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LONGSUNG GSM MUDLE

A8000 user guide describes interfaces, function and application, which is provided to LONGSUNG's customers for testing, evaluation, integration and information.

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VERSION HISTORY

Version	Author	Date	Chapter	What is new
V1.0	Liu Zhongrong	2009-5-13		Create

CAUTION: A8000 module is an ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 1 K Volts readily accumulate on the human body and test equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

Contents

1. Introduction

1.1 Overview

LONGSUNG A8000 is a dual band GSM/GPRS module that works on 850MHz/1900MHz. Powered by Infineon PMB7880 chipset, A8000 features GPRS multi-slot class 10 and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With power saving technique, A8000 can minimize current consumption to as low as 5.5mA in SLEEP mode, and is able to wake up on demand and to resume power saving automatically if no activity is required.

For battery powered applications, MC55/56 features a charging control which can be used to charge NiCd, Ni-Mh, Li-Polymer and Li-ON batteries. The charging circuit must be implemented outside the module on the application platform.

1.2 A8000 Key Features

The GSM module A8000 supports audio, SMS, and data transfer. Table1-1 lists the features of A8000.

<p align="center">**Table1-1 A8000 key features**</p>

Feature	Implementation
Power supply	Single supply voltage 3.5V – 4.2V
Power saving	Typical power consumption in SLEEP mode to 5.5mA
Frequency bands	• band 850MHz, 1900MHz • Compliant to GSM Phase 2/2+
GPRS class	Class 10
Temperature range	• Normal operation: -20°C to +55°C • Restricted operation: -30°C to -20°C and +55°C to +80°C • Storage temperature -40°C to +80°C
SMS	• MT, MO, CB, Text and PDU mode • SMS storage: SIM card
SIM interface	Supported SIM card: 1.8V ,3V

External antenna	Connected via 50 Ohm antenna connector or antenna pad
Audio features	Speech codec modes: • Half Rate (ETS 06.20) • Full Rate (ETS 06.10) • Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) • Echo suppression
Serial interface	•seven lines on serial port Interface; •software download; •print debug information.
Phonebook management	Supported phonebook types: SM, FD, LD, RC, ON, MC.
SIM Application Toolkit	Supports SAT class 3, GSM 11.14 Release 98
Real time clock	Implemented
Physical characteristics	Size: 28(±0.15) x 20(±0.15) x 2.85(±0.3) mm
Firmware upgrade	Firmware upgradeable over serial interface
Parallel port	Connects with external parallel port devices

1.3 Operating Modes

The table1-2 below briefly summarizes the various operating modes referred to in the following chapters.

Table1-2 Overview of operating modes

Mode	Function
GSM / GPRS SLEEP	Module will automatically go into SLEEP mode if there is no on air or audio activity is required and no hardware interrupt (such as GPIO interrupt or data on serial port). In this case, the current consumption of module will reduce to the minimal level. During sleep mode, the module can still receive paging message and SMS from the BTS.
GSM IDLE	Software is active. Once registered to the GSM network, paging with BTS is carried out, and the module is ready to send and receive.
GSM TALK	Connection is going on between two subscribers. In this case, the power consumption depends on network settings.
GPRS IDLE	Module is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multi-slot settings).

GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink/downlink data rates and GPRS configuration (e.g. used multi-slot settings).
SWITCH OFF	Normal shutdown by using the SWITCH_ON. In this case only the power supply for the RTC is remained. Software is not active. So the application interfaces cannot work. Operating voltage (connected to VBAT) remains applied.

2.1 Power Supply

The power supply of the GSM engine has to be a single voltage source in the range of 3.5V~4.2V. It must be able to withstand a sufficient current in a transmission burst which typically rises to 2A instantly. Additionally, the power supply must be able to account for increased current consumption if the module is exposed to inappropriate conditions, for example antenna mismatch.

2.1.1 Power Supply Pads on A8000

2 VBAT pads of A8000 connector are dedicated to connect the supply voltage, and 10 GND pads are recommended for grounding. VDD_LRTC used to back up RTC and VDD_LIO is a 2.85V LDO output for user application, max current 15mA, SWITCH_ON has the ON/OFF key function and RESET_N can reset system with logic low level. Table2-1 lists the power supplies of A8000.

Table2-1: Power supplies of A8000

Signal Name	PIN No.	I/O	Description	Notes
VBAT	61,62	I	Positive operating voltage	3.3 V-4.2 V, $I_{typ} \leqslant$ 2 A during transmit burst, the minimum operating voltage must never fall below 3.3 V.
CDT	64	I	Charger detect(only for A8000 recommended charging scheme, see Figure2-4)	-
CS	65	O	Charging switch(only for A8000 recommended charging scheme, see Figure2-4)	-
VDD_LRTC	43	I/O	Can be used to back up the RTC when VBAT is not applied.	1.8-2.0V, 4mA
VDD_LIO	18	O	A8000 LDO output, can used to drive led.	Output voltage 2.85V, and the max output drive current not exceed 15mA
SWITCH_ON	44	I	ON/OFF key to turn on/off A8000.	Pull the pin up to the VDD_LRTC to turn on/off A8000.

RESET_N	42	I	A8000 system reset	Logic LOW effective
GND	1,2,4,5,20,21,49,59,60	-	Ground	-

2.1.2 Turn On / Off A8000

2.1.2.1 Turn On A8000

To turn on A8000, the following procedures may be used:

• As default settings, A8000 will be turning on automatically when detecting voltage applied on VBAT pad over 3.5V;

• If ON/OFF key function needed, the signal SWITCH_ON could be defined as power key to turn on the system by pulling it up to VDD_LRTC.

2.1.2.2 Turn Off A8000

To turn off A8000, the following procedures may be used:

• As default settings, A8000 will be turning off automatically when detecting voltage applied on VBAT pad below 3.3V;

• If ON/OFF key function needed, the signal SWITCH_ON could be defined as power key to turn off the system by pulling it up to VDD_LRTC.

2.1.3 Power Saving

SLEEP mode can shut down unnecessary functions of the A8000 module to minimizes the power consumption to the lowest level.

2.1.3.1 Sleep Mode

When no on air or audio activity required and no any hardware interrupt (such as GPIO interrupt or data on serial port), A8000 will enter SLEEP mode automatically after 5 seconds, which can shut down unnecessary functions of the A8000 module to minimizes the power consumption. In sleep mode, A8000 can still receive paging or SMS from network and the serial will not be accessible until A8000 be waked up.

2.1.3.2 Wake Up A8000 From SLEEP Mode

When A8000 is SLEEP mode, the following method can wake up the module.

• Receive a voice or data call from network to wake up A8000;

• Receive a SMS from network to wake up A8000;

• Hardware interrupts (such as Key press or GPIO interrupt).

2.1.6 RESET_N

RESET provides an external reset control signal for A8000 system. It should be noted that logic LOW level is an effective signal for RESET_N

2.2 UART Interface

2.2.1 UART Interface Description

A8000 provides an UART to communicate with other terminal equipments, and support data The GSM module is designed as a DCE (Data Communication Equipment). The UART pins descripton is given in Table2-2 and table 2-3 lists the Logic levels of UART pins.

Table2-2 UART pins description of A8000

Signal Name	PIN No.	I/O	Description
DATA_DCD	19	I/O	UART: Data Carrier detection
DATA_DTR	22	I/O	UART: Data set ready
DATA_RI	23	I/O	UART: Ringing
DATA_CTS	24	I/O	UART: Clear to send
DATA_RTS	25	I/O	UART: Ready to send
DATA_RX	26	I/O	UART: Received data
DATA_TX	27	I/O	UART: Transmitted data
GND	1,2,4,5,20,21,49,59,60	-	Ground

Table2-3: Logic levels of UART pins

Parameter	Min	Max	Unit
Logic low input	0	0.3*VDD_LIO	V
Logic high input	0.7 *VDD_LIO	VDD_LIO +0.3	V

Logic low output	GND	0.2	V
Logic high output	VDD_LIO -0.2	VDD_LIO	V

2.3 SIM Interface

2.3.1 SIM Interface description

The SIM interface supports the functionality of the GSM Phase 1 specification and also Support of speed enhancement as specified in GSM 11.11 Phase 2+ with baud rates up to 100K baud SIM (intended for use with a SIM application Tool-kit). A8000 support 1.8V or 3.0V SIM card，Table2-4 gives the SIM interface pins description.

Table2-4 SIM interface pins description of A8000

Signal Name	PIN No.	I/O	Description
SIM_CLOCK	45	I/O	SIM card CLK
VDD_SIM	46	I/O	SIM card power: 1.8V/3.0V
SIM_DATA	47	I/O	SIM card data
SIM_RESET	48	I/O	SIM card reset
GND	1,2,4,5,20,21,49,59,60	-	Ground

2.5 LCD Interface

2.5.1 LCD Interface Description

A8000 provides SPI(Serial Peripheral Interface) interface that supports serial communication with LCD device. These are alternative pins that can be used as GPIO ports or LCD display interface. When use as LCD interface, table2-8 defines the pins function. LCD interface timing should be united with the LCD device.

Table2-8: LCD interface pins descripition of A8000

Signal Name	Pin No.	I/O	Description

LCD_DATA	70	O	LCD data signal
LCD_CLK	71	O	LCD data transfer clock
LCD_CS_N	72	O	LCD chip select
LCD_A0	73	O	LCD Register select (data or instruction)
LCD_RESET	74	O	LCD reset
GND	1,2,4,5,20,21,49,59,60	-	Ground

2.6 ADC

A8000 provides 2 auxiliary ADCs (General purpose analog to digital converter, ADC1, ADC2) for measurements of analog signal such as battery temperature, battery id and environment temperature etc. It should be noted that only voltage no more than 2.0V could be measured correctly. Table2-9 defines the 2 ADC pins.

Table2-9: ADC pins description of A8000

Signal Name	Pin No.	I/O	Description
ADC1	67	I	ADC input1, <2.0V
ADC2	66	I	ADC input2, <2.0V

2.7 Backlight

2.7.1 Backlight Control Description

With default setting, BACKLIGHT pin of A8000 is used to drive either keypad led or display backlight led. Table2-10 gives the BACKLIGHT pin description.

<div align="center">

Table2-10: Backlight pin description of A8000

</div>

Signal Name	Pin No.	I/O	Description
BACKLIGHT	16	O	Keyboard or lcd backlight led control

2.8 Keypad Interface

2.8.1 Keypad Interface Description

A8000 provides a 5X5(that is 5 output and 5 input) keypad array for user, and if needed, the array could be configured as 6X4(that is 6 output and 4 input), the keypad pins are defined as follows. It must be noted that when used as power key, SWITCH_ON signal should be connected to VDD_LRTC to turn on A8000, the keypad pins function are descript in table2-11 as following.

<div align="center">

Table2-11 keypad pins description of A8000

</div>

Signal Name	Pin No.	I/O	Description
SWITCH_ON	44	I	ON/OFF Key
KEYPADCOL0	6	O	Keypad array output
KEYPADCOL1	7	O	Keypad array output

KEYPADCOL2	8	O	Keypad array output
KEYPADCOL3	9	O	Keypad array output
KEYPADCOL4	10	O	Keypad array output
KEYPADCOL5/ KEYPADROW0	11	O/I	Keypad array input/output
KEYPADROW1	12	I	Keypad array input
KEYPADROW2	13	I	Keypad array input
KEYPADROW3	14	I	Keypad array input
KEYPADROW4	15	I	Keypad array input

2.9 IIC Interface

2.9.1 Interface Description

A8000 provides an IIC interface: IIC_SCL and IIC_SDA is working as serial clock and data lines respectively, and the serial clock speed is programmable in the range from 51 kHz to 3.25 MHz. external resistance(10KΩ) needed to pull both IIC_SCL and IIC_SDA up to 2.8V level power line(VDD_LIO) in user's application, the IIC pins is descript in table2-12 as follows.

Table2-12 IIC interface pins description of A8000

Signal Name	Pin No.	I/O	Description
IIC_CLK	68	I/O	IIC clock
IIC_DATA	69	I/O	IIC data
GND	1,2,4,5,20 ,21,49,59, 60	-	Ground

2.10 Parallel Port Interface

To communicate with parallel port devices, A8000 extended parallel port, which consists 3 bit address, 8 bit data, a CS bit, a /WE bit and an OE bit, just as defined in table2-13 below.

Table2-13 Parallel port pins description of A8000

Signal Name	Pin No.	I/O	Description
WEN	28	O	Paralllel data write enable
ADD_3	29	O	Parallel port address
ADD_2	30	O	Parallel port address
ADD_1	31	O	Parallel port address
OEN	32	O	Paralllel data read enable
DATA00	33	O	Parallel port data00
DATA01	34	I/O	Parallel port data01
DATA02	35	I/O	Parallel port data02
DATA03	36	I/O	Parallel port data03
DATA04	37	I/O	Parallel port data04
DATA05	38	I/O	Parallel port data05
DATA06	39	I/O	Parallel port data06
DATA07	40	I/O	Parallel port data07
EXT_CS	41	I/O	Parallel port chip select
GND	1,2,4,5,20 ,21,49,59, 60	-	Ground

2.12 Others

A8000 also provides 2 other interfaces listed in Table 2-16.

Table2-16 Other interface pins description of A8000

Signal Name	Pin No.	I/O	Description
CLKOUT	17	O	Could be cofigured as clock
HOOT_DET	75	I	Wireless phone hook detect

2.13 General Purpose Input Output (GPIO)

If needed, Many signal pins of function interfaces such as KEYPAD, LCD,UART and IIC can be used as GPIO alternatively by software configuration, please refer to appendix table4-1 for application.

3 Electrical Characteristics and Reliability

3.1 Absolute Maximum Ratings

Absolute maximum rating for power supply and voltage on digital and analog pins of A8000 are list in table3-1 as follows.

Table3-1 Absolute maximum ratings

Parameter	Min	Max	Unit
Peak current of power supply	0	3.0	A
Voltage at digit pins	-0.3	3.3	V
Voltage at analog pins	-0.3	3.0	V
Voltage at digit/analog pins in POWER DOWN mode	-0.25	0.25	V

3.3 Power Supply Ratings

Table3-3: A8000 power supply ratings

Parameter	Description	Conditions	Min	Typ	Max	Unit
VBAT	Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple, and spikes.	3.5	4.0	4.2	V
	Voltage drop during transmit burst	Normal condition, power control level for Pout max			400	mV
I_{VBAT}	Peak supply current (during transmission slot every 4.6ms)	Power control level		2	3	A

3.4 Electrostatic Discharge

Normally the module is designed inside customer terminal, so about Electrostatic Discharge (ESD) should be considered base on the requirement of terminal product. But for the module is protected against Electrostatic Discharge in conveyance and customer production, and some second level ESD protect design inside module.

The remaining ports are not special ESD protection in module, so the user should consider in the final product, and therefore, they are only protected according to the Human Body Model requirements.

Table3-4: The ESD endure statue measured table

(Temperature: 25℃, Humidity:45%)

Part	Contact discharge	Air discharge
VBAT,GND	±1KV	±2KV
KEYPADROW0-4, DTR, RXD, TXD, RTS, SPI_DATA, SPI_CLK	±1KV	±2KV
Antenna port	±1KV	±2KV
Other port	±1KV	±2KV

4 Mechanics

4.1 Mechanical Dimensions Of A8000

The top and bottom view of A8000 is shown in Figure4-1. llowing are A8000 top view, side view and bottom view. These show you Mechanical dimensions of A8000.
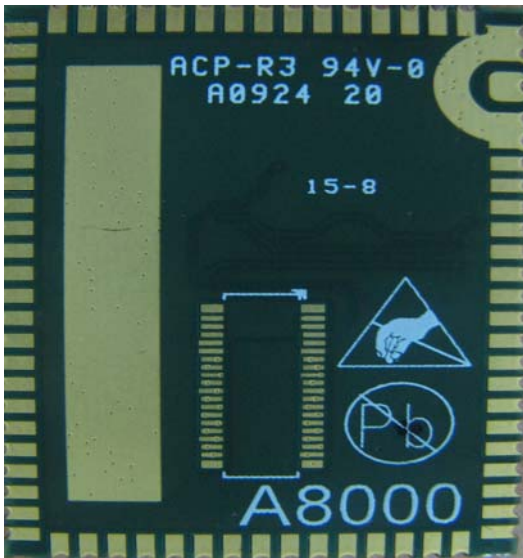
Figure4-1(a) BOTTOM View

Figure4-1(b) TOP View

Figure4-1 A8000 appearance

4.2 Mounting A8000 onto the application platform

Just solders A8000 on user's application platform with pad to pad.

4.3 Pins Assignment Of A8000

Table4-1 The definition of board to board connector

PIN No.	Signal name	Description	GPIO or Not	NOTES
1	GND	Ground		
2	GND	Ground		
3	ANT	Antenna		
4	GND	Ground		
5	GND	Ground		
6	KEYPADCOL0	Keypad array output0	GPIO	
7	KEYPADCOL1	Keypad array output1	GPIO	External interrupt input
8	KEYPADCOL2	Keypad array output2	GPIO	CC interrupt input*

9	KEYPADCOL3	Keypad array output3	GPIO	CC interrupt input
10	KEYPADCOL4	Keypad array output4	GPIO	CC interrupt input
11	KEYPADCOL5/KEYPADROW0	Keypad array output5 or input1	GPIO	CC interrupt input
12	KEYPADROW1	Keypad array input1	GPIO	External interrupt input
13	KEYPADROW2	Keypad array input 2	GPIO	
14	KEYPADROW3	Keypad array input 3	GPIO	CC interrupt input
15	KEYPADROW4	Keypad array input 4	GPIO	CC interrupt input
16	BACKLIGHT	Keypad or LCD backlight led control	GPIO	CC interrupt input
17	CLKOUT	Clock out	GPIO	
18	VDD_LIO	Internal LDO output:2.8V, 15mA		
19	DATA_DCD	UART: Data Carrier Detection	GPIO	CC interrupt input
20	GND	Ground		
21	GND	Ground		
22	DATA_DTR	UART: Data Set Ready	GPIO	External interrupt input
23	DATA_RI	UART: Ringing	GPIO	
24	DATA_CTS	UART: Clear To Send	GPIO	External/CC interrupt input
25	DATA_RTS	UART: Ready Ro Send	GPIO	CC interrupt input
26	DATA_RX	UART: Received Data	GPIO	External interrupt input
27	DATA_TX	UART: Transmitted Data	GPIO	
28	WEN	Parallel port: write enable		
29	ADD_3	Parallel port: address3		
30	ADD_2	Parallel port: address2		
31	ADD_1	Parallel port: address1		
32	OEN	Parallel port: read enable		
33	DATA00	Parallel port: data00		

34	DATA01	Parallel port: data01		
35	DATA02	Parallel port: data02		
36	DATA03	Parallel port: data03		
37	DATA04	Parallel port: data04		
38	DATA05	Parallel port: data05		
39	DATA06	Parallel port: data06		
40	DATA07	Parallel port: data07		
41	EXT_CS	Parallel port: chip select		
42	RESET_N	A8000 system reset		Logic LOW effective
43	VDD_LRTC	RTC power supply, 2.0V		
44	SWITCH_ON	ON/OFF key		
45	SIM_CLOCK	SIM card clock		
46	VDD_SIM	SIM card power supply,1.8V/3.0V		
47	SIM_DATA	SIM card data		
48	SIM_RESET	SIM card reset		
49	GND	Ground		
51	AOUT_P2	Auxiliary speaker output+(differential), load resistance 8 Ω		
52	AOUT_N2	Auxiliary speaker output-(differential), load resistance 8 Ω		
53	AOUT_N1	Loud speaker output-(differential,and internal audio amplifier, 350mW/8 Ω		
54	AOUT_P1	Loud speaker output+(differential,and internal audio amplifier, 350mW/8 Ω		

55	AIN_N2	Auxiliary MIC input-(differential)		
56	AIN_P2	Auxiliary MIC input-(differential)		
57	AIN_N1	Normal MIC input-(differential)		
58	AIN_P1	Normal MIC input-(differential)		
59	GND	Ground		
60	GND	Ground		
61	VBAT	A8000 power supply(3.4V~4.2V)		
62	VBAT	A8000 power supply(3.4V~4.2V)）		
63	GND	Ground		
64	CDT	Charger detect(only for PMB7880 charging scheme)		
65	CS	Charging switch(only for PMB7880 charging scheme)		
66	ADC2	Analog sample signal input		
67	ADC1	Analog sample signal input		
68	IIC_CLK	IIC clock	GPIO	Resistance(10K) needed to pulled up to VDD_LDO
69	IIC_DATA	IIC data	GPIO	Resistance(10K) needed to pulled up to VDD_LDO
70	LCD_CS	SPI: LCD chip select	GPIO	
71	LCD_A0	SPI: LCD register select(instruction or data)	GPIO	
72	LCD_CLK	SPI: LCD clock	GPIO	
73	LCD_RESET	SPI: LCD reset	GPIO	
74	LCD_DATA	SPI: LCD data	GPIO	

75	HOOT_DET	Hook detect	GPIO	External interrupt input
76	GND	Ground		
77	GND	Ground		

Notes:*CC interrupt is an interrupt detecting mechanism that means system will capture the contents of a timer on specific internal or external events, and they can compare a timer content with given values and modify output signals if they match.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly

approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operationis subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: XXXXX ".

If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.