L206 GSM/GPRS Module Hardware Design V1.0

2015-06-26

FCC Statement

The L206 module is designed to comply with the FCC statements. FCC ID: 2AHSAL206

The Host system using L206 should have label "contains modular's FCC ID: 2AHSAL206".

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body as well as kept minimum 20cm from radio antenna depending on the Mobile status of this module usage. This module should NOT be installed and operating simultaneously with other radio. The manual of the host system, which uses L206, must include RF exposure warning statement to advice user should keep minimum 20cm from the radio antenna of L206module depending on the Mobile status. Note: If a portable device (such as PDA) uses L206module, the device needs to do permissive change and SAR testing.

Note:

Single Modular Approval.

Output power is conducted. This device is to be used in mobile or fixed applications only. Antenna gain including cable loss must not exceed 5.45 dBi of GSM 850 and 3 dBi of PCS 1900 for the purpose of satisfying the requirements of 2.1043 and 2.1091. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operated in conjunction with any antenna or transmitter not described under this FCC ID. The final product operating with this transmitter must include operating instructions and antenna installation instructions, for end-users and installers to satisfy RF exposure compliance requirements. Compliance of this device in all final product configurations is the responsibility of the Grantee. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate. Installation of this device into specific final products may require the submission of a Class II

permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate.

Version History

Date	Version	Description of change	Author
2015-06-26	V1.0	Create	Jiali.liu

CONTENTS

VERSION HISTORY 2

1. INTRODUCTION 5

2. L206 OVERVIEW 5

2.1. Key Features 5

3. APPLICATION INTERFACE 7

3.1. Pin out Diagram 7

3.2. Pin Description 8

3.3. Functional Diagram 10

4. APPLICATION INTERFACE 10

4.1. Power Supply 10

4.2. Power on/down Scenarios 12

4.2.1. Power on L206 12

4.2.2. Power down L206 13

4.2.3. Reset Function 13

4.2.4. Power Saving Mode 14

4.3. Audio Interfaces 15

4.3.1. Audio Line1(PIN42,PIN43,PIN44,PIN45) 15

4.3.2. Audio Line2(PIN1,PIN2,PIN3) 16

4.3.3. PCM Interface 17

4.4. Antenna Interface 17

4.4.1. GSM Antenna Interface 17

4.4.2. Bluetooth antenna interface 18

4.5. Serial Port 19

4.5.1. Serial Interfaces 19

4.5.2. Software Upgrade and Debug 21

4.5.3. RI Behaviors 22

4.6. SIM Card Interface 23

4.6.1. SIM Card Application 23

5. PACKAGE DIMENSIONS 24

6. ELECTRICAL, RELIABILITY AND RADIO CHARACTERISTICS.....25

6.1. Absolute Maximum Ratings.....25

6.2. Recommended Operating Conditions.....25

6.3. Digital Interface Characteristics.....26

6.4. SIM Card Interface Characteristics.....26

6.5. SIM_VDD Characteristics.....26

6.6. VDD_EXT Characteristics.....26

6.7. VRTC Characteristics.....27

6.8. Current Consumption (VBAT=3.8V).....27

6.9. Current Consumption (VBAT=3.8V).....28

6.10. Radio Characteristics.....29

6.10.1. Module RF Output Power.....29

6.10.2. Module RF Receive Sensitivity.....30

6.10.3. Module Operating Frequencies.....30

7. MANUFACTURING.....31

7.1. Top and Bottom View of L206.....31

7.2. Typical Solder Reflow Profile.....31

7.3. The Moisture Sensitivity Level.....31

7.4. Baking Requirements.....32

1. Introduction

This document describes the hardware interface of the L206 module that connects to the specific application and the air interface. As L206 can be integrated into a wide range of applications, all functional components of L206 are described in great detail.
This document can help user to quickly understand L206 interface specifications, electrical and mechanical details. With the help of this document and other L206 application notes, user guide, users can use L206 module to design and set-up mobile applications quickly.

2. L206 Overview

Designed for Chinese and Indian market, L206 is a quad-band GSM/GPRS engine that works on frequencies, EGSM 850/900MHz and DCS 1800/1900MHz. L206 features GPRS multi-slot class 12/ class B (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of **15.8mm x 17.6mm x 2.3mm**, L206 can meet almost all the space requirements in user's applications, such as M2M, smart phone, PDA and other mobile devices.

The physical interface to the mobile application is a **45**-pin SMT pad, which provides all hardware interfaces between the module and customers' boards.

- Serial port and Debug port can help user easily develop user's applications.
- Two audio channels include a microphone input and a speaker output.
- Programmable General Purpose Input & Output.

The L206 is designed with power saving technique so that the current consumption is as low as 1.0mA in SLEEP mode.

The L206 is integrated with the TCP/IP protocol; extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

2.1. Key Features

Table 1: L206 key features

Feature	Information
Physical characteristics	Size: **15.8* 17.6*2.3**mm Weight:

Module control	Full set of AT commands for GSM/GPRS including GSM 07.07 And 07.05 AT command set. Specific AT commands for GPS management on same link as GSM/GPRS AT commands Direct reception of GPS data through serial link
GSM Band	Quad bands 850/900/1800/1900 GPRS multi-slot class 10/12 GSM Phase 2/2+ Transmit power: Class 4 (2 W) at 850/900MHz Class 1 (1 W) at 1800/1900MHz
GPRS	GPRS multi-slot class 10, DL 85.6kbps max Multi-slot class 2 supported Coding schemes: CS1 to CS4 PPP-stack non- transparent
Voice	GSM Voice Features with Emergency calls 112 Full Rate (FR)/ Enhanced Full Rate (EFR) / Half Rate (HR) Echo cancellation and noise reduction Full duplex Hands free
SMS	SMS MT, MO and SMS CB SMS. Support TXT and PDU mode.
GSM Supplementary Services	Call Forwarding, Call Barring Multiparty Call Waiting, Call Hold
Audio interface	Dual analog audio interfaces. One digital audio interface (PCM).

SIM interface	3 V or 1.8V SIM interface	
Serial interface	Support Dual UART interface (up to 115200bps)	
Other	Support I2C ,ADC and GPIO etc	
Environment Feature	Working temperature	-40~85℃
	Storage temperature	-45~90℃
	Humidity	5%~ 95%

* The L206 does work, but deviations from the GSM specification may occur.

Table 2: Coding schemes and maximum net data rates over air interface

Coding scheme	1 Timeslot	2 Timeslot	4 Timeslot
CS-1:	9.05kbps	18.1kbps	36.2kbps
CS-2:	13.4kbps	26.8kbps	53.6kbps
CS-3:	15.6kbps	31.2kbps	62.4kbps
CS-4:	21.4kbps	42.8kbps	85.6kbps

3. Application Interface

3.1. Pin out Diagram

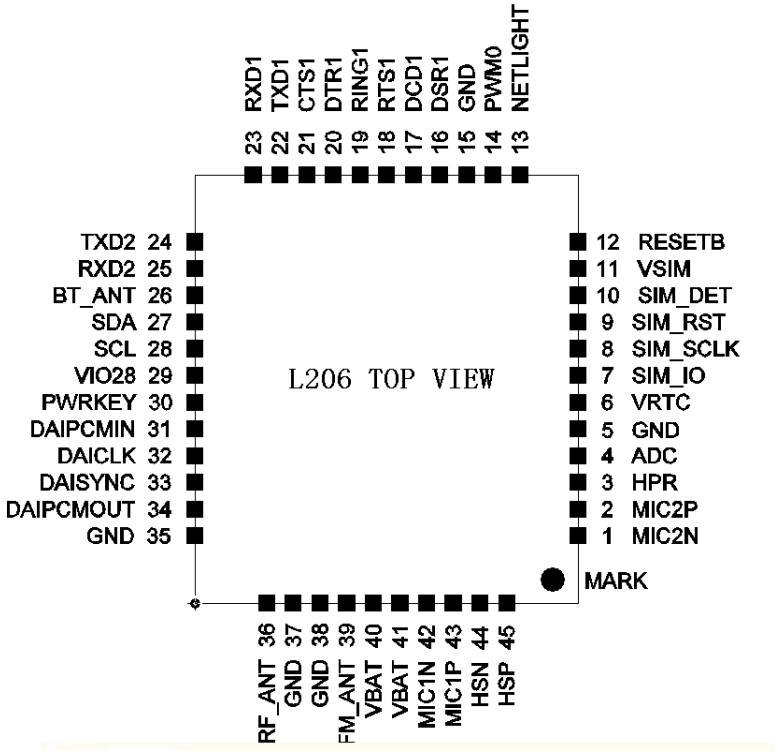

Figure 1: L206 pin out diagram (Top view)

3.2. Pin Description

L206 have 45 pins, including the following functions：

- Analog voice：Two MIC input，one way to speaker output, another way to earphone output
- Digit voice： PCM voice
- Simcard：support 1.8V and 3V，including VSIM、RST、IO、SCLK、DET
- Reset：Support RESETB pin to reset the module
- I2C：This pin is already pulled up to VIO28 in the module internal
- GPIO： PIN 10,13,14，another pins can be used as GPIO pin(detail information in the following table)
- Serial port: Full modem interface with status and control lines, unbalanced, asynchronous
- RF： GSM，BT，FM

Table 3: Pin Description

Pin NO.	Pin name	Type*	Reset	Function Description
1	MIC2N	AI	/	Differential input, integrated bias voltage in the module internal. Used with PIN 3 HPR
2	MIC2P	AI	/	
3	HPR	AO	/	Headphone right channel output, integrated 100 ohm resistor. Used with PIN1 and PIN2
4	ADC	AI	/	10bit general analog to digital converter. Max voltage is 2.8V.
5	GND	GND	/	GND
6	VRTC	POWER	/	Power supply for RTC. It is rcommended to connect with a battery or a capacitor(e.g. 4.7uF)
7	SIM_IO	I/O	PD	PIN 10 SIM_DET is SIM card hot plug detection signal(SIM card support hot swap function). If no use can be set NC. SIM_DET can be reused as GPIO mode. All signals of SIM interface should be protected against ESD with a TVS diode array.
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，pull up to1.8V in the module internal
13	NETLIGHT	I/O	PD	Net status light
14	PWM0	I/O	PD	PWM output

Pin NO.	Pin name	Type*	Reset	Function Description
15	GND	GND	/	GND
16	DSR1	O	PD	
17	DCD1	O	PD	Data carrier detect
18	RTS1	O	PU	Clear to send
19	RING1	O	PD	Ring indicator
20	DTR1	I	PD	Data terminal ready
21	CTS1	I	PU	Request to send
22	TXD1	O	PU	Transmit data
23	RXD1	I	PU	Receive data
24	TXD2	O	PD	Serial 2 transmit data
25	RXD2	I	PU	Serial 2 receive data
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	/	/	Connect 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)

3.3. Functional Diagram

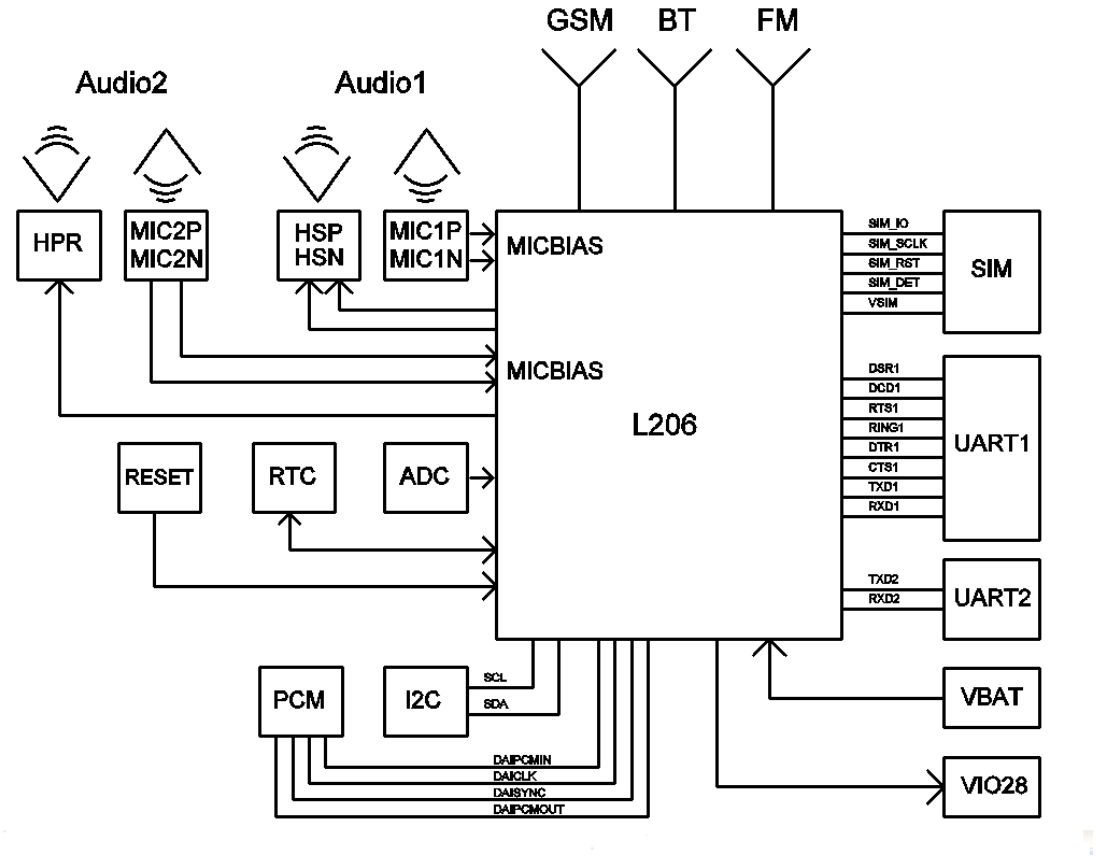

Figure 2: Function Diagram

4. Application Interface

4.1. Power Supply

The power supply range is from 3.4V to 4.2V. Recommended voltage is 3.8V. The transmitting burst will cause voltage drop and power supply must be able to provide sufficient current up to 2A. For the VBAT input, a bypass capacitor(low ESR) such as a 100 uF is strongly recommended.

Increase the 33PF and 10PF capacitors can effectively eliminate the high frequency interference. A 5.1V/500mW Zener diode is strongly recommended, the diode can prevent chip from damaging by the voltage surge. These capacitors and Zener diode should be placed as close as possible to VBAT pins.

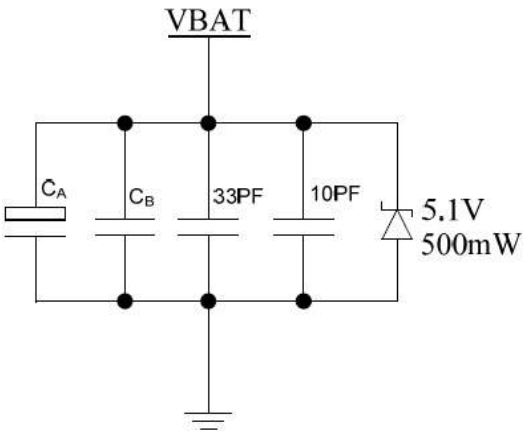

Figure 3: Reference circuit of the VBAT input

Table 4: Recommended Zener diode

Vendor	Part number	description
ONSEMI	MMSZ5231BT1G	DIO ZENER 5.1V 500MW SOD-123 RO
长电科技	MMSZ5231B	DIO ZENER 5.1V 500MW SOD-123 RO
VISHAY	MMSZ4689-V	DIO ZENER 5.1V 500MW SOD-123 RO
PRISEMI	PZ3D4V2H	DIO ZENER 5.1V 500mW SOD323 RO
Crownpo	CDZ55C5V1SM	DIO Zener 5.1V 500mW SOD323
ROHM	HDZMV4Z01 5.1B	DIO Zener 5.1V 500mW UMD2
DIODES	UDZ5V1BF	DIO Zener 5.1V 500mW SOD323
SIG	SIG1Z5V1T1G	DIO Zener 5.1V 500mW SOD323

If there is a high drop-out between the input and the desired output (VBAT), a DC-DC power supply will be preferable because of its better efficiency especially with the 2A peak current in burst mode of the module. The following figure is the reference circuit.

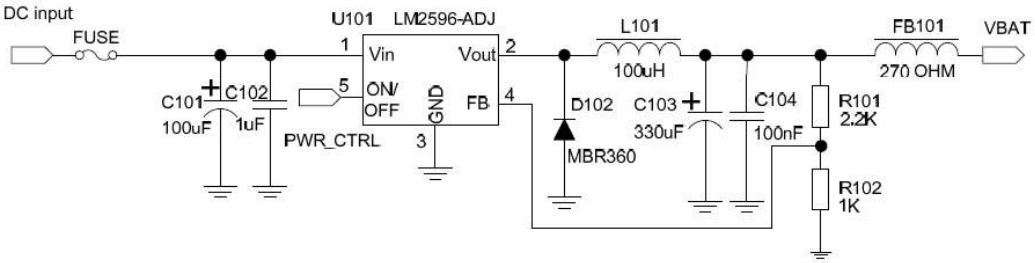

Figure 4: Reference circuit of the DC-DC power supply

The single 3.7V Li-ion cell battery can be connected to L206 VBAT pins directly. But the Ni-Cd or Ni-MH battery must be used carefully, since their maximum voltage can rise over

the absolute maximum voltage of the module and damage it. When battery is used, the total impedance between battery and VBAT pins should be less than 150mΩ. The following figure shows the VBAT voltage drop at the maximum power transmit phase, and the test condition is as following:

- VBAT=4.0V,
- A VBAT bypass capacitor C_A=100μF tantalum capacitor (ESR=0.7Ω),
- Another VBAT bypass capacitor C_B=1μF.

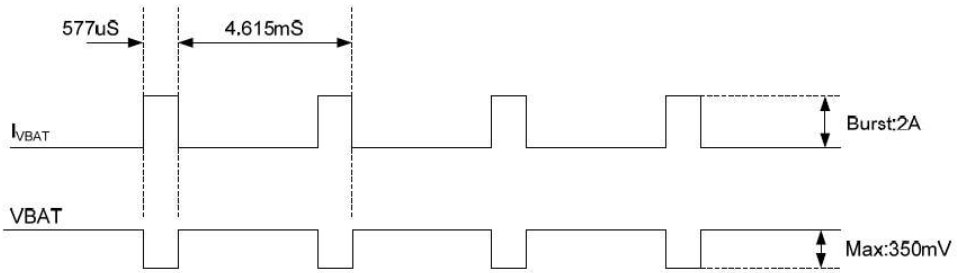

Figure 5: VBAT voltage drop during transmit burst

4.2. Power on/down Scenarios

4.2.1. Power on L206

User can power on L206 by pulling down the PWRKEY pin for at least 2 second and release. This pin is already pulled up to VBAT in the module internal, so external pull up is not necessary. Reference circuit is shown as below.

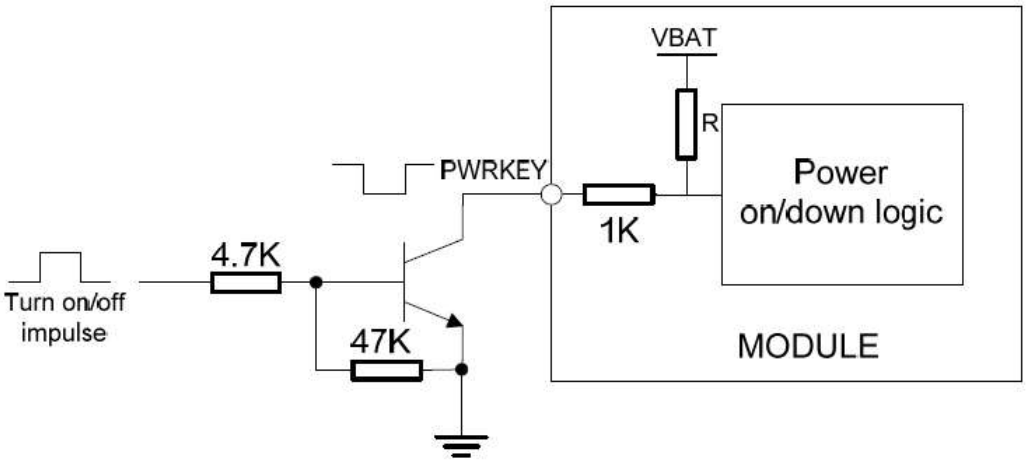

Figure 6: Powered on/down module using transistor

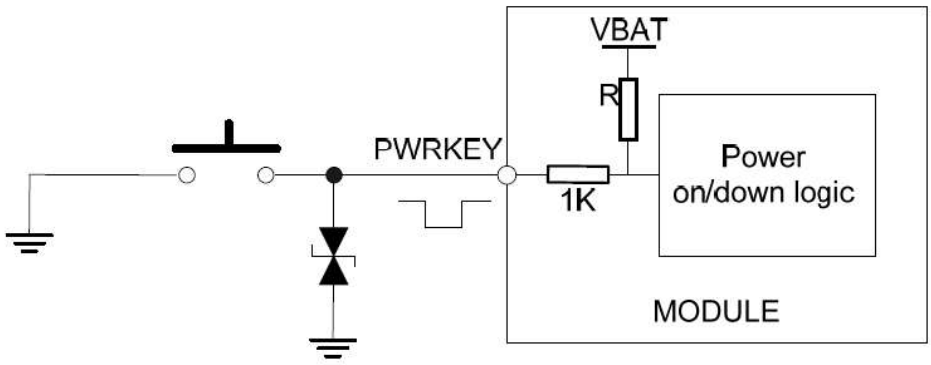

Figure 7: Powered on/down module using button

The power on timing is illustrated as in the following figure.

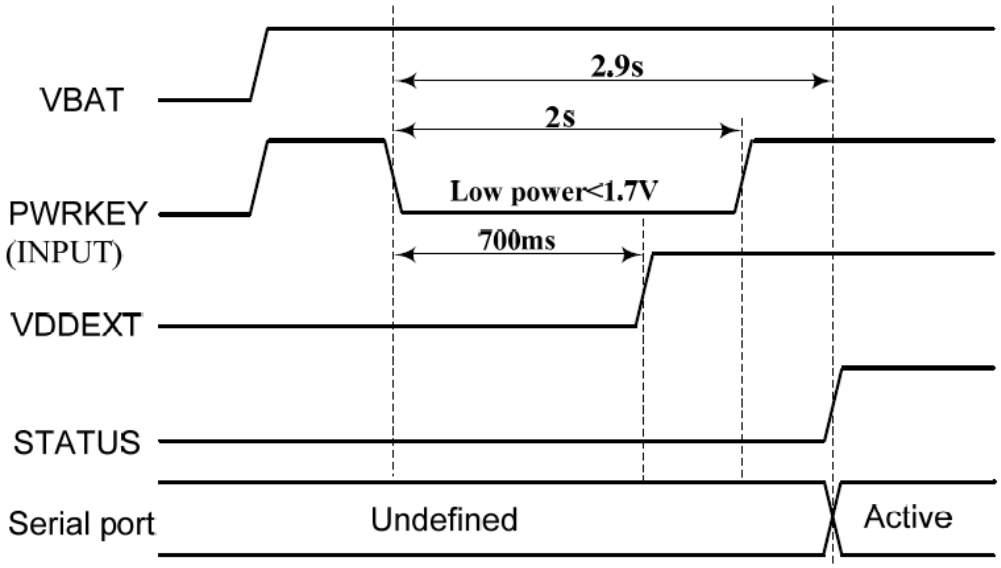

Figure 8: Timing of power on module

4.2.2. Power down L206

L206 will be powered down in the following situations：

- Normal power down procedure: power down L206 by the PWRKEY pin.
- Normal power down procedure: power down L206 by AT command “AT+EPOF”.

4.2.3. Reset Function

L206 also has a RESET pin (pin 12) used to reset the module. This function is used as an emergency reset only when AT command “AT+EPOF” and the POWER_ON pin has no effect. User can pull the RESET pin to ground, then the module will reset. This pin is already isolated in the module, so the external isolation is not necessary. Following figure

is internal circuit of the RESET pin.

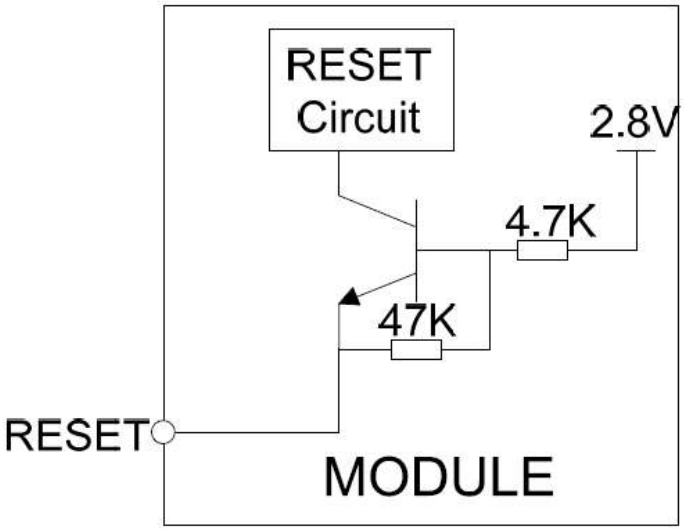

Figure 9: Reset circuit

The typical value of RESET pin at High level is 2.8V, so for the 3V or 3.3V, customer could use MCU's GPIO to driver this pin directly, cascading some resistors could enhance the ESD performance but the value should not be too big; otherwise the level of RESET could be lower than threshold value; RESET hardware parameters can refer to the table below:

Table 5: Electronic characteristic of the RESET pin

Pin name	Symbol	Min	Typ	Max	Unit
RESET	V_{IH}	2.7	2.8	2.9	V
	V_{IL}	-	-	0.6	V
	Low power time	105		-	ms

The reset scenarios are illustrated in the following figures.

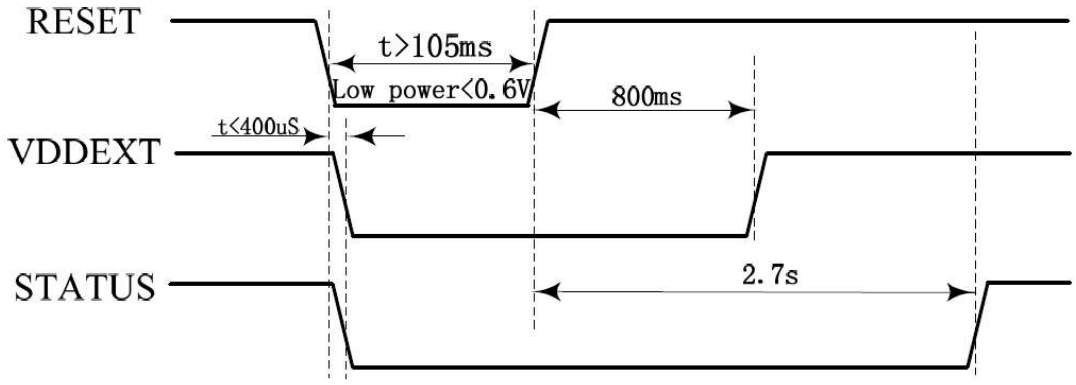

Figure 10: Reset timing sequence

4.2.4. 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.

(4). Receive external interrupt

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

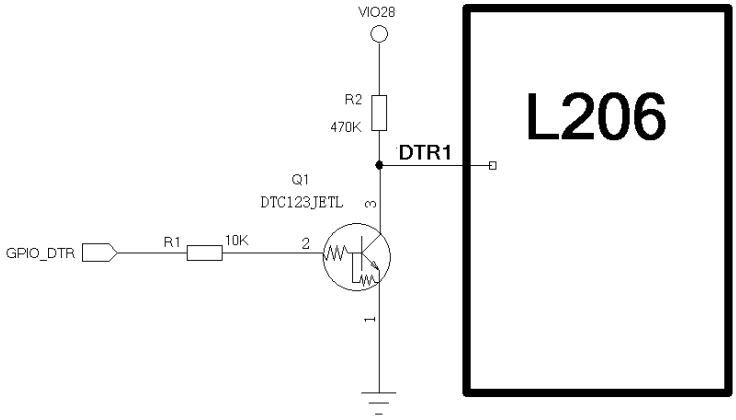

Figure 10: DTR circuit

4.3. Audio Interfaces

4.3.1. Audio Line1(PIN42,PIN43,PIN44,PIN45)

Receiver connect HSP and HSN（Note：this is receiver，not Speaker）

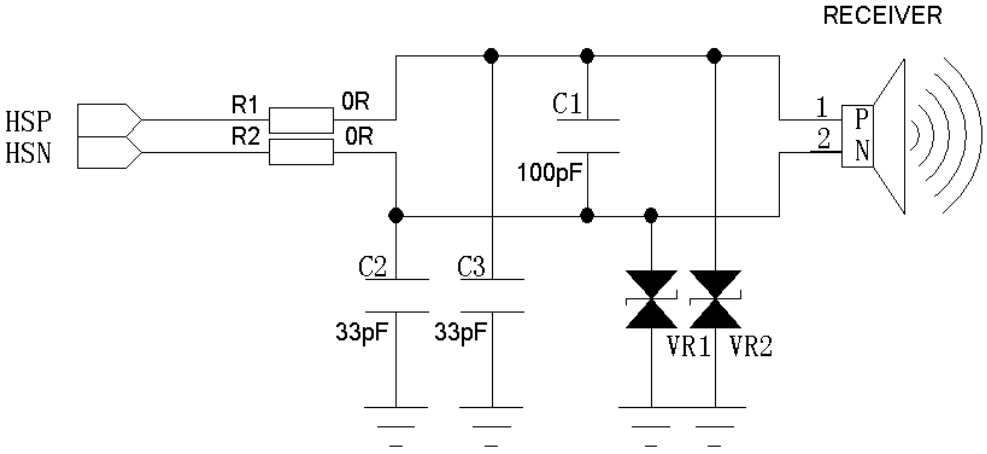

Figure 11: Receiver circuit

MIC1 integrates mic-bias and capacitance, can be directly connected to the outside, MIC1P and MIC1N must follow the differential line.

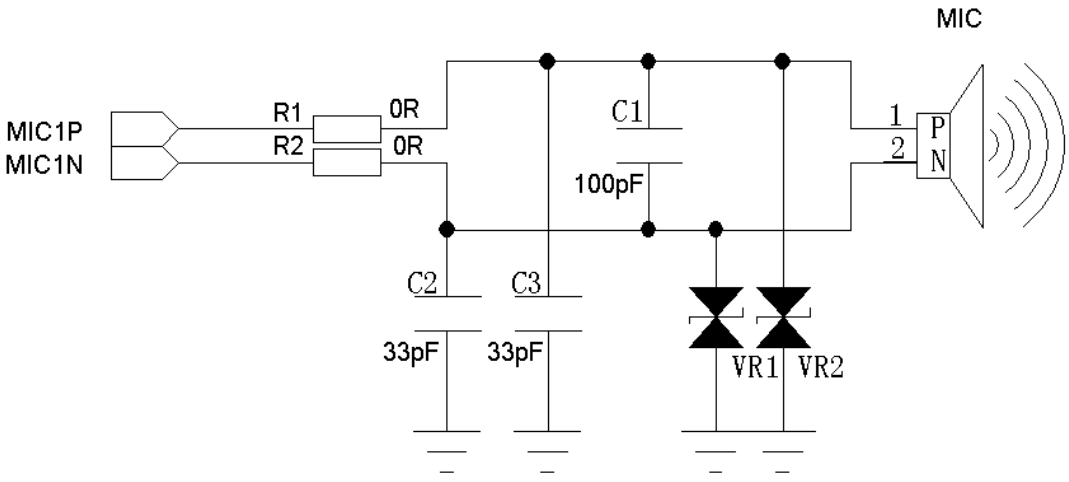

Figure 12: Mic circuit

4.3.2. Audio Line2(PIN1,PIN2,PIN3)

Pin3 HPR（head phone right）is a single audio output line, which is used to earphone or speaker with the PA. MIC2 is the same as MIC1, it also integrates mic-bias and capacitance, can be directly connected to the outside, MIC2P and MIC2N must follow the differential line.

If audio line is used to earphone, then the earphone's GND can be used to FM's antenna. See the following figure.

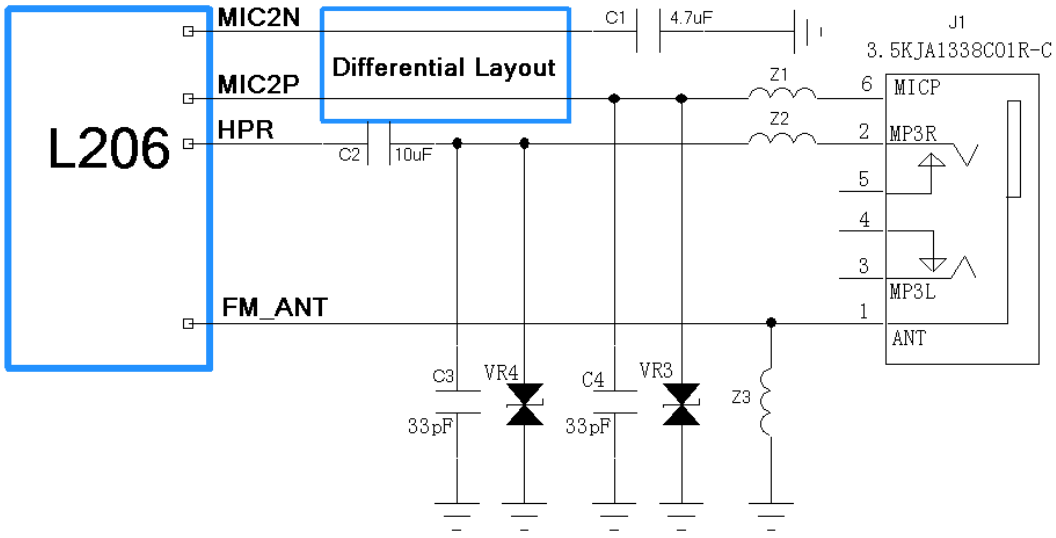

Figure 13: earphone and Fm antenna circuit

Note：Because MICBIAS is connected to MIC2P, MIC2N cannot connect to MIC。

4.3.3. PCM Interface

L206 provides a hardware PCM interface:

L206 PCM interface only supply master mode, data length is 16 bits (linear)，PCM clock rate is 256KHz.

Table 6: PCM specification

Parameter	Specification
Line Interface Format	Linear(Fixed)
Data length	16bits(Fixed)
PCM Clock/Sync Source	Master Mode(Fixed)
PCM Clock Rate	256Khz(Fixed)
PCM Sync Format	Short sync/Long sync both support
Zero Padding/Sign extension	Zero Padding(Fixed)
Data Ordering	MSB/LSB both support

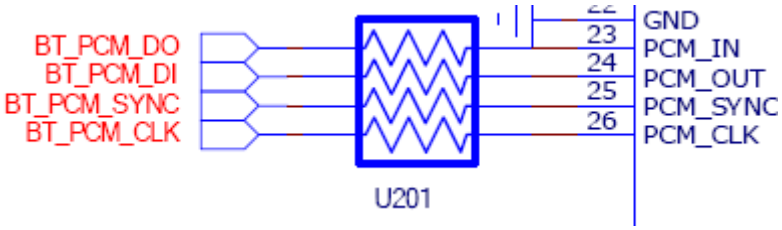

Figure 14: PCM circuit

4.4. Antenna Interface

There are three antenna ports for L206, GSM antenna port named RF_ANT, Bluetooth antenna port named BT_ANT and FM antenna port named FM_ANT, The RF interface of the three antenna ports has an impedance of 50Ω.

- The input impendence of the antenna should be 50Ω, and the VSWR should be less than 2.
- It is recommended that the GSM antenna and the BT antenna should be placed as far as possible.
- The isolations of the three antenna should be bigger than 30db

4.4.1. GSM Antenna Interface

There is a GSM antenna pad named RF_ANT for L206, the connection of the antenna must be decoupled from DC voltage. This is necessary because the antenna connector is DC coupled to ground via an inductor for ESD protection.

The external antenna must be matched properly to achieve best performance, so the matching circuit is necessary, the connection is recommended as following:

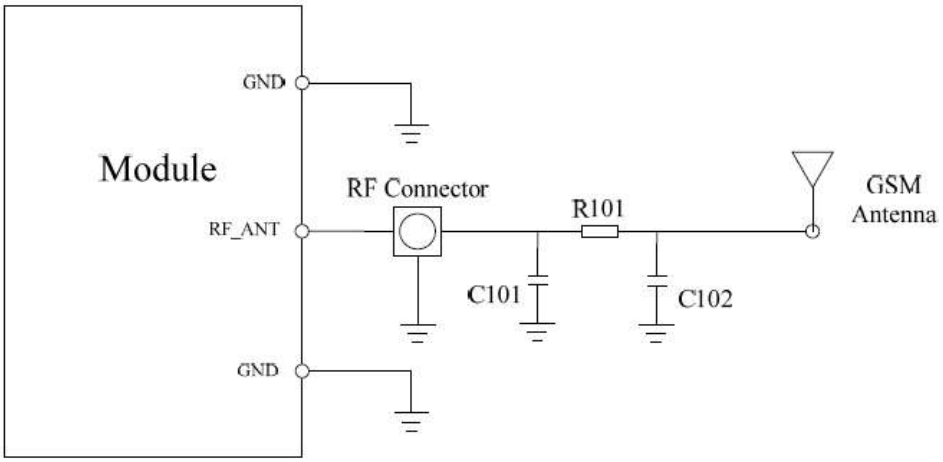

Figure 15: GSM antenna matching circuit

R101，C101，C102 are the matching circuit, the value should be defined by the antenna design. Normally R101 is 0Ω, C101 and C102 are not mounted. The RF connector is used for conduction test. If the space between RF pin and antenna is not enough, the matching circuit should be designed as in the following figure:

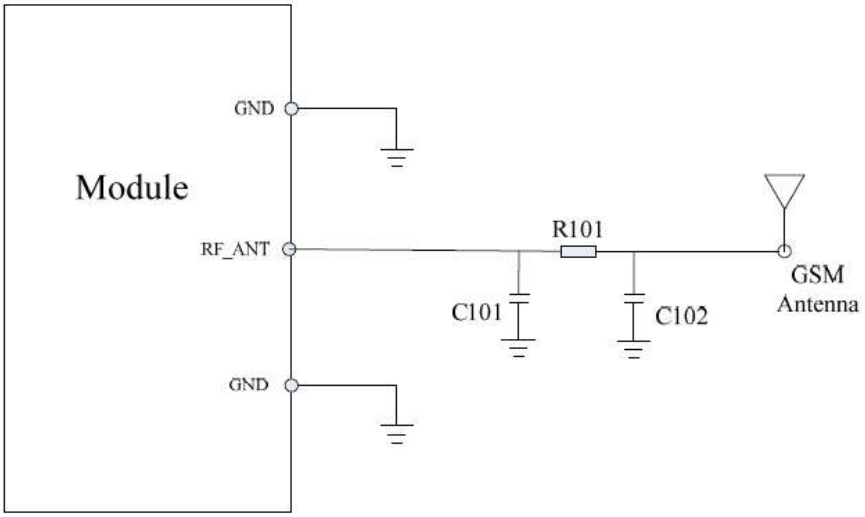

Figure 16: GSM simple antenna matching circuit

Normally R101 is 0Ω, C101 and C102 are not mounted.

4.4.2. Bluetooth antenna interface

The module provides a Bluetooth antenna pad named BT_ANT.

The external antenna must be matched properly to achieve best performance, so the matching circuit is necessary, the connection is recommended as in the following figure:

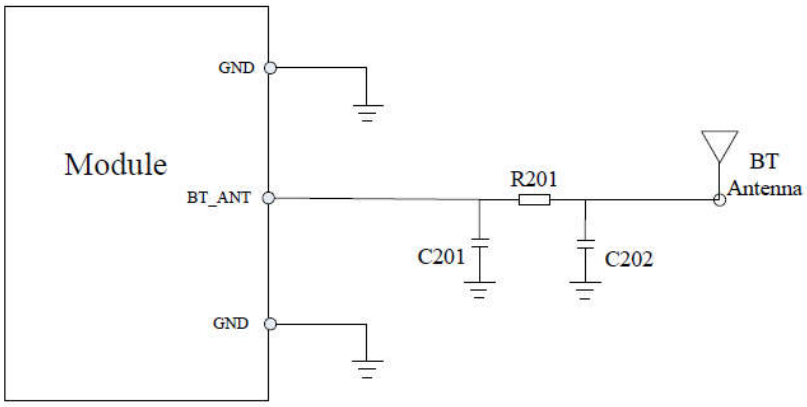

Figure 17: Bluetooth antenna matching circuit

R201, C201, C202 are the matching circuit, the value should be defined by the antenna design. Normally R201 is 1.2nH, C202 is 1.5pF and C201 are not mounted.

There are some suggestions for placing components and RF trace lying for GSM and Bluetooth RF traces:

The RF connector is used for conducted test, so keep it as close to pin RF_ANT as possible; 2.Antenna matching circuit should be closed to the antenna; □ Keep the RF traces as 50Ω;

The RF traces should be kept far away from the high frequency signals and strong disturbing source.

4.5. Serial Port

4.5.1. Serial Interfaces

The following figure shows the connection between module and client (DTE).

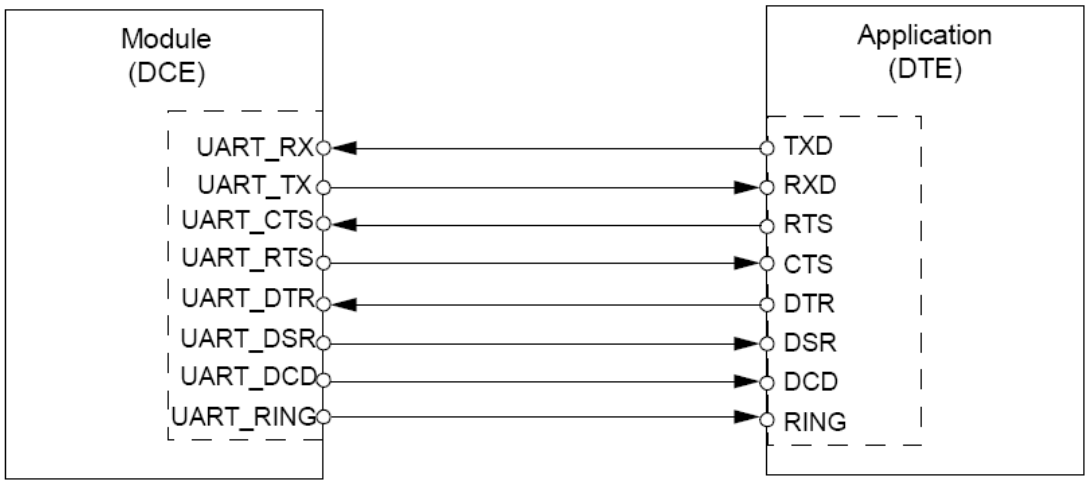

Figure 18: Connection of the serial interfaces

If the voltage of UART is 3.3V, the following reference circuits are recommended. If the

voltage is 3.0V, please change the resistors in the following figure from 5.6K to 14K.

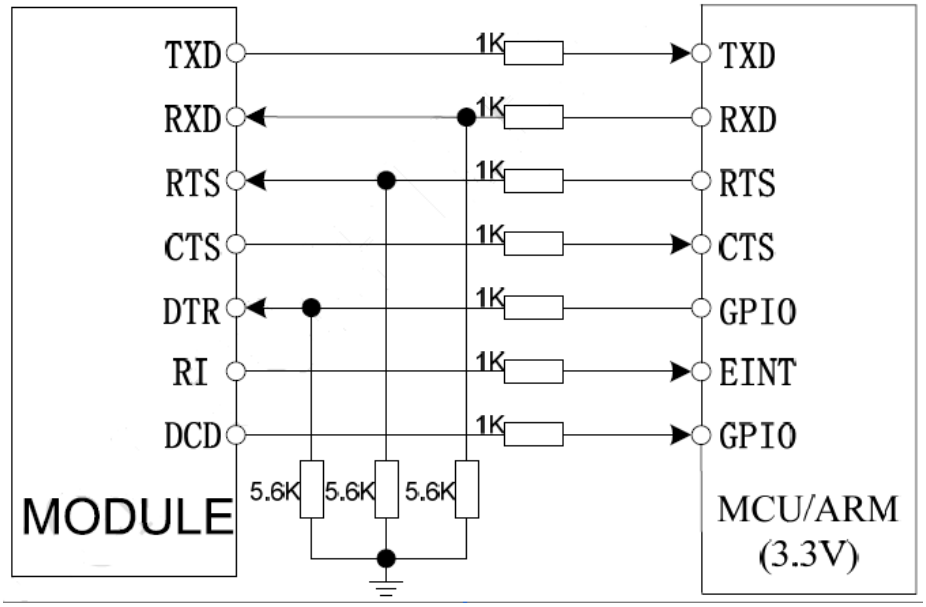

Figure 19: Resistor matching circuit

If the voltage of UART is 3V or3.3V, the following reference circuits are recommended:

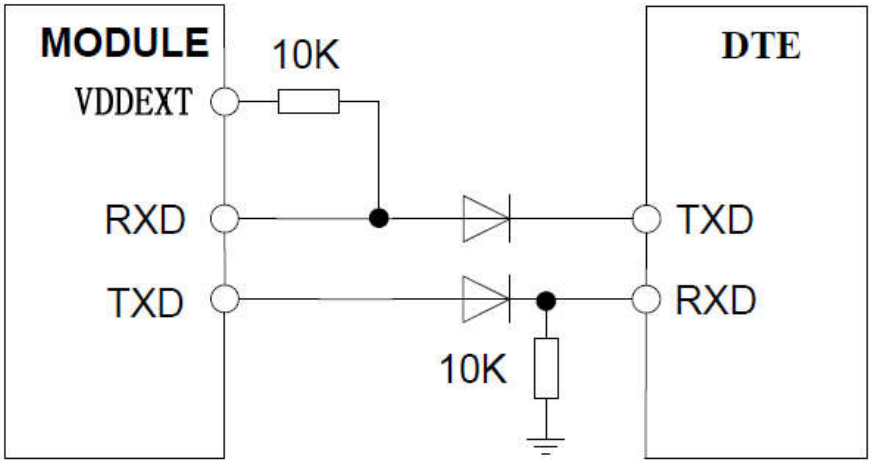

Figure 20 : Diode isolation circuit

Note: please make sure the minimum of client high limit should be less than 2.8V minus the diode drop.

If the voltage of UART is 5V, the following reference circuits are recommended:

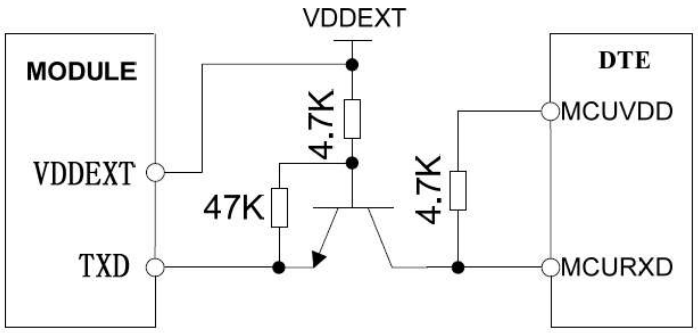

Figure 21: TX level matching circuit

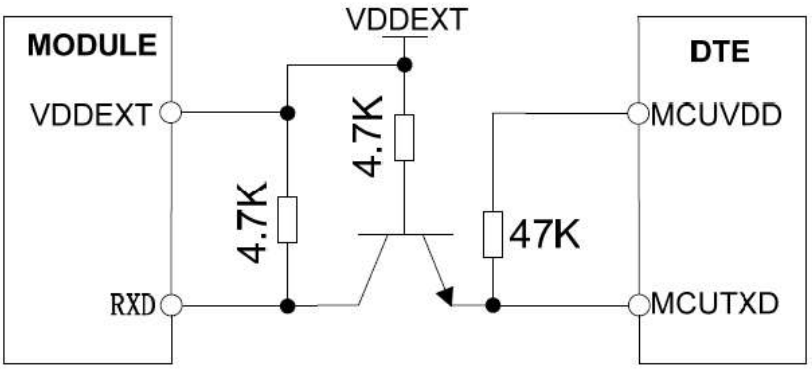

Figure 22: RX level matching circuit

Note: When Fig 21 and Fig 22are used for electrical level isolation, if customers use serial port to upgrade SW, please note VDDEXT has no voltage output during the upgrading process, LDO output could be used as VDDEXT in the figure.

4.5.2. Software Upgrade and Debug

Customer could upgrade module's firmware through UART interface.

Customer upgrades the software through UART port, it is strongly recommended to lead the UART1_TXD, UART1_RXD, GND and PWRKEY pin to IO connector for the upgrading, and PWRKEY pin should connect to GND while upgrading. Refer to the following figure for debugging and upgrading software.

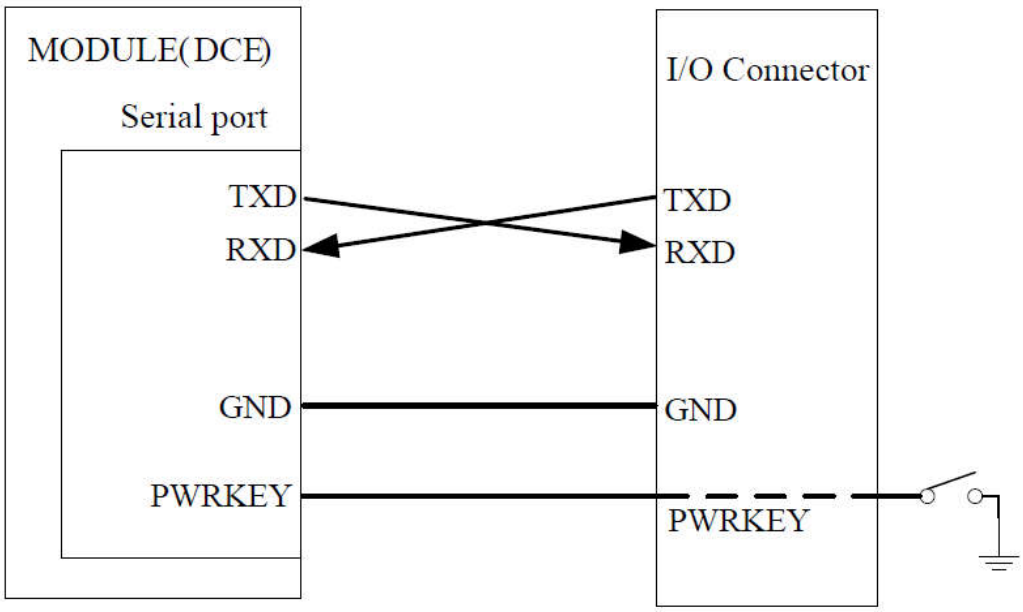

Figure 23: Connection for software upgrading and debugging

The serial port and the debug port support the CMOS level. If user connects the module to the computer, the level shifter should be added between the DCE and DTE.

4.5.3. RI Behaviors

Table 7: RI behaviors

State	RI response
Standby	High
Voice call	The pin is changed to low. When any of the following events occur, the pin will be changed to high: （1）Establish the call （2）Hang up the call
Data call	The pin is changed to low. When any of the following events occur, the pin will be changed to high: （1）Establish the call （2）Hang up the call
SMS	The pin is changed to low, and kept low for 120ms when a SMS is received. Then it is changed to high.
URC	The pin is changed to low, and kept low for 120ms when some URCs are reported. Then it is changed to high.

The behavior of the RI pin is shown in the following figure when the module is used as a receiver.

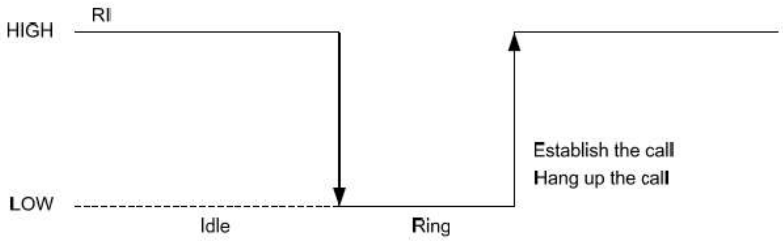

Figure 24: RI behaviour of voice calling as a receiver

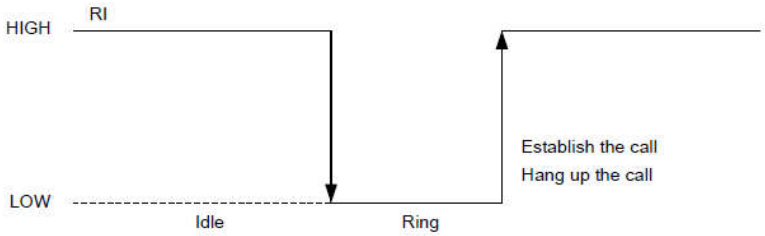

Figure 25: RI behaviour of data calling as a receiver L206

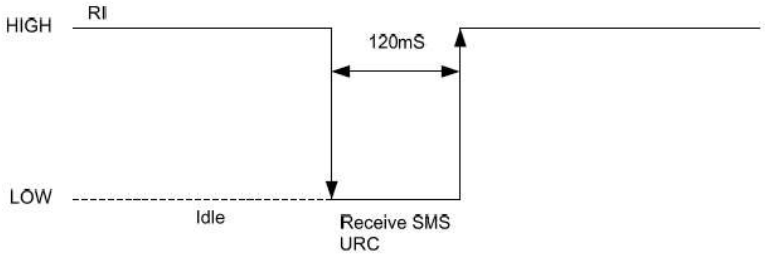

Figure 26: RI behaviour of URC or receive SMS

However, if the module is used as caller, the RI will remain high. Please refer to the following figure.

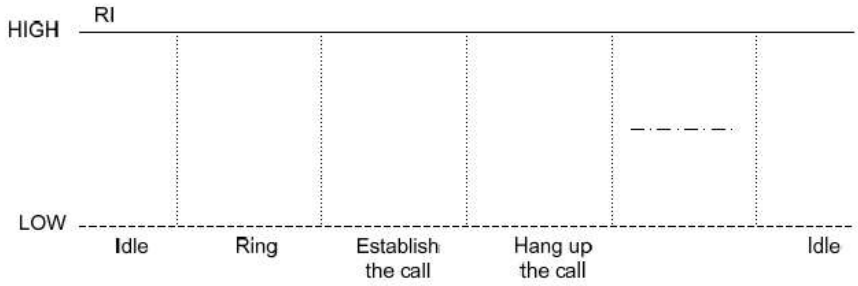

Figure 27: RI behaviour as a caller

4.6. SIM Card Interface

The SIM interface complies with the GSM Phase 1 specification and the new GSM Phase 2+ specification for FAST 64 kbps SIM card. Both 1.8V and 3.0V SIM card are supported. The SIM interface is powered from an internal regulator in the module.

4.6.1. SIM Card Application

Table 8: SIM pin definition

Pin name	Pin number	Function
VSIM	9	Voltage supply for SIM card. Support 1.8V or 3V SIM card
SIM_DATA	7	SIM data input/output
SIM_CLK	6	SIM clock
SIM_RST	5	SIM reset
SIM_PRE	8	SIM card detection

It is recommended to use an ESD protection component such as ST (www.st.com) ESDA6V1W5 or ON SEMI (www.onsemi.com) SMF05C. The SIM peripheral circuit should be close to the SIM card socket. The reference circuit of the 8-pin SIM card holder is illustrated in the following figure.

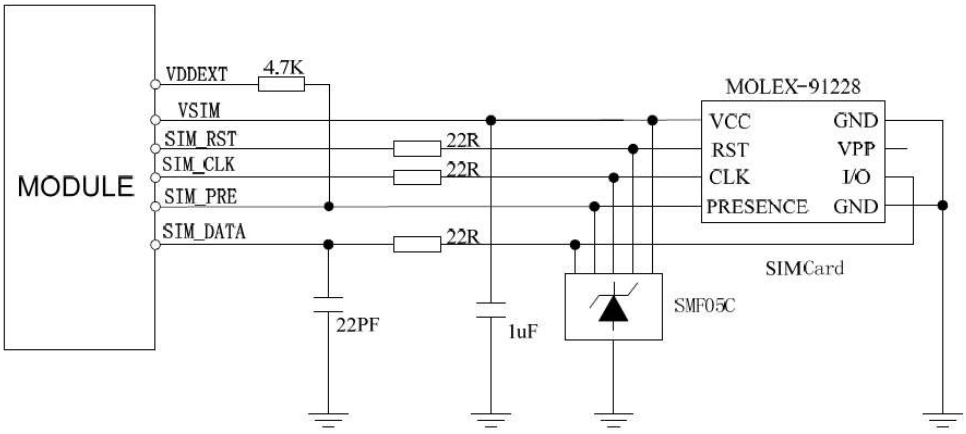

Figure 28: Reference circuit of the 8-pin SIM card holder

The SIM_PRESENCE pin is used for detection of the SIM card hot plug in. User can select the 8-pin SIM card holder to implement SIM card detection function.

If the SIM card detection function is not used, user can keep the SIM_PRESENCE pin open. The reference circuit of 6-pin SIM card holder is illustrated in the following figure.

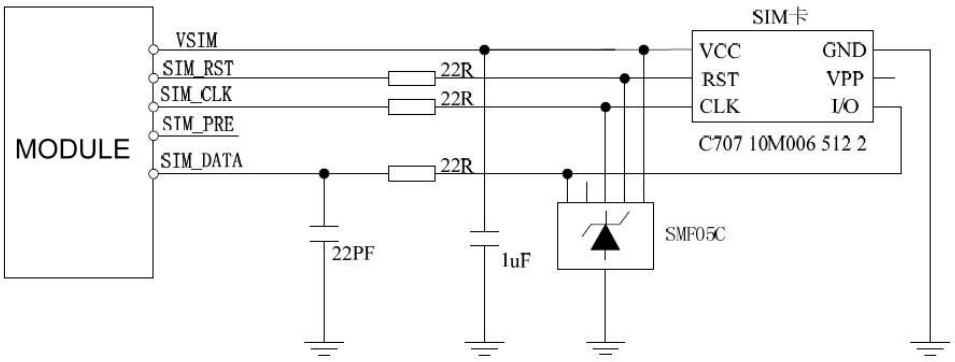

Figure 29: Reference circuit of the 6-pin SIM card holder

5. Package Dimensions

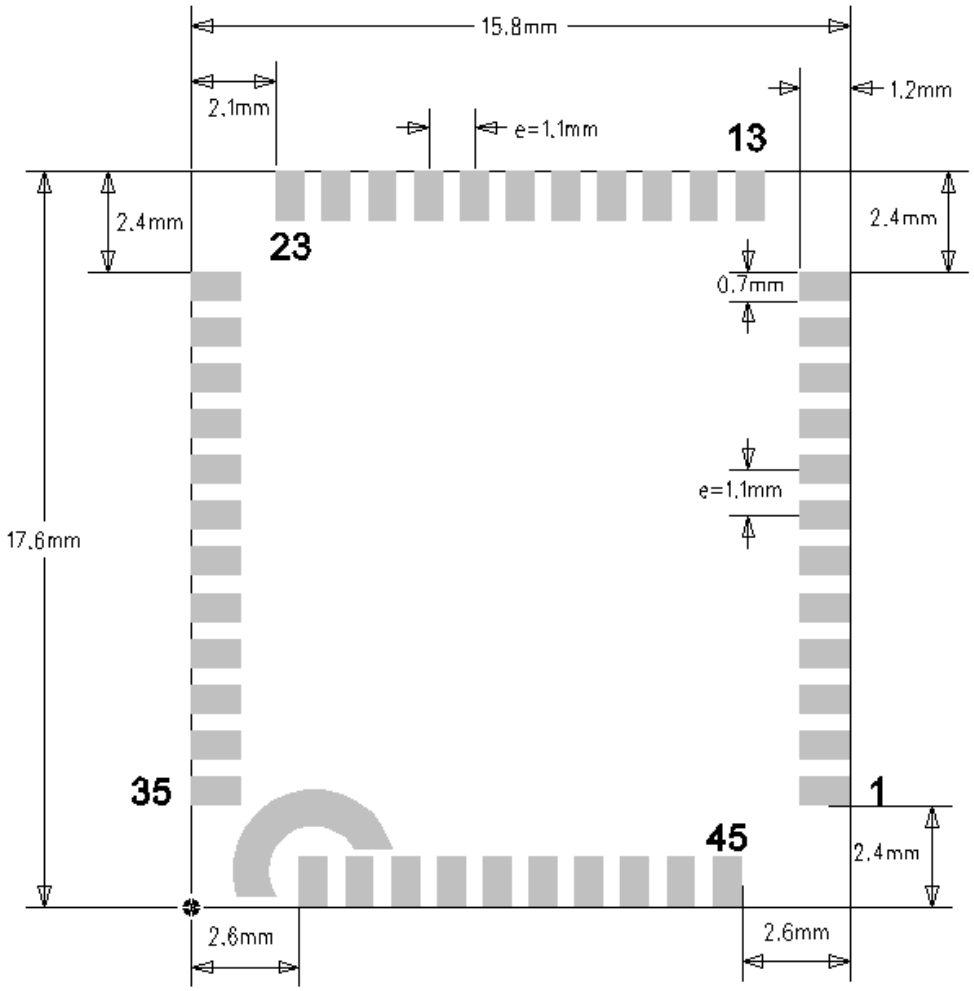

Figure 30: Dimensions of L206 (Unit: mm)

6. Electrical, Reliability and Radio Characteristics

6.1. Absolute Maximum Ratings

The absolute maximum ratings stated in following table are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to L206.

Table 9: Absolute maximum ratings

Symbol	Min	Typ	Max	Unit
VBAT	3.4	3.8	4.2	V
Current	0	-	2.0	A
I_I*	-	-	8	mA
I_O*	-	-	8	mA

*These parameters are for digital interface pins, such as GPIO, I2C, UART and PCM.

6.2. Recommended Operating Conditions

Table 10: Recommended operating conditions

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	3.4	3.8	4.2	V
T_{OPER}	Operating temperature	-40	+25	+85	℃
T_{STG}	Storage temperature	-45		+90	℃

6.3. Digital Interface Characteristics

Table 11: Digital interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input current	2.1	-	3.1	V
V_{IL}	Low-level input current	-0.3	-	0.7	V
V_{OH}	High-level output voltage	2.4	-	-	V
V_{OL}	Low-level output voltage	-	-	0.4	V

**** These parameters are for digital interface pins, such as GPIO, I2C, UART and PCM.***

6.4. SIM Card Interface Characteristics

Table 12: SIM card interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-1	-	1	uA
I_{IL}	Low-level input current	-1	-	1	uA
V_{IH}	High-level input voltage	1.4	-	-	V
		2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.27	V
				0.4	V
V_{OH}	High-level output voltage	1.62	-	-	V
		2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.36	V
		-	-	0.4	V

6.5. SIM_VDD Characteristics

Table 13: SIM_VDD characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	-	3	-	V
		-	1.80	-	
I_O	Output voltage	-	-	10	mA

6.6. VDD_EXT Characteristics

Table 14: VDD_EXT characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	2.70	2.80	2.90	V
I_O	Output current	-	-	50	mA

6.7. VRTC Characteristics

Table 15: VRTC characteristics

Symbol	Description	Min	Typ	Max	Unit
V_{RTC-IN}	VRTC input voltage		2.8		V
I_{RTC-IN}	VRTC input current	-	3	-	uA
$V_{RTC-OUT}$	VRTC output voltage	-	2.8	-	V
$I_{RTC-OUT}$	VRTC output current	-		2	mA

6.8. Current Consumption (VBAT=3.8V)

Table 16: Current consumption

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VBAT	Voltage		3.4	3.8	4.2	V
	Power drop	PCL=5			350	mV
	Voltage ripple	PCL=5 @ f<200kHz @ f>200kHz			 50 2	 mV mV
I_{VBAT}	Average curnet	Power down mode		50	60	uA
		Sleep mode (at+cfun=1): (BS-PA-MFRMS=9) (BS-PA-MFRMS=5) (BS-PA-MFRMS=2)		 1.8 2 2.1		 mA mA mA
		Idle mode (at+cfun=1): GSM850 EGSM900 DCS1800 PCS1900		 10.6 10.6 10.6 10.6		 mA
		Voice call (PCL=5): GSM850 EGSM900 DCS1800 PCS1900		 278.3 260.5 190.5 150.4		 mA mA
		Data mode GPRS (1Rx,4Tx): GSM850 EGSM900 DCS1800 PCS1900		 565.1 556.4 383.5 285.2		 mA mA
		Data mode GPRS (3Rx,2Tx): GSM850 EGSM900 DCS1800 PCS1900		 411.5 413.3 283.4 296.3		 mA mA
		Data mode GPRS (4Rx,1Tx): GSM850 EGSM900 DCS1800 PCS1900		 290.8 274.5 181 168.6		 mA mA
I_{MAX}	Peak current	During Tx burst		2.0		A

**** In above table the current consumption value is the typical one of the module tested in laboratory. In the mass production stage, there may be differences among each individual.***

6.9. Current Consumption (VBAT=3.8V)

L206 is an ESD sensitive component, so attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

Table 17: The ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Pin name	Contact discharge	Air discharge
VBAT	±6KV	±12KV
GND	±6KV	±12KV
RXD, TXD	±2KV	±8KV
Antenna port	±5KV	±10KV
SPK_P/SPK_N/MIC_P/MIC_N	±2KV	±5KV
PWRKEY	±2KV	±8KV

6.10. Radio Characteristics

6.10.1. Module RF Output Power

The following table shows the module conducted output power, it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 18:GSM850 RF output power

GSM850,GMSK: 32.4±1 dBm

GSM Voice (1 uplink) ,GMSK: 32±1 dBm

GPRS Multi-Slot Class 8(1 uplink) ,GMSK: 32±1 dBm

GPRS Multi-Slot Class 10(2 uplink), GMSK: 31±1 dBm

GPRS Multi-Slot Class 12(4 uplink), GMSK: 28±1 dBm

Table 19:GSM1900 RF output power

GSM1900,GMSK: 29.2±1 dBm

GSM Voice (1 uplink) ,GMSK: 29±1 dBm

GPRS Multi-Slot Class 8(1 uplink) ,GMSK: 29±1 dBm

GPRS Multi-Slot Class 10(2 uplink), GMSK: 28±1 dBm

GPRS Multi-Slot Class 12(4 uplink), GMSK: 25±1 dBm

6.10.2. Module RF Receive Sensitivity

The following table shows the module's conducted receiving sensitivity, it is tested under static condition.

Table 20: Conducted RF receive sensitivity

Frequency	Receive sensitivity（Typical）	Receive sensitivity(Max)
GSM850,EGSM900	< -108dBm	< -106dBm
DCS1800,PCS1900	< -108dBm	< -106dBm

6.10.3. Module Operating Frequencies

The following table shows the module's operating frequency range; it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 21: Operating frequencies

Frequency	Receive	Transmit
GSM850	869 ～ 894MHz	824 ～ 849MHz
EGSM900	925 ～ 960MHz	880 ～ 915MHz
DCS1800	1805 ～ 1880MHz	1710 ～ 1785MHz
PCS1900	1930 ～ 1990MHz	1850 ～ 1910MHz

7. Manufacturing

7.1. Top and Bottom View of L206

Figure 31: Top and bottom view of L206

7.2. Typical Solder Reflow Profile

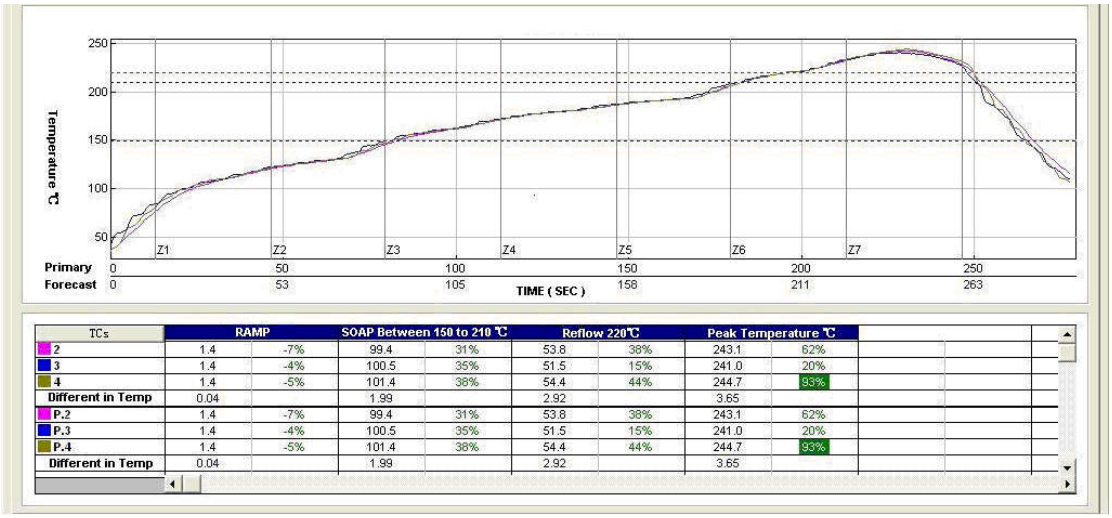

Figure 32: Typical solder reflow profile

7.3. The Moisture Sensitivity Level

The moisture sensitivity level of L206 module is 3. The modules should be mounted within 168 hours after unpacking in the environmental conditions of temperature <30℃ and relative humidity of <60% (RH). It is necessary to bake the module if the above conditions are not met:

Table 22: Moisture sensitivity level and floor life

Moisture Sensitivity Level (MSL)	Floor Life (out of bag) at factory ambient≤30° C/60% RH or as stated
1	Unlimited at ≦30℃/85% RH
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.

NOTES: For product handling, storage, processing, IPC / JEDEC J-STD-033 must be followed.

7.4. Baking Requirements

L206 modules are vacuum packaged, and guaranteed for 6 months storage without opening or leakage under the following conditions: the environment temperature is lower than 40℃, and the air humidity is less than 90%. If the condition meets one of the following ones shown below, the modules should be baked sufficiently before re-flow soldering, and the baking condition is shown in below table; otherwise the module will be at the risk of permanent damage during re-flow soldering.

If the vacuum package is broken or leakage;

If the vacuum package is opened after 6 months since it's been packed;

If the vacuum package is opened within 6 months but out of its Floor Life at factory ambient≦30℃ /60%RH or as stated.

Table 23: Baking requirements

Baking temperature	Moisture	Time
40℃±5℃	<5%	192 hours
120℃±5℃	<5%	6 hours

NOTES: Care should be taken if that plastic tray is not heat-resistant, the modules should be taken out for preheating, otherwise the tray may be damaged by high-temperature heating.