

GSM/GPRS Module

User Manual



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www.linksprite.com

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1 OVERVIEW

1.1 OBJECT OF THE DOCUMENT

This document gives an overview of the LinkSprite GSM/GPRS module: a miniature, single-side board, quad-band GSM 850/EGSM 900/DCS 1800/PCS 1900 module, ready for integration in various kinds of Fix wireless phones and other wireless devices.

1.2 SYSTEM BLOCK DIAGRAM

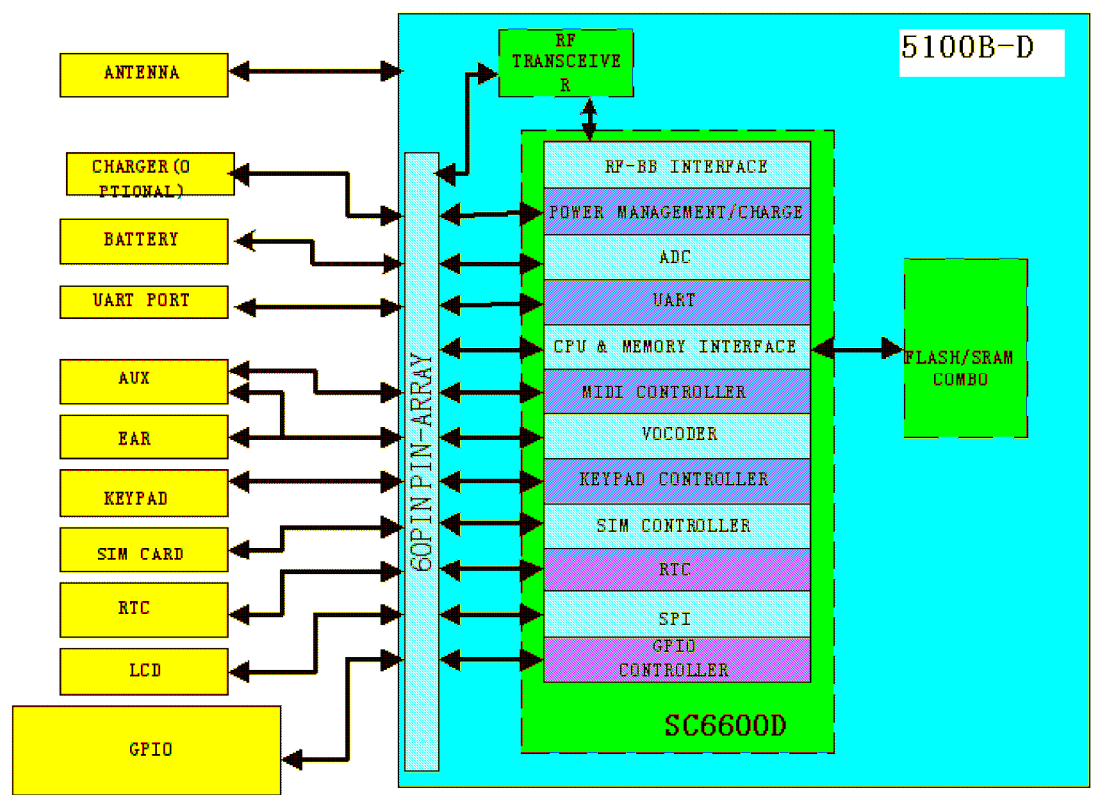


Figure 1: System block diagram

1.3 PRODUCT OVERVIEW

Temperature range	Normal range: -10°C to +55°C (full compliant) Storage: -40°C to +85°C
Weight	< 9g
Physical dimensions	35.0X39.0X2.9 mm (typical)
Connection	60 pins
Power supply	VBAT: 3.3V to 4.2V range, 3.6V typical.

Power consumption	Off mode: <100uA Sleep mode: <2.0mA Idle mode: <7.0mA (average) Communication mode: 350 mA (average,GSM) Communication mode: 2000mA (Typical peak during TX slot,GSM)
Li-ion Battery charging management and interface (OPTION)	Li-ion Battery charging management is included. The charger interface is provided on 60-pin connector. (only for 3.7V Li-ion Battery)
Frequency bands	EGSM900 +GSM850+ DCS1800+PCS1900
Transmit power	Class 4 (2W) for EGSM900/GSM850 Class 1 (1W) for DCS1800/PCS1900
Supported SIM card	3V/1.8V SIM card. (auto recognise)
Keyboard interface	4x6 keyboard interface is provided
UART0 interface with flow control	Up to 460 kbps Full hardware flow control signals (+3.0V) are provided on 60 pins.
UART1 interface without flow control	2-Wire UART interface Up to 460 kbps
LCD interface	Support standard SPI interface

1.4 FUNCTIONAL DESCRIPTION

1.4.1 RF Functionalities

The RF part of this module converts RF signals to baseband for receiver chain and translates base band signals into RF frequency spectrum.

The operating frequencies are:

Rx (EGSM 850): 869 to 894MHz

Tx (EGSM 850): 824 to 849MHz

Rx (EGSM 900): 925 to 960MHz

Tx (EGSM 900): 880 to 915MHz

Rx (DCS 1800): 1805 to 1880MHz

Tx (DCS 1800): 1710 to 1785MHz

Rx (PCS 1900): 1930 to 1990MHz

Tx (PCS 1900): 1850 to 1910MHz

1.4.2 Baseband Functionalities

The baseband part of SM5210 is composed of a SPREADTRUM's SC6600D chip. This chipset is using 0.18 μ m mixed signal CMOS technology which allows massive integration as well as low power consumption. SC6600D provides single-chip solution to wireless Quad-band telephone handsets and data modems conforming to the EGSM 900, GSM 850, DCS 1800 and PCS 1900.

1.4.3 Memory Functionalities

The memory used in this module is a combination of 32 Megabit (2M x 16-Bit) CMOS 3.0V Volt-only, simultaneous operation flash memory and 4 Megabit (256K x 16-Bit) static RAM.

2 INTERFACE AND FUNCTIONALITIES

2.1 POWER SUPPLY

2.1.1 Power Supply Description

The power supply is one of the key issues in the designing GSM terminals. Due to the 577us radio burst emission in GSM every 4.615ms, power supply must be able to deliver high current peaks in a short time. During these peaks, ripples and drops on the supply voltage must not exceed a certain limit.

Table 1: VBAT Pin Description

	Pin number	V _{MIN}	V _{NOM}	V _{MAX}	Ripple max
VBAT (V)	1,3,5,7	3.3V (*)	3.6V	4.2V (**)	50mV _{PP} for freq<200KHz 2mV _{PP} for freq>200KHz

(*): This value has to be guaranteed during the burst (with 2.0A Peak in GSM or GPRS mode).

(**): max operation Voltage Stationary Wave Ratio.

When supplying the module with a battery, the total impedance (battery + protections + PCBS) should be less than 150mOhms.

Table 2: GND Pin Description

	Pin number	Description
GND	9,11,13,15,17 Shielding can install pin(*)	Ground

2.1.2 Power Consumption

Table 3: Power consumption in OFF mode

Mode	Condition	I(Typical)	I(Max)
Off mode	off	50 uA	100uA

Table 4: Power consumption in EGSM 900MHz

Mode	Condition	I(Typical)	I(Max)
GSM850/900mode	During TX bursts @PCL5*	1.6 A	2 A
GSM850/900 mode	During RX bursts	100 mA	130 mA
GSM850/900 mode	Average @PCL5*	350 mA	400 mA
GSM850/900 mode	Average @PCL8*	250 mA	300 mA
GSM850/900 mode	Average idle mode	13 mA	20 mA

(*): PCL: Power control level

PCL5: 2W emission requested (max power)

PCL8: 0.5W emission requested

Table 5: Power consumption in DCS/PCS 1800MHz

Mode	Condition	I(Typical)	I(Max)
DCS/PCS mode	During TX bursts @PCL0*	1.4 A	1.6 A
DCS/PCS mode	During RX bursts	100 mA	130 mA
DCS/PCS mode	Average @PCL0*	300 mA	350 mA
DCS/PCS mode	Average @PCL3*	200 mA	250 mA
DCS/PCS mode	Average idle mode	13 mA	20 mA

(*): PCL: Power control level

PCL0: 1W emission requested (max power)

PCL3: 0.25W emission requested

2.2 VCC OUTPUT

This output can be used to power some external functions, such as LCD.

Table 6: VCC Pin Description

Module Pin No.	Pin name	I/O type	Description
47 , 60	VCC	Supply	2.8V Power supply

Table 7: VCC Electrical Characteristics

Parameter	Unit	Min.	Typ.	Max.
Output Voltage	V	2.5	2.8	3.0
Output Current	mA	Supply		50

2.3 SPI INTERFACE

The SPI bus includes a CLK signal, an IO signal, a RS signal and a CS signal complying with the standard SPI bus.

These pins can also be used as GPIO.

Table 8: SPI Pin Description

Module Pin No.	pin name	I/O type	description
33	GPIO42/LCD_DATA/NBOOT	O	SPI Data
38	GPIO6/LCD_CLK	O	SPI Serial Clock
39	GPIO1/LCD_RST	O	SPI Reset
41	GPIO9/LCD_RS	O	Command/Data Mode Select
54	GPIO8/LCD_CS	O	SPI Enable

Table 9: SPI Electrical Characteristics

Parameter	Min	Max
VL (V)	-	0.8
VH (V)	2.2	-
I (mA)	2	10
Input Impedance C (pF)	5	10

2.4 KEYPAD INTERFACE

This interface provides 10 connections: 4 rows (KBR0 to KBR3) and 6 columns (KBC0 to KBC5).

Table 10: Keypad Pin Description

Module Pin No.	60-pin NAME	TYPE	DESCRIPTION	FUNCTION
36	KEY_SENSE0	I		Keypad Interface
32	KEY_SENSE1	I		
31	KEY_SENSE2	I		
40	KEY_SENSE3	I		
24	KEY_DRIVER0	O		
28	KEY_DRIVER1	O		
26	KEY_DRIVER2	O		
23	KEY_DRIVER3	O		
25	KEY_DRIVER4	O		
30	KEY_DRIVER5	O		

No external pull-up resistors are needed when the internal pull-up at the input pads are enabled.

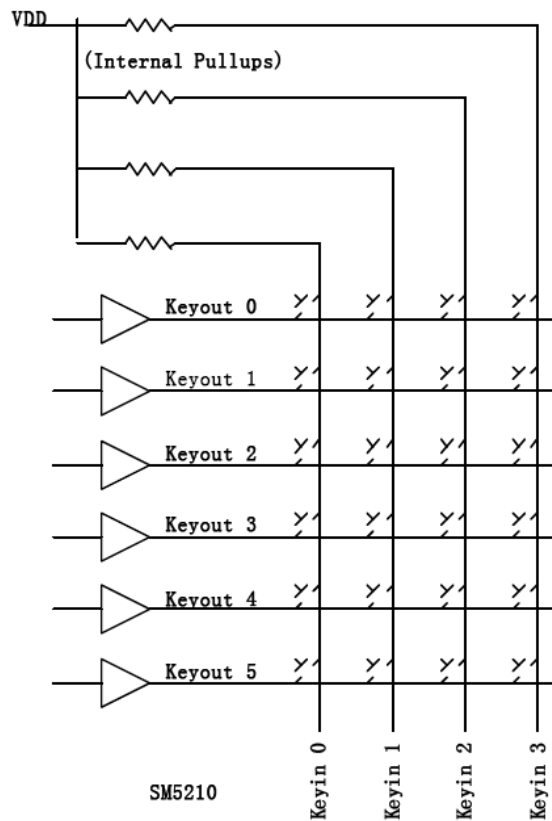


Figure 2: Keypad connection SIM

2.4.1 General Description

The SIM interface is compatible with the ISO 7816-3 IC card standard required by the GSM 11.11 Phase 2+ standard. The module also supports Release 99 of the SIM Toolkit recommendation and supports a Fixed Dialling Number directory.

2.4.2 SIM Interface

Table 11: SIM Pin Description

Pin number	Pin name	Type	Description
29	SIM_DA	I/O	SIM Serial Data
27	SIM_CLK	O	SIM Clock
21	SIM_RST	O	SIM Reset
51	SIM_VCC	P	SIM Power Supply

Table 12: SIM Electrical Characteristics

parameter	Min	Max	Remarks
VL (V)	-	0.6/0.8	
VH (V)	1.3/2.2	-	

SIM card connection:

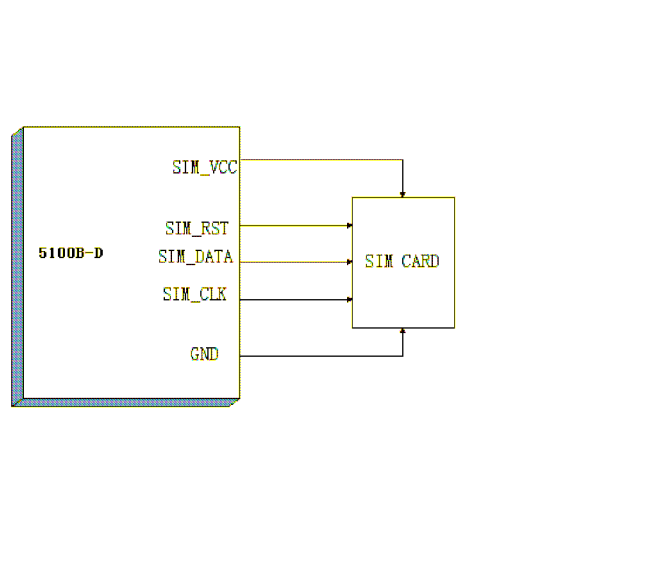


Figure 3: SIM connection (no power control)

Figure 3 shows system design for 3.0V and 1.8V SIM card interface. The SIM level shift is built in the SC6600D chip.

Note: 1)SIM_VCC need add three capacitor: 4.7uF,0.1uF, 27pF.

2)SIM_RST,SIM_DATA,SIM_CLK lines also need add 27pF capacitor for each line.

3) SIM_DATA need to Pull-up with 2K resistor to SIM_VCC.

NOTES: Does not support 5V SIM card.

2.5 AUDIO

The module supports the following voice codec:

- Full-Rate
- Enhanced Full Rate

Two different microphone inputs and two different speaker outputs are supported.

2.5.1 Audio Interface

Table 13: Audio Pin Description

Pin number	Pin name	Type	Description	Function
18	EAR_SPKP	AO	Earphone Differential Positive Output	Voice Band
16	EAR_SPKN	AO	Earphone Differential Negative Output	
14	EAR_MICP	AI	Microphone Differential Positive Input	
12	EAR_MICN	AI	Microphone Differential Negative Input	
44	AUX_SPKP	AO	Auxiliary Speaker Differential Positive Output	Auxiliary
58	AUX_SPKN	AO	Auxiliary Speaker Differential Negative Output	
42	AUX_MICP	AI	Auxiliary Microphone Differential Positive Input	Voice Band
50	AUX_MICN	AI	Auxiliary Microphone Differential Negative Input	

Their frequency response curve should be within the mask given by GSM specification.

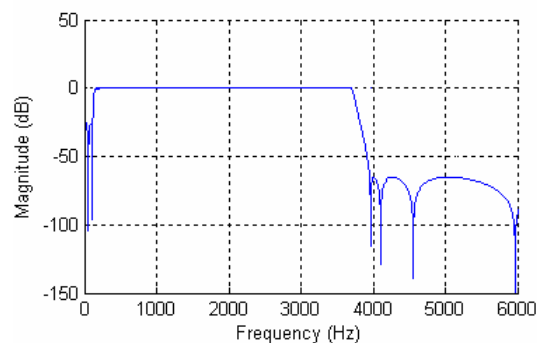


Figure 4: Audio Frequency Response Curve

2.5.2 Typical Microphone Inputs Characteristics

The gain of MIC inputs is internally adjusted and can be turned from 9dB to 42dB.

Table 14: Microphone Electrical Characteristics

Parameter	Conditions/Comments	Min.	Typ.	Max.	Units
Input common mode range	EAR_SPKP	0.6		1.8	V
PGA gain range		9		42	dB
Maximum analog input range after PGA	Differential			±1.5	V
Digital audio output sample rate			8		kHz
ADC resolution		13			bits
ADC signal to (noise + distortion) ratio				AO	dB
Digital output word			16		bits

2.5.3 Typical Speaker Outputs Characteristics

The gain of speaker outputs is internally adjusted and can be turned from -21dB to 12dB.

Table 15: Speaker Electrical Characteristics

Parameter	Conditions/Comments	Min.	Typ.	Max.	Units
Maximum differential output voltage			±1.4		V
Maximum single-ended output voltage			1.4		V
Output common mode voltage			1.1		V
Minimum load resistance		16			Ω
gain range		-21		12	dB

2.5.4 Typical Microphone Connection

Two MIC inputs already include the biasing for an electret microphone allowing easy connection to the headset.

The connection can be either differential or single ended; but using a differential connection in order to reject common mode noise TDMA noise is strongly recommended.

- Recommended characteristics for the microphone Type: Electret

- Impedance: 2.2Kohm
- Sensitivity: -42dB(typ)
- SNR > 50dB min
- Frequency response compatible with the GSM specifications

2.5.4.1 Differential Connection

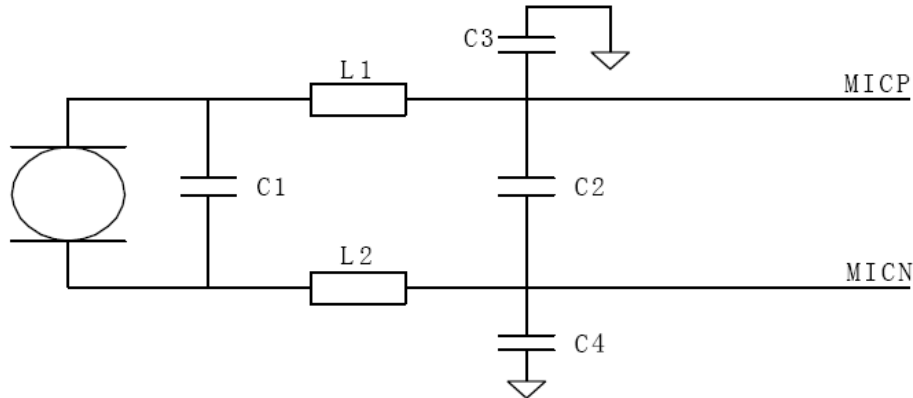


Figure 5: MIC input (differential input)

The recommended characteristic of capacitors:

$C1=22\text{pF}$ to 47pF

$C2=C3=C4=47\text{pF}$ to 100pF

$L1=L2=100\text{nH}$

Microphone manufacturer can provide a microphone soldered C1 directly on it, so that C1 can be the nearest to the Microphone.

2.5.4.2 Single-ended Connection

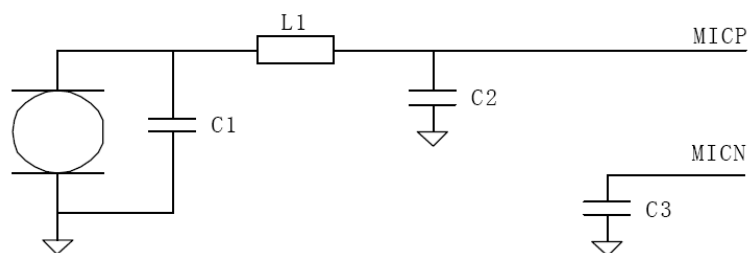


Figure 6: MIC input (single-ended input)

Do not recommend this connection.

When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

The recommended characteristic:

$C1=22\text{pF}$ to 47pF

$C2= C3=47\text{pF}$ to 100pF

L1= 100nH

Microphone manufacturer can provide a microphone soldered C1 directly on it, so that C1 can be the nearest to the Microphone.

2.5.5 Typical Speaker Connection

- Recommended characteristics for the speaker
- Type: 10 to 100mW, electro-magnetic
- Impedance: 16 to 150 Ohm
- Sensitivity: 110dB SPL min. (0dB = 120uPa)

Frequency response compatible with the GSM specifications.

2.5.5.1 Differential Connection

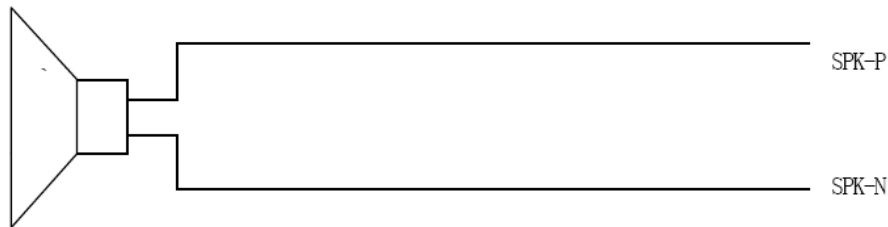


Figure 7: SPK output (differential output)

It shall drive up to 200mW speaker without external amplifier.

These traces have to be isolated from the others by ground on the motherboard layout.

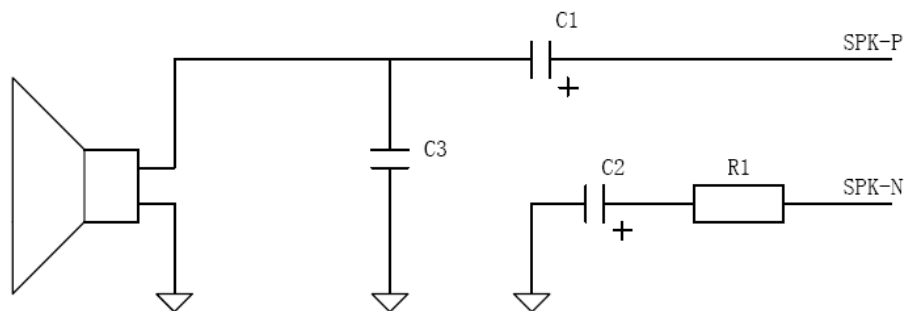


Figure 8: SPK output (single-end output)

These traces have to be isolated from the others by ground on the motherboard layout.

The recommended characteristic:

C1=C2=4.7uF to 47uF as per the speaker characteristics and the output power.

C3=33pF to 100pF

R1= Speaker Impedance

Single-ended connection mode loss half of the output power compared to a differential

connection mode.

2.6 GENERAL PURPOSE INPUT/OUTPUT

Table 16: GPIO Electrical Characteristics

Signal	VL (V)		VH (V)		Remarks	
	Min	Max	Min	Max		
Input	0	+0.9	+2.1	+3.0		
Output (< 10mA)	-	+0.9	+2.1	-		
Parameter	Conditions/Comments		Min.	Typ.	Max.	Unit
Input Impedance (R)			500k	1M	10M	Ohm
Input Impedance (C)			5	7	10	pF

LinkSprite GSM/GPRS module can provide 6 general purpose I/O.

Table 17: Pin Description

Pin number.	Pin name	Type	Description
35	GPIO4	I/O	General Purpose I/O
37	GPIO10	I/O	General Purpose I/O
49	GPIO26	I/O	General Purpose I/O
53	GPIO11	I/O	General Purpose I/O
55	GPIO3	I/O	General Purpose I/O
57	GPIO46	I/O	General Purpose I/O

The following GPIOs are not available (reserved) in case of module running with the AT commands firmware.

Table 18: Pin Description

Pin number.	Pin name	Type	Comment
10	GPIO19/ U0_CTS/JTAG_TMS	I/O	U0_CTS/JTAG_TMS
22	GPIO17/U0_RTS/JTAG_DI	I/O	U0_RTS/JTAG_DI

52	GPIO16/ U0_DTR/JTAG_DO	I/O	U0_DTR/JTAG_DO
45	GPIO18/ U0_DSR/JTAG_CK	I/O	U0_DSR/JTAG_CK
56	GPIO20(*)/JTAG_RST/PWMB	I/O	JTAG_RST/PWMB
33	GPIO42(*)/ LCD_DA/NBOOT	I/O	LCD_DA/NBOOT
38	GPIO6/ LCD_CLK	I/O	LCD_CLK
39	GPIO1/ LCD_RST	I/O	LCD_RST
41	GPIO9/ LCD_RS	I/O	LCD_RS
54	GPIO8/ LCD_CS	I/O	LCD_CS

2.7 UART

It is strongly recommended to make this interface externally accessible for debug.

2.7.1 UART Electrical Characteristics

Table 19: UART Electrical Characteristics

Parameter	Min	Min	Remarks
VL (V)	-	0.8	
VH (V)	2.2	3.2	
I (mA)	2	10	
Freq (kHz)	-	460	
Input Impedance C (pF)	5	10	

2.7.2 6-Wire UART 0 Interface

This UART port is also called UART 0, used only by ARM. It consists of the following pins.

Table 20: UART0 Pin Description

Pin number	Pin name	Type	Signal	Description
19	TXD0	O	U0TXDN	Transmit Data
20	RSD0	I	U0RXDN	Receive Data
10	GPIO19/ U0_CTS/JTAG_TMS	I	U0CTSN	Clear to Send
22	GPIO17/U0_RTS/JTAG_DI	O	U0RTSN	Request to Send

52	GPIO16/ U0_DTR/JTAG_DO	O	U0DTRN	Data Terminal Ready
45	GPIO18/ U0_DSR/JTAG_CK	I	U0DSRN	Data Set Ready

The hardware flow control pins are also shared with JTAG pins. When JTAG is used, only RX and TX pins are available, reducing to a 2-wire UART port.

UART's rate is up to 460kbps max.

2.7.3 2-Wire UART 1 Interface

This UART is also called UART 1 and can be used by either ARM or TeakLite. It consists of the following pins.

Table 21:UART1 Pin Description

Module Pin No.	60-pin NAME	TYPE	SIGNAL	DESCRIPTION
46	TX1	O	TXD	Transmit Data
43	RX1	I	RXD	Receive Data

There is no hardware flow control for this UART interface.

UART's rate is up to 460kbps max.

2.8 RTC POWER INTERFACE

This pin is used as a back-up power supply for the internal Real Time Clock. The RTC is supported by the module when powered on but a back-up power supply is needed to save time when the module is power off.

If the RTC is not used, this pin can be left open.

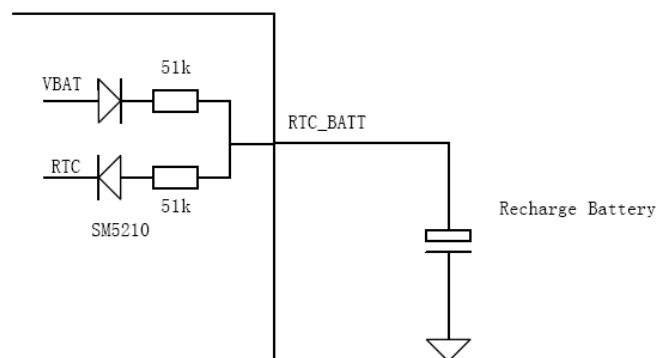


Figure 9: RTC battery connection

Recommended characteristics:

Recharge Battery: 3.0V 2.5mAH for 70 hours (Estimation)

Table 22: RTC Pin Description

Pin number	Pin name	TYPE	Description
48	RTC_BATT	Supply	Power Supply for RTC

Table 23: RTC Electrical Characteristics

Parameter	Min.	Typ.	Max.
V (V)	2.7	3.0	3.3
I (uA)	15	15	25

2.9 ADC Interface

The module can provide two ADC ports ranging from 0.1 to 1.2V, 0 to 8V.

Table 24: ADC Pin Description

Pin number.	Pin name	TYPE	DESCRIPTION	Input Rang
6	ADCIN1	AI	A/D Converter	0.3~3.0V
8	ADCIN2	AI	A/D Converter	0.3~3.0V

Table 25: ADC Electrical Characteristics

Parameter	Conditions/Comments	Min.	Typ.	Max.	Unit
Resolution	Guaranteed monotonic to 9 bits		10		bits
Integral non-linearity				±3	LSB
Differential non-linearity				±2	LSB
Number of input channels			4		
Conversion time				15	μs
Power up settling time				10	μs
Input Impedance (C)		5	7	10	pF

2.10 Reset

This signal is used to force a reset procedure by providing a low level voltage during at least 100 μ s. This signal has to be considered as an emergency reset only. A reset procedure is already driven by an internal hardware during the power-on sequence. **This pin function is only for NOR flash RESET.**

This signal is only an internal reset. It can not be used to provide a reset to an external device. Reset process is activated either by the external reset signal or by an internal signal (coming from a reset generator). This automatic reset is activated at power-up.

The pin is held low at power-up. An internal capacitor can provide a 100 μ s delay. If an external capacitor is connected at the RESET pin, the delay would be

$$T_{\text{delay}} = 1 \text{ ms} * C_{\text{extcap}} / 100 \text{ pF}$$

Table 26: Pin Description

Pin number	Pin name	Type	Description
34	RESET	I	Asynchronous Reset, active low

Table 27: Electrical Characteristics

Parameter	Min	Max
VL (V)	-	0.8
VH (V)	2.2	-
I (mA)	2	10
Input Impedance C (pF)		
Input Impedance R (Kohm)		

2.11 Power On Interface

This input is to switch ON GSM/GPRS module. A high level voltage has to be provided on this pin to switch on the module. After the module is switched on, this pin will be set as GPIO, the Power ON function will be screened.

NOTES: There are no Power OFF functions on this pin.

Table 28: Pin Description

Pin number	Pin name	Type	Description
59	POWER_ON	I	Module Power ON ,High Active

Table 29: Power-On Electrical Characteristics

Parameter	Min	Max
VL (V)	-	0.8
VH (V)	2.2	-
I (mA)	2	10
Input Impedance C (pF)		
Input Impedance R (Kohm)		

2.11.1 Power On Procedure

Once the module supplied, the application must set the POWER_ON pin to high to start the module power on sequence. A power on produce is already driven by an internal hardware after the module is supplied.

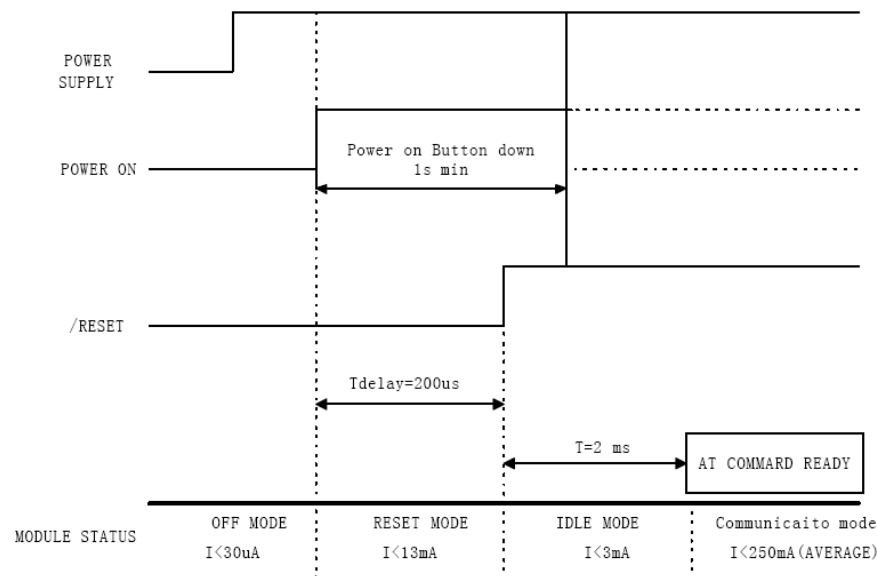


Figure 10: Power-on Sequence

I = overall current consumption (Base Band + RF Band)

2.12 NORMAL/BOOT

This input is used to setting the module booting mode.

Here is the function description:

- Low during reset: Download mode.
- High during reset: Normal-working mode.

In the normal working mode, the handset action is supported by the normal phone call software.

Since the CPU takes its level during reset, the pin can be used for other function after reset.

Table 30: Pin Description

Pin number	Pin name	Type	Description
33	GPO42/LCD_DA/NBOOT	O	Boot mode setting

2.13 BATTERY CHARGING INTERFACE (OPTIONAL)

2.13.1 Li-ion Battery Charge Interface

LinkSprite GSM/GPRS module supports one Li-ion battery charging. The charging circuit is built in the module. The circuit uses an interface VCHG to supply a constant charge current. This current value depends on the battery capacity. It is recommended to provide a current of $2/3C$. The current default charge setting in module is 500mA.

LinkSprite GSM/GPRS module also can monitor the battery voltage, and detect the end of the charge. This function is built into the module.

Table 31: Pin Description

Pin number	Pin name	Type	Signal	Description
2, 4	VCHAG	AI	CHG-IN	CHARGE INPUT

Table 32: Charge Electrical Characteristics

Parameter	Min.	Typ.	Max.	Unit
VCHAG	5	5.2	5.5	V

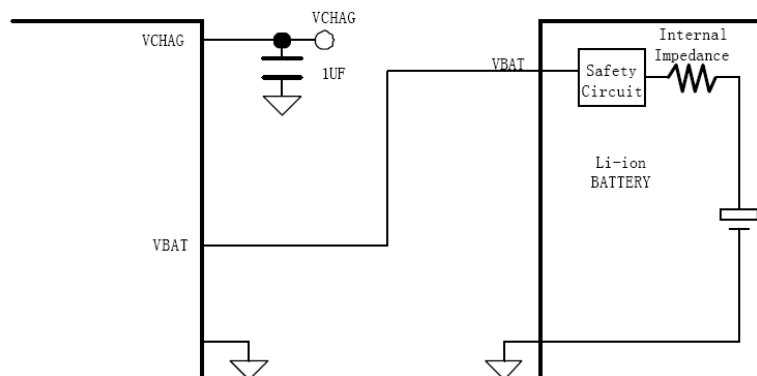


Figure 11: Battery Charging Connection

2.14 RF INTERFACE

The nominal impedance is 50 ohm.

2.14.1 RF Connection

One gold plated land pattern sitting at the corner of the module supports the RF connection. Application could access it through spring contacts or a soldered RF cable. Since no standard spring contact is available for the module, this solution requires customization design for the contact.

2.14.2 Antenna Specifications

The antenna shall meet the following requirements:

Table 33: Quad Frequency Band

	GSM 850	EGSM900	DCS1800	PCS 1900
Frequency Rx	869 to 894MHz	925 to 960MHz	1805 to 1880MHz	1930 to 1990MHz
Frequency Tx	824 to 849MHz	880 to 915MHz	1710 to 1785MHz	1850 to 1910MHz

- Frequency bands: Quad band GSM 850MHz, EGSM 900MHz, DCS 1800MHz & PCS 1900 MHz.
- Impedance: 50 ohm
- VSWR Tx max 2:1 / Rx max 2:1
- Typical radiated gain: 0dB

The RF performance is compliant with the ETSI recommendation 05.05 and 11.10 (Normal MS requirements).

Table 34: RF Performance

Receiver	
EGSM/GSM 850 Sensitivity	<-104dBm
DCS1800/PCS1900 Sensitivity	<-102dBm
Selectivity @ 200KHz	>+9dBc
Selectivity @ 400KHz	>+41dBc
Dynamic Range	62dB
Intermodulation	>-43dBm
Co-channel Rejection	>=9dBc

Transmitter	
Max. Output Power (EGSM/GSM 850)	+33dBm +/-2dB
Max. Output Power (DCS1800/PCS 1900)	+30dBm +/-2dB
Min. Output Power (EGSM/GSM 850)	5dBm +/-5dB
Min. Output Power (DCS1800/PCS 1900)	0dBm +/-5dB
H2 Level	<-30dBm
H3 Level	<-30dBm
Noise in 925 to 935MHz	< -67dBm
Noise in 935 to 960MHz	< -79dBm
Noise in 1805 to 1880MHz (DCS1800/PCS 1900)	< -71dBm
Phase Error at Peak Power	< 5 degrees rms
Frequency Error	+/-0.1ppm max.

3 TECHNICAL SPECIFICATIONS

3.1 PIN LIST

Table 35: LinkSprite GSM/GPRS Module 60-pin Description

PIN NO.	Pin name	1st Function			2nd Function		
		Name	Type	Description	Name	Type	Description
1	VBAT	VBAT	V	Battery Voltage			
2	VCHG	VCHG	V	Charge Voltage Supply			
3	VBAT	VBAT	V	Battery Voltage			
4	VCHG	VCHG	V	Charge Voltage Supply			
5	VBAT	VBAT	V	Battery Voltage			
6	ADIN1	ADIN1	AI	Detect Volt of Battery			
7	VBAT	VBAT	V	Battery Voltage			
8	ADIN2	ADIN2	AI	ADC			
9	GND	GND	G	Digital Ground			
10	GPIO19/U0_CTS/JTAG_TMS	U0_CTS	I	Clear to Send	GPIO19	I/O	GPIO
11	GND	GND	G	Digital Ground			
12	EAR_MICN	EAR_MICN	AI	Microphone Differential Negative Input			
13	GND	GND	G	Digital Ground			
14	EAR_MICP	EAR_MICP	AI	Microphone Differential Positive Input			
15	GND	GND	G	Digital Ground			
16	EAR_SPKN	EAR_SPKN	AO	Earphone Differential Negative Output			

17	GND	GND	G	Digital Ground			
18	EAR_SPKP	EAR_SPKP	AO	Earphone Differential Positive Output			
19	TXD0	U0TXD	O	Transmit Data			
20	RXD0	U0RXD	I	Receive Data			
21	SIM_RST	SIM_RST	O	SIM Reset			
22	GPIO17/U0_RT SN/JTAG_DI	U0_RTS	O	Request to Send	GPIO17	I/O	GPIO
23	KEY_DRV3	KEY_DRV3	O	Keypad Out			
24	KEY_DRV0	KEY_DRV0	O	Keypad Out			
25	KEY_DRV4	KEY_DRV4	O	Keypad Out			
26	KEY_DRV2	KEY_DRV2	O	Keypad Out			
27	SIM_CLK	SIM_CLK	O	SIM Clock			
28	KEY_DRV1	KEY_DRV1	O	Keypad Out			
29	SIM_DA	SIM_DA	I/O	SIM Serial Data			
30	KBY_DRV5	KEY_DRV5	O	Keypad Out			
31	KEY_SEN2	KEY_SEN2	I	Keypad Input			
32	KEY_SEN1	KEY_SEN1	I	Keypad Input			
33	GPO42/LCD_D A/NBOOT	LCD-DATA	O	LCD_DATA_SPI	NBOOT	I	BOOT
34	RESET	RESET	I	Asynchronous reset, active low			
35	GPIO4/HF_CTR L	GPIO4	I/O	GPIO			
36	KEY_SEN0	KEY_SEN0	I	Keypad Input			
37	GPIO10/CHAR GE_IN	GPIO10	I/O	GPIO			
38	GPIO6/LCD_CL K	LCD-CLK	O	LCD_CLK_SPI	GPIO6	I/O	GPIO
39	GPIO1/LCD_RS T	LCD-RST	O	LCD_RST_SPI	GPIO1	I/O	GPIO

40	KEY_SEN3	KEY_SEN3	I	Keypad Input			
41	GPIO9/LCD_RS	LCD_RS	O	LCD_RS_SPI	GPIO9	I/O	GPIO
42	AUX_MICP	AUX_MICP	AI	Auxiliary Microphone Differential Positive Input			
43	RXD1	RXD1	I	Receive Data			
44	AUX_SPKP	AUX_SPKP	AO	Auxiliary Speaker Differential Positive Output			
45	GPIO18/U0_DS R/JTAG_CK	U0_DSR	I	Data Set Ready	GPIO18	I/O	GPIO
46	TXD1	TXD1	O	Transmit Data			
47	VCC	VCC	V	2.8V POWER SUPPLY 50mA			
48	RTC_BATT	RTC_BATT	V	RTCVDD 3.0V			
49	GPIO26/LED_B K_CTRL	GPIO26	I/O	GPIO			
50	AUX_MICN	AUX_MICN	AI	Auxiliary Microphone Differential Negative Input			
51	SIM_VCC	SIM_VCC	V	SIM POWER 3V			
52	GPIO16/U0_DT R/JTAG_DO	U0_DTR	O	Data Terminal Ready	GPIO16	I/O	GPIO
53	GPO11/CS3	CS3	O	ARM external CS 3	GPO11	I/O	GPIO
54	GPIO8/LCD_CS	LCD_CS	O	LCD-CS-SPI	GPIO8	I/O	GPIO
55	GPIO3	GPIO3	I/O	GPIO			
56	GPIO20/JTAG_ RST/PWMB	JTAG_RST	O	JTAG Reset	GPIO20	I/O	GPIO
57	GPIO46	GPIO46	I/O	GPIO			
58	AUX_SPKN	AUX_SPKN	AO	Auxiliary			

				Differential Negative Output			
59	POWER_ON	POWER_ON	I	POWER Button Interrupt			
60	VCC	VCC	V	2.8V POWER SUPPLY 50mA			

3.2 ENVIRONMENTAL SPECIFICATIONS

Table 36: Module operating conditions

Parameter	Min	Max
Normal operating range	-10 °C	+55 °C
Supply voltage Vbat	+3.3V	+4.2V

Table 37: Ambient Temperature Conditions

Parameter	Min	Max
Ambient temperature	-10 °C	+55 °C
Storage temperature	-40 °C	+85 °C

4 DESIGN GUIDELINES

4.1 HARDWARE AND RF

4.1.1 EMC

The EMC tests should be conducted at the early stage of any application to detect possible problems.

More attention should be paid to the following issues during designs:

- Possible spurious or/and other unwanted emission radiated by the module to other RF receivers in the receiving band.
- ESD protection on SIM (if accessible from outside), serial link, ...
- EMC protection on audio inputs/outputs
- Bias of the microphone inputs.
- Ground plane location for microphones
- Length of the SIM interface lines (preferably <10cm)
- Metallic case or plastic casing with conductive paint is recommended.

4.1.2 Power Supply

Power supply design is the key in the GSM terminal projects.

A poor power supply design could affect in particular:

- EMC performances
- Emission spectrum
- Phase error and frequency error
- Transmit power

Warning:

Special attention should be paid to:

- Quality of the power supply such as low ripple, PWM converter preferred.
- Capacity to deliver high current peaks in a short time (pulse radio emission)
- Power supply can never be greater than 4.5 V.

4.1.3 Antenna

Antenna structure and integration in the application is a major issue.

Attention should be paid to:

- Selection of the antenna cable (performance, length, type, thermal resistance, etc.)
- Selection of antenna connector (type, losses, mismatch, etc.)
- Antenna isolation from digital circuits (including the interface signals)

A poor antenna could dramatically affect the GSM performance such as sensitivity and transmit power.

Warning:

LinkSprite strongly recommends working with an antenna manufacturer either to develop an antenna for the application or to adapt an existing solution to the application. The antenna adaptation (mechanical and electrical adaptation) is one of the key issues in the design of a GSM terminal.

4.2 MECHANICAL INTEGRATION

Attention should be paid to:

- Antenna cable integration (bend, length, position, etc).
- Legs of the module are mechanically mounted to the ground plane.

5 OUTLINE DRAWING

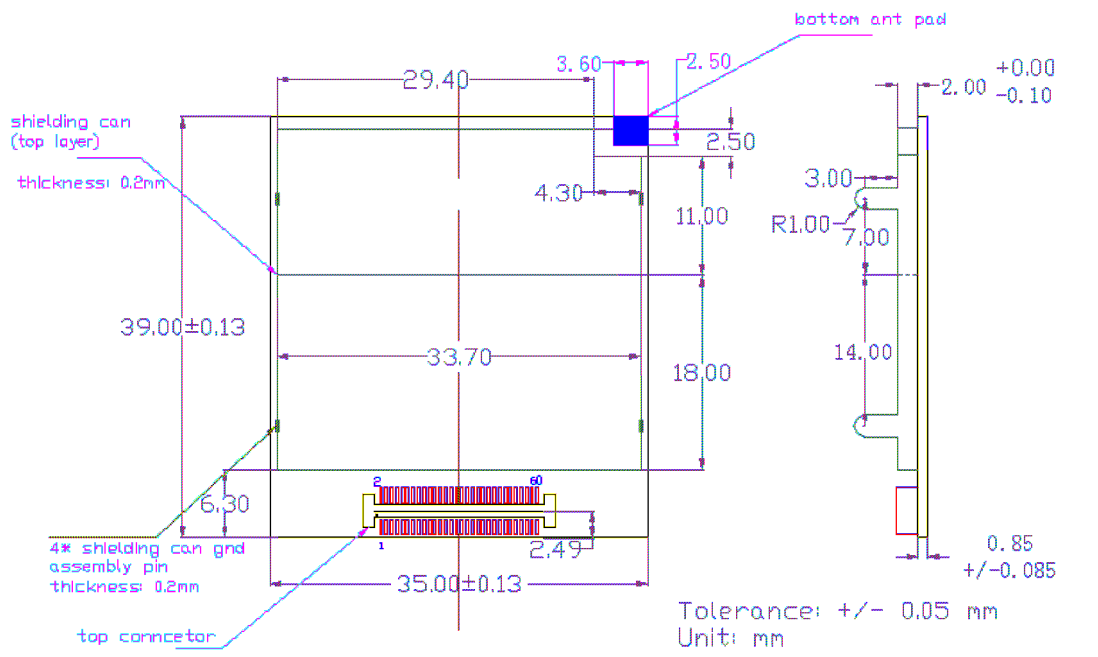


Figure 12: LinkSprite GSM/GPRS Module Outline Drawing (Bottom View / Side View)

6 INTEGRATION

6.1 60-PIN CONNECTOR

6.1.1 Connector

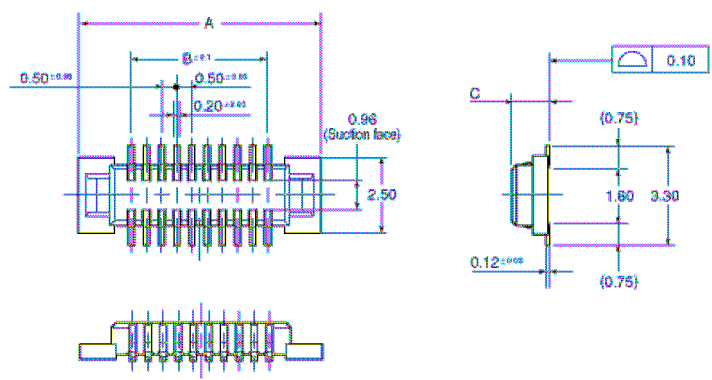


Figure 13: 60-pin Header Dimension

Recommended PC Board Mounting pattern:

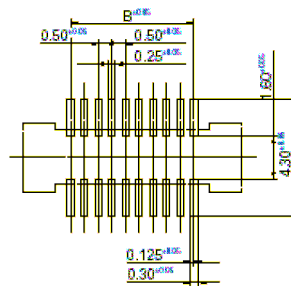


Figure 14: 60-pin Header PCB Pattern

Dimensions and references:

Table 38: 60-pin Header Descriptions

Pin Number	Reference	A (mm)	B (mm)	C (mm)
60	AXK6F60345P	28.00	24.5	1.25

6.1.2 Mother Board 60-pin Connector

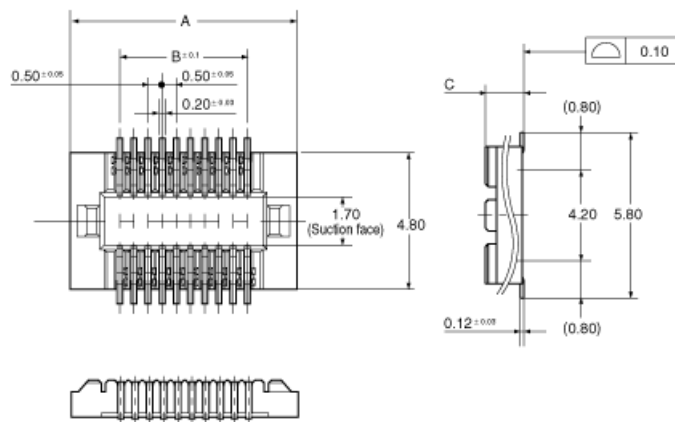
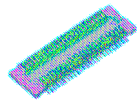


Figure 15: 60-pin Socket Dimension

Recommended PC Board Mounting pattern:

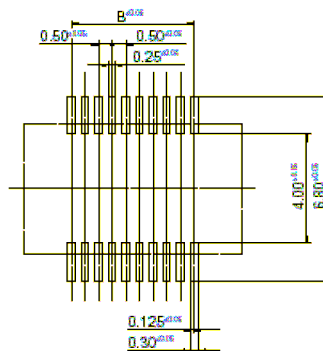


Figure 16: 60-pin Socket PCB Pattern

Dimensions and references:

Table 39: 60-pin Socket Descriptions

Pin Number	Reference	A (mm)	B (mm)	C (mm)
60	AXK5F60545P	28.00	24.5	1.85

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