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LONGSUNG Cellular Engine

U6100 user guide describes interfaces, function and application, which is provided to LONGSUNG's customers for testing, evaluation, integration and information.

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1. Introduction

1.1 Overview

The LONGSUNG HSPA module U6100, powered by Qualcomm MSM6290 chipset, can be integrated into any devices for 3G mobile applications. It provides audio, SMS and extended mass memory function as well as high speed internet access to HSUPA, HSDPA and UMTS networks worldwide.

The U6100 module complies with the technical standard listed below:

·HSUPA

3GPP R6, up to 2Mbps UL Category 4

·HSDPA

3GPP R5, up to 7.2 Mbps DL Category 8

·UMTS

Up to 384 Kbps DL and UL

·EDGE

3GPP R4, Class 12, up to 236.8 Kbps DL and 118.4Kbps UL

·GPRS

Up to 85.6 Kbps DL and 42.8 Kbps UL

It supports the frequency bands: UMTS 850/1900/2100 MHz and GSM/GPRS/EDGE 850/900/1800/1900 MHz.

1.2 Application scenario

The HSPA module U6100 supports Audio, SMS, extended mass memory and Internet access functions. The application of U6100 is as follows:

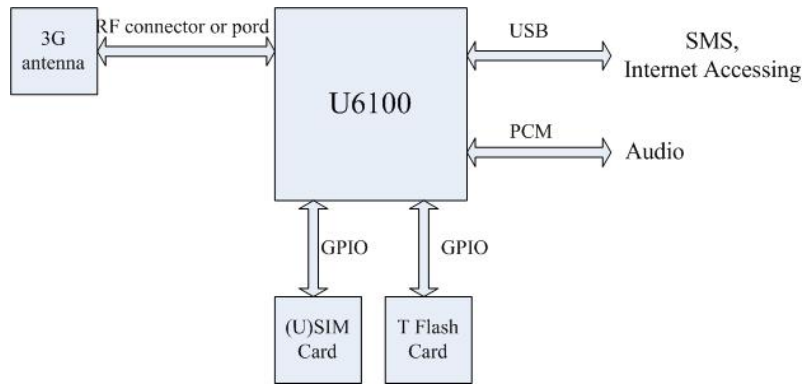


Figure1-1 U6100 application scenario

2. U6100 interfaces

2.1 U6100 interface summary

The HSPA module U6100 supports for multimode operation: HSDPA, HSUPA, tri-band UMTS (850/1900/2100 MHz) and quad-band GSM (850/900/DCS1800/PCS1900 MHz). The size of U6100 is 45×24×4.6mm. And the appearance is shown in Figure 2-1 and Figure 2-2.

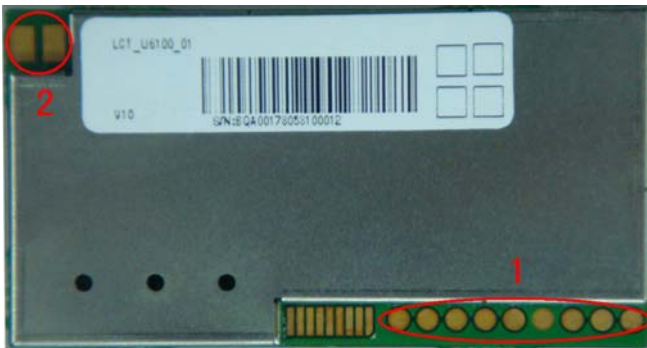


Figure 2-1 The front view of U6100

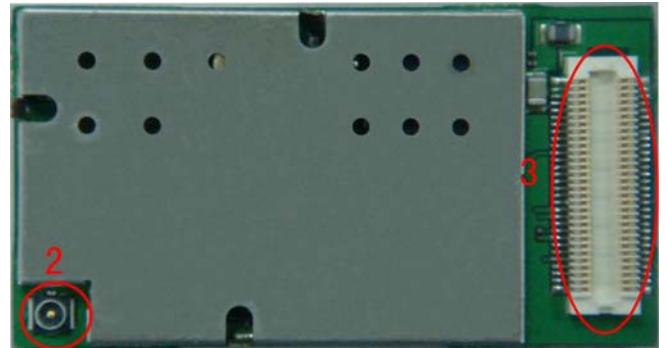


Figure 2-2 The rear view of U6100

There is a group of test points on the front of U6100 which is shown as part 1 in Figure 2-1. The 60PIN board to board connector is shown as part 3 in Figure 2-2, which is the main interface for application. An antenna pad and a RF connector is shown as part 2 in Figure 2-1 and Figure 2-2.

2.1.1 Test points

The test points of U6100 are shown in Figure 2-3, and the definition of each point is shown in Table 2-1.

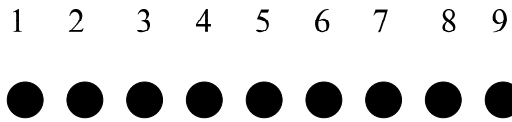


Figure 2-3 Test points of U6100

Table 2-1 The definition of U6100 test points

SN	Definition
1	USIM Card CLK
2	USIM Card Power
3	USIM Card Data
4	USIM Card Reset
5	USB Power Input
6	GND
7	USB DATA+
8	USB DATA-
9	U6100 Power Input

2.1.2 Board to board connector

A 60PIN board to board connector is provided to connect with other board for data communication, power supply and some other function, which is a narrow pinch dual line patch socket. The ball pinch is 0.5mm, the width of the ball is 0.2mm, the stacking height of the connector is 2.0mm. The length of connection area for the connector is larger than 0.55mm which ensure the reliable connection for the header & socket. The dimension of the connector is shown in figure 2-4. The value of parameter A, B and C is as follows:

A=18mm, B=14.5mm, C=1.85mm. It is recommended to use the AXK6F60345YJ, which is provided by NAIS, as the header to connect with the socket.

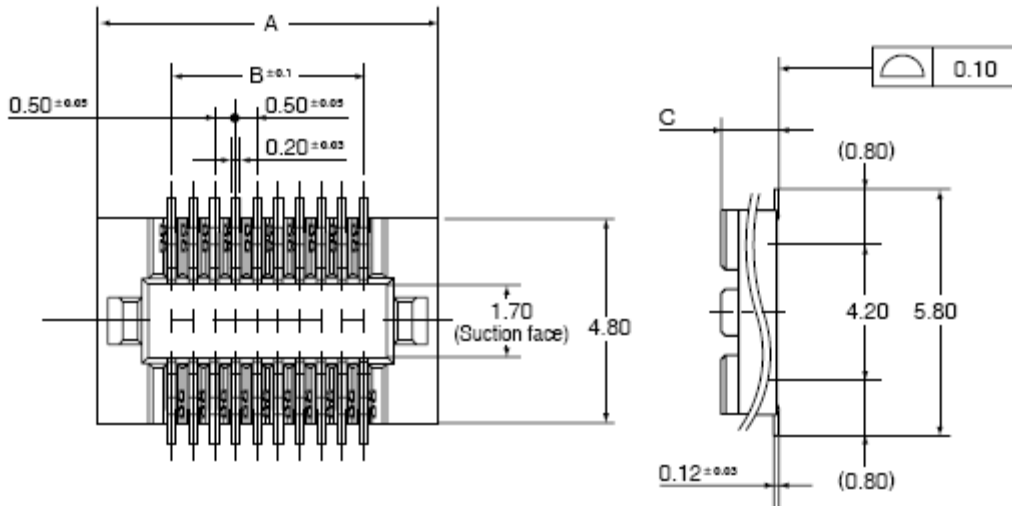


Figure 2-4 The dimension of board to board connector

To prevent the connector from damage of static electricity caused by plugging, it is better to use the ESD protection device which should be close to the connector as possible.

PIN definition of board to board connector is shown in Table 2-2.

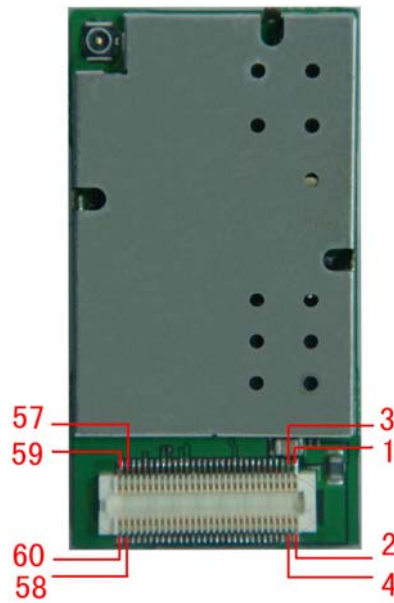


Figure 2-5 The 60PIN board to board connector of U6100

Table 2-2 The definition of board to board connector

SN	Definition	Description	Remark
1	VBAT	Power Supply	
2	VBAT	Power Supply	
3	VBAT	Power Supply	
4	VBAT	Power Supply	
5	VBAT	Power Supply	
6	VBAT	Power Supply	
7	GND	Ground	
8	GND	Ground	
9	MIC_P	MIC Data+	MIC Interface
10	USB_DM	USB Data-	USB Interface
11	MIC_N	MIC Data-	MIC Interface
12	USB_DP	USB Data+	USB Interface
13	GND	Ground	
14	GND	Ground	
15	EAROP	Earphone Data+	Earphone Interface
16	GND	Ground	
17	EARON	Earphone Data-	Earphone Interface
18	USIM_RESET	USIM Reset	USIM Interface
19	GND	Ground	
20	USIM_DATA	USIM Data	USIM Interface
21	VREG_EXTUSIM	USIM Power	USIM Interface
22	GND	Ground	
23	PCM_DOUT/GPIO[103]	PCM Data Output	PCM Interface, can be used as GPIO
24	PCM_CLK/GPIO[80]	PCM CLK	PCM Interface, can be used as GPIO
25	PCM_DIN/GPIO[14]	PCM Data Input	PCM Interface, can be used as GPIO
26	GND	Ground	
27	GND	Ground	
28	HKADC	External analog signal	

		detecting	
29	SDCC_DATA0/GPIO[32]	Micro SD Data 0	Micro SD Interface, can be used as GPIO, SDCC_DATA0, SDCC_CLK, SDCC_CMD and VREG_MMC are compatible for MMC card
30	GND	Ground	
31	SDCC_DATA1/GPIO[99]	Micro SD Data 1	Micro SD Interface, can be used as GPIO
32	SDCC_CLK/GPIO[31]	Micro SD CLK	Micro SD Interface, can be used as GPIO, SDCC_DATA0, SDCC_CLK, SDCC_CMD and VREG_MMC are compatible for MMC card
33	SDCC_DATA2/GPIO[100]	Micro SD Data 2	Micro SD Interface, can be used as GPIO
34	SDCC_CMD/GPIO[30]	Micro SD Command	Micro SD Interface, can be used as GPIO. SDCC_DATA0, SDCC_CLK, SDCC_CMD and VREG_MMC are compatible for MMC card
35	SDCC_DATA3/GPIO[101]	Micro SD Data 3	Micro SD Interface, can be used as GPIO
36	GND	Ground	
37	VREG_MMC	Micro SD Power	Micro SD Interface, can be used as GPIO. SDCC_DATA0, SDCC_CLK, SDCC_CMD and VREG_MMC are compatible for MMC card
38	USIM_CLK	USIM CLK	USIM Interface
39	USB_VBUS	USB Power	USB Interface
40	GND	Ground	
41	SLIC_RESET/GPIO[60]	SLIC Reset	Reset for peripheral device, can be used as GPIO
42	GND	Ground	
43	SLIC_INT/GPIO[59]	SLIC Interrupt	Interrupt for peripheral device, can be used as GPIO
44	SPI_CLK/GPIO[57]	SPI CLK	SPI Interface, can be used as GPIO
45	VREG_MSMP	VREG_MSMP voltage output	
46	SPI_DOUT/GPIO[55]	SPI Data Output	SPI Interface, can be used as GPIO
47	GND	Ground	
48	SPI_DIN/GPIO[56]	SPI Data Input	SPI Interface, can be used as GPIO
49	PWM_OUT	PWM Output	
50	SPI_CS/GPIO[58]	SPI CS	SPI Interface, can be used as GPIO
51	VCOIN	VRTC	

52	KPD_PWR_N	Power On	
53	EXT_RST_IN	Reset	
54	UART_TX/GPIO[95]	Tx in UART	UART, can be used as GPIO
55	GND	Ground	
56	UART_RX/GPIO[96]	Rx in UART	UART, can be used as GPIO
57	PCM_SYNC/GPIO[102]	PCM Synchronous Signal	PCM Interface, can be used as GPIO
58	LED_CTL_G	The Green LED Control	
59	GND	Ground	
60	LED_CTL_R	The RED LED Control	

2.1.3 RF interface

The U6100 module provides an interface for RF antenna which has two different modes for connection.

Connector mode: U6100 uses MURATA's MM9329-2700RA1 RF connector on the rear side, it is recommend to use MURATA's MXTK92XXXXX as matching connector. Please refer to MURATA's MXTK92XXXXX documents for more information.

Solder pad mode: The antenna can also be soldered to the pad on the module which has a ground pad close to the antenna pad.

The RF connector is shown in Figure 2-6.

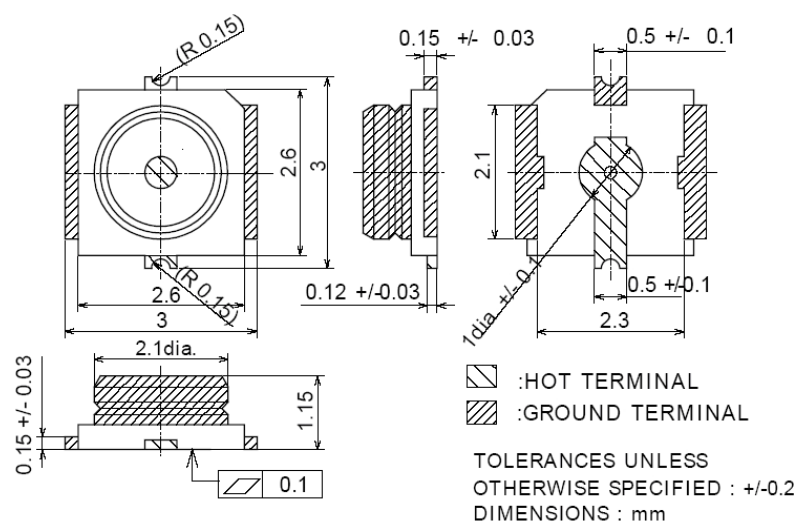


Figure 2-6 The sketch map of RF connector

2.2 Application note of U6100 interfaces

U6100 provides rich interfaces for secondary development by the 60PIN board to board connector, such as Micro SD/T-Flash card interface (Compatible for MMC card), USIM card interface, USB interface, audio interface, UART interface, PCM (Pulse Code Modulation) interface, SPI (Serial Peripheral interface) interface, power supply interface and so on. The detail information will be described in the following sections.

2.2.1 RF antenna interface

The ground impedance of RF antenna is 50Ω. There are two different modes for connection.

- A. Connector mode: Recommended, a connector is on the rear side of PCB board
- B. Solder pad mode: Antenna pad and ground pad are on the front side of PCB board

It's required to use RF cable of which the insertion loss should comply with:

- GSM850/900<1dB
- DCS1800/PCS1900<1.5dB
- UMTS2100/ UMTS1900/ UMTS850<1.5dB

And the gain of antenna should comply with the Table 2-3:

Table 2-3 Antenna gain requirements

Item	Parameter		
	GSM	DCS	UMTS
Gain (dBi)			
	0.5	1	1
Type	Omnidirectional antenna		

2.2.2 Power supply and ground

There are two power supply input for U6100 module listed as follows:

1. DC +3.8V~+4.15V, for U6100 working voltage;
2. DC +5V, for USB working voltage;

The description of U6100 Power supply and GND pins is shown in Table 2-4 below.

Table 2-4 the description of U6100 Power supply and GND pins

Power input	Pin name of 60Pin board to board connector	SN. of 60Pin board to board connector
DC: +3.8V~+4.15V input	VBAT	1, 2, 3, 4, 5, 6
USB power input	USB_VBUS	39
GND	GND	7, 8, 13, 14, 16, 19, 22, 26, 27, 30, 36, 40, 42, 47, 55, 59

2.2.3 USB interface

2.2.3.1 Description

U6100 provides a high-speed USB interface by 60PIN board to board connector, which supports USB 2.0 protocol. The detail information is given in Table 2-5.

Table 2-5 U6100 USB interface description

Signals of USB interface	Pins of 60Pin board to board connector	SN. of 60Pin board to board connector	Description
USB_VBUS	USB_VBUS	39	USB power
DM	DM	10	USB Data-
DP	DP	12	USB Data+
GND	GND	7, 8, 13, 14, 16, 19, 22, 26, 27, 30, 36, 40, 42, 47, 55, 59	GND

2.2.3.2 Reference circuit

The reference circuit of USB interface is shown in Figure 2-7 below.

- 1) To get the reliable USB power supply, it is recommended to use a 10uF (C406) filter capacitor and a 22pF (C407) filter capacitor which need to be grounded.
- 2) To reduce the reflection caused by the high frequency alternating signal in the transmission, it is recommended to

add a resistor with value below $10\ \Omega$ to the DM and DP in USB interface to ensure correct transmission for USB data. Just like the resistors R408 and R409 in Figure 2-7.

- 3) To avoid static electricity in USB interface, it is recommended to use the ESD protection device. Just like the varistor RV406, RV407 and RV408 with capacitor values below 3pF.
- 4) To ensure USB working reliably, it is recommended to use additional protection device.

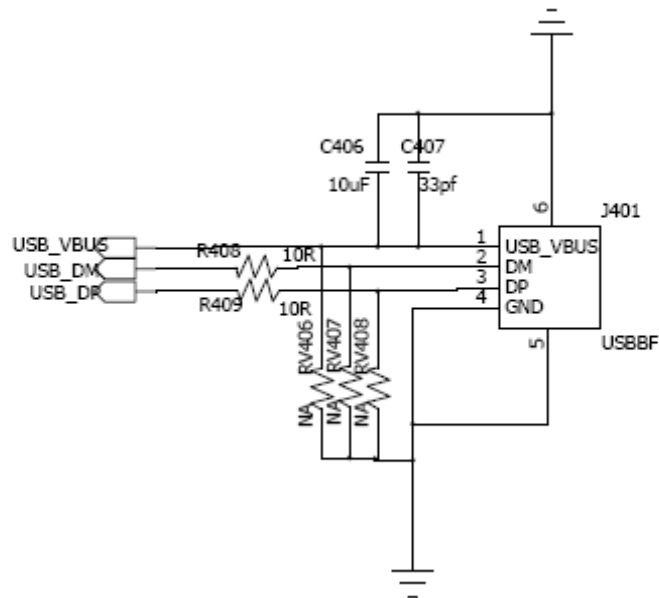


Figure 2-7 The reference circuit of USB interface

2.2.4 USIM interface

U6100 supports USIM card in UMTS mode as well as SIM card in GSM/GPRS/EDGE mode.

2.2.4.1 Description

U6100 provides USIM card interface by 60PIN board to board connector which can be used in both UMTS and GSM/GPRS/EDGE networks. The Table 2-6 gives more detail information.

Table 2-6 U6100 USIM card interface description

Signals of USIM interface	Pins of 60Pin board to board connector	SN. of 60Pin board to board connector	Description
DATA	USIM_DATA	20	USIM card data

CLK	USIM_CLK	38	USIM card CLK
RST	USIM_RESET	18	Reset signal
VCC	VREG_EXTUSIM	21	USIM card power
GND	GND	7, 8, 13, 14, 16, 19, 22, 26, 27, 30, 36, 40, 42, 47, 55, 59	GND

2.2.4.2 Reference circuit

The reference circuit of USIM interface is shown in Figure 2-8 below.

- 1) The DATA line of USIM is connected to SIM power supply by a pull-up resistor with reference value 15K Ω .
- 2) To avoid the instantaneous voltage overflowing, the resistor with reference value 22 Ω can be used for the DATA, CLK and RST line. Just like the resistors R307, R308 and R309 in Figure 2-8.
- 3) To avoid the static electricity in USIM socket, it is recommended to use the ESD protection device for the DATA, CLK and VCC line. Just like the varistors RV301, RV302, RV303 and RV304 in figure 2-8 which should be close to the USIM socket as possible.
- 4) To get more flat USIM power supply, it is recommended to use the filter capacitors. Just like C311 and C312 in Figure 2-8 with reference value 33pF and 100nF.
- 5) To eliminate the peak interference and high frequency interference signal on RST and CLK line, the filter capacities (C310, C309) can be placed in RST and CLK line, the reference value is 33pF.

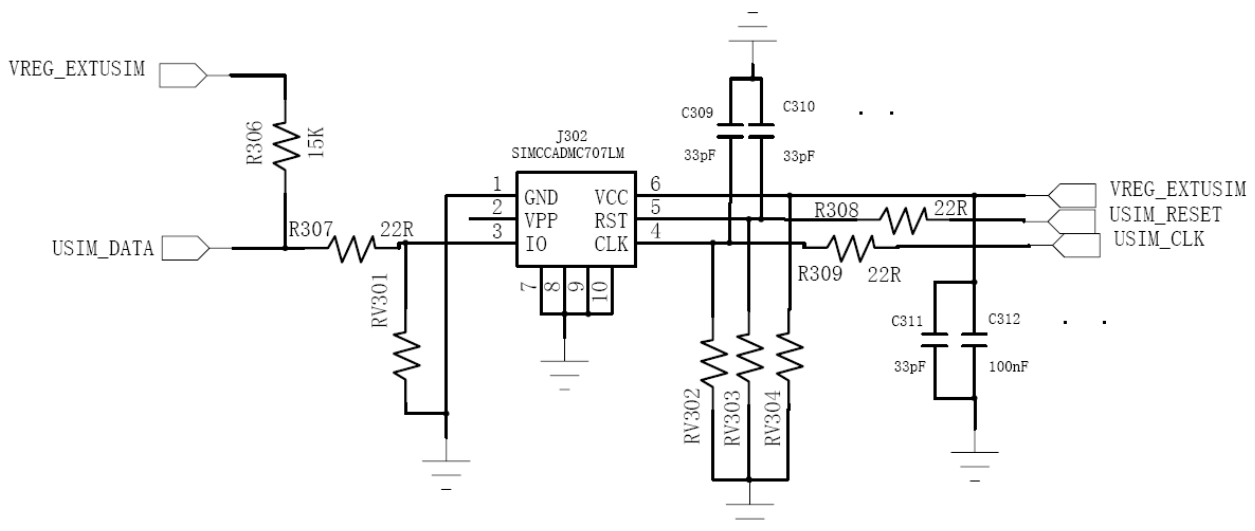


Figure 2-8 The reference circuit of USIM interface

2.2.5 Micro SD card interface

U6100 provides a Micro SD card interface for extended mass memory. The Micro SD card interface can also be used for T-Flash card and MMC card.

2.2.5.1 Description

U6100 provides Micro SD card interface by 60PIN board to board connector. The Table 2-7 gives the more detail information.

Table 2-7 U6100 Micro SD card interface description

Signals of Micro SD interface	Pins of 60Pin board to board connector	SN. of 60Pin board to board connector	Description
DATA2	SDCC_DATA2	33	Micro SD card data2
DATA3	SDCC_DATA3	35	Micro SD card data3
CMD	SDCC_CMD	34	The signal for command, reading or writing
VCC	VREG_MMC	37	SD/MMC Power
CLK	SDCC_CLK	32	CLK
DATA0	SDCC_DATA0	29	Micro SD card data0
DATA1	SDCC_DATA1	31	Micro SD card data1
GND	GND	7, 8, 13, 14, 16, 19, 22, 26, 27, 30, 36, 40, 42, 47, 55, 59	GND

2.2.5.2 Reference circuit

The reference circuit of Micro SD card interface is shown in Figure 2-9.

- 1) The data line of Micro SD such as SDCC_DATA0, SDCC_DATA1, SDCC_DATA2, SDCC_DATA3 and SDCC_CMD, should be connected to Micro SD card power supply by pull-up resistors with reference value 10K Ω . Just like R304, R305, R301, R302 and R303 in Figure 2-9.
- 2) To get more flat Micro SD card power supply, it is recommended to use filter capacitors. Just like C307 and C308 in Figure 2-9, and the reference values are 33pF and 100nF.

- 3) To eliminate high-frequency interference, it is recommended to use capacitors for Micro SD card data line, such as SDCC_DATA0, SDCC_DATA1, SDCC_DATA2, SDCC_DATA3 and SDCC_CMD、SDCC_CLK. Just like C301, C302, C303, C304, C305 and C306 in Figure 2-9.
- 4) To avoid static electricity in Micro SD card socket, it is recommended to use the ESD protection device which should be close to the Micro SD card socket as possible.

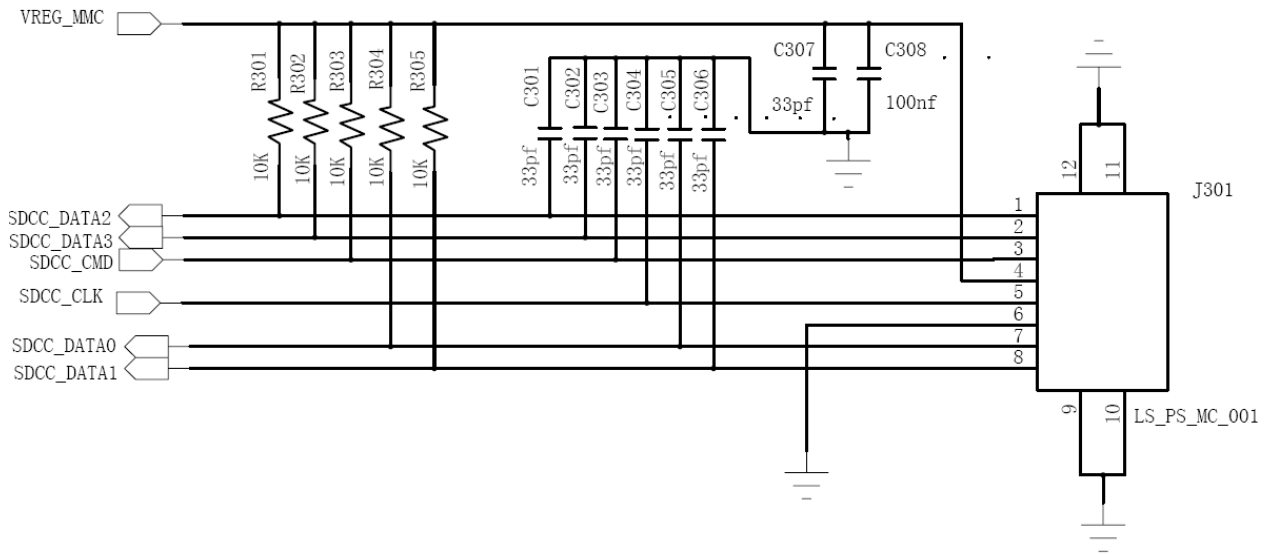


Figure 2-9 The reference circuit of Micro SD card interface

2.2.6 Audio interface

The audio signals include a pair of input differential signals (MIC1_P, MIC1_N) and a pair of output differential signals (EAR1OP, EAR1OR).

2.2.6.1 Description

The audio signals provided by U6100 are described in Table 2-8 below.

Table 2-8 U6100 audio signal description

Pins in board to board connector	SN. of 60Pin board to board connector	Description
EAROP	15	Audio output differential signal +
EARON	17	Audio output differential signal -

MIC_P	9	Audio input differential signal +
MIC_N	14	Audio input differential signal -

2.2.6.2 The connection between audio I/O and earphone

The audio I/O signals provided by U6100 can be connected to a stereo earphone jack which is shown in Table 2-9. The information about test points is shown in Table 2-1 above.

Table 2-9 The connection between earphone jack and the board to board connector

Pin name of earphone jack	Pins of board to board connector	SN. of 60Pin board to board connector	Description
Left Speaker	EAROP	15	The left output of stereo
Right Speaker	EARON	17	The right output of stereo
MIC	MIC_P	9	The microphone input
PGND	GND	14	Analog ground signal

2.2.6.3 The connection between audio I/O and phone handle

The audio I/O signals provided by U6100 can be connected to a phone handle which is shown in Table 2-10.

Table 2-10 The connection between phone handle and the board to board connector

Signals of phone handle	Pins of board to board connector	SN. of 60Pin board to board connector	Description
EAR_P	EAROP	15	Audio output differential signal +
EAR_N	EARON	17	Audio output differential signal -
MIC_P	MIC_P	9	Audio input differential signal +
MIC_N	MIC_N	11	Audio input differential signal -

2.2.6.4 Reference circuit

The reference circuit of audio interface is shown in figure 2-10.

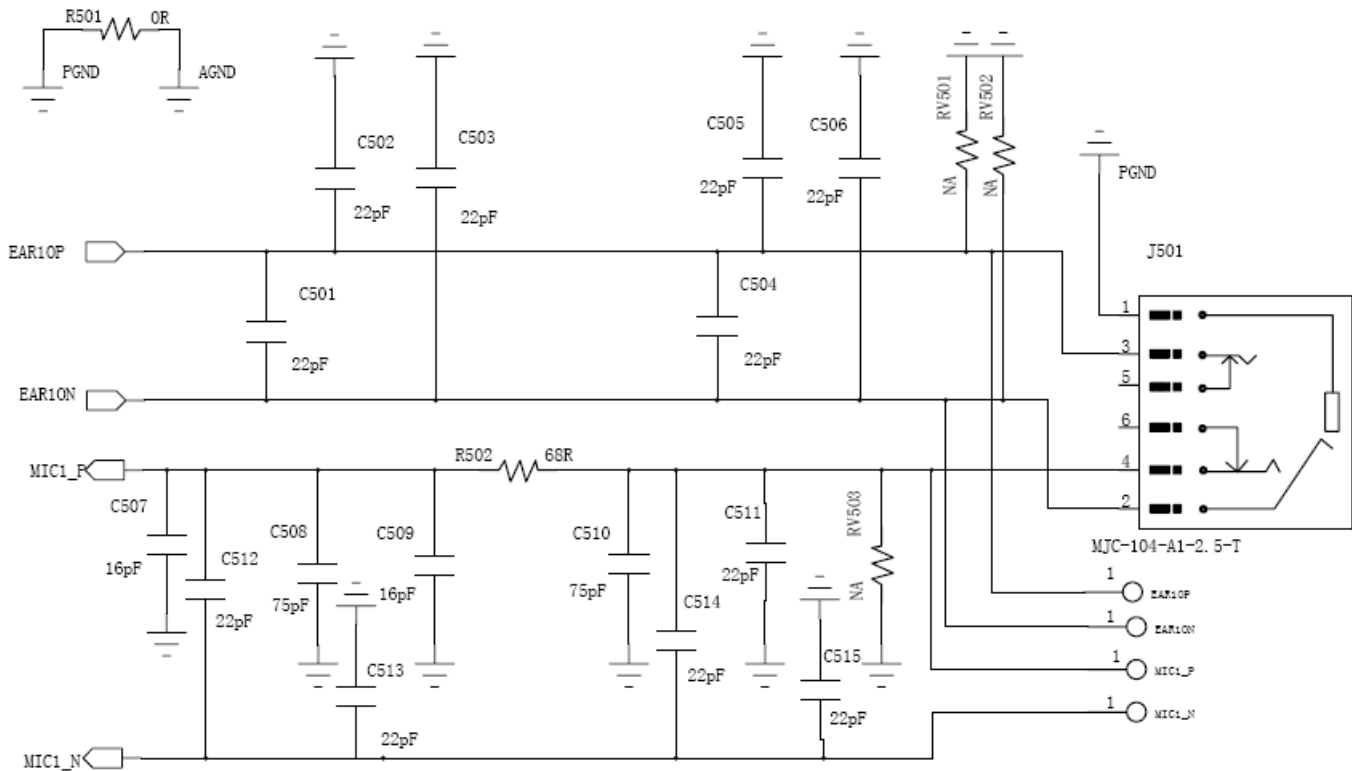


Figure 2-10 The reference circuit of audio interface

- 1) The audio output signals, a pair of differential signals, output to two speaker. The output signal is not real stereo signal which is different from traditional stereo sounds.
- 2) It is recommended to use the filter capacitor or filter circuit to reduce inter frequency interference and improve audio quality. Just like what is shown in Figure 2-10.
- 3) To avoid static electricity, it is recommended to use the ESD protection device just like the varistors RV501, RV502 and RV503 in Figure 2-10.
- 4) It requires to connect audio analog signal ground with the general digital circuit ground, magnetic bead or zero ohm resistance can be used just like R501 in Figure 2-10.
- 5) J501 is schematic diagram for four section of earphone jack, audio output signals connect with positive differential signal and negative differential signal, audio input signals connect with positive differential signal only.

2.2.7 PCM interface and SPI interface

U6100 provides PCM and SPI interface by 60PIN board to board connector.

2.2.7.1 PCM interface description

The information about PCM interface provided by U6100 is described in Table 2-11.

Table 2-11 U6100 PCM interface description

Signals of PCM	Pins of board to board connector	SN. of 60Pin board to board connector	Description
SYNC	PCM_SYNC	57	PCM Synchronous Signal
CLK	PCM_CLK	24	PCM CLK
DATA_IN	PCM_DIN	25	PCM Input
DATA_OUT	PCM_DOUT	23	PCM Output

2.2.7.2 SPI interface description

U6100 provides a SPI interface which is simulated by GPIO PIN. The detail information is given in Table 2-12 below.

Table 2-12 U6100 SPI interface description

Signals of SPI	Pins in board to board connector	SN. of 60Pin board to board connector	Description
DATA_OUT	SPI_DOUT	46	SPI Output signal
DATA_IN	SPI_DIN	48	SPI Input signal
CLK	SPI_CLK	44	SPI CLK
CS	SPI_CS	50	SPI CS

2.2.8 UART interface

U6100 provides a UART interface (RS232) by 60Pin board to board connector for debugging.

2.2.8.1 Description

The information about UART interface provided by U6100 is described in Table 2-13.

Table 2-13 U6100 UART interface description

Signals of UART	Pins in	SN. of 60Pin board to	Description
------------------------	----------------	------------------------------	--------------------

	board to board connector	board connector	
Rx	UART_RX	56	Rx in UART
Tx	UART_TX	54	Tx in UART
GND	GND	7, 8, 13, 14, 16, 19, 22, 26, 27, 30, 36, 40, 42, 47, 55, 59	GND

2.2.8.2 Reference circuit

The reference circuit of UART interface is shown in Figure 2-11.

- 1) As the UART interface can only supply TTL level while the PC serial port is RS232 level, it requires to use level conversion device. The reference device is SP3238EEA which provided by SIPEX, as shown in Figure 2-11. J401 is a 9 pin serial port socket which can connect to PC with serial cable.
- 2) To avoid static electricity, it is recommended to use the ESD protection device for the signal line of the UART socket. Just like the varistors RV401, RV402, RV403, RV404 and RV405 in Figure 2-11 which should be close to the socket as possible.

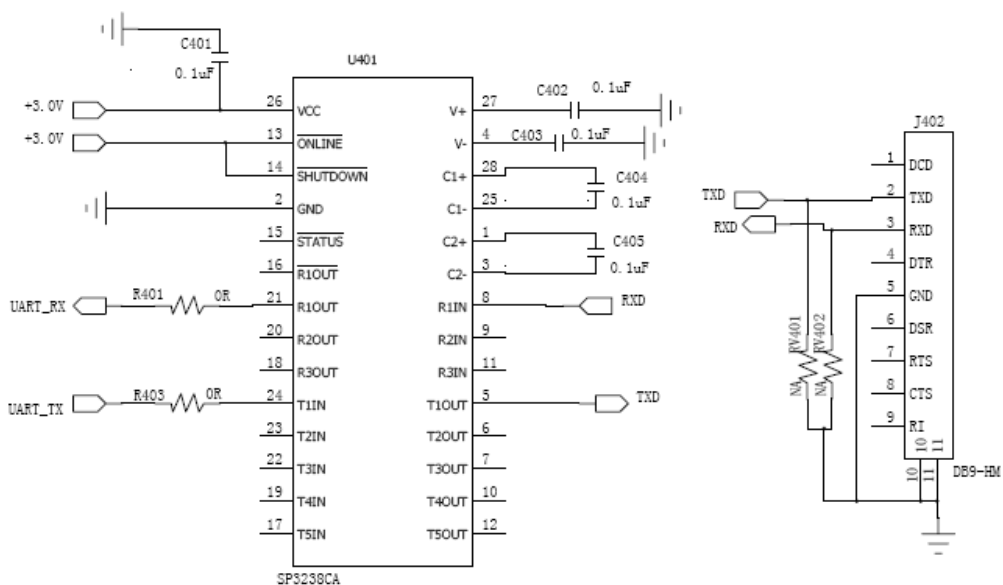


Figure 2-11 The reference circuit of UART interface

2.2.9 LED control

2.2.9.1 Description

There are two pins for LED control by the 60 PINs board to board connector. The detail information is given in Table 2-14.

Table 2-14 U6100 LED control description

Pins of board to board connector	SN. of 60Pin board to board connector	Description
LED_CTL_G	58	The Green LED control
LED_CTL_R	60	The Red LED control

U6100 status indication by LED is listed in Table 2-15.

Table 2-15 LED display description

LED	Status	Description
Green	Flicker quickly (100ms On/800ms Off)	Networks searching
	Flicker slowly(100ms On/3000ms Off)	Registered in 3G networks
	Flicker more quickly(100ms On/300ms Off)	Working in 3G networks, and the data is transmitting
	Always On	Connected to 3G networks, but no data transmitting
Green + Red	Flicker slowly(100ms On/3000ms Off)	Registered in 2G networks
	Flicker more quickly(100ms On/300ms Off)	Working in 2G networks, and the data is transmitting
	Always On	Connected to 2G networks, but no data transmitting
	Off	Closed
Red	Always On	Error(No SIM card or failed in registering networks)

2.2.9.2 Reference circuit

The reference circuit for LED is shown in Figure 2-12.

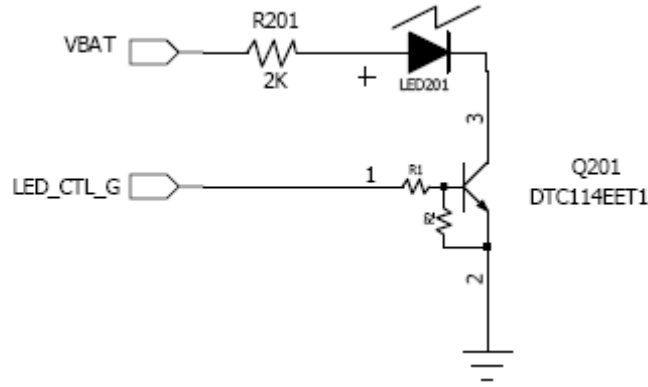


Figure 2-12 The reference circuit of LED control

- 1) The LED control pin (GPIO) controls the LED through a transistor, as is shown in Figure 2-12.
- 2) The reference value is 5mA. So the current-limiting resistor may be used. Just like the resistor R14 in Figure 2-12.
- 3) The reference circuit is for Green LED, and it is the same for Red LED.

2.2.10 Others

U6100 also provides some other interfaces listed in Table 2-16.

Table 2-16 Other interfaces by U6100

Pins of board to board connector	SN. of 60Pin board to board connector	Description
SLIC_INT	43	Interrupt signal of peripheral device
SLIC_RESET	41	Reset signal of peripheral device
KPD_PWR_N	52	Power on key
EXT_RST_IN	53	Reset signal of U6100 module
HKADC	28	External ADC input
VREG_MSMP	45	VREG_MSMP voltage output, +2.6V
VCOIN	51	Backup battery power supply input
PWM_OUT	49	PWM output

- 1) U6100 provides PWM signal output from PWM_OUT pin of the board to board connector.
- 2) U6100 provides power supply output named VREG_MSMP, with value of +2.6V and Max current value of 100mA.
- 3) U6100 provides power supply input pin named VCOIN for backup battery. The anode of the battery connects to VCOIN, and the cathode connects to ground. The backup battery will provide power supply for the real time clock, Crystal Oscillator Circuit and SMPL timer while U6100 powered off. And the battery will be charged while U6100 powered on. The voltage offered by battery must be less than 3.6V. To keep the SMPL timer working while sudden

momentary power losing, a backup capacitor connected to VCOIN can be used besides battery. The correlativity between the capacitance and the holding time is listed in Table 2-17.

Table 2-17 Correlativity between the capacitance and holding time

The capacitance	The Packaging (X5R)	The holding time (s)
1.5uF	0805	0.5
3.3uF	0805	1.0
4.7uF	0805	1.5
6.8uF	1206	2.0

- 4) KPD_PWR_N is used as power on for U6100 module. U6100 will be power on when connect KPD_PWR_N to ground. It's better to use a switch button to connected with KPD_PWR_N and ground, so the module can be power on/off by pressing the switch button. It's recommended to use ESD protection device close to the switch button.
- 5) EXT_RST_IN is used as reset signal for U6100 module. U6100 will be reset when connect EXT_RST_IN to ground. It's better to use a switch button connected to EXT_RST_IN and ground, so the module can be reset by pressing the switch button. It's recommended to use ESD protection device close to the switch button.
- 6) U6100 provides HKADC which can be used to measure some external analog signal, such as battery voltage, temperature and so on. The voltage input range of the HKADC is : 0~2.6V。
- 7) SLIC_INT and SLIC_RESET are the signals for peripheral device. SLIC_INT is for interrupt, SLIC_RESET is for reset.

3. U6100 key features

The U6100 module has features such as internet access, SMS, start-up mode switching, and extended mass memory. The features are described in following sections. For detail information about AT commands, please make refers to the related documents.

3.1 Internet access

AT commands can be used for querying/setting the network band, selecting network mode, setting the network search mode, setting register mode, querying network signal strength, setting APN and so on. The related AT commands are listed as follows:

·Network Band Set: AT+ BNDPRF =<nv441>, <nv946>

- Network Band Query: AT+BNDPRF?
- Network Mode Set: AT+MODODR=<mode >
- Network Mode Query: AT+MODODR?
- SIM LOCK status: AT+NWLCK?
- Network Mode Service Query: AT+MODPRF?
- Network Query: AT+PSRAT
- PIN and PUK Remain Times Query: AT+CPNNUM
- APN Set: AT+CGDCONT=1,"IP","CMNET"
- Dial up Access: ATDT*99***1#
- Network Disconnecting: ATH

The users need to use PPP protocol for internet access besides AT commands. The PPP protocol can be provided by customers or API functions offered by OS, such as the RasDial function in Windows OS.

```
DWORD RasDial(  
  
    LPRASDIALEXTENSIONS dialExtensions,  
  
    LPTSTR phoneBookPath,  
  
    LPRASDIALPARAMS rasDialParam,  
  
    DWORD NotifierType,  
  
    LPVOID notifier,  
  
    LPHRASCONN pRasConn  
  
);
```

3.2 SMS

The SMS feature is implemented by AT commands. You can set the service center address, switch message format, enable/disable receiving message report, delete message, preview message, receive/send message and so on.

The related AT commands are listed as follow:

- New Message Indication: AT+CNMI
- Message Send: AT+CMGS
- Message Preview: AT+CMGPR
- Message Delete: AT+CMGD
- Message format Switch: AT+CMGF
- Service Center Address Set: AT+CSCA
- Receiving Message Report enable/disable: AT+CNMI=2,1,0,1,0

3.3 start-up mode switching

The U6100 module supports start-up mode switch between USB Disk start-up and Modem start-up, mode switch between Read-Only and Read-Write, mode switch between USB Disk function and Modem function.

The related AT commands are listed as follows:

- Set USB Disk start-up mode: AT+BOOTDEV=0
- Set Modem start-up mode: AT+BOOTDEV=1
- Set Read-Only mode: AT+FILEMODE=1
- Set Read-Write mode: AT+FILEMODE=0
- Switch from Modem mode to USB Disk mode: AT+DEVCHG

3.4 Extended Mass Memory

The U6100 module supports T-Flash card as extended mass memory device. The Max capability is 32GB.

4. Application Illustration

4.1 Dial-up procedure

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CPIN?	SIM card querying
2	R	READY	

3	S	AT+CPNNUM	PIN And PUK querying
4	R	PIN1=3; PUK1=10; PIN2=0; PUK2=8	
5	S	AT+NWLCK?	SIM LOCK querying
6	R	+NWLCK: NETWORK UNLOCKED	
7	S	AT+CIMI	Get IMSI
8	R	460020177608847	IMSI, by which APN is selected
9	S	AT+CGDCONT=1,"IP","CMNET"	Set APN
10	R	OK	
11	S	ATDT*99***1#	Dial-up
12		PPP protocol	

4.2 SMS

4.2.1 Message Format

U6100 supports two kinds of message format, PDU and TEXT which can be set by AT command AT+CMGF, AT+CMGF=0 means PDU format, and AT+CMGF=1 means TEXT format.

4.2.2 Set Message Storage Location

The command **AT+CPMS=<mem1>,<mem2>,<mem3>** is used to set message storage location.

<mem1>, <mem2>, <mem3> can be set as SM and ME, SM means SIM card, ME means the U6100 module.

<mem1>: The parameter set here means memory storage used as read and delete message function. It can be operated by the followed AT commands: AT+CMGL, AT+CMGR and AT+CMGD;

<mem2>: The parameter set here means memory storage used as writing and send message function. It can be operated by the followed AT commands: AT+CMSS and AT+CMGW;

<mem3>: Received messages will be storage in this memory if routing to PC is not set;

Response:

If no error:

+CPMS:<used1>,<total1>,<used2>,<total2>,<used3>,<total3>

OK

<used1, 2, 3> Number of messages currently storage in <mem1, 2, 3>

<total1, 2, 3> Number of message capacity of <mem1, 2, 3>

If error:

+CMS ERROR:<err>

The command AT+CPMS? is used to display the remained capacity of memory.

AT+CPMS?

Response:

If no error:

+CPMS:<mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3> OK

If error:

+CMS ERROR

4.2.3 PDU Format

Sending:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CSCS=" UCS2"	Select TE character set
2	R	OK	
3	S	AT+CMGF=0	Select message PDU format
4	R	OK	
5	S	AT+CMGS=26 0011000D91683198916718F3000000CC8329BFD0 65DDF72363904 <ctrl-Z>	Send message
6	R	+CMGS: 2 OK	Send successfully

Writing message to memory:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGW=26< 0011000D91683198916718F30000000CC8329BFD0 65DDDF72363904 <ctrl-Z>	Write a message
2	R	+CMGW: 6 OK	Memory location index 6 of the stored message is returned.

Receiving message:

+CMTI: "SM",0

Means new received message in the memory located from index 0.

Reading message:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGR=0	Read message has been received in the memory location index 0
2	R	+CMGR: 0,,24 0891683108200905F0240D91683198916718F3000 880509111258023047A7A8C03 OK	Read successfully

Deleting message:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGD=0	Delete message from preferred memory location index 0.
2	R	OK	Delete successfully

4.2.4 TEXT Format

Sending:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100..

SN.	Type	AT Command/Respond	Explain
1	S	AT+CSCS=" GSM"	Select TE character set
2	R	OK	
3	S	AT+CMGF=1	Select message TXT format
4	R	OK	
5	S	AT+CMGS="13572034257" > 1233455664788666555 <ctrl-Z>	Send message
6	R	+CMGS: 4 OK	Send successfully

Writing message to memory:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100..

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGW="13572034257" > 11111114 <ctrl-Z>	Write a message
2	R	+CMGW: 8 OK	Memory location index 8 of the stored message is returned.

Receiving message:

+CMTI: "SM",1

Means new received message in the SIM card located index is 1.

Reading message:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGR=8	Read message has been received in the memory location index 8
2	R	+CMGR: 0,,24 +CMGR: "STO UNSENT","13572034257", 11111114 OK	Read successfully

Deleting message:

The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100. The type “S” means the AT Command sent to U6100, and the type “R” means Respond from U6100.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CMGD=8	Delete message from preferred memory location index 8.
2	R	OK	Delete successfully

4.2.5 SMS Service Center Address Setting

The user can set the SMS service center address, TP-Validity-Period and SMS Data Coding Mode.

SN.	Type	AT Command/Respond	Explain
1	S	AT+CSCA="+8613800201500",145	Set the SMS service center address, and the address will be kept in SIM card.
2	R	OK	
3	S	AT+CSMP=17,167,0,8	Set the TP-Validity-Period as 167 (24 hours) ,and the SMS Data Coding Mode as UCS2
4	R	OK	

Remark:

- 1) TP-MTI supports SMS-DELIVER, SMS-SUBMIT and SMS-STATUS-REPORT, while not support SMS-DELIVER-REPORT, SMS-SUBMIT-REPORT and SMS-COMMAND.

- 2) TP-PID is 0 by default while TPDU is sending or saving.
- 3) The Min. length of <pdu> is 8 and the Max. length of <pdu> is 164 while TPDU is sending or saving,.
- 4) The parameter <stat> can only be 2 for the command AT+CMGW.
- 5) In TEXT Format, the parameter <fo> can be 17 and 49, the parameter <pid> can only be 0, the parameter <dcs> can be 0~31 and the parameter <vp> can be 0~255 for AT+CSMP command
- 6) In TEXT Format, the parameter <stat> can only be "STO UNSENT" for the command AT+CMGW

4.3 Start-up Mode Switching

In Modem mode, the command AT+BOOTDEV=? can be used for querying the current start-up mode. The response value "0" means USB Disk start-up mode, and the value "1" means Modem start-up mode.

If user wants to switch the mode from USB Disk start-up to Modem start-up, a special SCSI command whose code is 0xFF and length is 1, needs to send to the module. It can be sent by CreateFile and DeviceIoControl for windows OS.

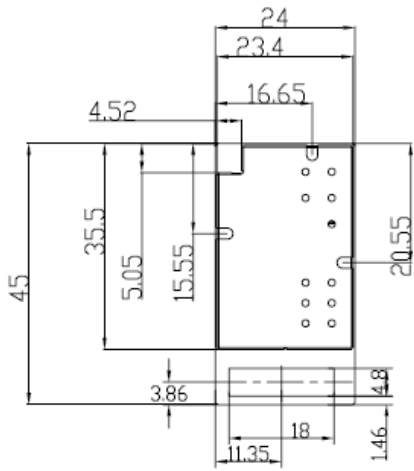
If user wants to switch the mode from Modem start-up to USB Disk start-up, the AT command AT+BOOTDEV=0 needs to send to the module. When the module is restart it will be changed to USB Disk start-up mode.

In the Modem mode, the AT command AT+DEVCHG will change the device to be a USB Disk directly.

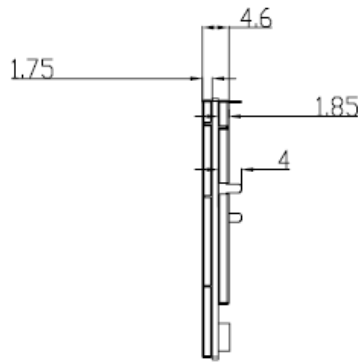
In USB Disk mode, the USB Disk is a read-only device by default. If user wants to change the module to be read-write, it needs to switch to modem mode firstly, then use AT commands AT+FILEMODE=0 and AT+DEVCHG. The module will be read-only again after restart.

Appendix: Mechanical dimensions of U6100

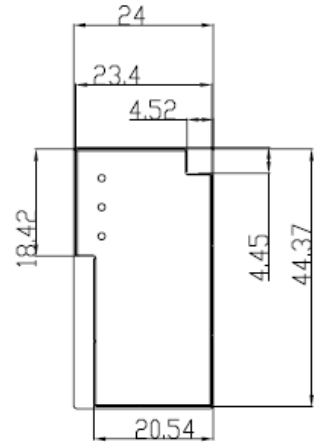
The following are Mechanical dimensions of U6100 bottom view, side view and top view. (Unit: mm)



Bottom View



Side View



Top View