



EC-01F Specification

Version V1.0

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Formulation / Revision / Abolition of CV

Version	Date	Formulation / Revision	Make	Verify
V1.0	2021.05.25	First development	Nannan Yuan	Ning Guan

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1. Product overview

EC-01F is an NB 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:

- 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.

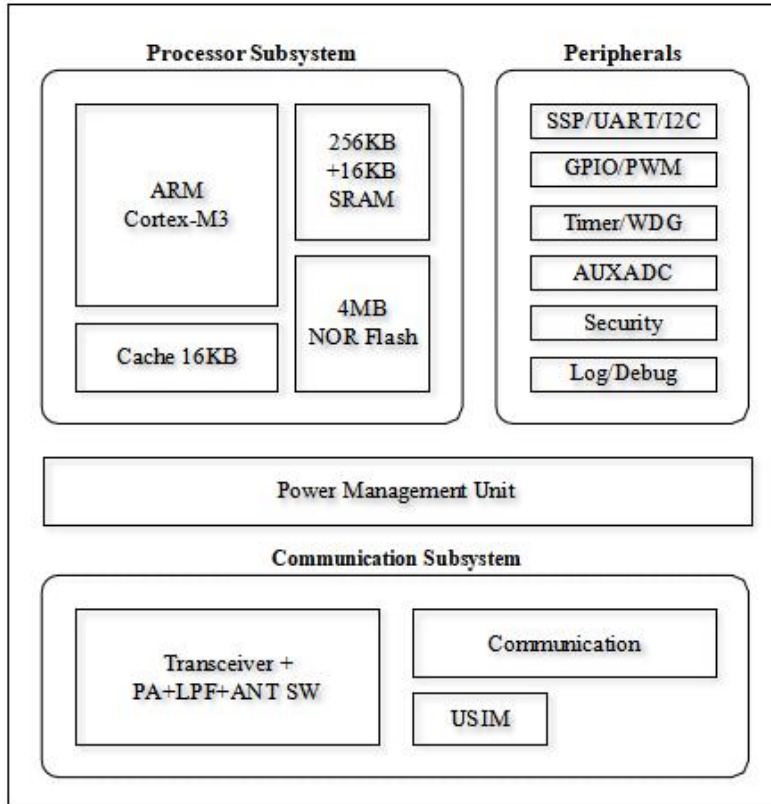


Figure 1 Chip architecture diagram

1.1. Features

- CPU:
 - ✓ Cortex-M3, support MPU
 - ✓ Configurable CPU frequency, up to 204MHz
 - ✓ 8-channel DMA
- Memory:
 - ✓ 4MB NOR flash on chip
 - ✓ 272KB on-wafer SRAM, divided into 256KB and 16KB
 - ✓ 16KB instruction cache
- System:
 - ✓ Flexible configuration supports 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 个 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 value10mA
- ✓ 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 mainstream 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

Model	EC-01F
Package	SMD-44
Side	17.7*15.8*2.8(±0.2)MM
Antenna	External antenna
Spectrum range	Band3,Band5,Band8
Operating temperature	-40°C~85°C
Storage environment	-40°C~125°C,<90%RH
Power supply range	Voltage 3.3V~4.5V, current >500mA
Support	SSP/UART/I2C/PWM/ADC/GPIO

interface	
Serial port rate	Support 110~4608000 bps, default 9600 bps
Safety	AES/SHA
Flash	4MB NOR Flash

2. 1. Electrical parameters

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



Figure 2 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 _{IO}	-	0.25V _{IO} /4.5	V
	V _{OL} /V _{OH}	-	N/0.8V _{IO}	-	0.1V _{IO} /N	V
	I _{MAX}	-	-	-	24	mA

2. 3. NB RF performance

List 3 NB RF performance table

Ban	Cha	1 Tone@11(15KHz)	12 Tone(15KHz)
-----	-----	------------------	----------------

d	n	Pout	EVMRM	SEMMar	ACLRMax	Pout	EVMR	SEMMarg	ACLRMa
	nel	(dBm)	S (%)	gin(dB)	(dBc)	(dBm)	MS(%)	in(dB)	x (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	Mix	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

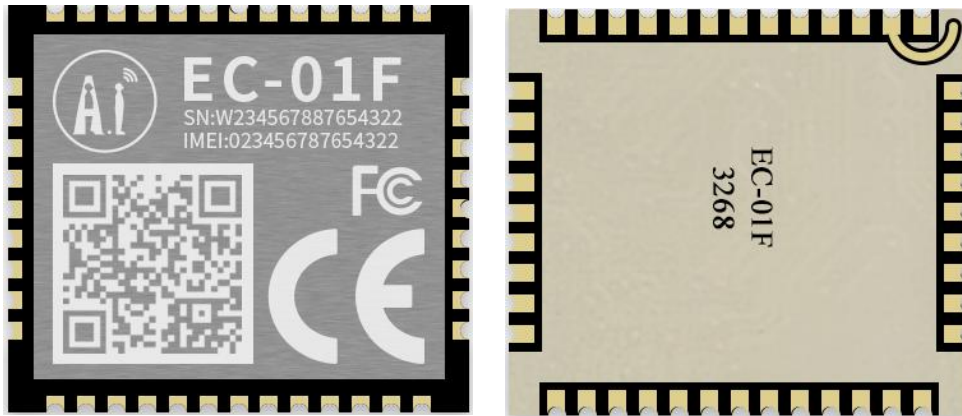


Figure 3 EC-01F appearance (The picture and silk screen are for reference only, the actual product shall prevail)

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

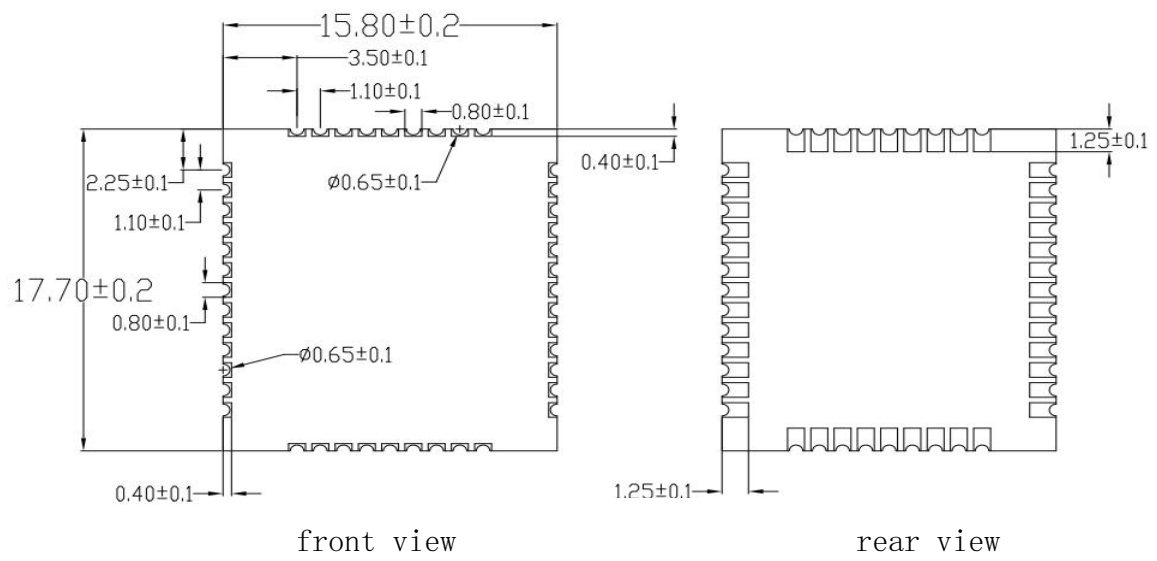


Figure 4 Module size chart

4. PIN definition

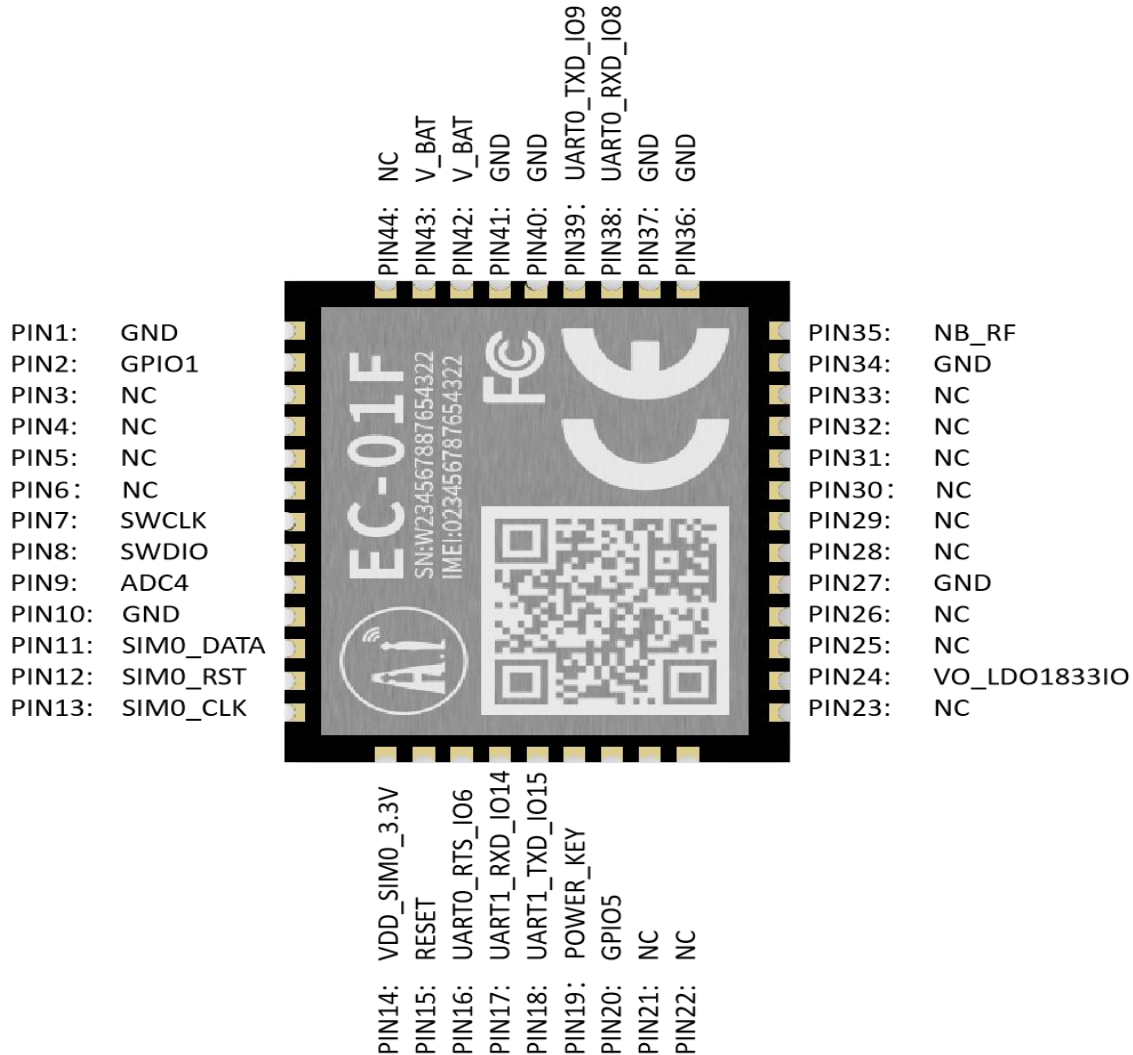


Figure 5 EC-01F Pin diagram(The picture and silk screen are for reference only, the actual product shall prevail)

The EC-01F module has 44 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	GND	Grounded
2	GPIO1	GPIO1

3-6	NC	Empty
7	SWCLK	SWCLK/Serial Wire Debug Clock
8	SWDIO	SWDIO/Serial Wire Debug Data
9	ADC4	AIO4/ADC Channel
10	GND	Grounded
11	SIM0_DATA	USIM_UIO/SIM Card IO
12	SIM0_RST	USIM_URSTn/SIM Card reset
13	SIM0_CLK	USIM_UCLK/SIM Card clock
14	VDD_SIM0_3.3 V	VO_LDOSIM/Output of LDO_SIM,1.8V/3.3V
15	RESET	RESETn
16	UART0_RTS_I O6	GPIO6/UART0_RSTn
17	UART1_RXD_I O14	GPIO14/UART1_RXD
18	UART1_TXD_I O15	GPIO15/UART1_TXD
19	POWER_KEY	WAKEUP
20	GPIO5	GPIO5
21-23	NC	Empty
24	VO_LDO_1833I O	VO_LDO_33IO
25-26	NC	Empty
27	GND	Grounded
28-33	NC	Empty

34	GND	Grounded
35	NB_RF	NB RF port
36-37	GND	Grounded
38	UART0_RXD_I O8	GPIO8/UART0_RXD
39	UART0_TXD_I O9	GPIO9/UART0_TXD
40-41	GND	Grounded
42-43	V_BAT	Power input
44	NC	Empty

5. Schematic diagram

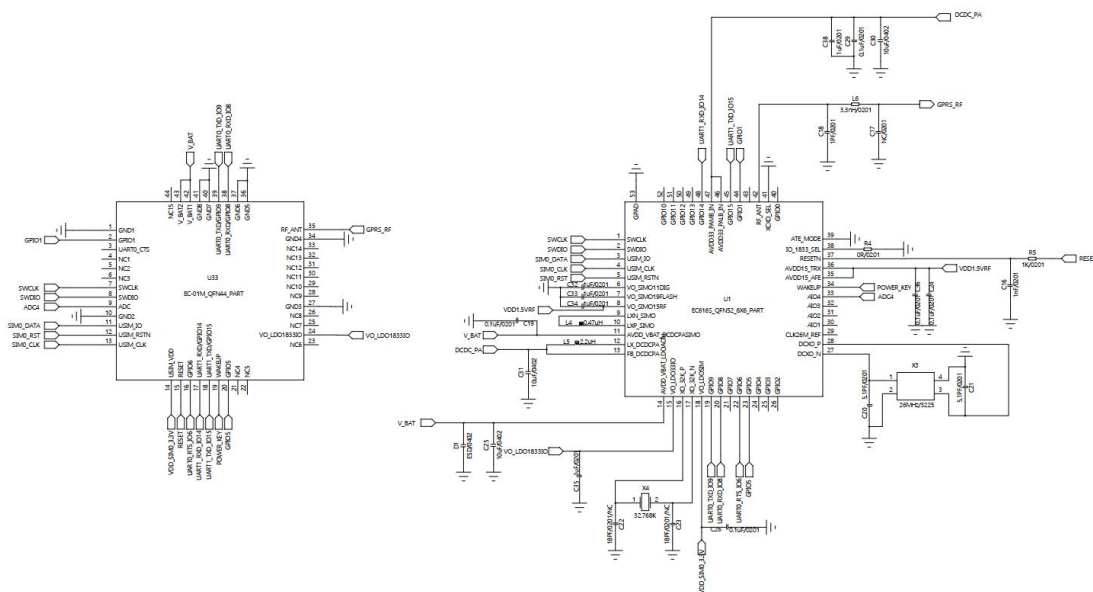


Figure 6 Module schematic

6. Design guide

6.1. Application circuit

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

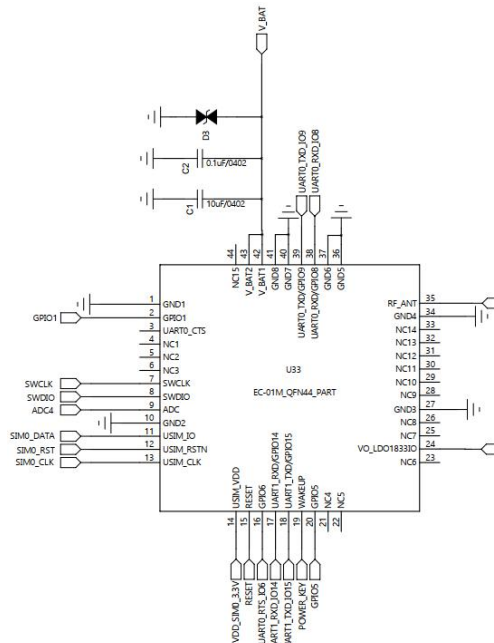


Figure 7 Application circuit schematic

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.

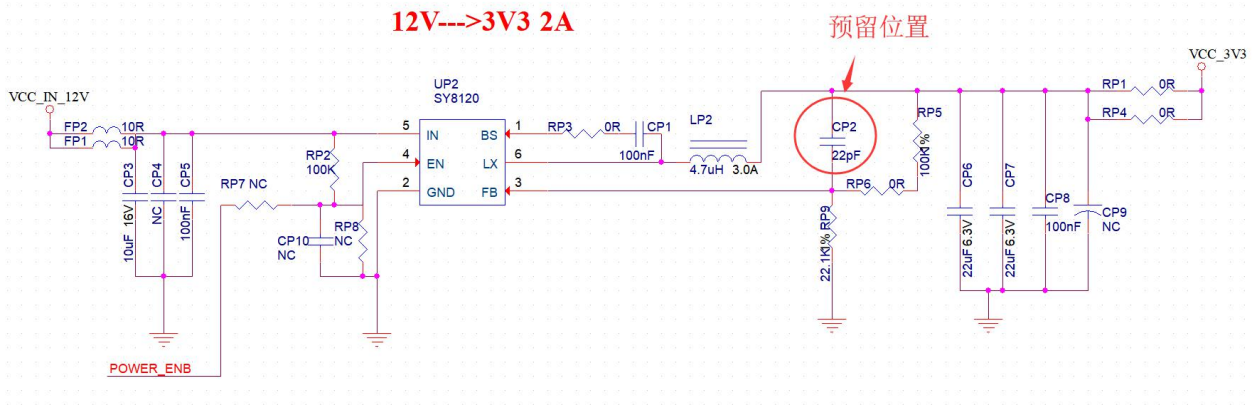


Figure 8 Recommended power supply circuit

7. Reflow soldering curve

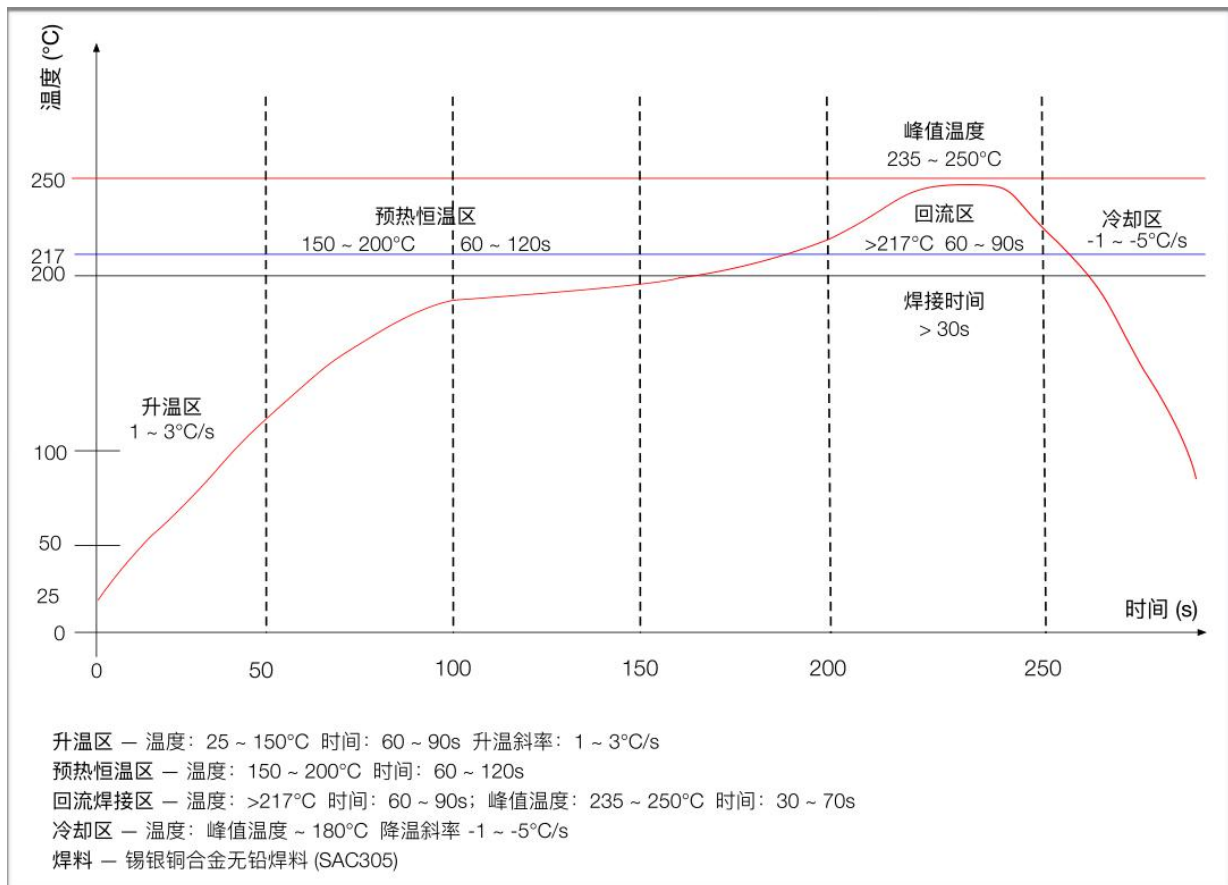


Figure 9 reflow soldering curve

8. Packaging

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



Figure 10 tape package

9. Contact us

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