

# **L206 Hardware Design**

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**GSM/GPRS Module Series**

**Version:** V2.2

**Date:** 2019-02-13



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## Version History

Date	Version	Description of change	Author
2015-11-16	V1.0	Initial version	
2016-05-18	V1.1	1,modified power supply content	x.ren
2016-05-23	V1.2	1,modified UART content 2,modified PCM content. 3,modified reset content	x.ren
2016-05-31	V1.3	1,Fixed figure error	x.ren
2016-06-06	V1.4	1, Fixed figure 39 error	x.ren
2016-06-16	V1.5	1.modified PIN table	x.ren
2016-09-26	V1.6	1.modified Picture	x.ren
2017-07-31	V1.7	Update Picture	
2017-08-01	V1.8	Update Picture	x.ren
2017-09-01	V1.9	Update Picture	robin
2018-07-23	V2.0	Change Power on time	x.ren
2018-11-10	V2.1	Update product baking instructions	Jacky.ren
2019-02-13	V2.2	Update hardware config information	

## Summary

This document is intended for products: L206 module.

This document describes the hardware interface of the L206 module, can help user to quickly understand L206 interface specifications, electrical and mechanical details, with the help of this document users can use L206 module to design and set-up various types wireless terminals.

## Intended audience

This document applicable to:

- Systems Design Engineer
- Structural Engineer
- Hardware Engineer
- Software Engineer
- Test Engineer

## Introduction

This document contains contents as below:

Chapter	Content
1 Overview	Introduce L206 module basic technical SPEC. and reference standard.
2 Pin definitions	Introduce L206 module pin names and functions.
3 Hardware interface	Introduce L206 module hardware interface.
4 Module Dimensions,	Introduce L206 module packaging size,
5 Electrical, reliability and RF	Introduce L206 module electrical, reliability and RF.
6 Manufacturing	Introduce L206 module notice of production.
7 Package information	Introduce L206 module Package information
8 Related documents	List L206 module related documents.

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# 1. Introduction

L206 is a quad-band GSM/GPRS module, working frequency: GSM/GPRS 850/900/1800/1900 MHz.

With a tiny package of 15.8mm x 17.6mm x 2.3mm, L206 fits all the applications, such as M2M, smart phone, PDA, etc.

It is a 45-pin SMT pad module, which provides rich hardware interfaces. It supports voice, SMS and data transmission with low power consumption.

## 1.1 Key Features

**Table 1-1: Main Feature**

<ul style="list-style-type: none"> <li>● GSM quad-band 850/900/1800/1900 MHz</li> <li>● GSM 2/2+ standard               <ul style="list-style-type: none"> <li>– Class 4 (2 W @ 850/900 MHz)</li> <li>– Class 1 (1 W @ 1800/1900 MHz)</li> </ul> </li> <li>● AT command (GSM 07.07, 07.05 and Enhanced AT command set)</li> <li>● Power supply: 3.4 ~ 4.2V (Recommended 3.8V)</li> <li>● Operating temperature: -40 ~ +85 °C</li> <li>● Storage temperature: -45 ~ +90 °C</li> <li>● weight: 1.3g</li> </ul>	
Data Transmission	<ul style="list-style-type: none"> <li>● Coding schemes CS 1, 2, 3, 4</li> <li>● PPP-stack</li> <li>● Transparent transmission mode</li> </ul>
SMS	<ul style="list-style-type: none"> <li>● Point to Point MO and MT</li> <li>● SMS Broadcast</li> <li>● Text and PDU mode</li> </ul>
Voice	<ul style="list-style-type: none"> <li>● Half Rate (HR)</li> <li>● Full Rate (FR)</li> <li>● Enhanced Full Rate (EFR)</li> <li>● Adaptive Multi-Rate (AMR)</li> </ul>
Interface	<ul style="list-style-type: none"> <li>● 45 SMT pads (Stamps Holes)</li> <li>● Two analog audio</li> <li>● PCM Digital Audio</li> </ul>

	<ul style="list-style-type: none"> <li>● Two serial interfaces</li> <li>● I2C interface</li> <li>● One SIM card interface(3V/ 1.8V)</li> <li>● One ADC interface</li> <li>● GPIO interface</li> <li>● GSM antenna pad</li> <li>● BT antenna pad</li> <li>● FM antenna pad</li> </ul>
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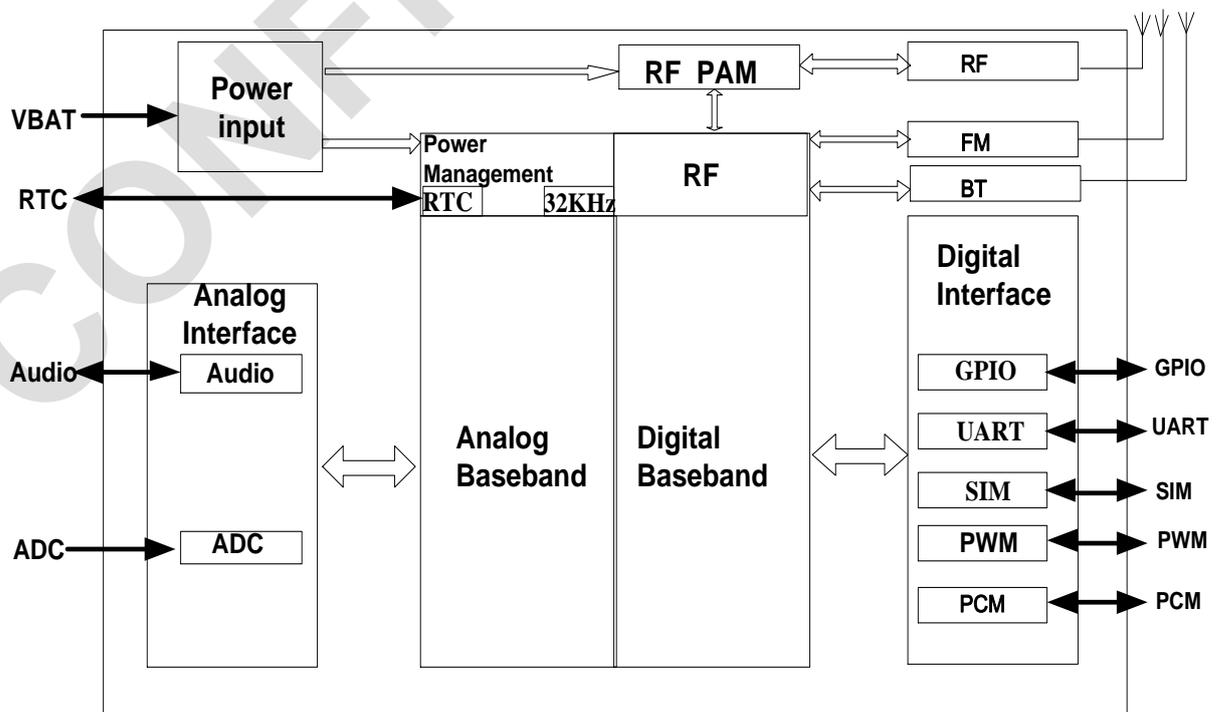
**Table 1-2: Hardware config**

Config	L206	L206D	Remarks
BT	Not support	Support (3.0)	Reference software version
RAM	32M bit	32M bit	
ROM	24M bit	32M bit	

## 1.2 Module system diagram

Following figure: List main function of module

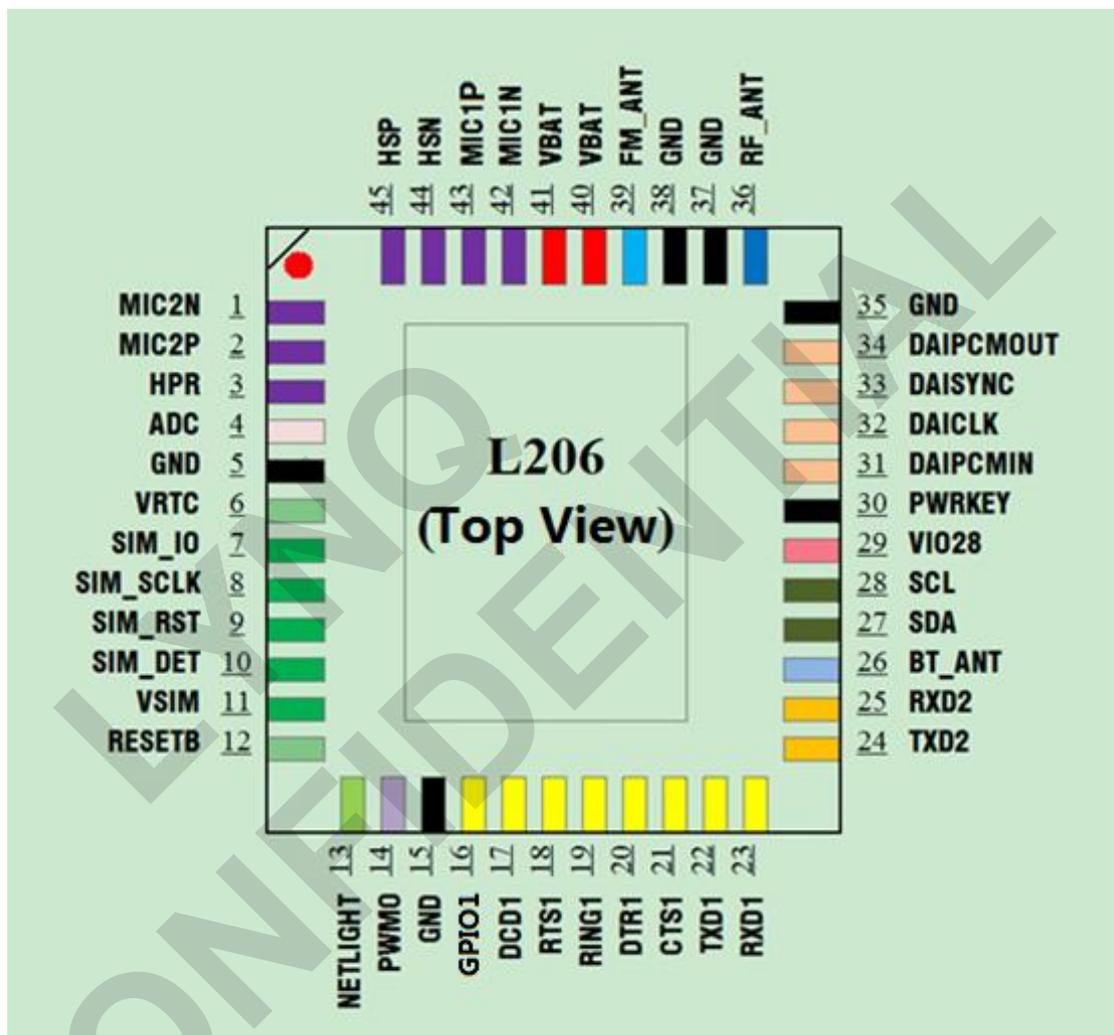
- GSM Baseband and RF
- Power Management
- Antenna Interface
- Other interfaces



**Figure 1-1: Module function diagram**

## 2. Application Interface

### 2.1. PIN Assignment



**Figure1-1:** L206Pin out diagram (TOP View)

Interfaces as below:

- Analog voice: Two MIC inputs, one for speaker output, another for earphone right channel output.
- Digital voice: PCM voice.
- SIM card: support 1.8V and 3V.
- Reset: Support RESETB pin to reset the module. Recommended by controlling module

power supply to reset.

- I2C: One group I2C pulled up to VIO28 in the module.
- GPIO: PIN 16 for normal general purpose in/out, and some other pins can be configured as GPIO pin(detail information in the following table).
- Serial port: Contain one full functional serial interface and one 2-wire serial interface. CTS and RTS etc. should be NC when not used.
- RF: Provide GSM, BT, FM. interfaces.

## 2.2. PIN Description

L206 PIN description as below:

**Table 2-1:**PIN description

PIN NO.	PIN name	Type*	Reset	Function Description
1	MIC2N	AI	/	Differential input, with internal bias voltage. Used with PIN 3 HPR
2	MIC2P	AI	/	
3	HPR	AO	/	Headphone right channel output, integrated 100ohm resistor.can combine with MIC2
4	ADC	AI	/	Analog to digital conversion interface, Max voltage is 2.8V.
5	GND	GND	/	GND
6	VRTC	POWER	/	RTC voltage, input 2.8V, maximum output current of 2mA. External button battery or a large capacitor, if no use can be set NC
7	SIM_IO	I/O	PD	PIN 10 SIM_DET is SIM card(SIM card support hot swap function). If no use can be set NC. SIM_DET can be configure das GPIO.
8	SIM_SCLK	I/O	PD	
9	SIM_RST	I/O	PD	
10	SIM_DET	I/O	PD	
11	VSIM	POWER	/	
12	RESETB	AI	/	Reset signal, internal pulled up to1.8V.
13	NETLIGHT	I/O	PD	Net status indication
14	PWM0	I/O	PD	PWM output
15	GND	GND	/	GND
16	GPIO1	I/O	PD	General purpose input/output 1
17	DCD1	O	PD	Data carrier detect
18	RTS1	I	PU	Request to Send

19	RING1	O	PD	Ring indicator
20	DTR1	I	PD	Data terminal ready(Control module wake or sleep)
21	CTS1	O	PU	Clear to send
22	TXD1	O	PU	Request to Send, For AT command, firmware upgrades and data transmission.
23	RXD1	I	PU	Receive data,For AT command, firmware upgrades and data transmission.
24	TXD2	O	PD	Send data, For AT command, firmware upgrades and data transmission.
25	RXD2	I	PU	Receive data, For AT command, firmware upgrades and data transmission.
26	BT_ANT	/	/	Bluetooth antenna
27	SDA	I/O	PD	I2C interface(pull up 4.7K to 2.8V)
28	SCL	I/O	PD	
29	VIO28	POWER	/	VDDIO 2.8V output, max current is 20mA
30	PWRKEY	AI	/	PWRKEY should be pulled low at least 1 second and then released to power on/down the module
31	DAIPCMIN	I	PU	PCM digital interface
32	DAICLK	I/O	PU	
33	DAISYNC	I/O	PD	
34	DAIPCMOUT	O	PD	
35	GND	GND	/	GND
36	RF_ANT	/	/	GSM Antenna
37	GND	GND	/	GND
38	GND	GND	/	GND
39	FM_ANT	/	/	FM Antenna
40	VBAT	POWER	/	Power supply. The power supply range is from 3.4V to 4.2V. Recommended voltage is 3.8V.
41	VBAT	POWER	/	
42	MIC1N	AI	/	Differential audio input. Used with PIN 44, 45
43	MIC1P	AI	/	
44	HSN	AO	/	Differential audio output.Used with PIN 42,43
45	HSP	AO	/	

\* Type I,O,I/O can be configured as general GPIO, its status is PU or PD when reset.

\* The high level of the digital signal is 2.8V(min:2.6V; max3.0V)

## 2.3. Functional Diagram

Main function of module PINs listed as below

- SIM card interface
- Audio interface
- Antenna interface
- Other interfaces

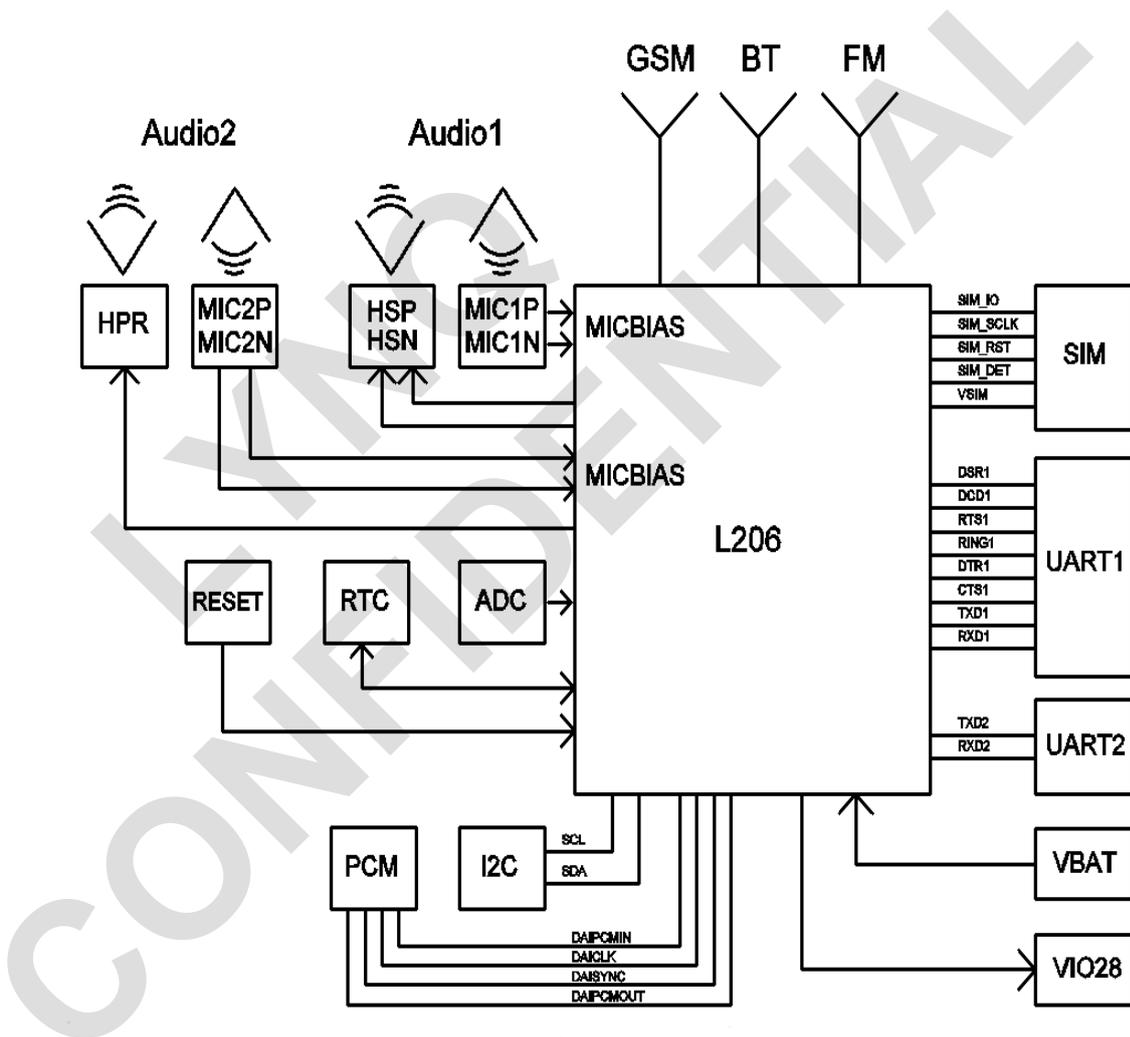


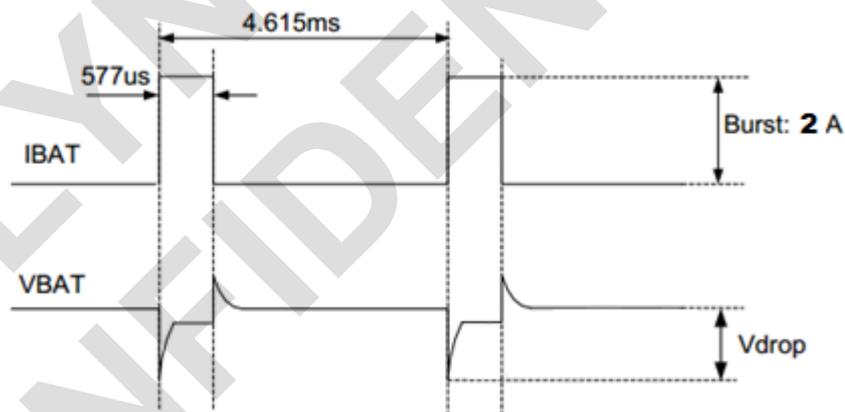
Figure3-2: Function diagram

## 3. Interface Circuit Reference Design

### 3.1 Power

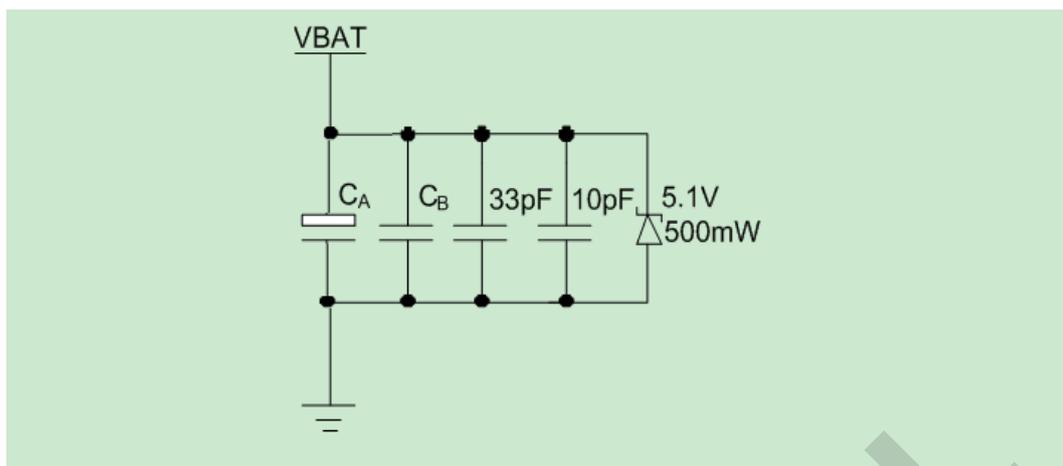
#### 3.1.1 Power Supply

VBAT is the main power source of L206 module., from 3.4V to 4.2V, and 3.8V is the recommended voltage. In GSM system, RF signal works in burst transmit, a continuous 577us(1/8 of a TDMA period) burst will be found at intervals of 4.615ms. In burst period, peak current is necessary to make sure operating voltage won't drop to the base one. Because when module is working under the base voltage, the burst will cause VBAT has instantaneous large current, which the peak value could reach 2A or above and lead to the Vdrop about 350mV.



**Figure3-1:** Module burst current and voltage waveforms

It is recommended to use a large capacitor close to VBAT PIN. The capacitor is the bigger the better to improve power stability. 470uF or more low-ESR aluminum electrolytic capacitors is recommended for CA. If the lithium battery directly connected, 220uF or 100uF tantalum capacitor (low ESR) is recommended for CB. The capacitors of 33pF and 10pF in parallel can effectively remove high-frequency interference. The capacitors should close to the VBAT pin of module.



**Figure3-2: VBAT input (Reference circuit)**

It is strongly recommended to add a 5.1V / 500mW Zener diode to VBAT pin in parallel, Zener diode should close to the VBAT pin. Recommended parts list as below:

**Table4-1: Recommended Zener diode**

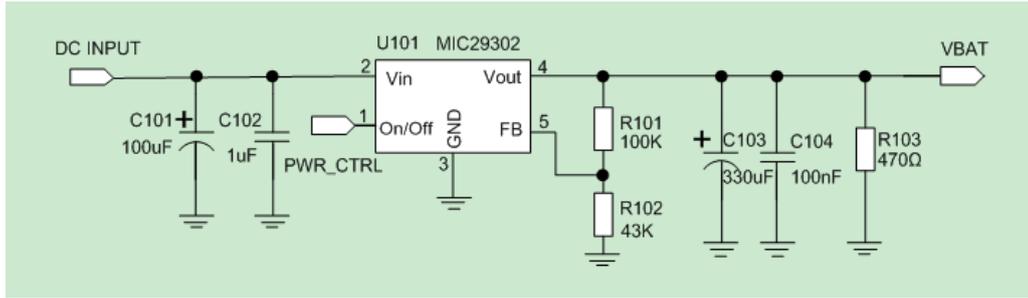
Vendor	Factory Model	Power	Encapsulation
On semi	MMSZ5231BT1G	500mW	SOD123
JCST	MMSZ5231B	500mW	SOD123
Prisemi	PZ5D4V2H	500mW	SOD523
ROHM	HDZMV4Z015.1B	500mW	UMD2
SIG	SIG1Z5T1G	500mW	SOD323
Vishay	MMSZ4689-V	500mW	SOD123
Crownpo	CDZ55C5V1SM	500mW	0805

**NOTE:**

If the power supply is over 4.2V, voltage conversion is required, LDO or Buck chipset can do that function.

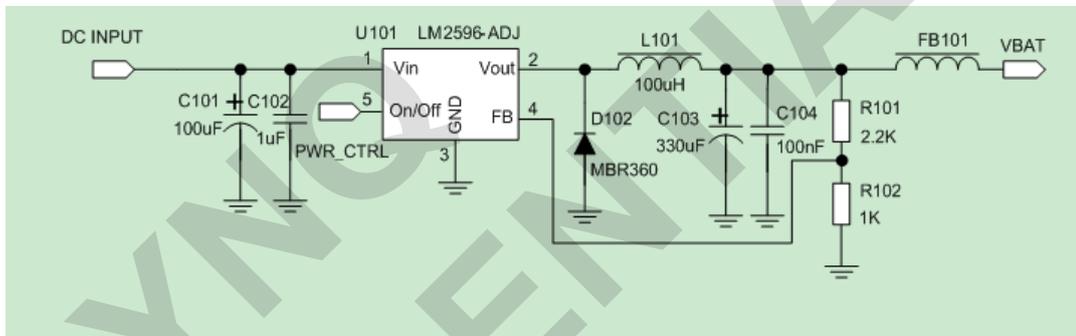
- As the LDO efficiency is closely related to the input/output dropout voltage value, the greater the voltage difference, the lower the efficiency, and at the same time, the problem of heat radiation will be detected, there is a demand of the small dropout voltage between DC input and LDO output. For instance, the voltage difference between 5V input and 4.1V output is acceptable.

The reference power supply circuit design with LDO is shown as figure below:



**Figure3-3:** LDO(Reference circuit)

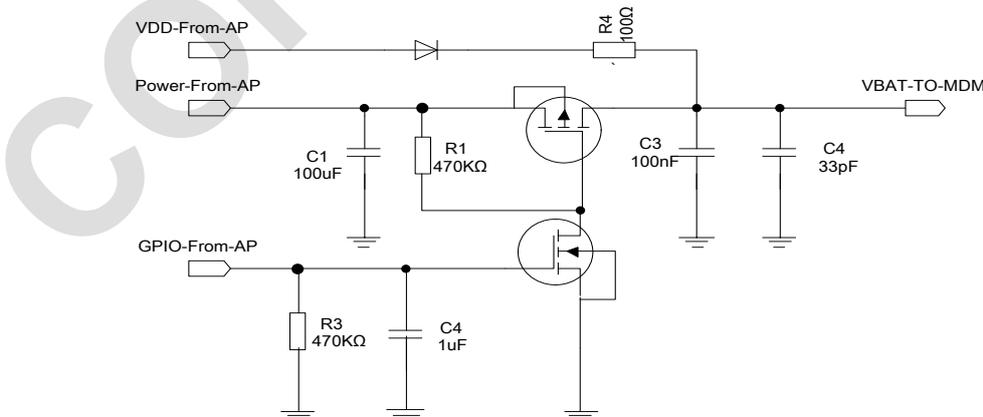
2、 Buck circuit can enhance the conversion rate if the differential value is great. But meanwhile, the EMI issue caused by DCDC will be concerned.



**Figure3-4:** DC-DC (Reference circuit)

3、 PMOS control circuit for power switch.

If want to control VBAT under the circumstance that there is no need of power conversion, for example, lithium-ion battery is the direct power supply, PMOS control circuit can be the choice.



**Figure3-5:** PMOS (Reference circuit)

### 3.1.2 Power Monitor

To monitor the power supply voltage, you can use "AT+CBC" command. For details, you can refer to AT command manual.

### 3.1.3 Power On

Module to normal boot mode is through the lower PWRKEY pin through lower PWRKEY pin at least 1.5 seconds. After successful boot PWRKEY pin can be released. NETLIGHT signal can be used to determine whether module boot. When NETLIGHT start according to certain frequency output pulse signal, if connect lights flashing, suggests that successful boot module. If no output pulse signal, has been as low level, no boot module.

Recommend the following boot circuit (PWRKEY came on the module VBAT). The reference circuit is as follows:

- 1、 With triode control boot

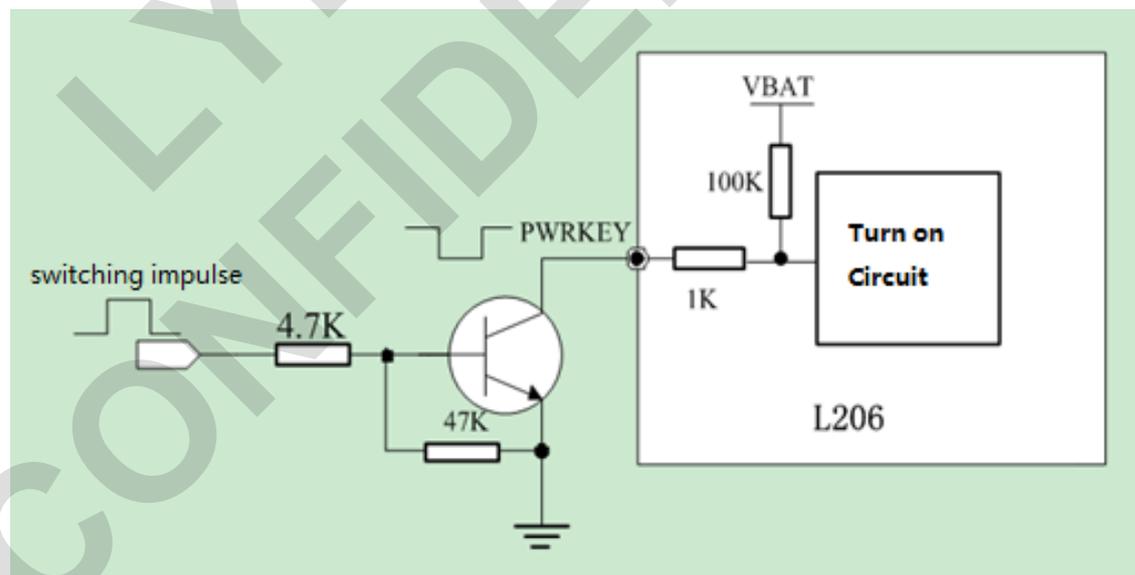
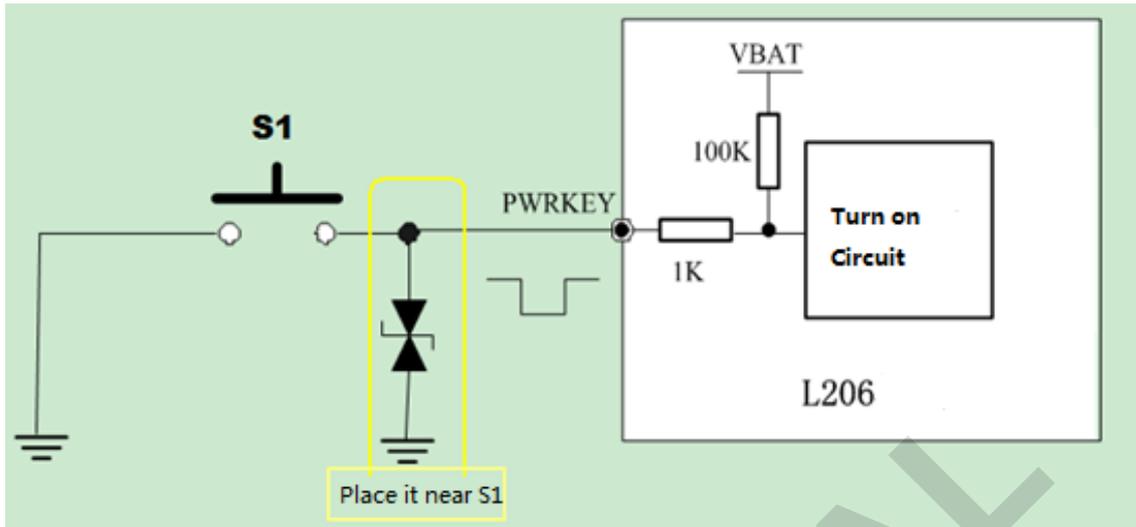


Figure3-6: Use triode control boot

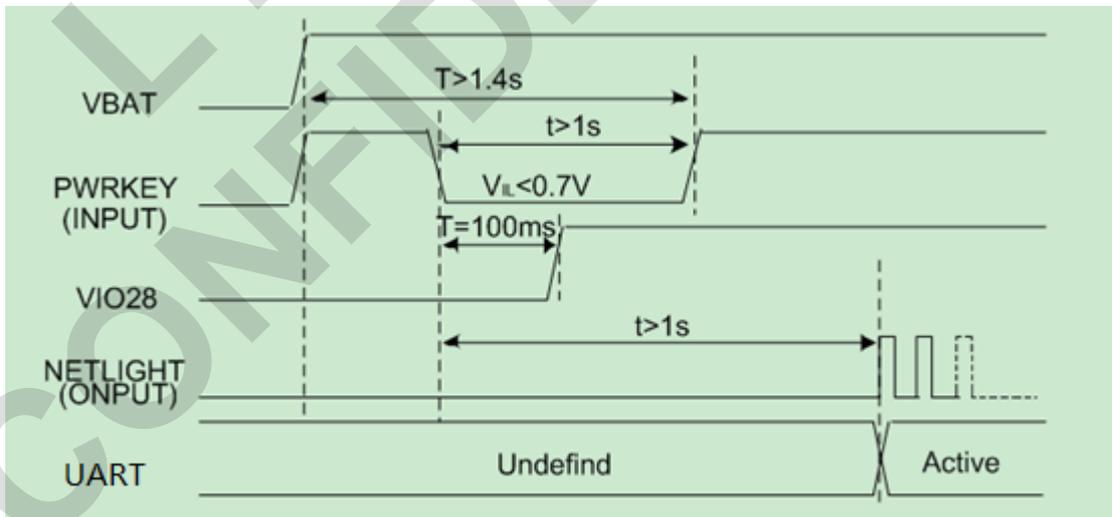
- 2、 Use key boot



**Figure3-7:**Use key to boot

Module on the mains electricity cannot be earlier than the external MCU with electricity, prevent module on the electric moment, external MCU serial port is in unstable condition, cause the module into the mode of the error.To ensure stable operation of external MCU, then control module is powered on.

Boot sequence diagram below:



**Figure3-8:**Boot sequence

Also pay attention to the external MCU and module connection interface level anomaly, especially the main UART port, could affect the module of the boot sequence, when switched on. For example, external MCU IO interface is in a state of output, the module of UART0 mouth UORTS signal (output pin) forced to lower or higher, the module may not be able to normal boot.

### 3.1.4 Power Off

It is a safe way to turn off the module by driving the PWRKEY to a low level voltage for a certain time. The power down scenario is illustrated below.

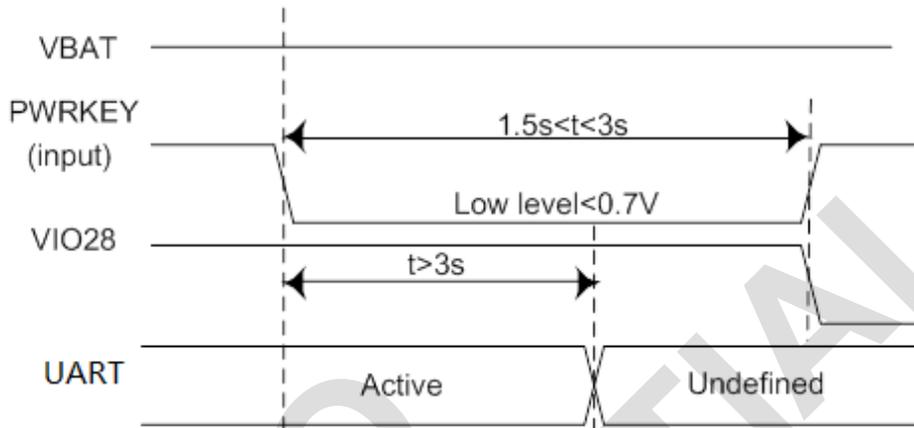


Figure3-9:Shutdown sequence

Note: As logout network time is related to the local mobile network, it is recommended to delay about 12seconds before disconnecting the power supply or restarting the module.

### 3.1.5 Reset

The hardware reset reference design as below (Key reset and MCU reset L206 Module):

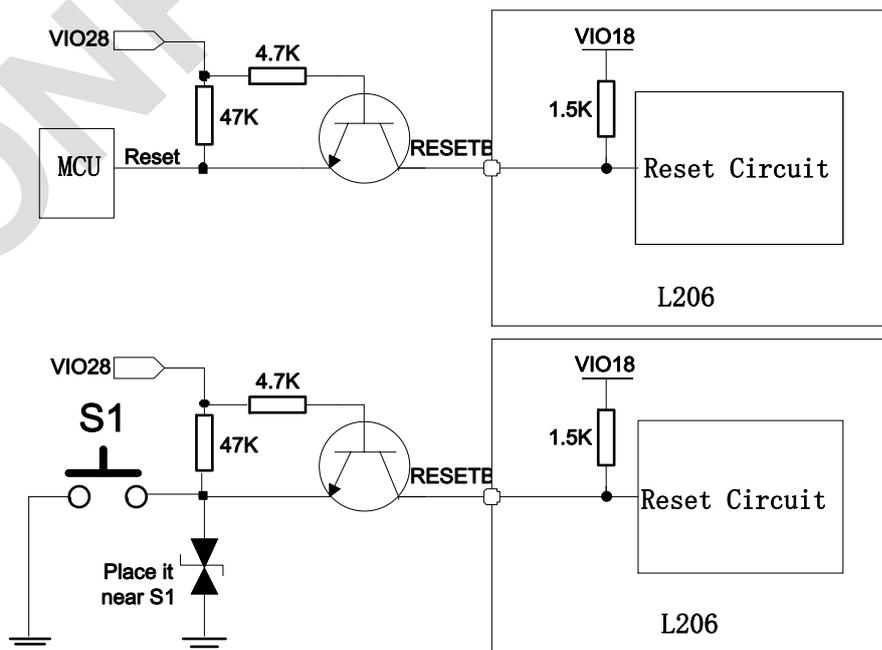


Figure3-10:Recommend the reset circuit:Key reset and MCU reset L206 Module

Note:

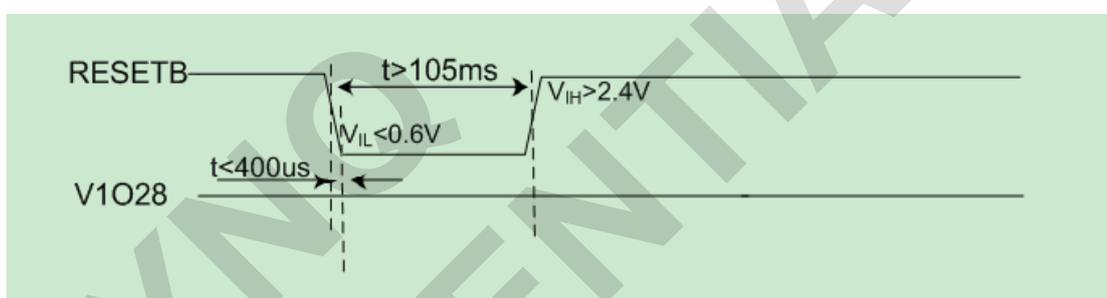
1, Only use under emergency, such as no AT response, PWRKEY failure.

2, Don't connect RESETB PIN to MCU directly.

**Table5-2:** Electronic characteristic of the RESET pin

PIN name	Symbol	Min	Typ	Max	Unit
RESETB	$V_{IH}$	2.4	--	--	V
	$V_{IL}$	--	--	0.6	V
	Low power time	105	--	--	ms

RESETB Reset timing sequence:



**Figure3-11:** Reset timing sequence

### 3.1.6 Power Saving Mode

When L206 is in sleep mode, the following methods can wake up the module:

(1) Pull down DTR pin

The serial port will be active after DTR pin is pulled to low level for about 50ms.

(2) Receive a voice or data call from network.

(3) Receive a SMS from network.

When L206 is in wake up mode, the following methods can sleep the module: Pull up DTR pin.

(1) Pull up DTR pin.

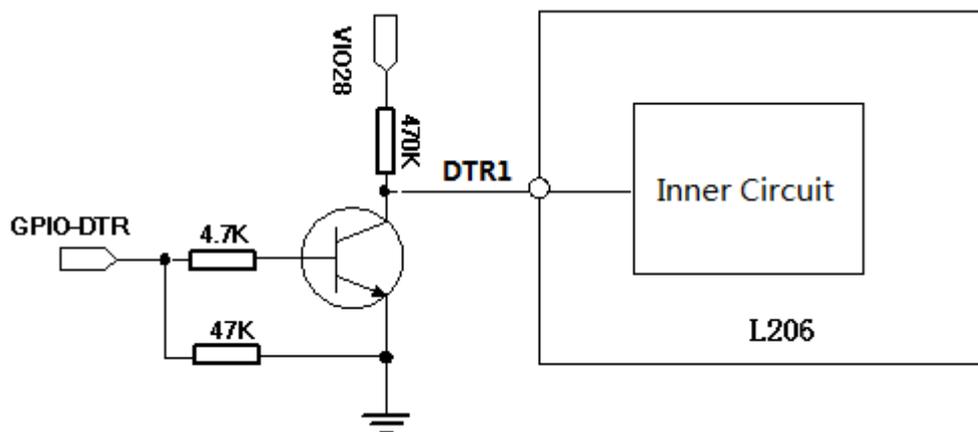


Figure3-12: DTR circuit

### 3.1.7 RTCPower

When VBAT disconnect, users need to save the real time clock, the VRTC pin can't hung up. It need an external large capacitor or batteries. Real time clock can be kept for 1 minute when using recommended external 100uf capacitor. RTC power using external large capacitor or battery to RTC power supply inside the module. Modules contain a 1.5 K current-limiting resistance. Button cell or super capacitor can be used to give the RTC power supply. Notes: In order to accurate clock, VBAT power supply. Below are several to RTC power supply circuit of reference:

- External capacitor of power supply

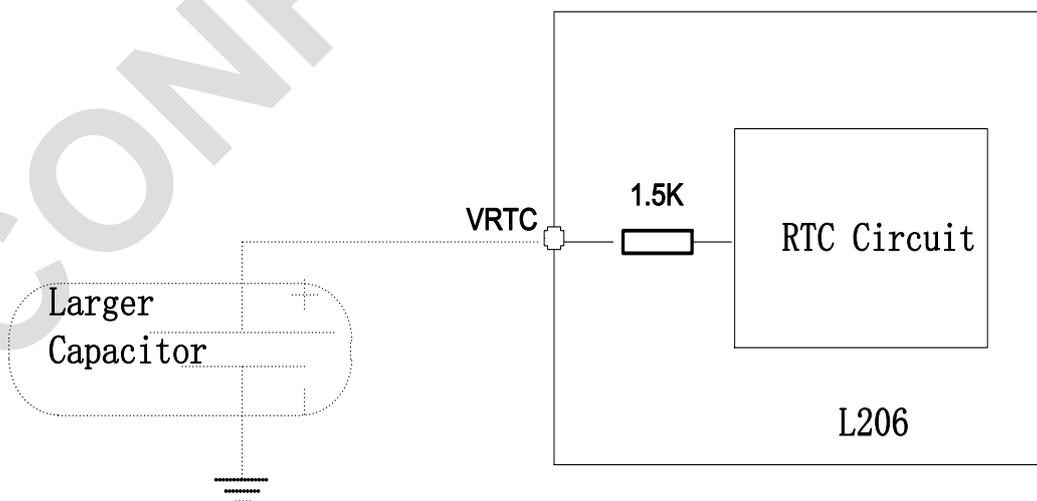


Figure3-13: External capacitor to the RTC power supply

- Non-chargeable Backup battery

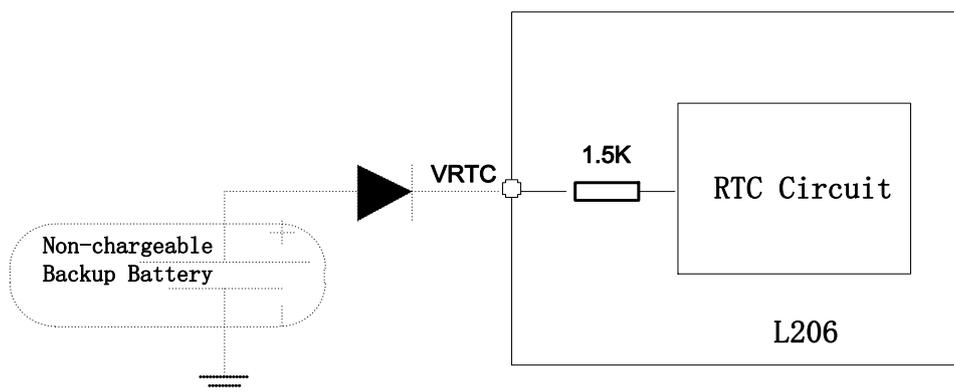


Figure3-14: Non-chargeable battery

- Rechargeable battery

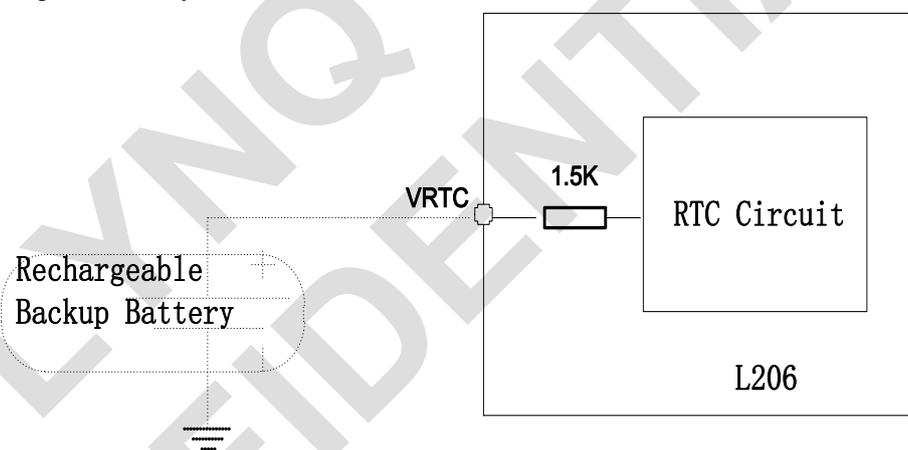


Figure3-15: Rechargeable battery

The VRTC power typical value of 2.8 V, consumption flow about 3uA when VBAT disconnect.

## 3.2 Audio

Table6-3: Audio interface pin definition

NO.	PIN name	PIN NO.	Description
1	MIC2N	1	Audio differential input 2 negative
2	MIC2P	2	Audio differential input 2 positive
3	MIC1N	42	Audio differential input 1 negative
4	MIC1P	43	Audio differential input 1 positive
5	HSN	44	Audio differential input 1 negative
6	HSP	45	Audio differential input 1 positive

7	HPR	3	Headphone output
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### 3.2.1 Audio Channel 1

1、The difference signal HSP, HSN of audio, directly connected to the receiver device (note: is the receiver, not the Speaker).

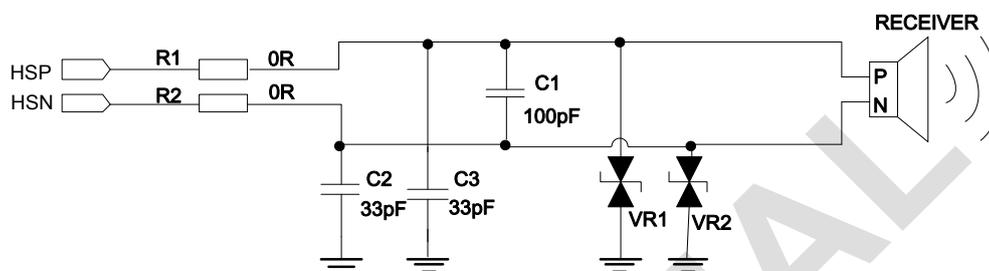


Figure3-16:receiver circuit

2、MIC1hasinternalMICBIAS power,external microphone can be directly connected MIC1P and MIC1N.

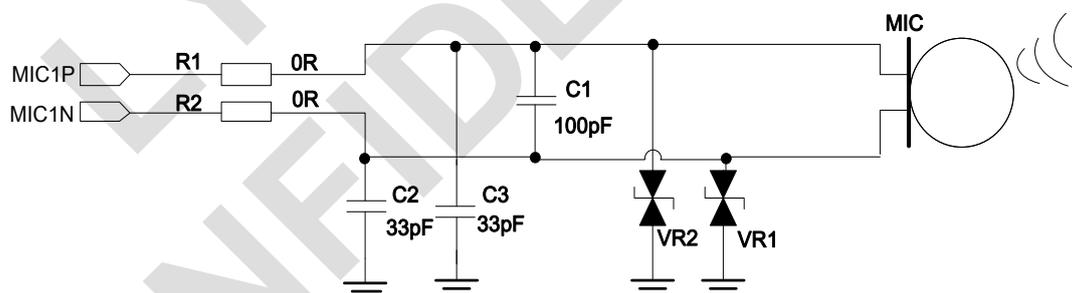


Figure3-17:MIC1(Reference circuit)

### 3.2.2 Audio Channel 2

- 1、 HPR (headset right) is a separate audio signal lines, it can be used for headphones, and can be used for speaker with external audio power amplifier.
- 2、 MIC2 and MIC1 have the same circuits, module has built-in MICBIAS.
- 3、 If the headset used as the audio path, the headphones GND line can be used as the FM antenna. If not, keep it open. Please refer to the earphone audio interface below:



Module supports PCM interface, it can be also configured to normal GPIO. It can be used as the master or slave mode with 8K sampling rate, 8/16bit data.

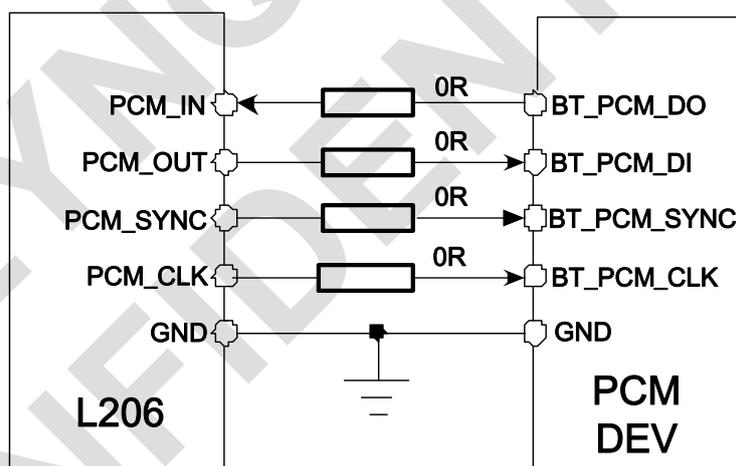
**Table7-4:** PCM interface pin definition

NO.	PIN name	PIN NO.	Description
1	DAIPCMOUT	34	PCM Data output
2	DAISYNC	33	PCM Sync signal
3	DAICLK	32	PCM clock signal
4	DAIPCMIN	31	PCM Data input

Support three operating modes:

- Short sync
- Long sync
- Complex model

Example, Digital audio channel is connected to the BT device chip, convenient for debugging, the customer can place zero ohm resistance.



**Figure3-19:** PCM(Reference circuit)

### 3.2.5 PCM Multiplexing Function

PCM interface have multiple function, can be configured to SPI, please refer to the table below:

**Table8-5:** PCM interface multiplex

No.	PIN name	PIN NO.	Default function	Reuse function 1	Reuse function 2
1	DAIPCMOUT	34	DAIPCMOUT	SPI_MOSI	GPIO28
2	DAISYNC	33	DAISYNC	SPI_MISO	GPIO29
3	DAICLK	32	DAICLK	SPI_CK	GPIO26

4	DAIPCMIN	31	DAIPCMIN	SPI_SCK	GPIO27
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### 3.3 UART Communication

#### 1、Serial pin definition

Modules provide 2 groups of UART serial port, including UART1 support full serial port function, main effect for the AT communications, data services, software upgrades, etc. UART2 provides only the TX and RX, can be used as the AT communication, debug, etc. Module called a DCE device (Data Communication Equipment), according to the traditional DCE - DTE (Data Terminal Equipment) connection. Adaptive baud rate support range 4800bps to 115200bps.

**Table9-6:** Serial pin definition:

Interface	PIN name	PIN NO.	Description
Main serial port	DCD1	17	Data carrier detect
	RTS1	18	DTE request data
	RING1	19	Ringing indicating
	DTR1	20	DTE is ready
	CTS1	21	Clear to send
	TXD1	22	Data sent
	RXD1	23	Data reception
Debug serial port	TXD2	24	Debug serial port data sending
	RXD2	25	Debug serial port data reception

#### 2、Serial port characteristics

Main serial port:

- 7 signal lines. Including cable TXD and RXD, hardware flow control line RTS and CTS, and other line of DTR, DCD and RI.
- 8 data bits, No parity, One stop bit.
- Hardware flow control off by default, if use hardware flow control, use the "AT + ICF = 0" open flow control function.
- AT command transfer, GPRS data transmission.
- Support a fixed baud rate is as follows:  
2400,4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200
- The default configuration module for adaptive baud rate. Adaptive support the following baud rate: 4800,9600,19200,38400,57600,115200bps.

The baud rate is fixed or adaptive baud rate synchronization settings. And send a command string "A-T" when serial ready after module will reply "OK".

The host controller by sending "AT" command to the module, the module will automatically

detect and identify the host controller's current baud rate. Adaptive baud rate function can make the host controller don't need to know the current baud rate and the module of communication will be finished. Adaptive baud rate function open by default.

Adaptive baud rate operating configuration:

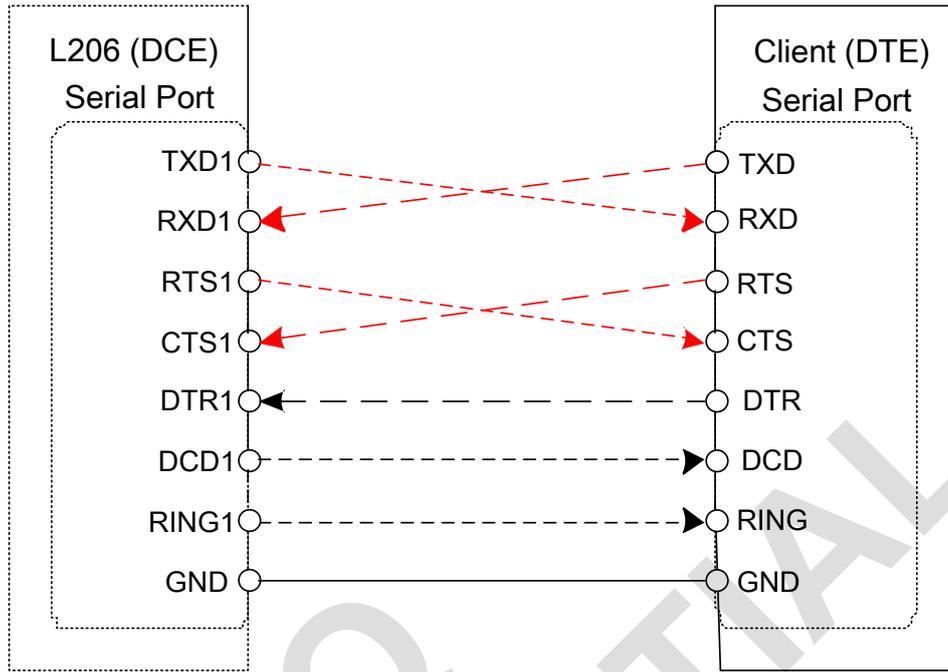
- Serial interface is configured to 8 bits of data bits, parity bits, one stop bit (the factory configuration).
- Adaptive baud rate mode, if there is no first synchronization module boot, such as "RDY", "+ CFUN: 1" and "+ CPIN: READY" URC information will not be reported.
- DTE in switching to a new baud rate, will first through the "AT" set up the new baud rate, before module detection and synchronous new baud rate, the module will use previous messages URC baud rate. DTE when switch to the new baud rate, the equipment is likely to receive unrecognized characters.
- Baud rates, is not recommended in a fixed mode switch to the adaptive baud rate model

Note: the default module is adaptive baud rate ( $AT + IPR = 0$ ), in the baud rate adaptive mode, after power on the URC information "RDY" will not back to the master machine. In the module boot after 2 ~ 3 seconds, can send the module AT commands. Master need to first send the "AT" the baud rate of character to the module to detect a master, and continue to send 1 ~ 5 "AT" string until module returns "OK". Then send a "AT + IPR = x & W" command to the module set the baud rate of a fixed, and save the configuration, after completed the configuration, each module after boot, will return to a URC information via a serial port "RDY". To further understand, please refer to the document [AT\_DOCUMENT] "AT + IPR" in the chapter.

### 3、Serial port connection

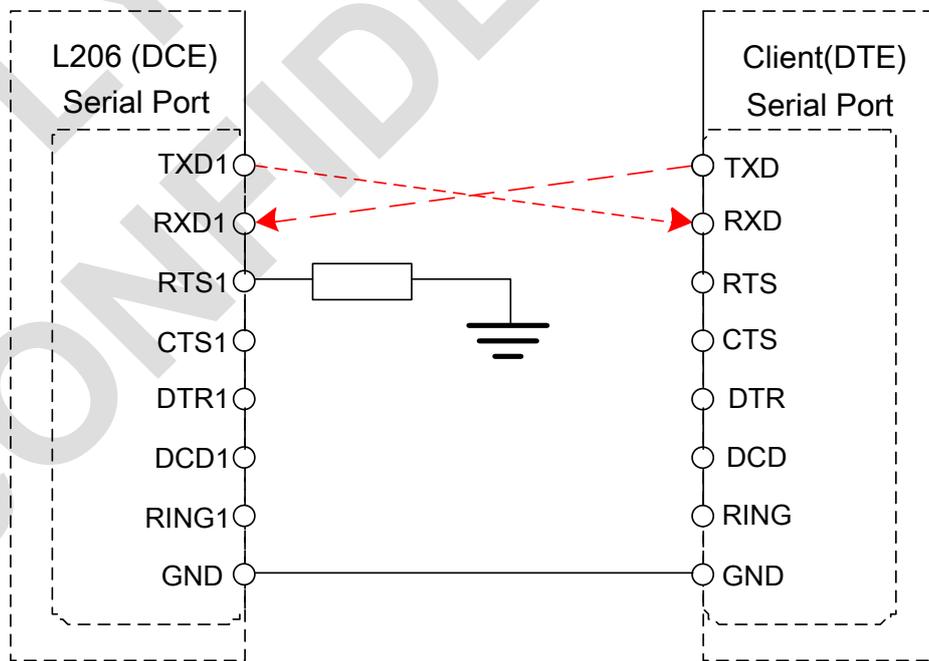
The main serial port connection mode is more flexible, as follows are three common ways of connection.

1、Full-featured serial connection as shown in the figure below, this way is mainly used in the modem mode dial (PPP)



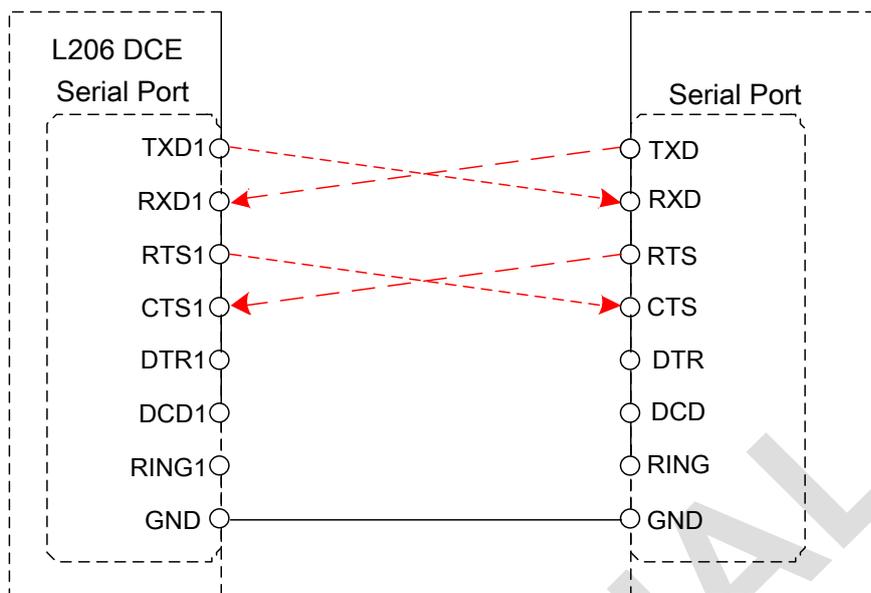
**Figure3-20:**Full-featured serial connection

2、 Three wire system without hardware flow control of the serial port is as follows



**Figure3-21:** Serial port three line connection

3、 Three wire system with hardware flow control of the serial port is as follows:

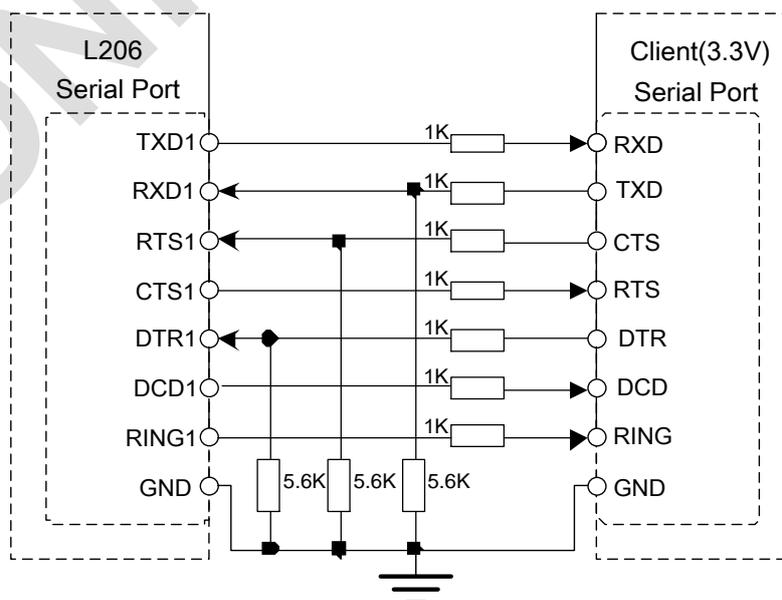


**Figure3-22:Serial flow control connection**

#### 4、Serial level matching

Module serial port is COMS VIO28 level signal, connected to the external MCU, it should pay attention to the matching of IO level. Normal job requirements input level lower than 3.0V, the default rate is 115200 bps.

When external MCU serial level of 3.3 V, it is recommended to use the following reference circuit.If the external MCU level is 3.0 V, please change the resistance of 5.6 K to 14 K.



**Figure3-23:Resistor level matching (Reference circuit)**

If the external host MCU serial level is 5 v, can use the transistor voltage conversion circuit or use special voltage conversion circuit, the reference is as follows:

1、 Use triode to do level transformation

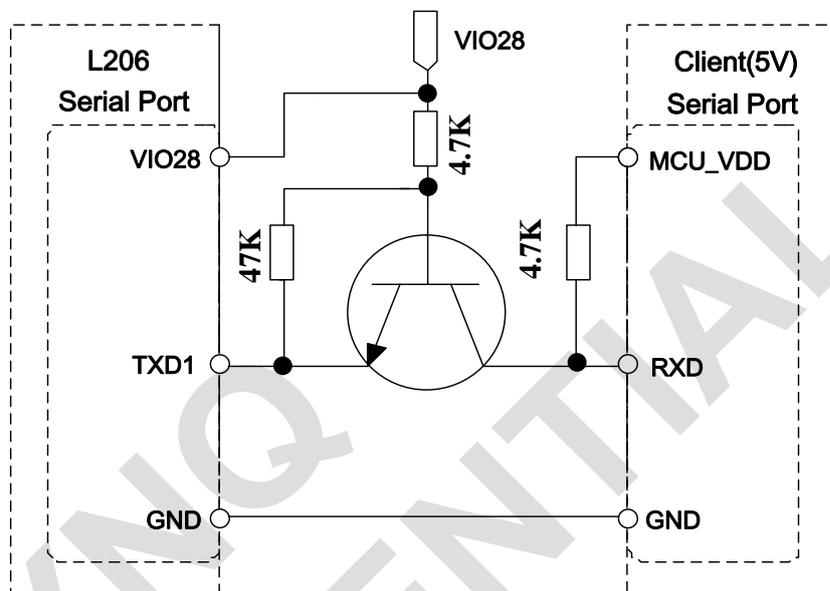


Figure3-24:5 v TXD level matching (Reference circuit)

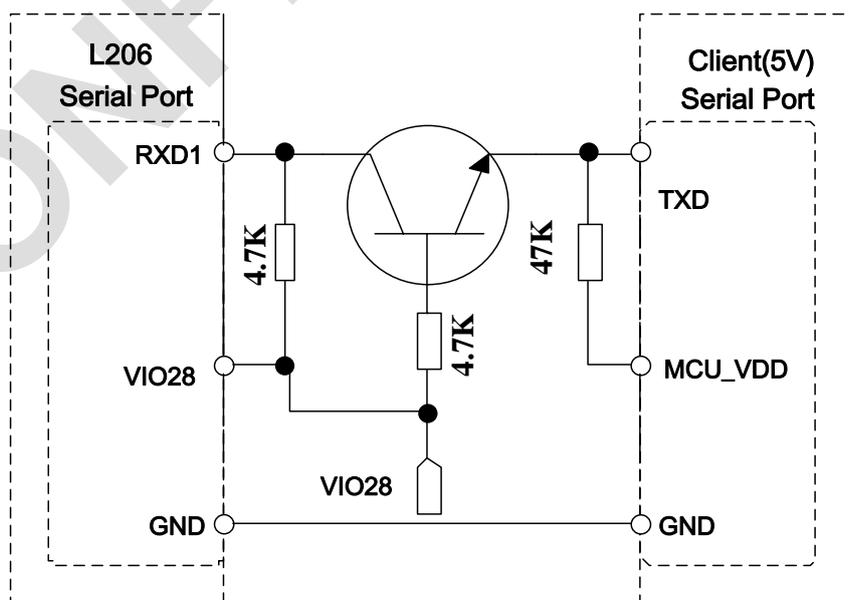


Figure3-25: 5 v RXD level matching (Reference circuit)

2、Use FAIRCHILD to convert the chip NC7WZ07:

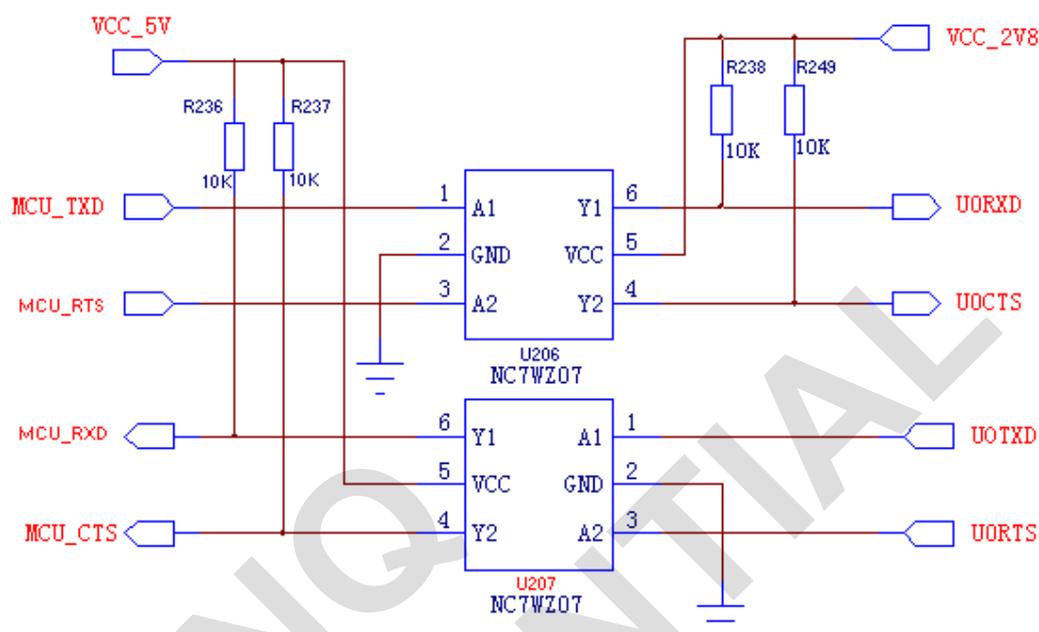


Figure 3-26: Chip level matching (Reference circuit)

## 3.4 SIM Card Interface

SIM card interface support GSM Phase1 specification function, also support the function of the GSM Phase 2 + specification and FAST 64 kbps SIM CARDS (for SIM application toolkit). SIM card supports 1.8V and 3.0V power supply through the internal power supply of the module.

### 3.4.1. SIM Interface

Table10-7: SIM card interface pin definition:

NO.	PIN name	PIN NO.	Description
1	SIM_IO	7	SIM card data I/O
2	SIM_SCLK	8	SIM card clock
3	SIM_RST	9	SIM card reset
4	SIM_DET	10	SIM card insert detection pin
5	VSIM	11	SIM power supply, according to the type of SIM card automatically select the output voltage, 3.0V 10% or 1.8V 10%, the output current of about 10mA.

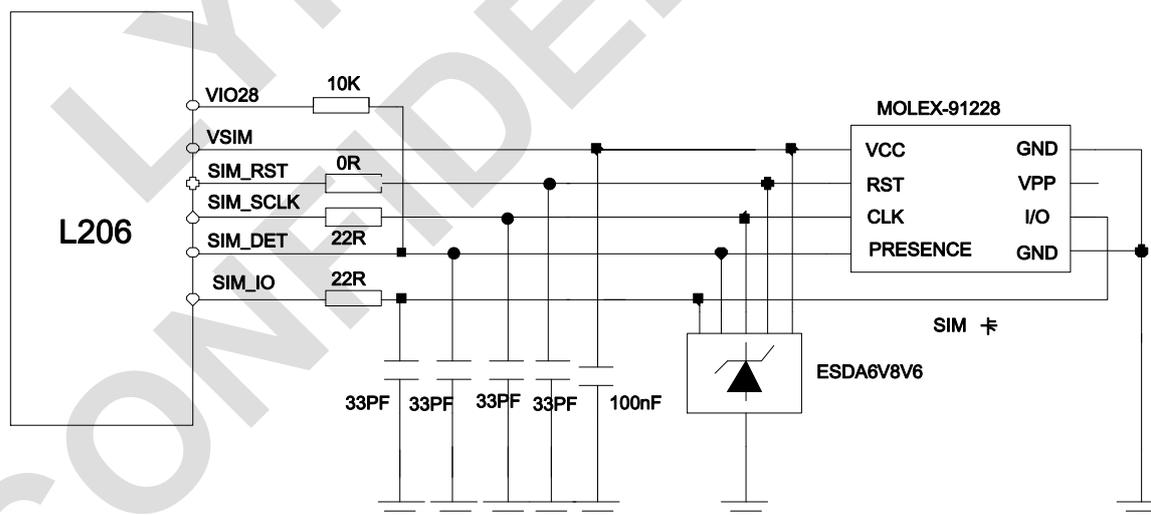
Below is a SIM card interface reference circuit, using 8 pin SIM gets stuck.SIM\_DET pins for Molex SIM booth detection.When cato is inserted into the booth, SIM\_DET into a low level.At this time whether or not a SIM card inside the cato, SIM\_DET level from high to low make initialization module produces a SIM card.By default, the SIM card detection is off, you can use the "AT + ESIMS = 1" to open or "AT + ESIMS = 0" to close the function.Learn more about the content of the AT command, please refer to the document [AT\_DOCUMENT].

When sending the "AT+CPIN?" the order, if not SIM card into the booth, can appear the URC information below:

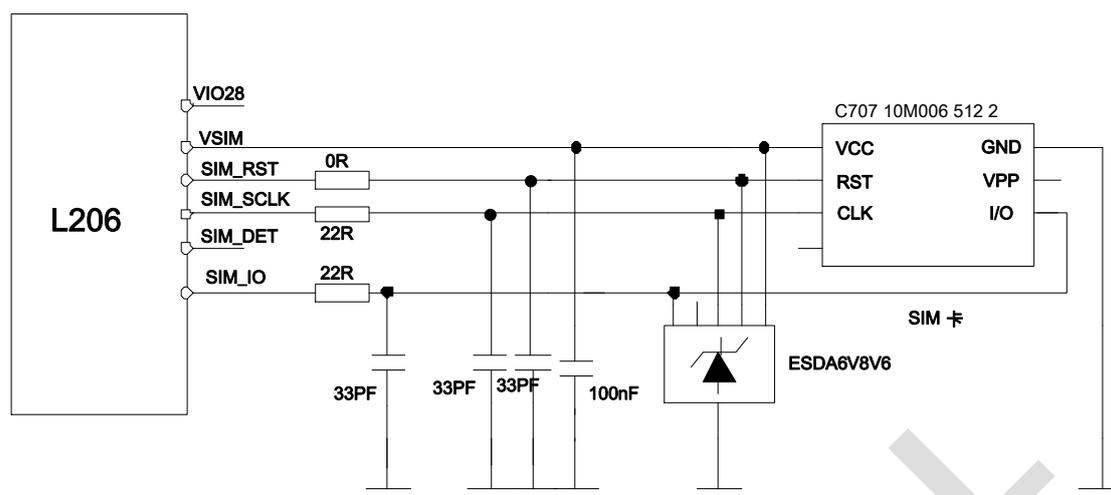
**+CPIN: NOT READY**

If the SIM card has been done into the booth, SIM initialized, the URC information will appear as below:

**Call Ready**



**Figure 3-27:** 8-pin SIM card(Reference circuit)



**Figure 3-28:** 6-pin SIM card(Reference circuit)

SIM card each signal need to increase the ESD protection devices used for ESD protection. In circuit design, in order to ensure the good performance of SIM card and is not damaged, in circuit design advice follow the following principles:

1. SIM gets stuck close to the module put, keep SIM card signal wiring less than 100 mm.
2. SIM card signal cable wiring away from the RF line and VBAT power line.
3. SIM gets-stuck and module of SIM\_GND wiring to short and thick. SIM\_VDD and SIM\_GND wiring width ensure that not less than 0.5 mm, and between SIM\_VDD and GND bypass capacitor does not exceed 1uF, and close to put SIM gets-stuck.
4. In order to prevent and SIM\_DATA SIM\_CLK signal crosstalk mutually, both wiring can't stand too close to, and between two linear increase shielding. In addition, SIM\_RST signal also need to protect.
5. In order to ensure good ESD performance, it is recommended that the SIM card pin increase TVS diode. Choose the TVS diode parasitic capacitor is not more than 50 pf, for example: WILL ESDA6V8AV6 (<http://www.willsemi.com>). Series between the module and SIM card need to 22 ohm resistance to suppress stray EMI and ESD protection. SIM card of peripheral devices should be placed near the SIM holder.
6. Suggest SIM\_DATA, SIM\_RST SIM\_CLK and SIM\_VDD online parallel 33 pf capacitor is used to filter out radio frequency interference, and close to put SIM gets-stuck.

### 3.4.2. SIM gets stuck(Reference Figure)

SIM card connector 8 pin recommended Molex 91228. Please visit the <http://www.molex.com> website for more information!

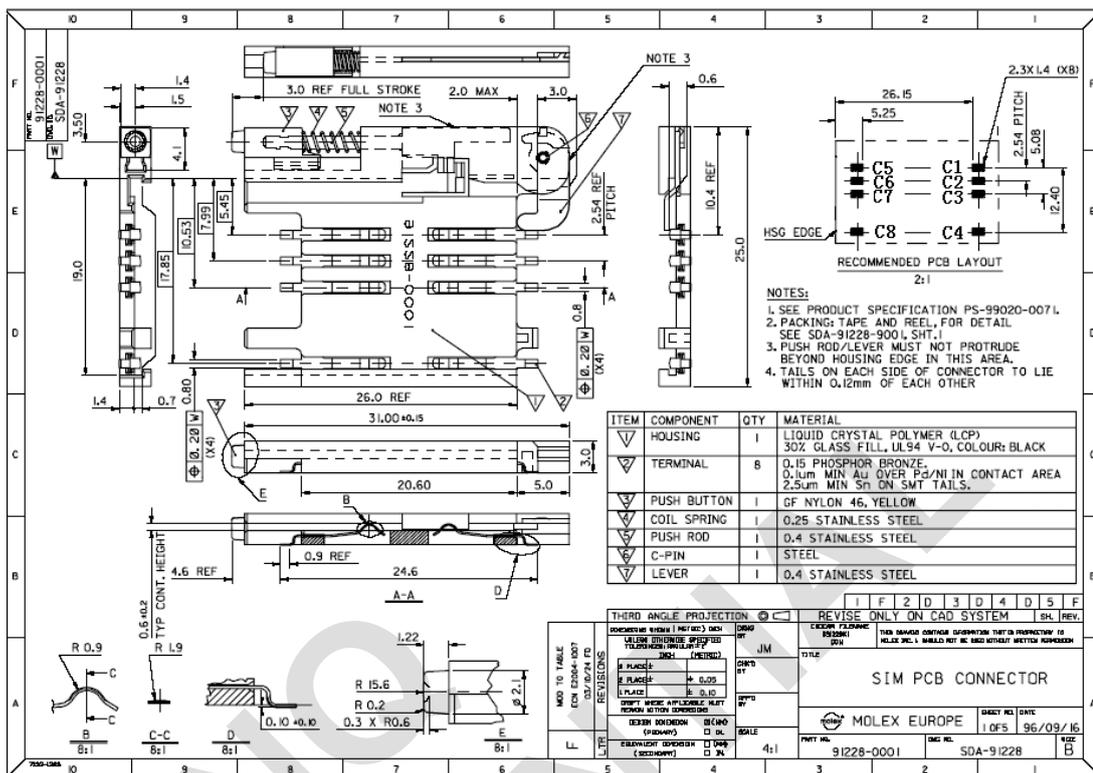
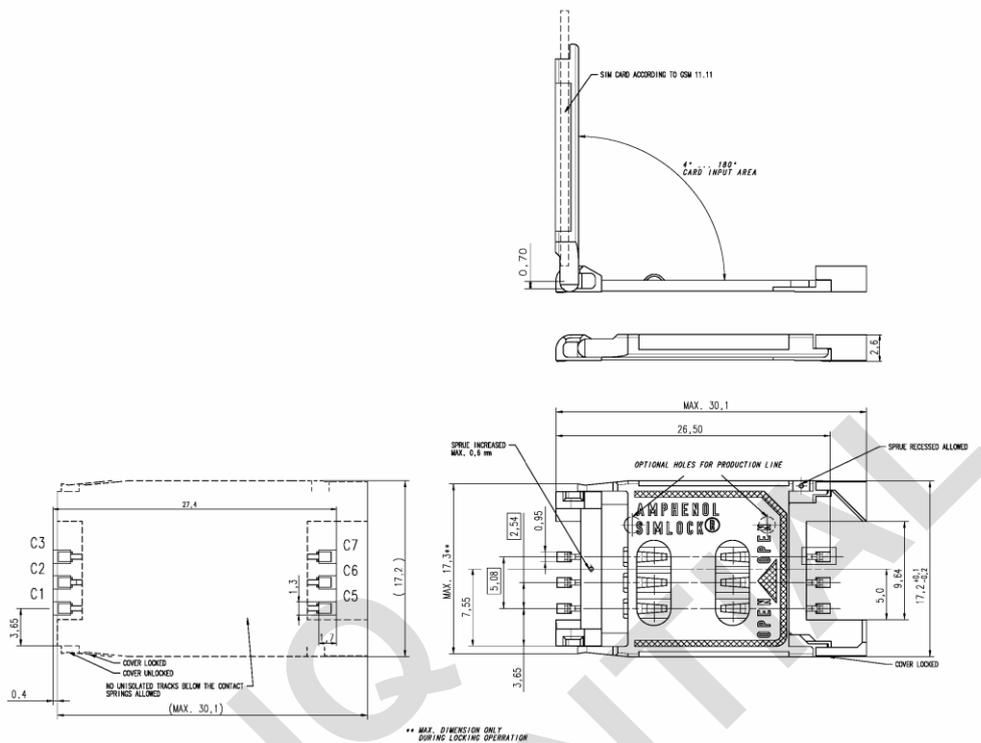


Figure 3-29: Molex 91228 SIM gets stuck

Table11-8: PIN description (Molex SIM gets stuck)

PIN name	Signal	Description
C1	SIM_VDD	SIM card power supply pin
C2	SIM_RST	SIM card reset
C3	SIM_CLK	SIM card clock
C4	SIM_PRESENCE	SIM card detect pin
C5	GND	GND
C6	VPP	Not connected
C7	SIM_DATA	SIM card data input/output
C8	SIM_DETECT	Card SIM in position detection, the pin is directly connected to the ground, with the use of SIM_PRESENCE. When the SIM card tray is inserted, C4 and C8 are short circuit.

6 pins SIM booth is recommended to use Amphenol company C707 m006 10 5122. Please visit <http://www.amphenol.com> for more information!



**Figure 3-30:** Amphenol C707 10M006 5122 SIM gets stuck

**Table12-9:** PIN description(Amphenol SIM gets stuck)

PIN name	Signal	Description
C1	SIM_VDD	SIM card power supply pin
C2	SIM_RST	SIM card reset
C3	SIM_CLK	SIM card clock
C5	GND	GND
C6	VPP	Not connected
C7	SIM_DATA	SIM card data input/output

### 3.5 PWMInterface

**Table13-10:** PWM Pin definition

PIN NO.	PIN name	Description
14	PWM0	PWM signal, Reusable forGPIO2

PWM can provide the frequency range of 0~2KHz, the user can set the output frequency,

duty cycle through the AT+SPWM command, please refer to the AT document.

PWM pin can be used to drive buzzer.

NOTE: Make sure the PWM pin keep low level when module in the boot process.

Buzzer volume can be set by "AT + CRSL".

The reference circuit as follows:

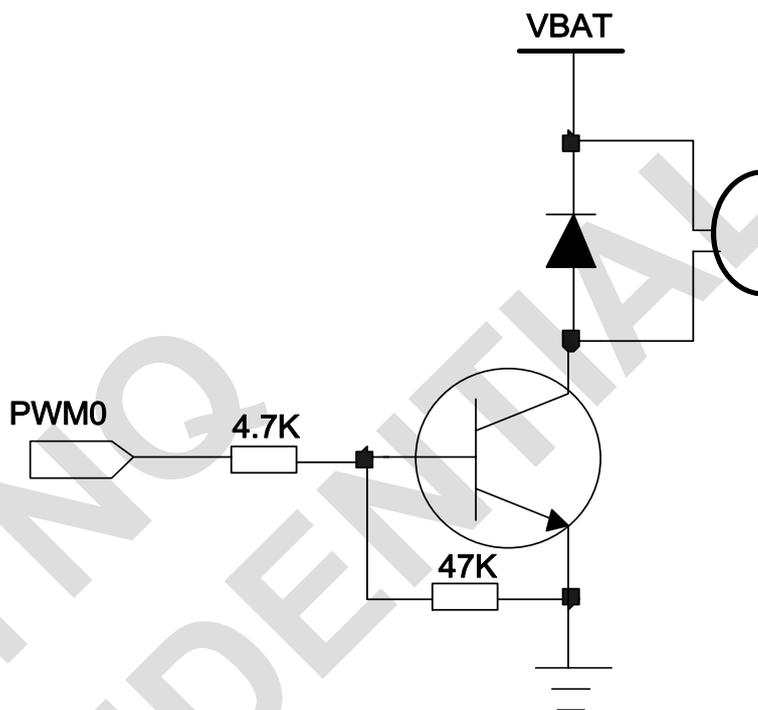


Figure 3-31: PWM(Reference circuit)

### 3.6 NETWORK Status Indicator

Table14-11: NETLIGHT pin definition

PIN NO.	PIN name	Description
13	NETLIGHT	Network status indicator

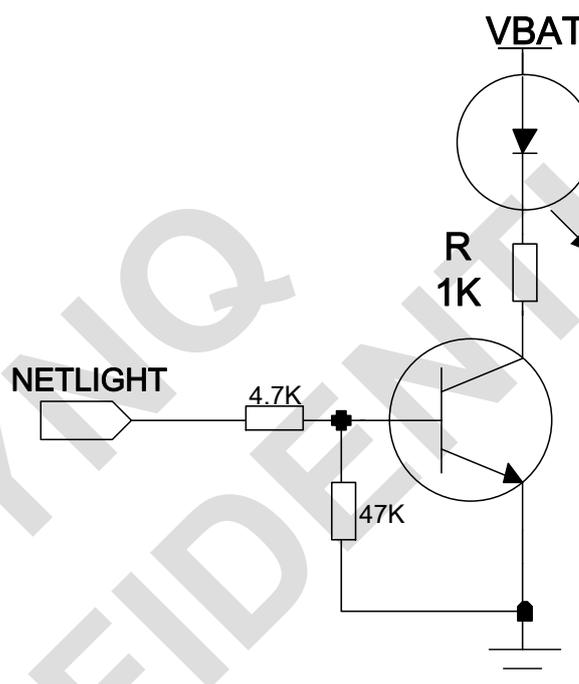
The NETLIGHT signal can be used to drive network status LED, the working state of this pin in the following table:

Table15-12: working state of NETLIGHT

Light status	Work status
--------------	-------------

off	Power off
64ms on/ 800ms off	No Network
64ms on/ 3000ms off	Register to network
64ms on/ 300ms off	GPRS Data Communication

Reference circuit:



**Figure 3-32: NETLIGHT(Reference circuit)**

### 3.7 ADC Interface

L206 provides an ADC channel, the user can use the AT command "AT + CADC" to read voltage value on ADC pin. Note: the ADC sampling the voltage cannot be more than 2.8 V, otherwise easy to cause damage to the ADC. About the AT commands related information please refer to the document [AT\_DOCUMENT]. In order to improve the accuracy of ADC, the layout of ADC should be surrounded by ground.

**Table16-13: ADC interface pin definition**

PIN NO.	PIN name	Description
4	ADC	Analog sampling

**Table17-14:** ADC Parameter

Item	Min	Typ.	Max	Units
Input voltage range	0	-	2.8	V
ADC resolution	-	10	-	bits
ADC sampling rate	-	-	1.0833	MHz
ADC precision		10	30	mV

### 3.8 Antenna Interface

L206 provides three antenna interfaces, pin definition as below:

**Table18-15:** Antenna interface pin definition

PIN NO.	PIN name	Description
26	BT_ANT	BT antenna interface
36	RF_ANT	RF antenna interface
39	FM-ANT	FM antenna interface

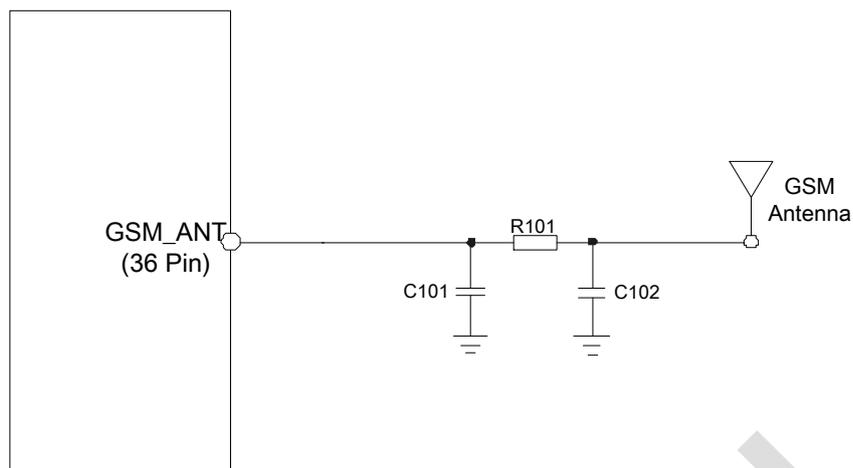
The GSM antenna and BT antenna need to select the input impedance of 50 ohm and the standing wave coefficient is less than 2.

Two kinds of antennas try not to put too close.

The isolation of each port antenna and other port antennas is greater than 30db.

#### 1、RF reference circuit

For the peripheral circuit design of the antenna interface, in order to better adjust the RF performance, the proposed reservation matching circuit. Antenna connection reference circuit as shown below. Where C101, C102 default is not posted, only 0 ohm R101 resistance, the line needs to be controlled by 50 ohm.



**Figure 3-33:RF (Reference circuit)**

Component placement and RF routing takes note:

- Matching circuit must be placed near the antenna
- RF ANT foot to the antenna RF cable must be 50 ohm impedance control
- RF\_ANT PIN to antenna RF line must be far away from the high speed signal lines and strong interference sources, to avoid any signal lines cross or parallel and adjacent layer

## 2、Bluetooth Function

L206 supports Bluetooth interface. Bluetooth is a wireless technology that allows devices to communicate, or transmit data or voice, wirelessly over a short distance. It is described as a short-range communication technology intended to replace the cables connecting portable and/or fixed devices while maintaining high level of security. Bluetooth is standardized as IEEE802.15 and operates in the 2.4 GHz range using RF technology. Its data rates of up to 3Mbps.

L206 is fully compliant with Bluetooth specification 3.0.

L206 supports profile including SPP and OPP.

L203 provides a Bluetooth antenna pad named BT\_ANT.

Table 28: Pin Definition of the BT\_ANT.

Refer to the documentation for the AT command on the Bluetooth operation [AT\_DOCUMENT].

**Table 19-16:** Pin Name Pin No. Description

PIN NO.	PIN name	Description
26	BT_ANT	BT antenna interface

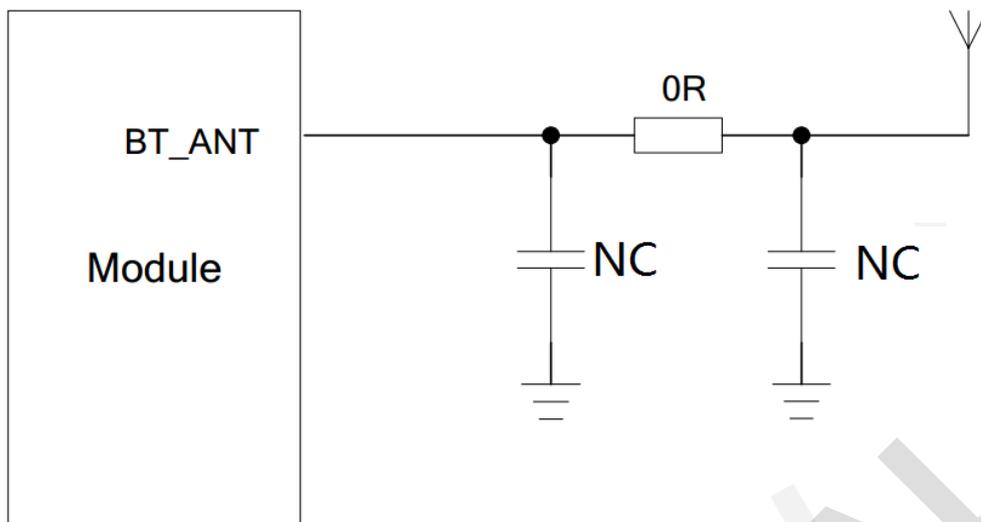


Figure 3-34:BT(Reference circuit)

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## 4. Mechanical Dimensions

Mechanical dimensions of Module:

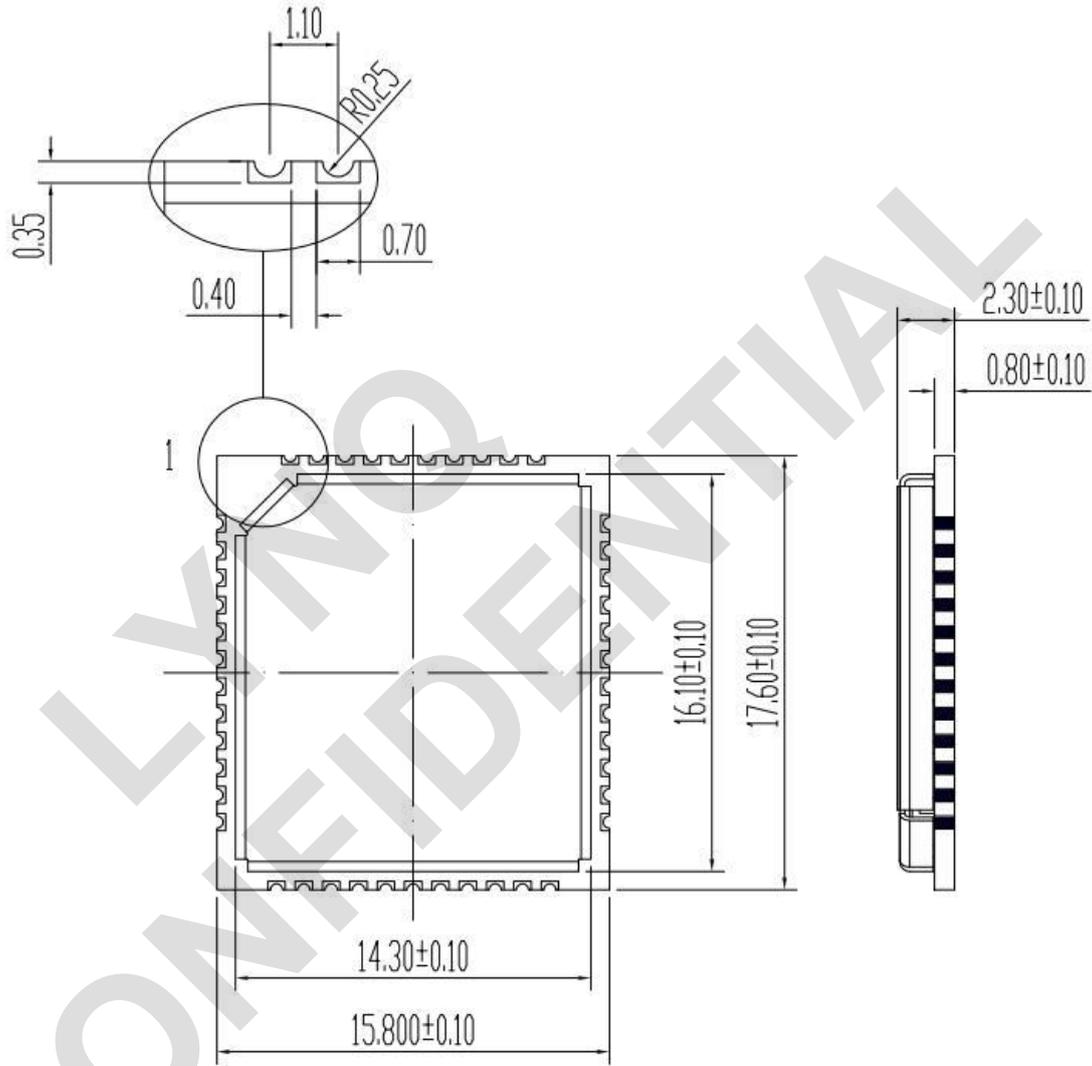
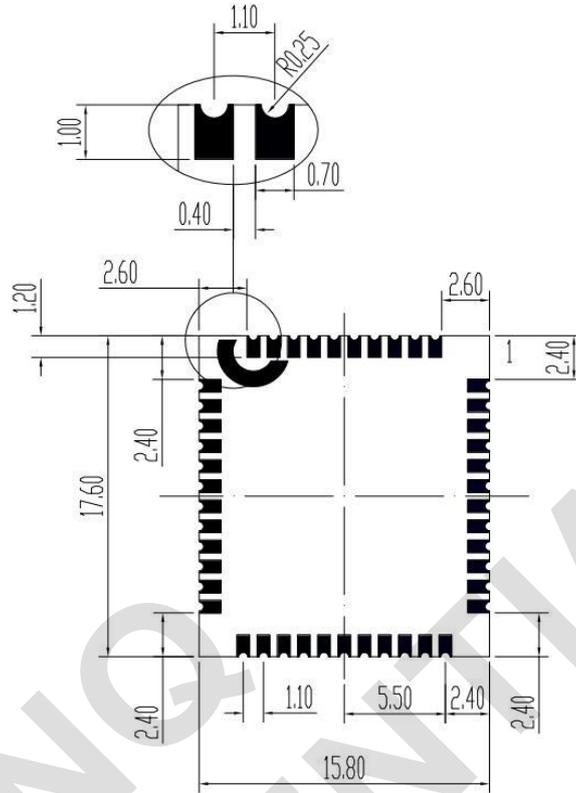
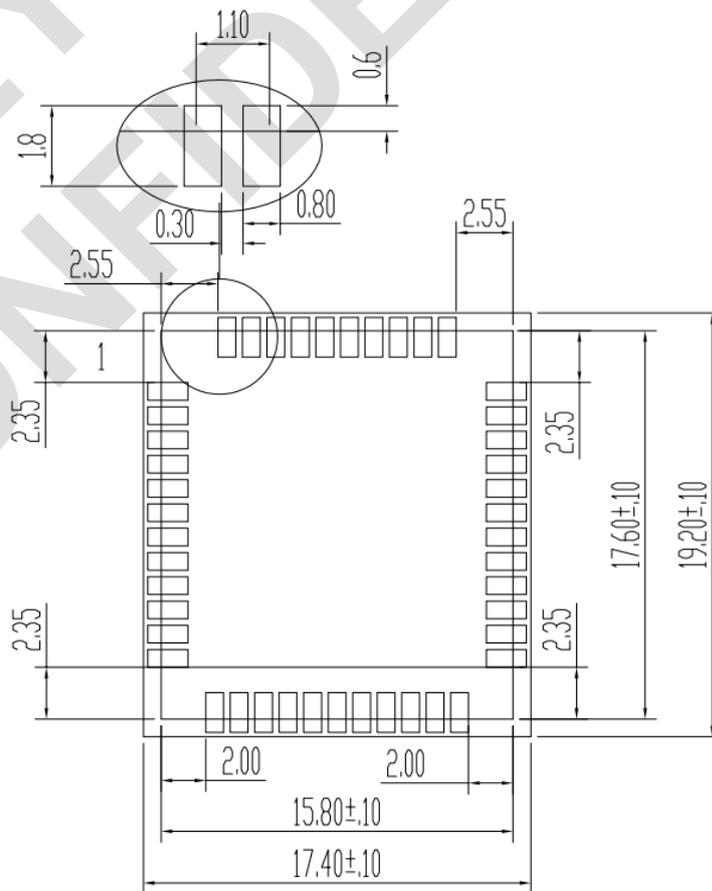


Figure4-1:L206 top view and side view(mm)



**Figure4-2:L206 Bottom view(mm)**



**Figure4-3: L206 Recommended Pad(mm)**

## 5. Electrical Characteristics

### 5.1 Absolute Maximum Ratings

The following table shows the absolute maximum state in abnormal situation, more than the limit value will likely result in permanent damage to the module.

**Table5-1:** Absolute Maximum Ratings

Parameter	Min	Typ.	Max	Unit
VBAT	3.4	3.8	4.2	V
Peak current	-0.3	-	3	A
Digital signal input voltage	-0.3	-	3.1	V
Analog input voltage	-0.3	-	3.1	V
Working temperature	-40	25	+85	°C
Storage temperature	-45	25	+90	°C

### 5.2 Digital Interface Characteristics

**Table5-2:** Digital Interface Characteristics

Parameter	Description	Min	Typ.	Max	Unit
VIH	Input high level	2.1	-	3.1	V
VIL	Input high level	0	-	0.7	V
VOH	Input high level	2.5	-	3.1	V
VOL	Input high level	0	-	0.3	V
VIH	Input high level	2.1	-	3.1	V

\* Apply to the GPIO, I2C, UART, PCM digital interface, etc.

### 5.3 VSIM Characteristics

**Table5-3:** SIM card interface characteristics

Parameter	Description	Min	Typ.	Max	Unit
VO	Output voltage	1.65	1.8	1.95	V
		2.8	3.0	3.2	V
IO	Output current	-	-	60	mA

## 5.4 Current Consumption

**Table5-4:** Current consumption

Parameter	Conditions	Min	Typ.	Max	Unit
Bottom current	Shutdown mode	--	0.07	--	mA
Working current	Sleep mode	--	2	--	mA
	Standby mode	--	10.6	--	mA
	Voice (maximum power)	--	280	--	mA
	Data transfer mode GPRS(1Rx,4Tx)	--	565	--	mA
Peak current	Data transfer mode GPRS(3Rx,2Tx)	--	413	--	mA
	Maximum power burst current	--	--	2.0	A
	Data transfer mode GPRS(3Rx,2Tx)	--	413	--	mA

## 5.5 ESD

In the use of the module, due to the human body static electricity, electric charge and friction between the two kinds of static electricity generated by various means of discharge to the module, may cause some damage, so ESD protection must pay attention, whether in the development, production assembly, testing process, especially in product design, should be taken to prevent ESD protection measures. Such as circuit design in the interface or vulnerable to the ESD point to increase the ESD protection, the production of anti-static gloves, etc.. Because the module is not specifically designed for electrostatic discharge protection, so in the production, assembly and operation module must pay attention to the electrostatic protection. The performance of the module test parameters in the following table:

ESD performance parameters (temperature: 25, humidity: 45%)

**Table5-5:** ESD performance parameters

PIN	Contact discharge	Air discharge
VBAT	±5KV	±10KV
GND	±5KV	±10KV
RXD,TXD	±1KV	±6KV
RF_ANT	±5KV	±10KV

MIC_P/N	±2KV	±6KV
RCV_P/N		
PWRKEY	±3KV	±6KV
RESET_N		

## 5.6 RF Performance

- RF output power

Following table lists the conducted output power of modules, compliant with 3GPP TS 05.05 SPEC.

**Table5-6:** EGSM900 and GSM850 conducted output power

PCL	Output power(dBm)	Tolerance (dB) for conditions	
	Nominal	Normal	Extreme
--			
5	32.5	±0.4	±2
6	30.8	±1	±2
7	29	±1	±2
8	27	±1	±2
9	25	±1	±2
10	23	±1	±2
11	21	±1	±2
12	19	±1	±2
13	17	±1	±2
14	15	±1	±2
15	13	±1.5	±2
16	11	±1.5	±2
17	9	±1.5	±2
18	7	±1.5	±5

**Table5-7:** DCS1800 and PCS1900 conducted output power

PCL	Output power(dBm)	Tolerance (dB) for conditions	
	Nominal	Normal	Extreme
--			
0	29.5	±0.4	±2
1	27.5	±1	±2
2	26	±1	±2
3	24	±1	±2
4	22	±1	±2
5	20	±1	±2

6	18	$\pm 1$	$\pm 2$
7	16	$\pm 1$	$\pm 2$
8	14	$\pm 1$	$\pm 2$
9	12	$\pm 1.5$	$\pm 2$
10	10	$\pm 1.5$	$\pm 2$
11	8	$\pm 1.5$	$\pm 2$
12	6	$\pm 1.5$	$\pm 2$
13	4	$\pm 1.5$	$\pm 2$
14	2	$\pm 1.5$	$\pm 5$
15	0	$\pm 2$	$\pm 5$

- Module conduction receiver sensitivity

The following table lists the module's conduction reception sensitivity and is tested under static conditions.

**Table5-8:**Conduction sensitivity

Band	Receiving sensitivity (Typ.)
GSM850	$\cong -108\text{dBm}$
EGSM900	$\cong -108\text{dBm}$
DCS1800	$\cong -108\text{dBm}$
PCS1900	$\cong -108\text{dBm}$

- Module frequency band

The following table lists the module's working frequency bands, compliant with the TS 3GPP 5.05 specification.

**Table5-9:**Module frequency band

Band	Receiving sensitivity (Typ.)	Receiving sensitivity (Max))
GSM850	869 ~ 894MHz	824 ~ 849MHz
EGSM900	925 ~ 960MHz	880 ~ 915MHz
DCS1800	1805 ~ 1880MHz	1710 ~ 1785MHz
PCS1800	1930 ~ 1990MHz	1850 ~ 1910MHz

## 6. Manufacturing

### 6.1 L206 Top And Bottom View



Figure6-1: L206 top and bottom view

### 6.2 Soldering

In order to ensure soldering quality, special attention should be paid to the control of temperature curve pipes. The soldering profile shown below is only a general recommendation and should be adjusted according to the specific application and manufacturing.

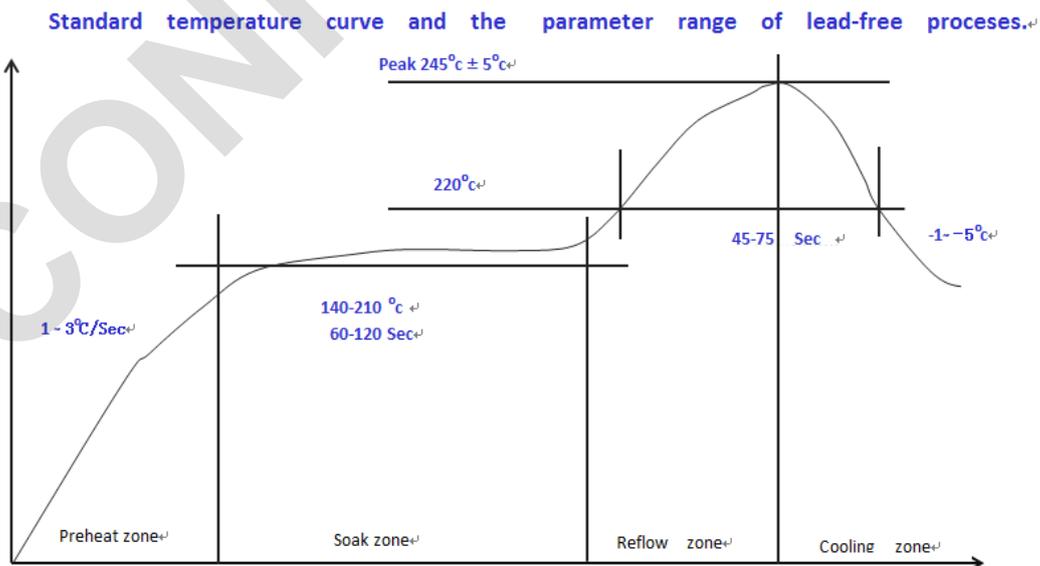


Figure 6-2 The reference temperature curve

## 6.3 The Moisture Sensitivity Level (MSL)

L206 module complies with the humidity level 3. At a temperature of <30 degrees and relative humidity of <60% of the environmental conditions, dry pack to perform J-STD-020C specification according to IPC / JEDEC standard. At a temperature of <40 degrees and a relative humidity of <90% of the environmental conditions, in the case of unopened shelf life of at least six months. After unpacking, Table29 shows the module shelf life at different times corresponding to the level of humidity.

**Table6-1:** Moisture sensitivity level and floor life

The Moisture Sensitivity Level (MSL)	Floor Life(out of bag) at factory ambient $\leq +30$ /60%RH
1 RH °C condition	Unlimited at $\leq +30$ /85%
2	1 Year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	Mandatory bake before use. After bake,it must be reflowed within the time limit specified on the label.

After unpacking,<30 degrees in temperature and relative humidity <60% environmental conditions, 168 hours in the SMT patch. If not meet the above conditions need to be baked.

NOTES: For product handling, storage, processing, IPC / JEDEC J-STD-020C must be followed

## 6.4 Baking Requirements

Due to the humidity sensitive characteristics of the L206 module, the L206 is a vacuum packaging, which can be stored for 6 months without damage to the package, and the ambient temperature is less than 40 C and the relative humidity is less than 90%. To meet one of the following conditions, the process of reflow soldering should be performed before the full bake, or the module may cause permanent damage to the process.

- 1、 Vacuum packing damage or leakage
- 2、 The module is exposed in the air for 168 hours or more
- 3、 The module is exposed in air for 168 hours, not meet the temperature <30 degrees and

relative humidity of the environment conditions <60%

**Table6-2:**Baking requirements

Baking temperature	Humidity	Baking time
120° C±5° C	<5%	4 Hours

**Note:** The original packaging of the module cannot bear the high temperature of baking. The packaging needs to be removed before baking, otherwise the packaging will be damaged.

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## 7. Package and Storage information

### 7.1 Package information

L206 module adopts by tape and reel. Shipping with the coil packaging and vacuum sealing anti-static bag to seal it.

#### 7.1.1 Tape and reel information

There are 500L206 module assemble in a tape reel, below figure show the detail information.

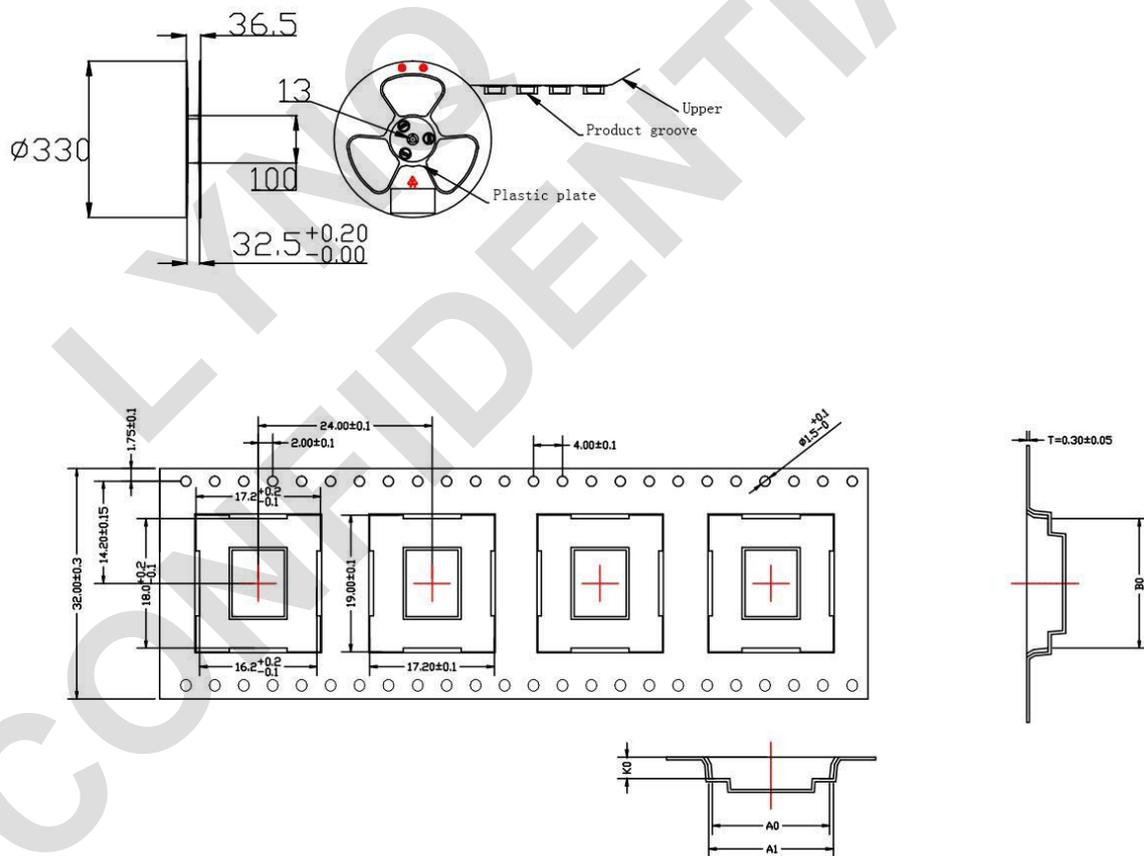
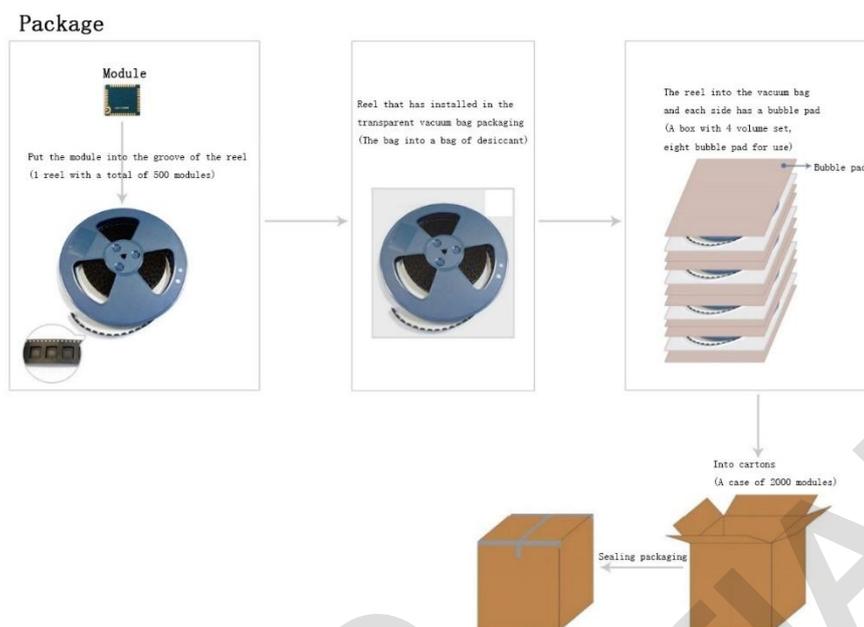


Figure 7-1: Tape and reel information

#### 7.1.2 Assemble and carrier information

L206 packing diagram is as follows, every 4 volumes of material packed in a case between each volume of material has a bubble mat do isolation protection. Specific as shown in the figure below:



**Figure7-2:** Package and ship information

## 7.2 Bagged storage conditions

L206 shipments in the form of vacuum sealing anti-static bag. Module of storage need to follow the following conditions: Environment below 40 Degrees Celsius temperature, air humidity is less than 90% of cases, the module can be in vacuum sealed bags for 12 months. Conditions set the storage environment Suggestions with reference to the following form.

**Table 7-1:**Storage conditions (less than 90% humidity of the air vacuum sealed packaging)

Parameter	Min.	Typ.	Max.	Unit
Storage temperature	-45	25	90	°C

When on the vacuum bags, if meet the following conditions, the module can be directly for reflow soldering (furnace temperature setting reference 6.2 furnace temperature curve) or other high temperature process:

- Module temperature below 30 degrees c, the air humidity is less than 60%, factory within 72 hours to complete the SMT.
- The humidity is less than 10%.

If the module is in the following conditions, to be baked before SMT:

- When the environment temperature is 23 degrees Celsius (allow upper and lower volatility of 5 degrees Celsius), humidity index greater than 10%.
- When open vacuum bags, module temperature below 30 degrees Celsius, air humidity is less than 60%, but the factory have not finished the SMT within 72 hours.
- When open the vacuum bags, module storage air humidity is more than 10%.

If modules need baking, please under 125 degrees Celsius (allowing fluctuations of 5 degrees Celsius) up and down bake for 48 hours.

## 8. Related Documents

**Table 8-1:** Related documents

NO.	Documents	Note
[1]	AT_DOCUMENT_R1.04	
[2]	ITU-T Draft new recommendation V.25ter:	Serial asynchronous automatic dialing and control
[3]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[4]	GSM 07.10:	Support GSM 07.10 multiplexing protocol
[5]	GSM 07.05:	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[6]	GSM 11.14:	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface

## 9 Safety Information

For the reasonable usage of the module, please comply with all these safety notices of this page. The product manufacturers should send followed safety information to user, operator or product's spec.



The devices using the module may disturb some electronic equipment. Put the module away from the phone, TV, radio and automation equipment to avoid the module and the equipment to interfere with each other.



Shut down the mobile device or change to flying mode before boarding. The Using of wireless appliances in an aircraft is forbidden to avoid the interference, or else cause to unsafe flying, even violate the law.



In hospital or health care center, switch off the mobile devices. RF interference may damage the medical devices, like hearing-aid, cochlear implant and heart pacemaker etc.



Mobile devices can't guarantee to connect in all conditions, like no fee or with an invalid SIM card. When you need emergent help, please remember using emergency calls and make sure your device power on in an area with well signal.



Put the module away from inflammable gases. Switch off the mobile device when close to gas station, oil depot, chemical plant etc.



The module is not water proof. Please don't use the module in the area with high humidity like bathroom, which will decelerate the physical performance, insulation resistance and mechanical strength.



Non-professionals can't teardown the module which will damage it. Refer to the specification or communicate the related staffs to repair and maintain it.



Please switch on the module before cleaning. The staffs should be equipped with anti-ESD clothing and gloves.

The users and product manufacturers should abide by the national law of wireless modules and devices. If not, Mobiletek will not respond the related damages.