SM5100B-D GSM/GPRS Module

Hardware Specification

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1 Introduction

1.1 Objective

The SM5100B-D is a Dual-Band EGSM900/DCS1800[*1] GSM/GPRS module. The leading features of SM5100B-D make it ideal for virtually unlimited applications, such as Fixed Wireless Phone, Fixed Wireless Terminal and M2M applications, handsets, GSM/GPRS data card, vehicle On-Board Equipment, etc.

[*1] Dual-Band EGSM900/DCS1800 is the default band of SM5100B-D, we can provide the Dual-Band GSM850/PCS1900 or Quad-Band GSM850/ EGSM900/DCS1800/PCS1900 for customization.

This document describes the hardware specifications of the SM5100B-D module including hardware structure, application interfaces, main function index and performance index. So this guide helps you design various cellular applications incorporating the SM5100B-D module.

1.2 Overview

The document describes the hardware interfaces in detail , which is divided into the following chapters:

- Chapter 1—describes the objective, related documents, version history, etc.
- Chapter 2—describes the basic functions and features of the SM5100B-D module
- Chapter 3—describes the functions, features and application of all the hardware interfaces of SM5100B-D in detail
- Chapter 4—describes the mechanical features and notices of SM5100B-D in detail

1.3 Related documents

- SM5100B-D Datasheet
- SM5100B-D AT Command
- SM5100B-D-EVB User's Guide

1.4 Correlative standards

Table 1：Correlative standards

No.	Standard	Remark
[1]	ITU-T Draft new recommendation V.25ter:	Serial asynchronous automatic dialing and control
[2]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[3]	GSM 07.10:	Support GSM 07.10 multiplexing protocol
[4]	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)
[5]	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
[6]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[8]	GSM 11.10	Digital cellular telecommunications system (Phase 2)；Mobile Station (MS) conformance specification；Part 1: Conformance specification

1.5 Version History

Table 2：Version History

Date	Version	History of the evolution	Author
2008-12-15	V1.0	The first version published	Peng.sun

1.6 Terms and abbreviations

Table 3: Terms and abbreviations

Abbr.	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
BER	Bit Error Rate
BTS	Base Transceiver Station
CHAP	Challenge Handshake Authentication Protocol
CS	Coding Scheme
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
Inorm	Normal Current
Imax	Maximum Load Current
kbps	Kilo bits per second
LED	Light Emitting Diode
Li-Ion	Lithium-Ion
MO	Mobile Originated

Abbr.	Description
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
RTS	Request to send
Rx	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
VIHmax	Maximum Input High Level Voltage Value
VIHmin	Minimum Input High Level Voltage Value
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value
VImax	Absolute Maximum Input Voltage Value
VImin	Absolute Minimum Input Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value

2 Product concept

SM5100B-D is a Dual-Band EGSM900/DCS1800[*2] GSM/GPRS module which supports GPRS multi-slot class10. Based on an advanced design scheme, SM5100B-D integrates the RF and Baseband onto one small PCB. It can fulfill all the functions of RF signal receiving and transmitting, Baseband signal processing and audio signal processing so that the customers can develop all kinds of their own wireless terminal products with very few extra components.

[*2] Dual-Band EGSM900/DCS1800 is the default band of SM5100B-D, we can provide the Dual-Band GSM850/PCS1900 or Quad-Band GSM850/ EGSM900/DCS1800/PCS1900 for customization.

Designed on a single sided PCB, SM5100B-D has a tiny dimension of 39.0mm X 35.0mm X 2.9mm, with a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards. The main hardware interfaces of SM5100B-D consist of power supply interfaces, serial interfaces, audio interfaces, SPI serial LCD interface, 4X6 matrix keypad interface, standard SIM interface, RF antenna interface, etc. It is integrated with the TCP/IP protocol and supports an extended AT commands which are very suited for developing all kinds of the customized applications.

2.1 Key features at a glance

Table 4: SM5100B-D key features at a glance

No.	Feature	Implementation
1	Power supply	DC supply voltage: 3.3V-4.2V Typical value: 4.0V
2	Frequency bands	EGSM900/DCS1800 (default) GSM850/PCS1900 (customized) GSM850/EGSM900/DCS1800/PCS1900(customized)
3	GPRS	✧ GPRS mobile station: class B ✧ GPRS multi-slot Class: class 10
4	Network protocols	PPP, TCP/IP, USSD
5	Voice	✧ FR/EFR ✧ Echo suppression
6	SMS	✧ MO/MT/CB, support TEXT/PDU mode ✧ SMS Over GPRS
7	Current consumption	✧ Off mode: <100uA ✧ Sleep mode: 2mA(Min)

		✧ Talk mode（EGSM900,PCL=5:270mA ✧ Data mode（EGSM900,PCL=5,Class10）: 400mA ✧ Peak: 2.0A
8	Temperature	✧ Normal operation: -20°C to +55°C ✧ Restricted operation: -30°C to +80°C ✧ Storage temperature: -40°C to +85°C
9	Serial interfaces	✧ UART0:support full function UART，used for AT commands by default ✧ Uart1:three-wire interface，reserved for debug
10	Audio interfaces	✧ Two analog audio input: MIC1P,MIC1N,MIC2P,MIC2N ✧ Two analog audio output: SPK1P,SPK1N,SPK2P,SPK2N
11	Real time clock & RTC Backup	Support
12	Keypad	4x6 keyboard interface
13	LCD	SPI serial interface
14	SIM card	1.8V、3V
15	Structure	✧ Dimensions：39X35X2.9 mm ✧ weight： 9g ✧ Module side of 60 pins board-to-board connector[*3] ✧ Fixed structure：Fixed by four pins on the grounding of shielding case
16	Antenna interface	Antenna Pad
17	Software upgrade	Upgrade via serial port
18	AT commands	GSM 07.07, 07.05 and Sendtrue extended AT commands
19	Approvals	✧ GCF ✧ PTCRB ✧ Local Type Approval

[*3] For different hardware version, the 60 pins board-to-board connector maybe will different. Please read the hardware version release notes.

2.2 Functional block diagram

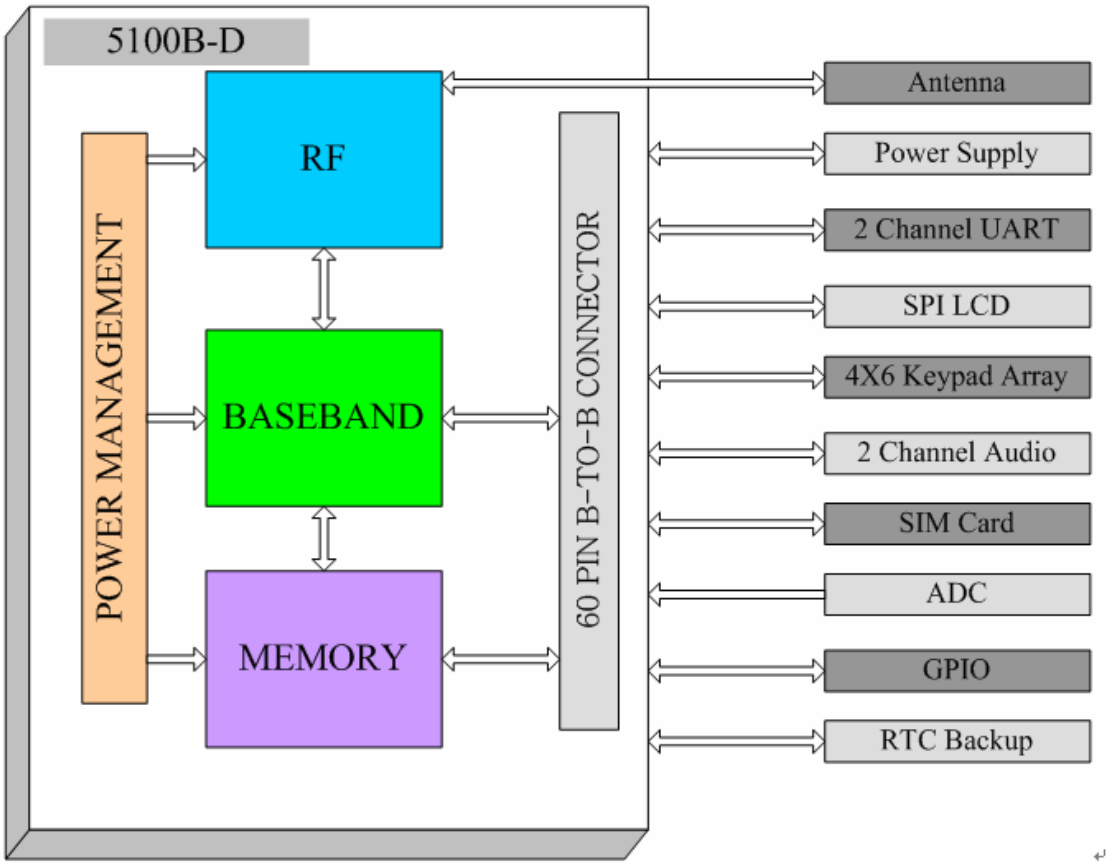

Figure 1: SM5100B-D functional block diagram

3 Application interfaces and functional components

The SM5100B-D physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface. In this chapter, all the application interfaces will be described in detail.

3.1 Pin description of the 60-pin connector

Table 5：Pin description of the 60-pin connector

（see chapter 4.4 Table 21 for PIN assignment of the 60-pin connector）

PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS
Power Supply			
VBAT	I	4 pins of the board-to-board connector are dedicated to connect the power supply. The power supply of SM5100B-D has to be a voltage source of VBAT from 3.3V to 4.2V. It must be able to provide sufficient current in a transmit burst which may rise up to 2A in maximum.	Vmax= 4.2V Vmin=3.3V Vnorm=4.0V
VRTC	I/O	VRTC charges the backup battery when VBAT is supplied for the system; VRTC supplies the system via the backup battery when VBAT is not supplied for the system, which will avoid the system data loss.	Vmax=3.3V Vmin=2.7V Vnorm=3.0V Inorm= 15uA
VOUT	O	2.8V output, provide the external module circuit to use, you can judge the status of the module is power-on or power-off by measuring the voltage of this pin.	Vmax=3.0V Vmin=2.5V Vnorm=2.8V Imax=50mA
GND		Digital ground	
Power on/off control			
PWR_ON	I	High level voltage input for user to Power-on or Power-off the system. Users can configure it	VILmax=0.8V VIHmin=2.2V VImax=VBAT

		by software. The Auto Power-on mode is default.	
UART			
RXD0	I	Receive Data	VILmin=0V VILmax=0.8V VIHmin=2.2V VIHmax=3.2V VOLmin=0V VOLmax=0.8V VOHmin=2.2V VOHmax=3.2V
TXD0	O	Transmit Data	
RTS0/GPIO17	O	Request to Send	
CTS0/GPIO19/ADC4	I	Clear to Send	
DSR0/GPIO18	I	Data equipment is ready, it is used to wake up the module, low voltage level is valid.	
RI0/GPIO46	O	Ring indicator	
DCD0/GPIO32	O	Carrier Detect	
RXD1	I	Receive Data	
TXD1	O	Transmit Data	
Audio interfaces			
MIC1P MIC1N	I	Main audio channel input	
MIC2P MIC2N	I	Auxiliary audio channel input	
SPK1P SPK1N	O	Main audio channel output	
SPK2P SPK2N	O	Auxiliary audio channel output	
LCD			
LCD_DATA/NBOOT/GPIO42	I/O	LCD data input/output	VILmin=0V VILmax=0.8V VIHmin=2.2V VIHmax=3.2V VOLmin=0V VOLmax=0.8V VOHmin=2.2V VOHmax=3.2V
LCD_CLK/GPIO6	O	LCD clock	
LCD_CS/GPIO8	O	LCD chip-select	
LCD_RS/GPIO9	O	LCD data/control select	
LCD_RST/GPIO1	O	LCD reset	
Keypad			
KEY_SENSE0~ KEY_SENSE3	I	Keypad line input signal, weakly pull-up internal	VILmin=0V VILmax=0.8V VIHmin=2.2V VIHmax=3.2V
KEY_DRIVER0~ KEY_DRIVER5	O	Keypad column output signal	VOLmin=0V VOLmax=0.8V

			VOHmin=2.2V VOHmax=3.2V
SIM interface			
SIM_VCC	O	Voltage Supply for SIM card	1.8V or 3.0V supported
SIM_DATA	I/O	SIM card data input/output	VILmin=0V VILmax=0.8V VIHmin=2.2V VIHmax=3.2V VOLmin=0V VOLmax=0.8V VOHmin=2.2V VOHmax=3.2V
SIM_CLK	O	SIM card clock	
SIM_RST	O	SIM reset	
SIM_DET/GPIO4	I	SIM presence detect, low voltage level is SIM inserted.	
ADC			
ADC1	I	ADC	VImin=0.3V VImax=5.0V
ADC2	I	ADC	VImin=0.3V VImax=1.0V
NETLIGHT			
NETLIGHT/GPIO26	O	NETLIGHT, the network status of the module.	VOLmin=0V VOLmax=0.8V VOHmin=2.2V VOHmax=3.2V
GPIO			
GPIO10	I/O	General input and output port	VILmin=0V VILmax=0.8V VIHmin=2.2V VIHmax=3.2V VOLmin=0V VOLmax=0.8V VOHmin=2.2V VOHmax=3.2V
GPIO11	I/O		
GPIO16	I/O		
GPIO20/PWMB	I/O		

3.2 Power supply interface

3.2.1 VBAT

The power supply of SM5100B-D should be a single voltage source with VBAT ranged from 3.3V to 4.2V. As a mobile terminal conformed to the GSM criterions, in some case, the ripple in a transmit burst may cause a maximum voltage drop of 450mv while the current consumption will rise to the typical peak of 2A. So the power supply must be able to provide sufficient current. For the VBAT input, a local bypass capacitor (about 100μF, low ESR) is recommended. Multi-layer ceramic chip (MLCC) capacitors can provide a good combination of low ESR and small size but may not be cost effective. A lower cost and better effect choice is using a 100 μF tantalum capacitor (low ESR) with a small (0.1 μF) ceramic in parallel, which is illustrated in the following figure.

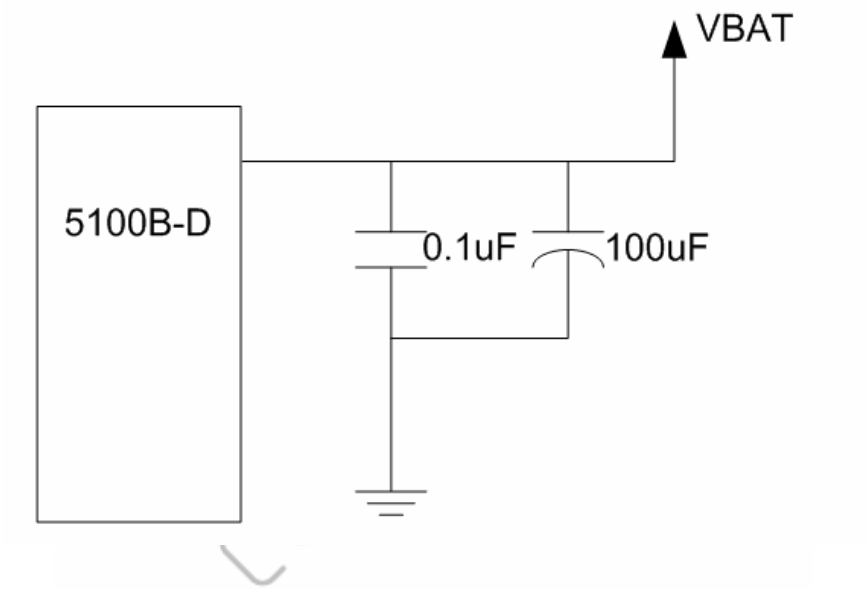

Figure 2：VBAT connection reference

Notice: A higher capacity VBAT capacitor is recommended for data transmit applications.

3.2.2 VOUT

SM5100B-D provides a 2.8V power supply output for the customer's peripheral circuit，such as LCD module.

Table 6：VOUT parameters

Parameter	Minimum	Typical	Maximum	Unit
Output voltage	2.5	2.8	3.0	V
Output current			50	mA

3.2.3 VRTC

The 60-pin board to board connector is dedicated for VRTC interface to connect the external backup battery. VRTC provides power supply for the SM5100B-D internal RTC unit when VBAT is not supplied for the system. SM5100B-D will charge the external backup battery via VRTC pin48 if an external backup battery is connected. If the customer doesn't need this function, pin48 should be left unconnected.

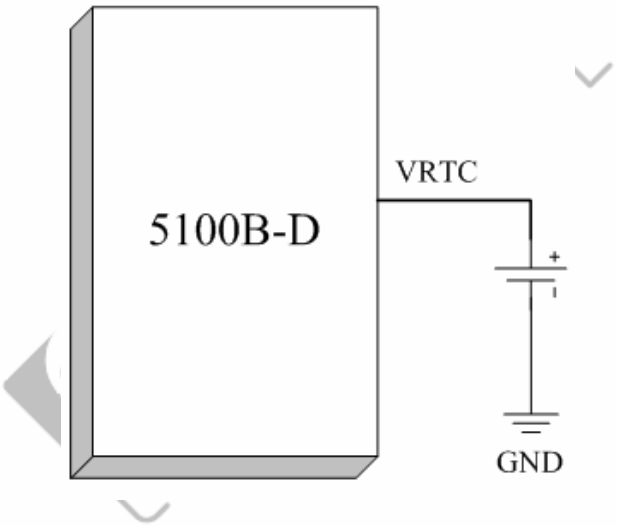

Figure 3：VRTC connection reference

The parameters of the recommended external backup battery shows below：
Rechargeable battery, 3.0V，2.5mAH.

Table 7：VRTC parameters

Parameter	Minimum	Typical	Maximum	Unit
Voltage	2.7	3.0	3.3	V
Current	15	15	25	uA

3.3 Power on/off control

SM5100B-D can be activated in two modes: Auto Power-on Mode, Power Key Mode. The user can judge whether SM5100B-D is activated by examining the VOUT output voltage level. The Auto Power-on Mode and Power Key Mode are set by firmware, the Auto Power-on Mode is default.
There are three ways to Power-off the module: Power Key Mode, AT command shutdown and Low-voltage auto shutdown. Similarly, the user can judge whether SM5100B-D is powered off by examining the VOUT output voltage level.

3.3.1 Auto Power-on Mode

If SM5100B-D is set to Auto Power-on Mode by firmware, it will be turned on automatically when power supply is turned on, see the following figure:

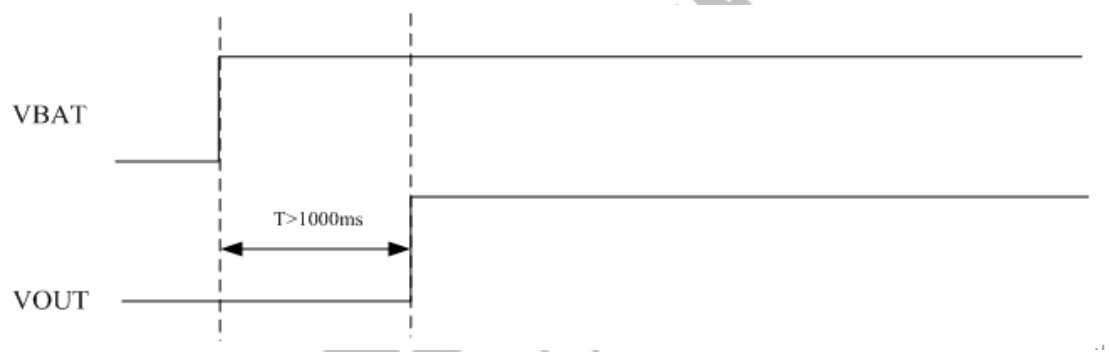

Figure 4：Timing of Power Auto Mode

3.3.2 Power Key Mode

If SM5100B-D is set to Power Key Mode by firmware, it will be turned on when POWER_ON key is pressed down for several seconds，see the following figure:

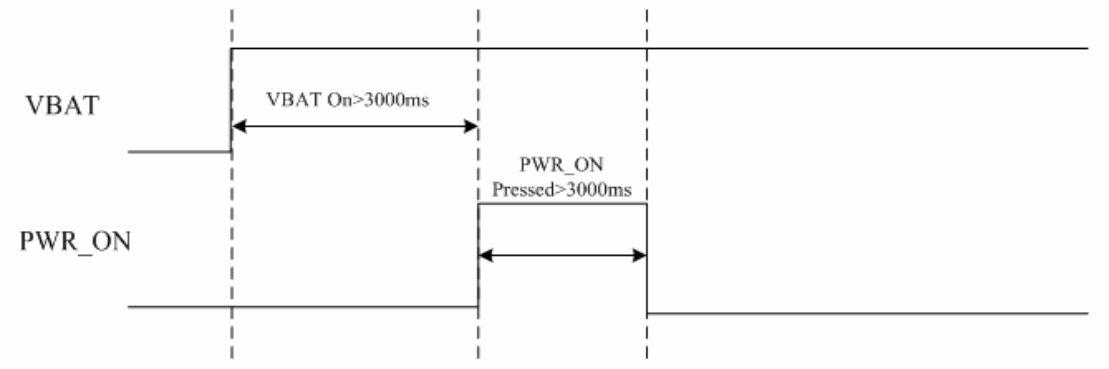

Figure 5：Timing of Power Key Mode

3.3.3 Power Key Mode shutdown

If SM5100B-D is set to Power Key Mode shutdown by firmware, it will be powered off when POWER_ON key is pressed down for several seconds，see the following figure:

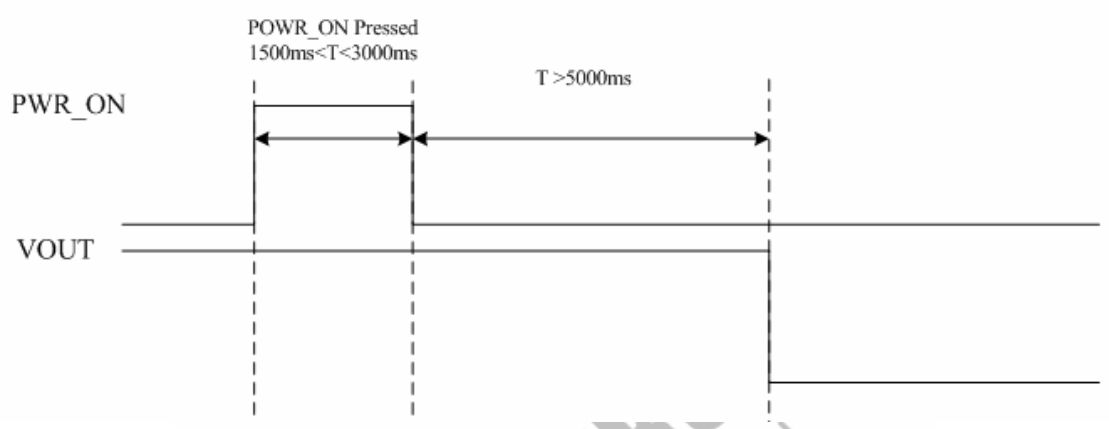

Figure 6：Timing of Power Key Mode shutdown

3.3.4 AT command shutdown

The user can set SM5100B-D to AT command shutdown mode by AT command, please read the document《AT Command_SM5100B-D》for details.

3.3.5 Low-voltage auto shutdown

When the voltage level of VBAT is lower than the threshold level 3.4V preset by firmware, SM5100B-D will auto power-off.

3.4 Boot-up control

The pin33 (LCD_DATA/NBOOT/GPIO42) of the SM5100B-D can be used as NBOOT pin to configure boot-up mode. When a reset signal from hardware occurs：

- ✧ If LCD_DATA/NBOOT/GPIO42 is low voltage level, SM5100B-D will enter "download mode";
- ✧ If LCD_DATA/NBOOT/GPIO42 is high voltage level, SM5100B-D will enter "normal working mode".

After SM5100B-D boot up normally, the pin LCD_DATA/NBOOT/GPIO42 can be configured for other use by firmware.

3.5 Sleep mode

The sleep low consumed power mode is supported (shoud be set in NV in advance). You can enter into or exit sleep mode by controlling the status of pin38 DSR0.

- ✧ If the DSR0 is high voltage level, SM5100B-D enter into sleep mode
- ✧ If the DSR0 is low voltage level, SM5100B-D exit the sleep mode. SM5100B-D can also be waked up by hardware interrupt, phone call,SMS or data through Uart port etc.

NOTICE: you can use the AT+S32K command to start the sleep mode or not. Please see the document 《AT Command_SM5100B-D》 for details.

3.6 UART interface

SM5100B-D provides two UART interface: UART0 and UART1. The UART0 supports full function UART. See the following circuit:

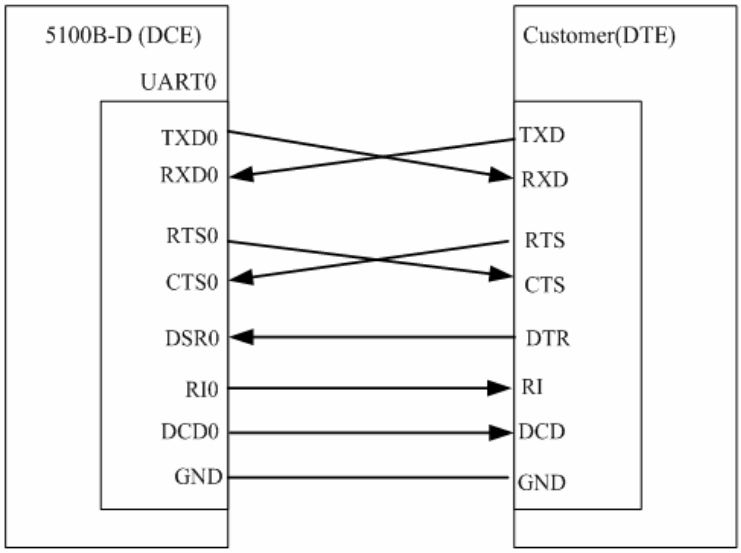

Figure 7: UART0 interface

UART0 supports baud rate up to 460800 bps. It is generally used as AT command or download.

By default, UART0 support 3-wire standard, CTS0, RTS0, DCD0, RI0 is invalid. If require, you can use the AT commands to set. Please see the document 《AT Command_SM5100B-D》 for details.

UART1 can be configured as a standard 3-wire serial port, which is illustrated in the following figure:

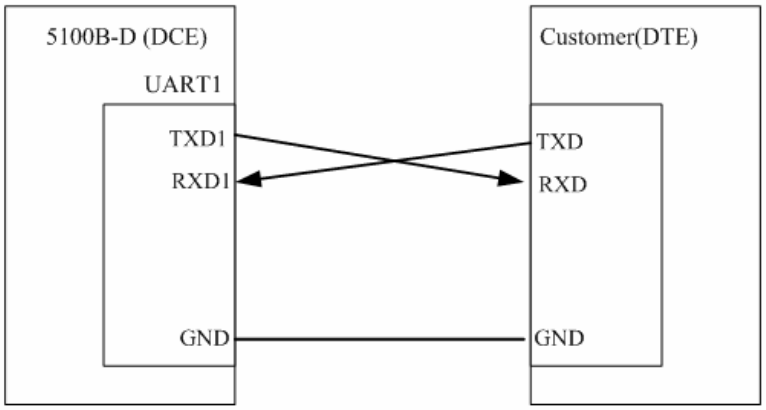

Figure 8: UART1 interface

UART1 supports baud rate up to 460800 bps. It is used to debug generally. RI0 pin is used to tell you incoming call, SMS etc. See table 8 as follows:

Table 8: RI0 status

Pin NO.	I/O	status	Module status
57	RI0/GPIO46	High voltage level	Idle
		Low voltage level	Incoming call
		Low voltage level for 200ms, later high voltage level	Receive SMS

3.7 NETLIGHT interface

The pin49 is the NETLIGHT interface, used to indicate GSM network status, see the table 9 as follows:

Table 9: NETLIGHT status

Pin NO.	I/O	status	Module status
49	NETLIGHT/ GPIO26	Off	Power-off
		Always on	Power-on but not register the GSM network
		Glitter: 100ms on , 3000ms off	Power-on and register the GSM network

The reference circuit is as follows:

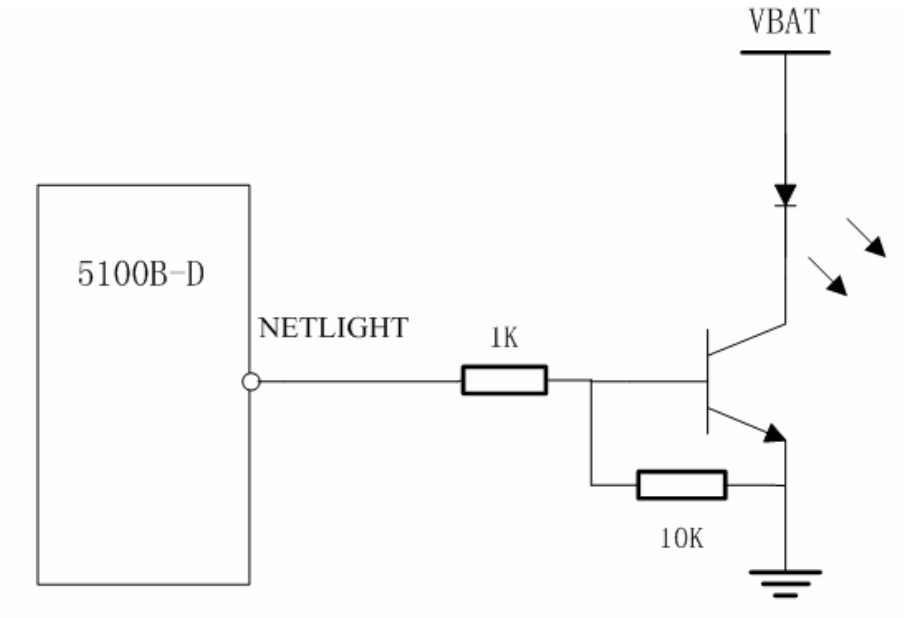

Figure 9: the reference circuit of NETLIGHT

3.8 Audio interface

SM5100B-D provides two analog audio input, two analog audio output, which are defined as main audio channel(MIC1P，MIC1N，SPK1P，SPK1N) and auxiliary audio channel(MIC2P，MIC2N，SPK2P，SPK2N). The user can switch between two channels and set each channel's input/output gain by AT command.

Table 10: Audio interface pin description

Pin No.	PIN Name	Description
14	MIC1P	Main audio channel positive input
12	MIC1N	Main audio channel negative input
42	MIC2P	Auxiliary audio channel positive input
50	MIC2N	Auxiliary audio channel negative input
18	SPK1P	Main audio channel positive output
16	SPK1N	Main audio channel negative output
44	SPK2P	Auxiliary audio channel positive output
58	SPK2N	Auxiliary audio channel negative output

3.8.1 Audio input circuit

The main audio channel input is connected in differential input mode to the microphone on the terminal PCB or phone handle. It will greatly suppress the common mode noise caused by the TDMA RF transmission.
The main audio channel differential input is showed in the following figure:

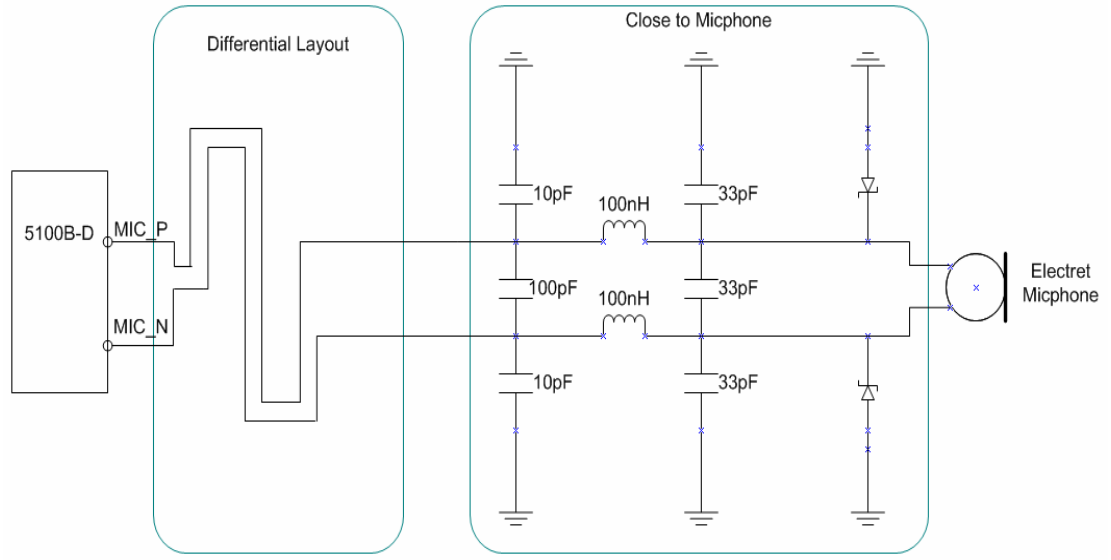

Figure 10: microphone differential input

The auxiliary audio channel input is same with main audio channel.The differential input mode is recommended.

The recommended microphone parameters list below:

- Electrets microphone
- Resistance：2.2K ohm
- Sensibility：-42dB(Typical)
- SNR>50dB
- Frequency response：conform to GSM criterions

3.8.2 Audio output circuit

Two audio outputs can be connected in either differential output or single-ended output. The differential output mode will greatly suppress the common mode noise caused by the TDMA RF transmission.
The differential output mode is showed in the following figure:

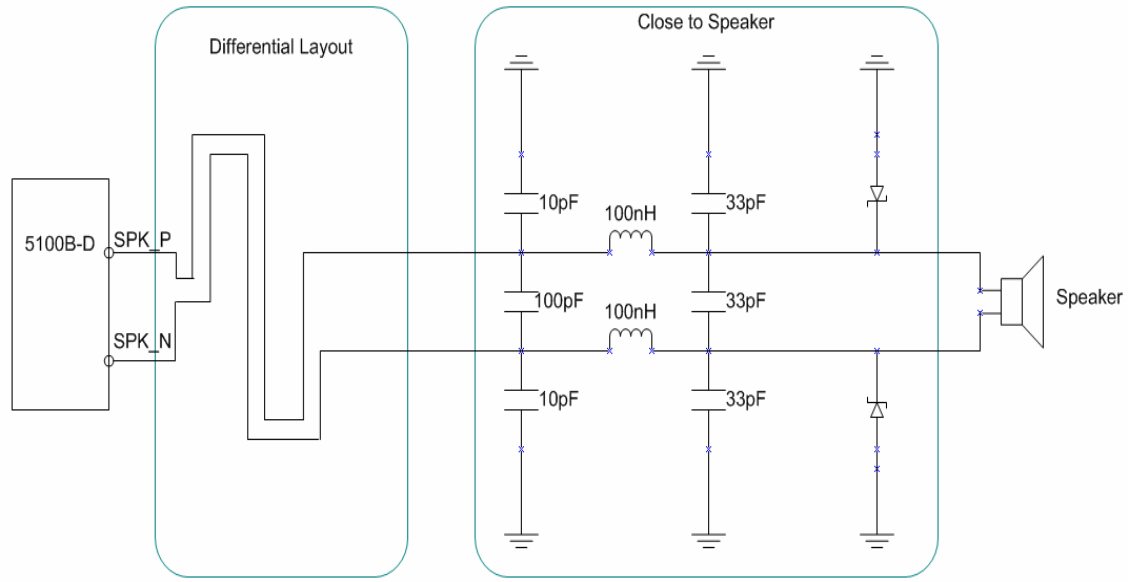

Figure 21: Speaker differential output

The recommended speaker parameters list below:

- Electromagnetic speaker
- Resistance:32ohm
- Sensibility: >110dB SPL（0dB=120uPa）
- SNR>50dB
- Frequency response：conform to GSM criterions
- Power： from 10mW to 100mW

The user also can add extra audio amplifier for better audio effect, such as National Semiconductor Corporation's LM4890.

3.8.3 Audio interface electronic characteristics

Table 11: Microphone DC input characteristics

Parameter	Min	Typical	Max	Unit
Common mode input voltage	0.6		1.8	V
Adjustable input gain	9		42	dB
Sample rate		8		kHz
ADC		13		Bit
SNR		62		dB

Table 12: Speaker DC output Characteristics

Parameter	Min	Typical	Max	Unit
Differential output voltage		±1.4		V
Single-ended output voltage		1.4		V
Common mode output voltage		1.1		V
Load resistance	16			Ohm
Adjustable output gain	-21		12	dB

3.9 LCD interface

SM5100B-D provides a serial SPI interface that supports serial communication with LCD. These are composite pins that can be configured as GPIO ports if the user doesn't need the LCD interface.

Table 13: LCD interface pins description

Pin No.	Pin Name	Description
33	LCD_DATA/NBOOT/GPIO42	LCD data I/O
38	LCD_CLK/GPIO6	LCD clock output
54	LCD_CS/GPIO8	LCD chip-select output
41	LCD_RS/GPIO9	LCD data/control select
39	LCD_RST/GPIO1	LCD reset

3.10 Keypad interface

SM5100B-D provides a 4X6 matrix keypad interface. If the user doesn't need keypad interface, the pins can be configured as GPIO ports by firmware.

Table 14: Keypad interface pins description

Pin No.	Pin Name	Description
24	KEY_ DRIVER0	Output: the 0 column
28	KEY_ DRIVER1	Output: the 1 column
26	KEY_ DRIVER2	Output: the 2 column
23	KEY_ DRIVER3	Output: the 3 column
25	KEY_ DRIVER4	Output: the 4 column
30	KEY_ DRIVER5	Output: the 5 column
36	KEY_SENSE0	Input: the 0 line
32	KEY_SENSE1	Input: the 1 line
31	KEY_SENSE2	Input: the 2 line
40	KEY_SENSE3	Input: the 3 line

3.11 SIM card interface

SM5100B-D supports both 1.8V and 3.0V SIM cards(5.0V not supported）. It confirms to the ISO 7816-3 standard of the GSM 11.11 Phase 2+ and the SIM toolkit release 99 standard.

Table 15: SIM interface pins description

Pin No.	Pin Name	Description
51	SIM_VCC	Voltage supply for SIM card
29	SIM_DATA	SIM card data I/O
27	SIM_CLK	SIM card clock
21	SIM_RST	SIM card reset
35	SIM_DET/GPIO4	SIM presence detect, low voltage level is SIM inserted.

The following figure is the reference circuit about SIM interface. We recommend connecting an Electro-Static discharge device (such as Semtech SMF05C) near SIM card to avoid ESD effect. The 100Ω resistors showed in the following figure should be added respectively in series on the SIM_RST, SIM_CLK, SIM_DATA line between the module and the SIM card for the impedance matching. A 10KΩ pull up resistor must be added on the SIM_DATA line connecting to SIM_VCC.

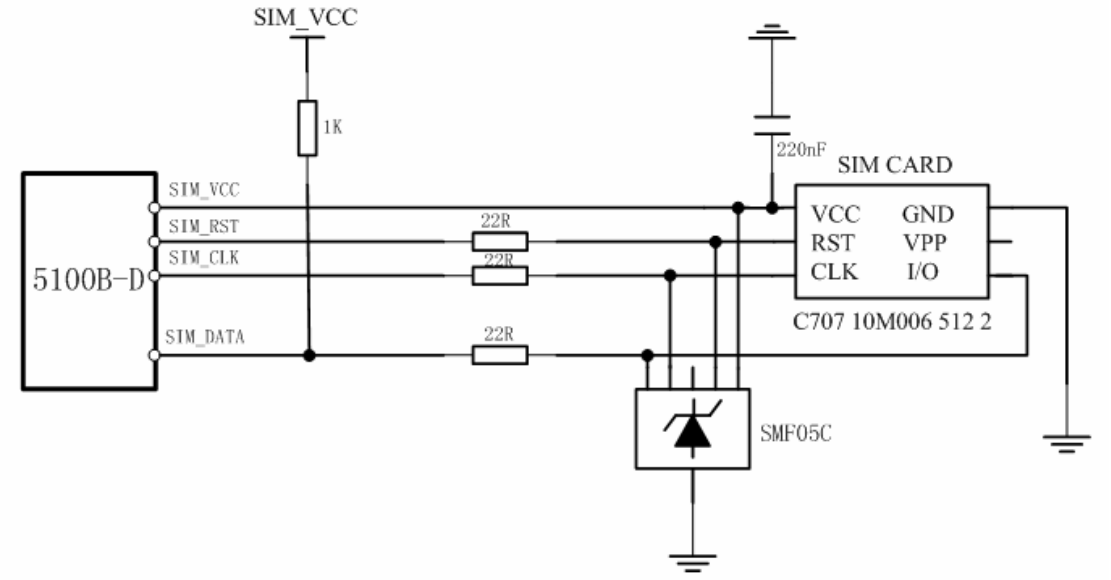

Figure 14: SIM peripheral circuit

SIM_DET/GPIO4 is used to detect whether the SIM card is inserted. The low voltage level is SIM card inserted, high voltage level is not. The pin is low voltage by default. If the user needs to use the function, you must add a resistor pulling up to 3V voltage and use the special SIM card socket with detecting function. See the figure as follows:

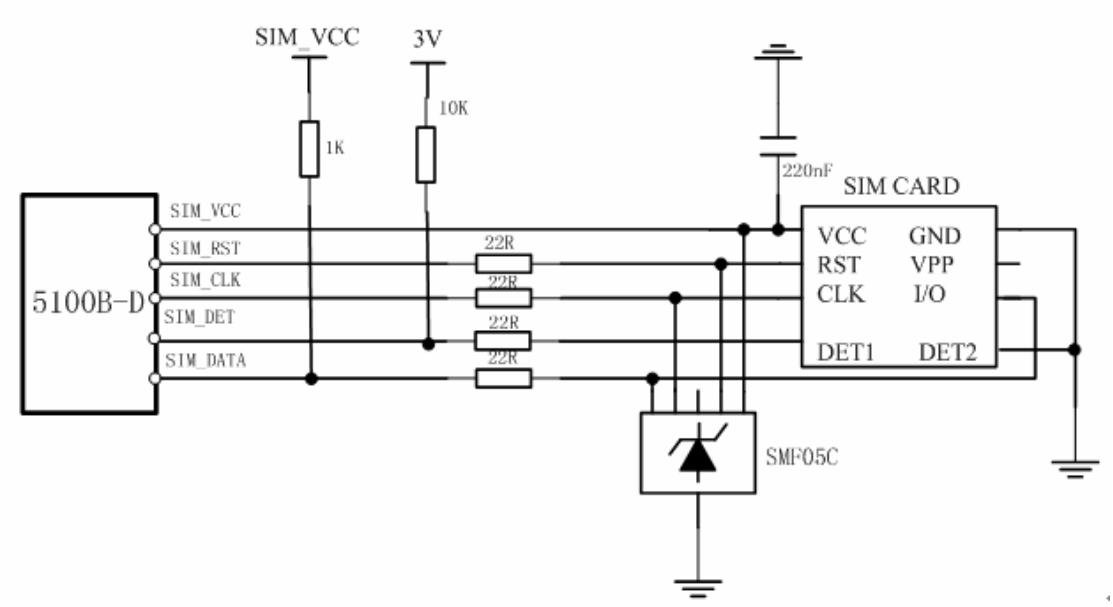

Figure 15: SIM card detect

Notice：When using a larger PCB，the line between SM5100B-D and SIM card getting longer，then the next measures should be taken：

1) Recommend connecting a 4.7uF and a 100nF ceramic capacitor between SIM_VCC and GND;

2) Recommend respectively connecting a 27pF ceramic capacitor between SIM_RST,SIM_CLK,SIM_DATA and GND.

3.12 ADC interface

SM5100B-D provides three ADC interfaces, which can be used to detect the values of some external items such as voltage, temperature etc.

Table 16: ADC interface pins description

Pin No.	Pin Name	Description
6	ADC1	0.3V-5.0V

Notice: The touch-panel function is supported when using PIN10 CTS0/GPIO19/ADC4 and PIN8 ADC2.

3.13 GPIO interface

SM5100B-D provides several GPIO pins for users.

Table 17: GPIO interface pins description

Pin No.	Pin Name	Description
37	GPIO10	GPIO
53	GPIO11	GPIO
52	GPIO16	GPIO
56	GPIO20/PWMB	GPIO

3.14 Antenna interface

SM5100B-D has an RF interface impedance of 50Ω. Users can plug the antenna to the RF pad or GND pad.
SM5100B-D RF characteristics is showed in Table 18~20:

Table 18: SM5100B-D Operating Frequencies

Default is EGSM900/DCS1800

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

Table 19: SM5100B-D conducted RF output power

Default is EGSM900/DCS1800

Frequency	Minimum	Maximum
GSM850	5dBm±5dBm	33dBm ±2dBm
EGSM900	5dBm±5dBm	33dBm ±2dBm
DCS1800	0dBm±5dBm	30dBm ±2dBm
PCS1900	0dBm±5dBm	30dBm ±2dBm

Table 20: SM5100B-D conducted RF receive sensitivity

Default is EGSM900/DCS1800

Frequency	Receive sensitivity
GSM850	< -105dBm
EGSM900	< -105dBm
DCS1800	< -105dBm
PCS1900	< -105dBm

4 Physical characteristics

4.1 Mechanical dimensions

The following figure shows the top view, side view and bottom view of SM5100B-D:

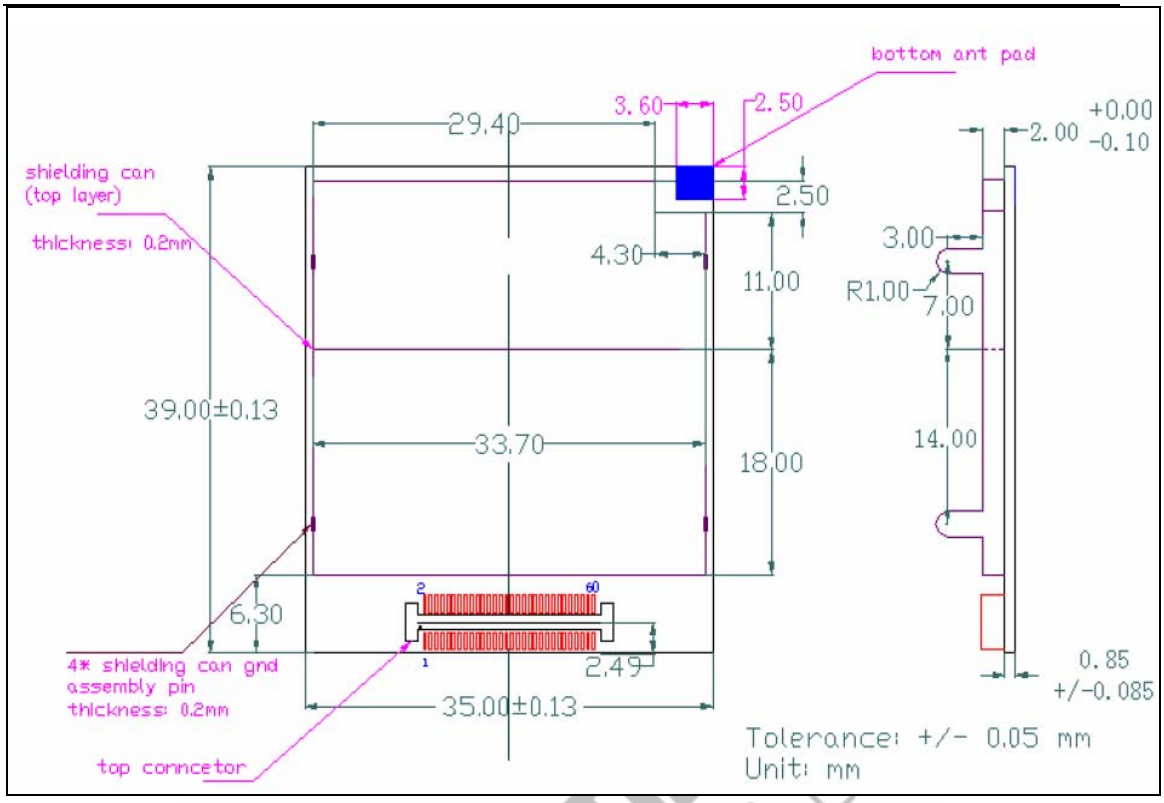

Figure 16: SM5100B-D mechanical dimensions（unit: mm）

4.2 60pin board-to-board connector

The physical interface of SM5100B-D to the user board is made through a 60 pins board-to-board connector.[*4]

[*4] For different hardware version, the 60 pins board-to-board connector maybe will different. Please read the hardware version release notes.

4.3 Pin assignment of the 60-pin connector

Table 21: Pin assignment of the 60-pin connector

PIN NO.	PIN NAME	I/O	PIN NO.	PIN NAME	I/O
2	NC		1	VBAT	I
4	NC		3	VBAT	I
6	ADC1	I	5	VBAT	I
8	ADC2	I	7	VBAT	I
10	CTS0/GPIO19/ADC4	I	9	GND	
12	MIC1N	I	11	GND	
14	MIC1P	I	13	GND	
16	SPK1N	O	15	GND	
18	SPK1P	O	17	GND	
20	RXD0	I	19	TXD0	O
22	RTS0/GPIO17	O	21	SIM_RST	O
24	KEY_DRIVER0	O	23	KEY_DRIVER3	O
26	KEY_DRIVER2	O	25	KEY_DRIVER4	O
28	KEY_DRIVER1	O	27	SIM_CLK	O
30	KEY_DRIVER5	O	29	SIM_DATA	I/O
32	KEY_SENSE1	I	31	KEY_SENSE2	I
34	RESET	I	33	LCD_DATA/NBOOT/ GPIO42	I/O
36	KEY_SENSE0	I	35	SIM_DET/GPIO4	I
38	LCD_CLK/GPIO6	O	37	GPIO10	I/O
40	KEY_SENSE3	I	39	LCD_RST/GPIO1	O
42	MIC2P	I	41	LCD_RS/GPIO9	O
44	SPK2P	O	43	RXD1	I
46	TXD1	O	45	DSR0/GPIO18	I
48	VRTC	I/O	47	VOUT	O
50	MIC2N	I	49	NETLIGHT/GPIO26	O
52	GPIO16	I/O	51	SIM_VCC	O
54	LCD_CS/GPIO8	O	53	GPIO11	I/O
56	GPIO20/PWMB	I/O	55	DCD0/GPIO32	O
58	SPK2N	O	57	RI0/GPIO46	O
60	VOUT	O	59	PWR_ON	I