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HUAWEI MG323-B GSM LCC Module

Hardware Guide

Issue 04

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About This Document

History

Version	Date	Chapter	Descriptions
03	2012-04-12		Creation
04	2012-07-02	6.4	Revised Figure 6-1 Dimensions of the MG323-B module (unit: mm)
		6.5.1	Revised Figure 6-2 PCB pad design (Top View)
		6.6	Revised 6.6 Stencil Design

Contents

1 Introduction

This document describes the hardware application interfaces and air interfaces that are provided when the Huawei MG323-B GSM LCC module (hereinafter referred to the MG323-B module) is used.

This document helps you to understand the interface specifications, electrical features, and related product information of the MG323-B module.

2 Overall Description

2.1 About This Chapter

This chapter gives a general description of the MG323-B module and provides:

- Function Overview
- Application Block Diagram
- Circuit Block Diagram

2.2 Function Overview

Table 2-1 Feature

Feature	Description
Working bands	GSM/GPRS: 850 MHz/900 MHz/1800 MHz/1900 MHz
Maximum transmission power	GSM850 Class 4 (2 W)
	GSM900 Class 4 (2 W)
	GSM1800 Class 1 (1 W)
	GSM1900 Class 1 (1 W)
Receiver sensitivity	< –107 dBm
Working temperature	Normal working temperature: –20°C to +70°C
	Extreme working temperatures: –30°C to –20°C and +70°C to +75°C
Ambient temperature for storage	–40°C to +85°C
Power voltage	3.3 V to 4.2 V (3.8 V is recommended.)
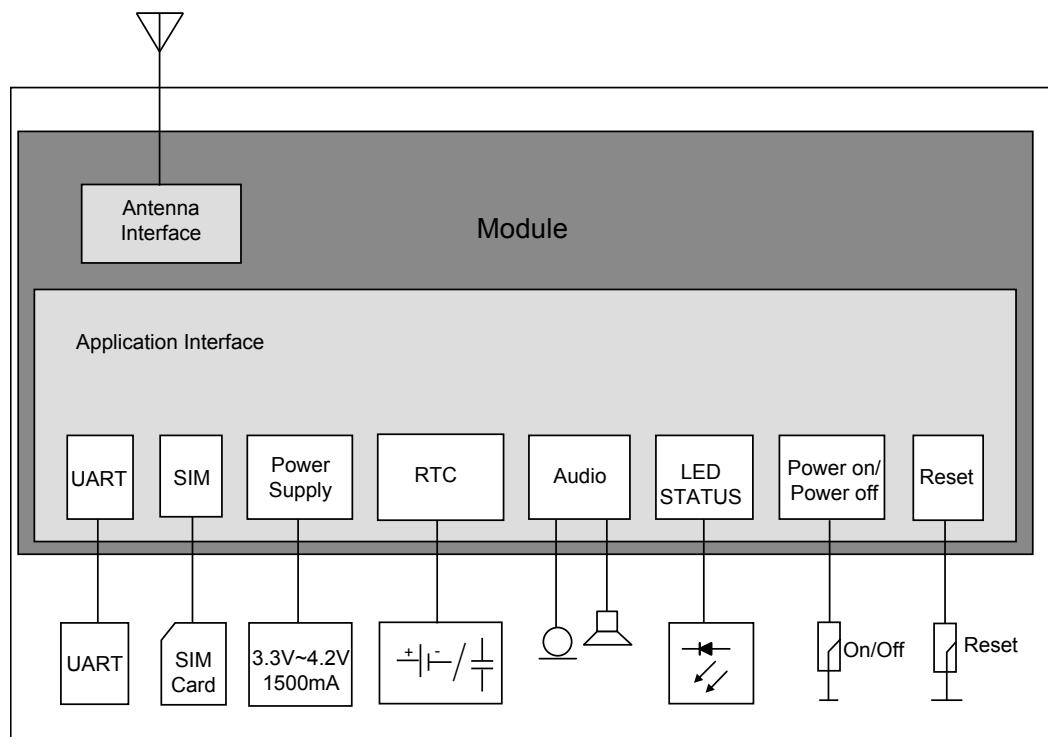
Feature	Description		
Power consumption (current)	Power-off current: 50 µA		
	Average standby current	MFRMS=2	I< 3.0 mA
		MFRMS=5	I< 3.0mA
		MFRMS=9	I< 3.0 mA
	GPRS Class 10 (maximum): $I_{typical}$=460 mA		
Protocols	GSM/GPRS Phase2/2+		
AT commands	See the *HUAWEI MG323-B GSM LCC Module AT Command Interface Specification*.		
Application interface (68-pin LCC interfaces)	UART 1 (supporting 8-wire UART) and UART 0 (supporting 2-wire UART)		
	One standard Subscriber Identity Module (SIM) card interface (3 V or 1.8 V)		
	Interfaces for two analog audio channels		
	Power Interface		
	Network status light-emitting diode (LED) control interface		
Antenna interface	Antenna pad		
Voice services	Two analog voice channels		
SMS	New message alert, text message receiving, and text message sending		
	Management of text messages: read messages, delete messages, storage status, and message list		
	Support for the protocol data unit (PDU) mode		
GPRS	GPRS CLASS 10		
	Encoding schemes: CS 1, CS 2, CS 3, and CS 4		
	Maximum downlink transmission rate: 85.6 kbps		
	Maximum uplink transmission rate: 42.8 kbps		
	Packet Broadcast Control Channel (PBCCH)		
	Embedded with TCP/IP protocols, supporting multiple links		
Circuit Switched Data (CSD) data services	CSD data services at the maximum rate of 9.6 kbit/s		
Physical features	• Dimensions (L × W × H): 24 mm X 24 mm X 2.95 mm • Weight: <3.5 g		

Feature	Description
Certification information	Restriction of the use of certain Hazardous Substances (RoHS)
	European Conformity (CE)
	China Compulsory Certification (CCC)
	GSM Certification Forum (GCF)

2.3 Application Block Diagram

Figure 2-1 shows the application block diagram of the MG323-B module.

Figure 2-1 Application block diagram of the MG323-B module
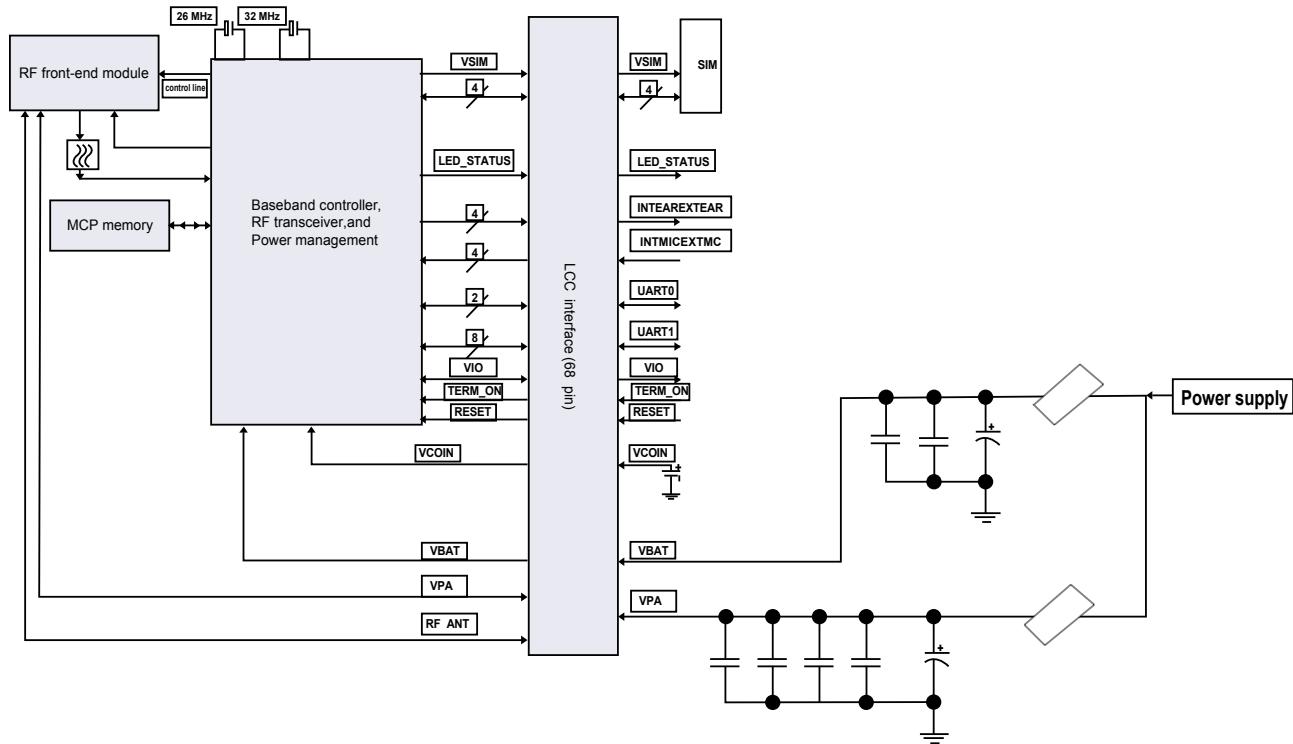
2.4 Circuit Block Diagram

The circuit block diagram and major functional units of the MG323-B module contain the following parts:

- GSM baseband controller
- Power management
- Multi-chip package (MCP) memory
- Radio frequency (RF) transceiver

- 26 MHz reference clock
- RF front-end modules
- Receive filter

Figure 2-2 Circuit block diagram of the MG323-B module

3 Description of the Application Interfaces

3.1 About This Chapter

This chapter mainly describes the external application interfaces of the MG323-B module, including:

- LCC Interface
- Power Interface
- Signal Control Interface
- UART 0 Interface
- UART 1 Interface
- SIM Card Interface
- Audio Interface
- RF Antenna Interface
- NC Interfaces

3.2 LCC Interface

The MG323-B module uses a 68-pin LCC as its external interface. For details about the model and dimensions of the LCC, see "6.4 Dimensions of the Module."

Table 3-1 shows the definitions of pins on the LCC signal interface of the MG323-B module.

Table 3-1 Definitions of pins on the LCC interface

Pin No.	Pin Name		I/O	Description	DC Characteristics (V)		
	Normal	MUX			Min.	Typ.	Max.
1	GND	-	-	Ground	-	-	-
2	GND	-	-	Ground	-	-	-
3	GND	-	-	Ground	-	-	-
4	RF_ANT	-	-	RF antenna interface	-	-	-

Pin No.	Pin Name		I/O	Description	DC Characteristics (V)		
	Normal	MUX			Min.	Typ.	Max.
5	GND	-	-	Ground	-	-	-
6	GND	-	-	Ground	-	-	-
7	VPA	-	P	Power supply for PA	3.3	3.8	4.2
8	VPA	-	P	Power supply for PA	3.3	3.8	4.2
9	GND	-	-	Ground	-	-	-
10	NC	-	-	Not connected, please keep this pin open	-	-	-
11	LED_STATUS	-	O	network status indicating	–0.4	2.8	3.2
12	NC	-	-	Not connected, please keep this pin open	-	-	-
13	NC	-	-	Not connected, please keep this pin open	-	-	-
14	NC	-	-	Not connected, please keep this pin open	-	-	-
15	NC	-	-	Not connected, please keep this pin open	-	-	-
16	NC	-	-	Not connected, please keep this pin open	-	-	-
17	NC	-	-	Not connected, please keep this pin open	-	-	-
18	NC	-	-	Not connected, please keep this pin open	-	-	-
19	NC	-	-	Not connected, please keep this pin open	-	-	-
20	VIO	-	P	external power output	2.7	2.8	2.95
21	VBAT	-	P	Power supply for baseband	3.3	3.8	4.2
22	VBAT	-	P	Power supply for baseband	3.3	3.8	4.2
23	GND	-	-	Ground	-	-	-
24	UART1_DCD	-	O	The second group of DCE data carrier detect	–0.4	2.8	3.2
25	URAT1_RING	-	O	The second group of DCE ring indicator	–0.4	2.8	3.2

Pin No.	Pin Name		I/O	Description	DC Characteristics (V)		
	Normal	MUX			Min.	Typ.	Max.
26	UART1_DSR	-	O	The second group of DCE data set ready	–0.4	2.8	3.2
27	UART1_DTR	-	I	The second group of DCE data terminal ready	–0.4	2.8	3.2
28	UART1_TD	-	I	The second group of DCE receive data	–0.4	2.85	3.25
29	UART1_RD	-	O	The second group of DCE transmit data	–0.4	2.85	3.25
30	UART1_CTS	-	O	The second group of DCE clear to send	–0.4	2.85	3.25
31	UART1_RTS	-	I	The second group of DCE request to send	–0.4	2.85	3.25
32	GND	-	-	Ground	-	-	-
33	EXTEAR_N	-	AO	Negative pole of the output of headset speaker	-	-	-
34	EXTEAR_P	-	AO	Positive pole of the output of headset speaker	-	-	-
35	INTMIC_P	-	AI	Positive pole of the input of handset microphone	-	-	-
36	INTMIC_N	-	AI	Negative pole of the input of handset microphone	-	-	-
37	INTEAR_N	-	AO	Negative pole of the output of handset speaker	-	-	-
38	INTEAR_P	-	AO	Positive pole of the output of handset speaker	-	-	-
39	EXTMIC_P	-	AI	Positive pole of the input of headset microphone	-	-	-
40	EXTMIC_N	-	AI	Negative pole of the input of headset microphone	-	-	-
41	GND	-	-	Ground	-	-	-

Pin No.	Pin Name		I/O	Description	DC Characteristics (V)		
	Normal	MUX			Min.	Typ.	Max.
42	VCOIN	-	P	Standby power input of the RTC	2	3	3.15
43	GND	-	-	Ground	-	-	-
44	NC	-	-	Not connected, please keep this pin open	-	-	-
45	GND	-	-	Ground	-	-	-
46	UART0_RD	-	O	The first group of DCE transmit data	–0.4	2.85	3.25
47	UART0_TD	-	I	The first group of DCE receive data	–0.4	2.85	3.25
48	NC	-	-	Not connected, please keep this pin open	-	-	-
49	NC	-	-	Not connected, please keep this pin open	-	-	-
50	NC	-	-	Not connected, please keep this pin open	-	-	-
51	NC	-	-	Not connected, please keep this pin open	-	-	-
52	NC	-	-	Not connected, please keep this pin open	-	-	-
53	NC	-	-	Not connected, please keep this pin open	-	-	-
54	GND	-	-	Ground	-	-	-
55	SIM_CLK	-	O	Clock signal of the SIM card	–0.4	1.80/2.90	2.2/3.3
56	SIM_DATA	-	I/O	Data signal of the SIM card	–0.4	1.80/2.90	2.2/3.3
57	SIM_RST	-	O	Reset signal of the SIM card	–0.4	1.80/2.90	2.2/3.3
58	VSIM	-	P	Power supply of the SIM card	1.65/2.75	1.80/2.90	1.95/3.00
59	NC	-	-	Not connected, please keep this pin open	-	-	-
60	GND	-	-	Ground	-	-	-
61	NC	-	-	Not connected, please keep this pin open	-	-	-
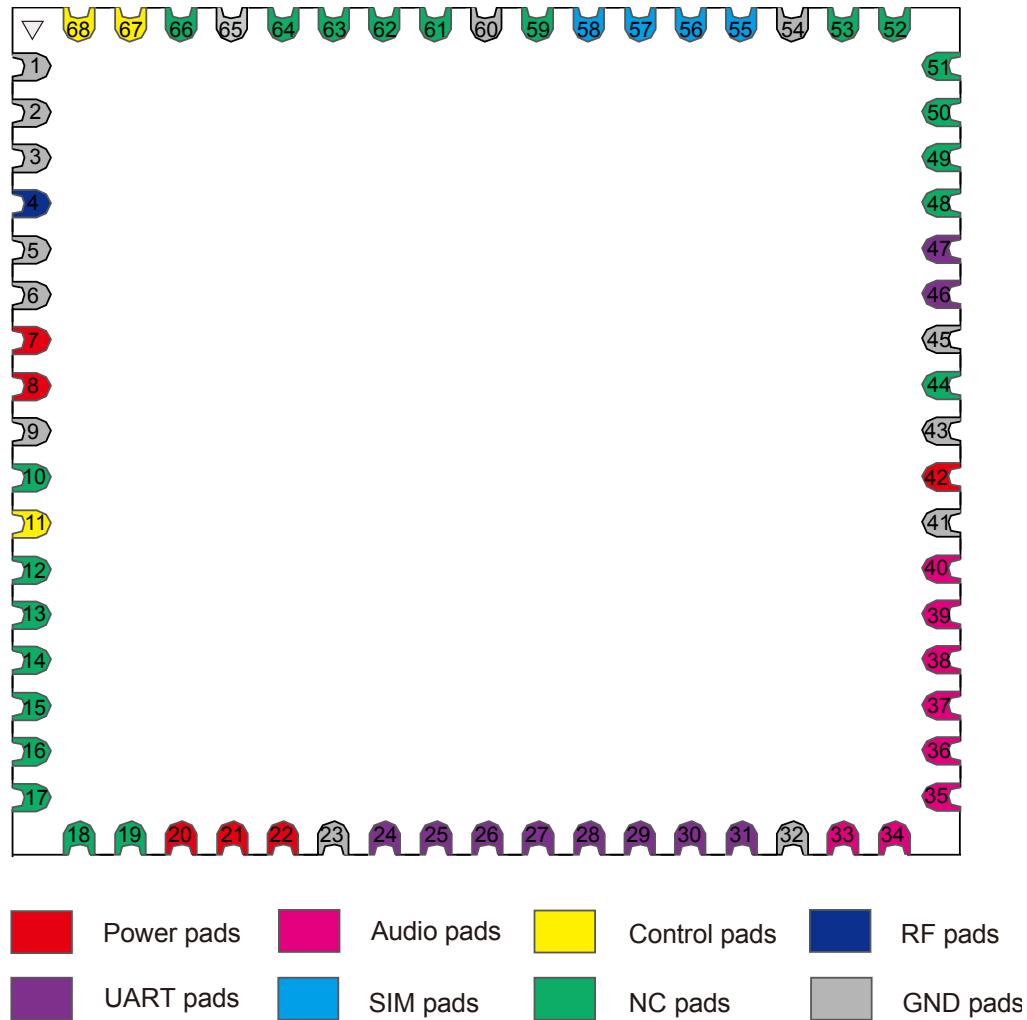
Pin No.	Pin Name		I/O	Description	DC Characteristics (V)		
	Normal	MUX			Min.	Typ.	Max.
62	NC	-	-	Not connected, please keep this pin open	-	-	-
63	NC	-	-	Not connected, please keep this pin open	-	-	-
64	NC	-	-	Not connected, please keep this pin open	-	-	-
65	GND	-	-	Ground	-	-	-
66	NC	-	-	Not connected, please keep this pin open	-	-	-
67	RESET	-	I	Hardware reset	–0.4	2.8	3.2
68	TERM_ON	-	I	Power on/power off control	-	Internal pulled up	-

📖 NOTE

- For detailed information about the pins of MG323-B module, please see Table 5-3 . Electrical features of application interfaces

- **P** indicates power pins; **I** indicates pins for digital signal input; **O** indicates pins for digital signal output; **AI** indicates pins for analog signal input; **AO** indicates pins for analog signal output.

- The **NC** (Not Connected) pins are internally connected to the module. Therefore, these pins should not be used, otherwise they may cause problems. Please contact us for more details about this information.

Figure 3-1 shows the sequence of pins on the 68-pin LCC signal interface of the MG323-B module.

Figure 3-1 The sequence of pins on the 68-pin signal interface of the MG323-B module (top view).

🟥 Power pads	🟪 Audio pads	🟨 Control pads	🟦 RF pads
🟪 UART pads	🟦 SIM pads	🟩 NC pads	⬜ GND pads

3.3 Power Interface

3.3.1 Overview

The power supply part of the LCC interface of the MG323-B module contains:

- VBAT interface for the baseband power supply
- VPA interface for the PA power supply
- VCOIN interface for the standby power supply of the real-time clock (RTC)
- VIO interface for external power output

Table 3-2 lists the definitions of the pins on the power supply interface.

Table 3-2 Definitions of the pins on the power supply interface

Pin No.	Signal Name	I/O	Description
21, 22	VBAT	P	Pins for baseband power voltage input
7, 8	VPA	P	Pins for PA power voltage input
1, 2, 3, 5, 6, 9, 23, 32, 41, 43, 45, 54, 60, 65	GND	-	GND
42	VCOIN	P	Pin for power input of the RTC
20	VIO	P	Pin for 2.8V power output

3.3.2 **VBAT and VPA Interface**
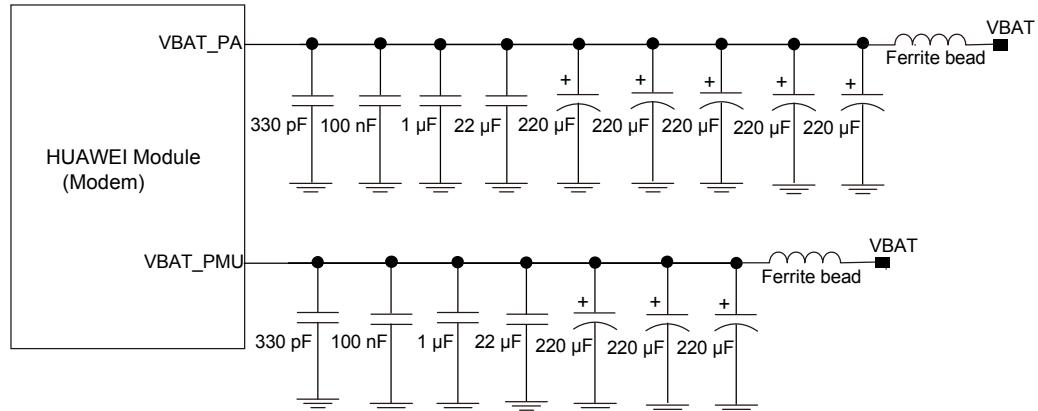
When the MG323-B module works normally, power is supplied through the VBAT and VPA pins and the voltage ranges from 3.3 V to 4.2 V (the typical value is 3.8 V). The 68-pin LCC module provides two VBAT pins, two VPA pins and fourteen GND pins. To ensure that the MG323-B module works normally, all the pins must be connected.

When the MG323-B module is used for different applications, special attention should be paid to the design of the power supply. When the MG323-B module transmits at the maximum power, the transient peak current may reach 2.0 A. In this case, the VPA voltage drops. Make sure that the voltage does not decrease below 3.3 V in any case. Otherwise, exceptions such as reset of the MG323-B module may occur.

A low-dropout (LDO) regulator or switch-mode power supply with load current larger than 2 A is recommended. At least three 220 μF capacitors should be installed to VBAT pins. And the trace of the power supply should be as short and wide as possible.

It is recommended to employ a ferrite bead in series on VBAT and VPA to improve the EMI performance. And the rated current of the ferrite bead is required at least 2 A.

Figure 3-2 shows the recommended power circuit of MG323-B module.

**Figure 3-2** Recommended power circuit of MG323-B module
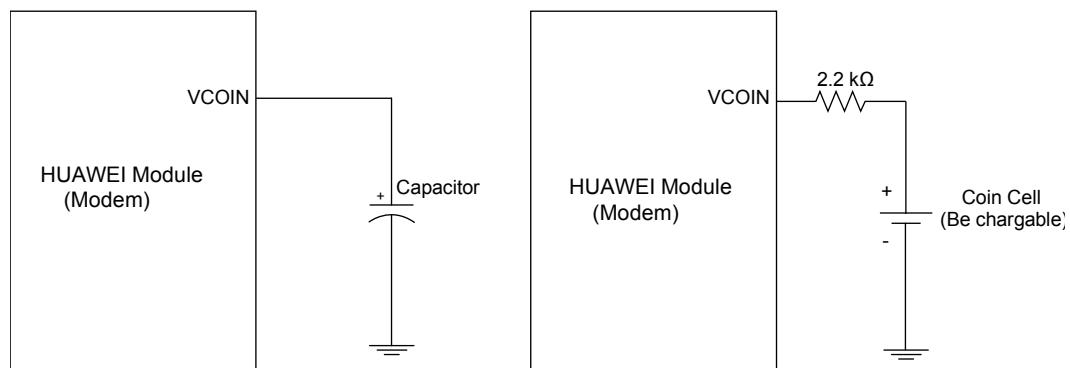
3.3.3 VCOIN Interface

VCOIN is an interface for standby power input of the RTC in the MG323-B module. If the VBAT interface is ready for power supply, it on priority supplies the RTC with power. If the VBAT interface is not ready, the VCOIN interface provides standby power input for the RTC. In this case, the MG323-B module needs 5 µA to maintain the RTC function.

You can use an external battery to supply power through the VCOIN interface. The recommended voltage is 3 V. You can also use an external capacitor if you do not use a battery. The capacitance determines the duration of the RTC when the VBAT interface is not ready.

The MG323-B module supports charging external standby batteries. When the VBAT voltage is 3.8 V, the charging current is about 0.6 mA (typical value). Figure 3-3 shows two types of circuits for your reference.

Figure 3-3 VCOIN interface circuit

3.3.4 VIO Interface

Through the VIO interface, the MG323-B module can supply 2.8 V power externally with an output current of 10 mA (typical value) for external level conversion or other applications.

If the MG323-B module is in Sleep mode, the VIO interface is in the low power consumption state (< 500 µA). If the MG323-B module is in Power Down mode, the VIO is in the disabled state. If VIO pin is not in use, disconnect the pin and make sure it is not grounded.

3.4 Signal Control Interface

3.4.1 Overview

The signal control part of the LCC interface in the MG323-B module consists of:

- Power-on/off (TERM_ON) pin
- Hardware reset (RESET) pin
- Network status (LED_STATUS) pin

Table 3-3 lists the pins on the signal control interface.

Table 3-3 Pins on the signal control interface

Pin No.	Signal Name	I/O	Description
68	TERM_ON	I	Pin for controlling power-on and power-off
67	RESET	I	Pin for resetting the hardware
11	LED_STATUS	O	Pin for network status LED

3.4.2 Input Signal Control Pins

The MG323-B module implements power-on and power-off and resets the hardware through the input signal control pins.

The TERM_ON pin is used to implement power-on and power-off. If the TERM_ON pin is pulled down for 1 second to 2 seconds, the module is powered on; if the TERM_ON pin is pulled down for 1 second to 2 seconds again, the module is powered off.
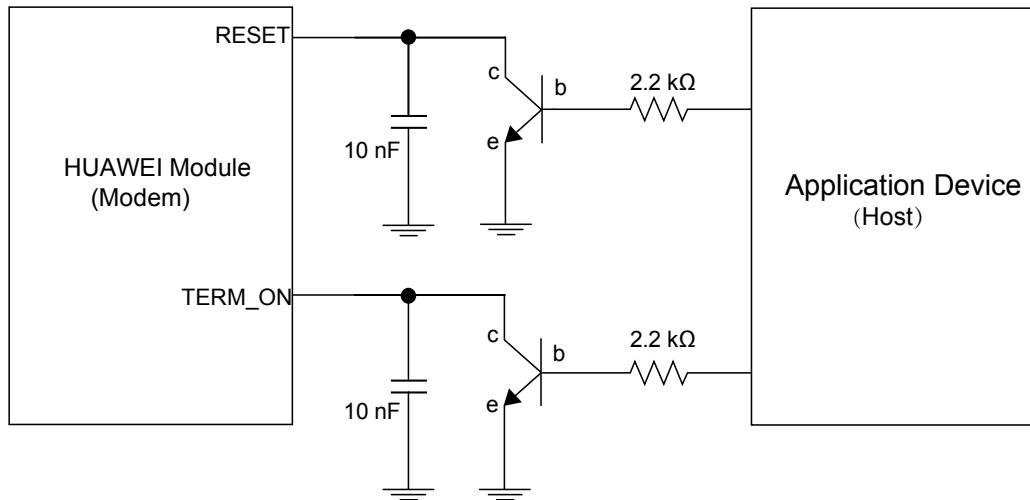
The RESET pin is used to reset the hardware. When the software stops responding, the RESET pin can be pulled down for at least 10 ms to reset the hardware.

⚠ **CAUTION**

As the RESET and TERM_ON signals are relatively sensitive, it is recommended that you install a 10 nF capacitor near the RESET and TERM_ON pins of the LCC interface for filtering. In addition, when you design a circuit on the PCB of the interface board, it is recommended that the circuit length not exceed 20 mm and that the circuit be kept at a distance of 2.54 mm (100 mil) at least from the PCB edge. Furthermore, you need to wrap the area adjacent to the signal wire with a ground wire. Otherwise, the module may be reset due to interference.

Figure 3-4 shows the connections of the TERM_ON and RESET pins.

Figure 3-4 Connections of the TERM_ON and RESET pins

Power-On/Off Time Sequence

The power-on, power-off, and reset control parts of the LCC interface of the MG323-B module includes power-on/power-off interface signal (TERM_ON) and the hardware reset interface signal (RESET). Table 3-3 lists the definitions of the interface pins.

⚠ **WARNING**

- Make sure that the MG323-B module is powered on at the voltage and working temperature in the recommended range. Otherwise, the module may get damaged or work improperly.
- External application interfaces must be powered on after the module is powered on.

You can power on the MG323-B module through the TERM_ON interface. The software will report relevant information according to the actual settings after the module is powered on. For example, the AT command automatically reports **^SYSSTART**[1]. In this case, the external VIO interface is enabled and supplies 2.8 V power.
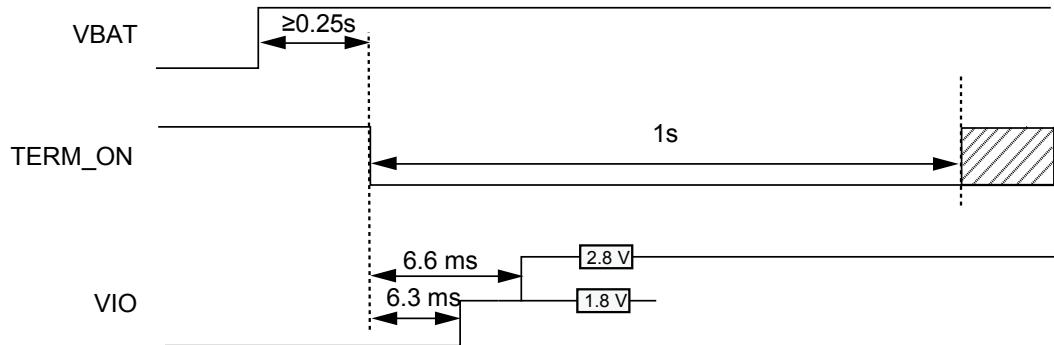
📖 **NOTE**

[1] For specific setting information about the power-on/power-off software, see the *HUAWEI MG323-B GSM LCC Module AT Command Interface Specification*.
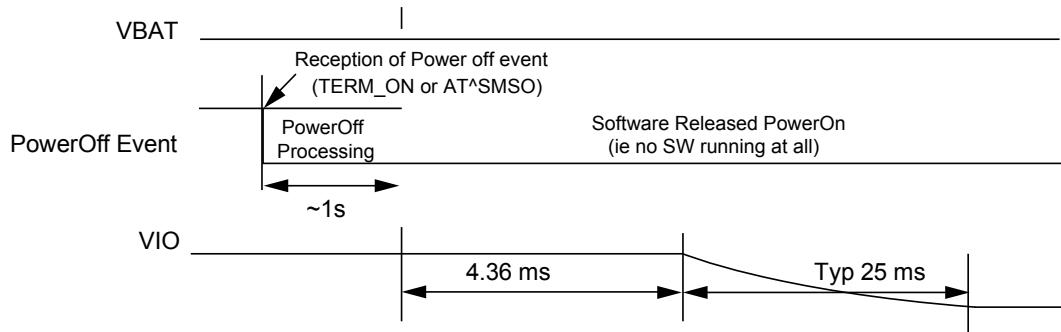
Figure 3-5 shows the power-on time sequence. The module will be power-on after pull up VBAT pin at least 0.25s and then pull down TERM_ON pin at least 1s.

Figure 3-5 Power-on time sequence

The MG323-B module supports power-off through the TERM_ON interface or the **AT^SMSO** command. Figure 3-6 shows the power-off time sequence.

Figure 3-6 Power-off time sequence

 NOTE

- The processing of the power-off event depends on the normal stop time of the file system in the MG323-B module. The processing varies with the capacity of the file system.

- It's recommended to turn off the module before stopping power supply.

RESET

The MG323-B module supports hardware reset function. If the software of the MG323-B module stops responding, you can reset the hardware through the RESET signal. After the hardware is reset, the software starts powering on the module and reports relevant information according to the actual settings. For example, the AT command automatically reports **^SYSSTART**. In this case, the external VIO interface is enabled and supplies 2.8 V power.

3.4.3 Output Signal Control Pin

The MG323-B module provides a network status LED pin LED_STATUS. The pulse signal output through this pin controls the status LED on the user interface board to display the network status.
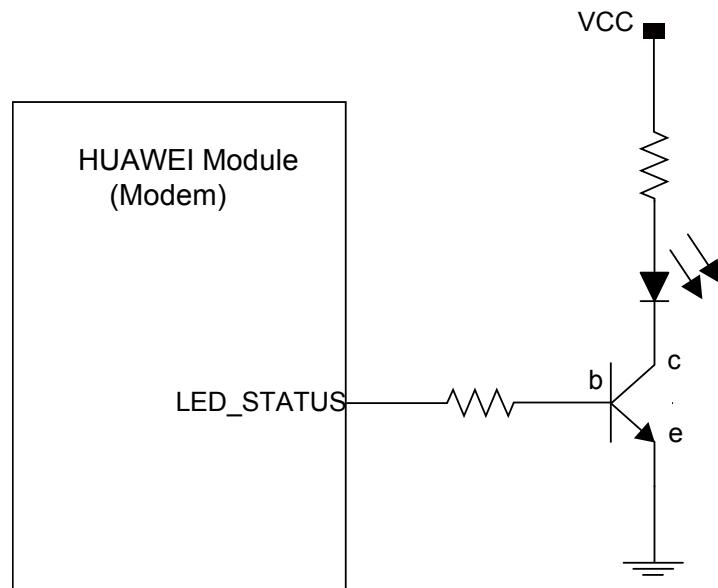
Different blinking modes of the status LED indicate different network status. Table 3-4 describes the status of the LED_STATUS pin.

Table 3-4 Status of the LED_STATUS pin

Working or Network Status	Output Status of the LED_STATUS Pin
Sleep mode	A low-level signal is output continuously.
Network-searching or non-network status (including the case when the SIM card is not inserted and the case when the PIN number is unblocked)	An output signal of high-level continues for 0.1s in a period of 1s.
Registered with a 2G network	An output signal of high-level continues for 0.1s in a period of 3s.
GPRS data service	An output signal of high-level continues for 0.1s in a period of 0.125s.
Voice call	A high-level signal is output continuously.

In practical application, the LED_STATUS pin cannot be directly used to drive the status LED. The LED_STATUS pin needs to be used with a transistor. To select a suitable current-limiting resistor for the LED, check the actual voltage drop and rated current of the LED. Figure 3-7 shows the driving circuit.

Figure 3-7 Driving circuit

3.5 UART 0 Interface

The MG323-B module provides a 2-wire UART 0 interface for debugging. It's recommended to reserve test points for these two pins.

Table 3-5 UART 0 interface signals (named by the reference of DTE)

Pin No.	Signal Name	Description	Feature	I/O	Direction
46	UART 0_RD	The first group of DCE transmit data	The data terminal equipment (DTE) receives serial data.	O	DCE→DTE
47	UART 0_TD	The first group of DCE receive data	The DTE transmits serial data.	I	DTE→DCE

3.6 UART 1 Interface

3.6.1 Overview

The MG323-B module provides the RS-232 UART 1 (8-wire UART) interface for one asynchronous communication channel. As the UART 1 interface supports signal control through standard modem handshake, AT commands are entered and serial communication is performed through the UART 1 interface. The UART 1 has the following features:

- Full-duplex
- 7-bit or 8-bit data
- 1-bit or 2-bit stop bit
- Odd parity check, even parity check, or non-check
- Baud rate clock generated by the system clock
- Direct memory access (DMA) transmission
- Baud rate ranging from 600 bit/s to 230400 bit/s (115.2 kbit/s by default)
- Self-adapted baud rate ranging from 1200 bit/s to 115.2 kbit/s

Table 3-6 lists the UART1 interface signals.

Table 3-6 UART1 interface signals (named by the reference of DTE)

Pin No.	Signal Name	Description	Feature	I/O	Direction
29	UART 1_RD	The second group of DCE transmit data	The data terminal equipment (DTE) receives serial data.	O	DCE→DTE