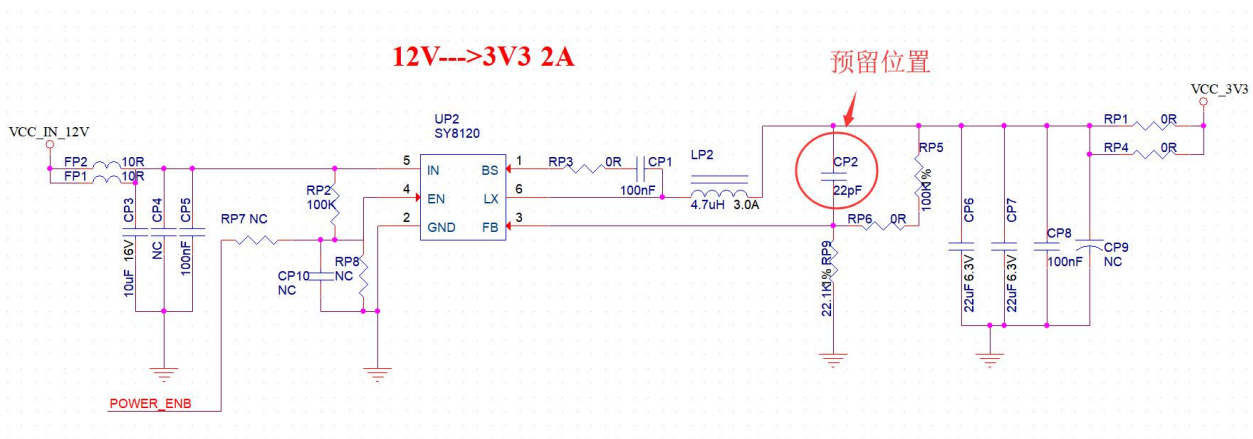
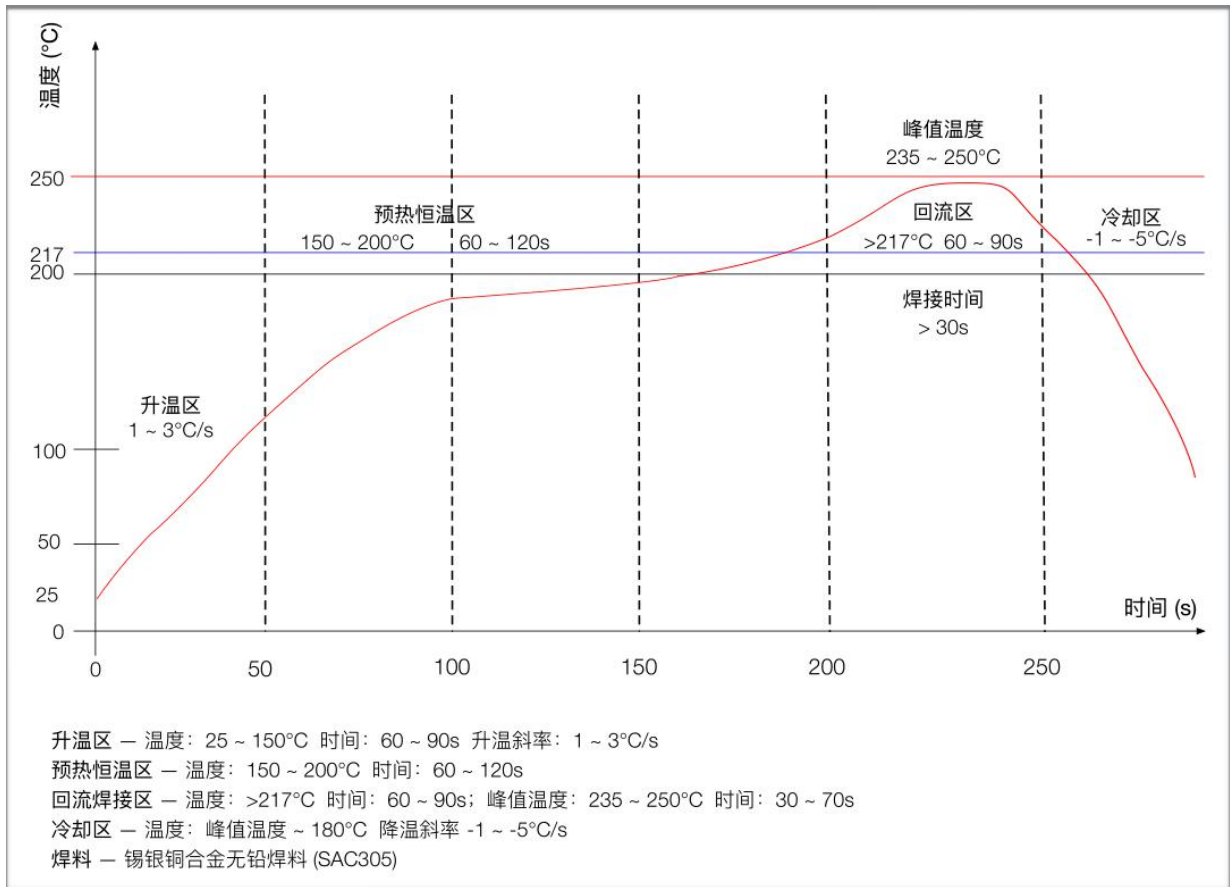


Figure 10 Recommended power supply circuit

## 7. Reflow soldering curve



**Figure 11 Reflow soldering curve**

## 8. Packaging

As shown in the figure below, the default packaging of EC-01G is taping.



Figure 12 tape package

## 9. Contact us

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