GC868-DUAL Hardware User Guide

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Making machines talk.

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Contents

1. Introduction

This document describes the hardware interface of the Telit GC868-DUAL module that connects to the specific application and the air interface. As GC868-DUAL can be integrated with a wide range of applications, all functional components of GC868-DUAL are described in great detail.

This document can help you to understand GC868-DUAL interface specifications, electrical and mechanical details. With the help of this document and other GC868-DUAL application notes, user guide, you can use GC868-DUAL module to design and set-up mobile applications in a short time.

1.1. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit's Technical Support Center (TTSC) at:

TS-EMEA@telit.com

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1.2. Text Coventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.3. Related documents

Table 1：Related documents

SN	Document name	Remark
[1]	ITU-T Draft new recommendation V.25ter:	Serial asynchronous automatic dialing and control
[2]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[3]	GSM 07.05:	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[4]	GSM 11.14:	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[5]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[6]	GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[7]	GSM 11.10	Digital cellular telecommunications system (Phase 2) ； Mobile Station

		(MS) conformance specification ; Part 1: Conformance specification

1.4. Terms and abbreviations

Table 2 : Terms and abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
BER	Bit Error Rate
BTS	Base Transceiver Station
CHAP	Challenge Handshake Authentication Protocol
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying

GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications

Abbreviation	Description
HR	Half Rate
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
Inorm	Normal Current
Imax	Maximum Load Current
kbps	Kilo bits per second
LED	Light Emitting Diode
Li-Ion	Lithium-Ion
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
Rx	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction

UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code
Abbreviation	**Description**
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
VIHmax	Maximum Input High Level Voltage Value
VIHmin	Minimum Input High Level Voltage Value
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value
VImax	Absolute Maximum Input Voltage Value
VImin	Absolute Minimum Input Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value

Phonebook abbreviations	
Abbreviation	**Description**
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook

1.5. Document History

Revision	Date	Changes
1	2009-11-17	Updated on temperature range and IO descriptions Changed on B2B connector selection
0	2009-10-12:	First issue

2. Product concept

Designed for global market, GC868-DUAL is a Dual-band GSM engine that can work on frequencies EGSM900 MHz/DCS1800 MHz , it supports by default a low/high pair of bands at the same time.

With a tiny configuration of 35mm x 32mm x 3.1 mm , GC868-DUAL was developed for very low cost voice-only GSM system solutions.

The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- One serial port can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs. This can be easily configured by AT command.

GC868-DUAL provide RF antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700, or customer's antenna can be soldered to the antenna pad.

The GC868-DUAL is designed with power saving technique, the average current consumption is as low as 2.9mA in SLEEP mode.

2.1. GC868-DUAL key features

Table 3 : GC868-DUAL key features

Feature	Implementation
Power supply	Single supply voltage 3.4V – 4.5V
Power saving	Typical power consumption in SLEEP mode to 2.9mA
Frequency bands	● GC868-DUAL Dual-band: EGSM 900/DCS 1800 ● Compliant to GSM Phase 2/2+
GSM class	Small MS
Transmit power	● Class 4 (2W) at EGSM900 ● Class 1 (1W) at DCS1800
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 +85°C

CSD:	• CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent • Unstructured Supplementary Services Data (USSD) support
SMS	• MT, MO, CB, Text and PDU mode • SMS storage: SIM card • Support transmission of SMS alternatively over CSD . User can choose preferred mode.
SIM interface	Supported SIM card: 1.8V, 3V
External antenna	Connected via 50 Ohm antenna connector
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) • AMR • Echo suppression
One serial interface	• Serial Port 1 Seven lines on Serial Port Interface • Serial Port 1 can be used for CSD FAX, and send AT command of controlling module.
Phonebook management	Supported phonebook types: SM, FD, LD, RC, ON, MC.
SIM Application Toolkit	Supports SAT class 3, GSM 11.11 phase 2+ standard
Real time clock	Implemented
Timer function	Programmable via AT command
Physical characteristics	Size: 35±0.15 x 32±0.15 x 3.3±0.3 mm (including application connector) 35±0.15 x 32±0.15 x 2.85±0.3 mm (excluding application connector) Weight: 8g
Firmware upgrade	Firmware upgradeable over serial interface

3. Application Interface

All hardware interfaces, except for RF interface that connects GC868-DUAL to the customers' cellular application platform, go through a 60-pin 0.5mm pitch board-to-board connector.

Sub-interfaces included in this board-to-board connector are described in detail in following chapters:

- Power supply (see Chapters 3.3)
- One serial interface (see Chapter 3.7)
- Two analog audio interfaces (see Chapter 3.8)
- SIM interface (see Chapter 3.9)

Mechanical characteristics of the board-to-board connector are specified in Chapter 6.3. There is also descrived the information of mating connector.

3.1. GC868-DUAL Pin description

Table 4 : Board-to-Board Connector pin description

Power Supply			
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS
VBAT	P	Eight BAT pins of the board-to-board connector are dedicated to connect the supply voltage. The power supply of GC868-DUAL has to be a single voltage source of VBAT= 3.4V...4.5V. It must be able to provide sufficient current in a transmit burst which typically rises to 2A.mostly, these 8 pins are voltage input	Vmax= 4.5V Vmin=3.4V Vnorm=4.0V
VRTC	P	Current input for RTC when the battery is not supplied for the system. Current output for backup battery when the main battery is present and the backup battery in low voltage state.	Vmax=2.14V Vmin=1.86V Vnorm=2.0V I max=13mA I min=0.5mA

VDD_EXT	P	Supply 2.85V voltage for external circuit. By measure this pin, user can judge the system is on or off. When the voltage is low, the system is off. Otherwise, the system is on.	Vmax=2.95V Vmin=2.75V Vnorm=2.85V Imax=20mA
GND	G	Digital ground	
Power on or power off			
PIN NAME	I/O	DESCRIPTION	
PWRKEY	I	Voltage input for power on key. ON/OFF get a high level Voltage as VRTC for user to power on or power off the system. The user should keep pressing the key for a moment when power on or power off the system. Because the system need margin time assert the software.	
Audio interfaces			
PIN NAME	I/O	DESCRIPTION	
MIC1P MIC1N	I	Positive and negative voice-band input	
MIC2P MIC2N	I	Auxiliary positive and negative voice-band input	
SPK1P SPK1N	O	Positive and negative voice-band output	
SPK2P SPK2N	O	Auxiliary Positive and negative voice-band output	
GERNERAL PURPOSE input/output			
PIN NAME	I/O	DESCRIPTION	
GPIO1	I/O	The GPO can be configured by AT command for outputting high or low level voltage. All of the GPIOs are initial low without any setting from AT command.	
GPIO2	I/O		
GPIO3	I/O		
GPIO4	I/O		
GPIO5	I/O		

GPIO6	I/O		
GPIO7	I/O		
GPIO8	I/O		
Serial interface			
PIN NAME	I/O	DESCRIPTION	
RXD	I	Receive Data	
TXD	O	Transmit Data	
RTS	I	Request to Send	
CTS	O	Clear to Send	
DCD	O	Data Carrier Detect	
DSR	O	Data Set Ready	
DTR	I	Data Terminal Ready	
RING	O	Ring Indicator(RI)	
SIM interface			
PIN NAME	I/O	DESCRIPTION	
SIM_VDD	O	Voltage Supply for SIM card	
SIM_I/O	I/O	SIM Data Input/Output	
SIM_CLK	O	SIM Clock	
SIM_RST	O	SIM Reset	

3.2. Operating modes

The following table summarizes the various operating modes:

Table 5：Overview of operating modes

Mode	Function	
Normal operation	GSM 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 system normally.
	GSM IDLE	Software is active. Module has registered to the GSM network, and the module is ready to send and receive.
	GSM TALK	CSD connection is going on between two subscribers. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.
Alarm mode	RTC alert function launches this restricted operation while the module is in POWER DOWN mode. GC868-DUAL will not be registered to GSM network and only parts of AT commands can be available.	

3.3. Power supply

The power supply of GC868-DUAL is from a single voltage source of VBAT= 3.4V...4.5V. In some case, the ripple in a transmit burst may cause voltage drops when current consumption rises to typical peaks of 2A. Therefore the power supply must be able to provide sufficient current up to 2A.

For the VBAT input, a local bypass capacitor is recommended. A capacitor about 100μF, low ESR is recommended. Multi-layer Ceramic Chip (MLCC) capacitors can provide the best combination of low ESR and small size but are not cost effective. A lower cost choice may be a 100 μF tantalum capacitor (low ESR) with a small (1 μF to 10μF) ceramic in parallel, which is illustrated as following figure. And the capacitors should put as closer as possible to the GC868-DUAL VBAT pins. The following figure is the recommended circuit.

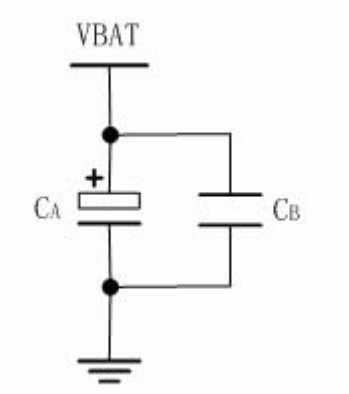


Figure 1 : VBAT input

The following figure is the VBAT voltage ripple wave at the maximum power transmit phase, the test condition is VBAT=4.0V, VBAT maximum output current =2A, C_A =100 µF tantalum capacitor (ESR=0.7Ω) and $C_{B=4.7\mu F}$.

Figure 2 : VBAT ripple wave at the maximum power transmit phase

3.3.1. Power supply pins on the board-to-board connector

Eight VBAT pins of the board-to-board connector are dedicated to connect the supply voltage, eight GND pins are recommended for grounding.

3.3.2. Minimizing power losses

Please pay special attention to the supply power when you are designing your applications. Please make sure that the input voltage will never drops below 3.5V even in a transmit burst during which the current consumption rises up to 2A. If the power voltage drops below 3.4V, the module is switched off. Using the board-to-board connector is the best way to reduce the voltage drops. You should also take the resistance of the power supply lines on the host board or of battery pack into account.

3.4. Power up and power down scenarios

3.4.1. Turn on GC868-DUAL

GC868-DUAL can be turned on by various ways, which are described in following chapters:

Via PWRKEY pin: starts normal operating mode (see chapter 3.4.1.1);

Via RTC interrupt: starts ALARM modes (see chapter 3.4.1.2)

NOTE: Only enter AT command through serial port after GC868-DUAL is power on and Unsolicited Result Code “RDY” is received from serial port.

3.4.1.1. Turn on GC868-DUAL using the PWRKEY pin (Power on)

You can turn on the GC868-DUAL by driving the PWRKEY to a high level voltage for period time. The power on scenarios illustrate as following figure.

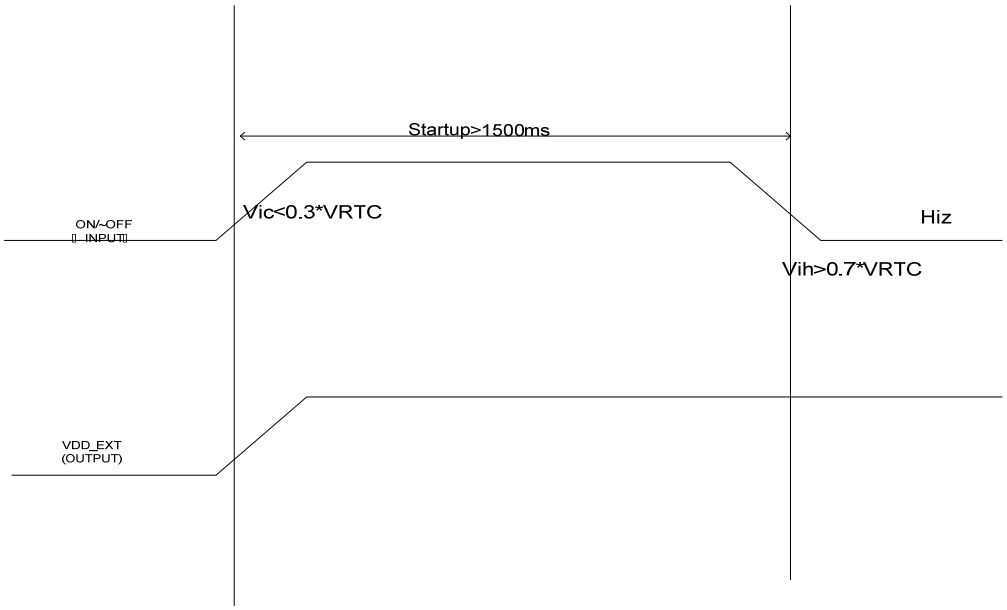


Figure 3：Timing of turn on system

When power on procedure has completed, GC868-DUAL sends out the following result code to indicate the module is ready to operate:

RDY

3.4.1.2. Turn on GC868-DUAL using the RTC (Alarm mode)。

Alarm mode is a power-on approach by using the RTC.The alert function of RTC makes the GC868-DUAL wake up while the module is power off. In alarm mode, GC868-DUAL does not register to GSM network and the software protocol stack is close. Thus, the parts of AT commands related to SIM card and Protocol stack are not accessible, and the others can be used as well as in normal mode.

3.4.2. Turn off GC868-DUAL

Following procedure can be used to turn off the GC868-DUAL:

- Normal power down procedure: Turn off GC868-DUAL using the PWRKEY pin
- Normal power down procedure: Turn off GC868-DUAL using AT command
- Under-voltage automatic shutdown: Takes effect if Under-voltage is detected

3.4.2.1. Turn off GC868-DUAL using the PWRKEY pin (Power down)

You can turn off the GC868-DUAL by driving the PWRKEY to a high level voltage for a period of time. The power down scenarios are illustrated in the following Figure.

This procedure lets the module log off from the network and allow the software entering into a secure state and save data before completely disconnect the power supply.

Before the completion of the switching off procedure, the module sends out result code:

POWER DOWN

After this moment, no any AT commands can be executed. Module enters the POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

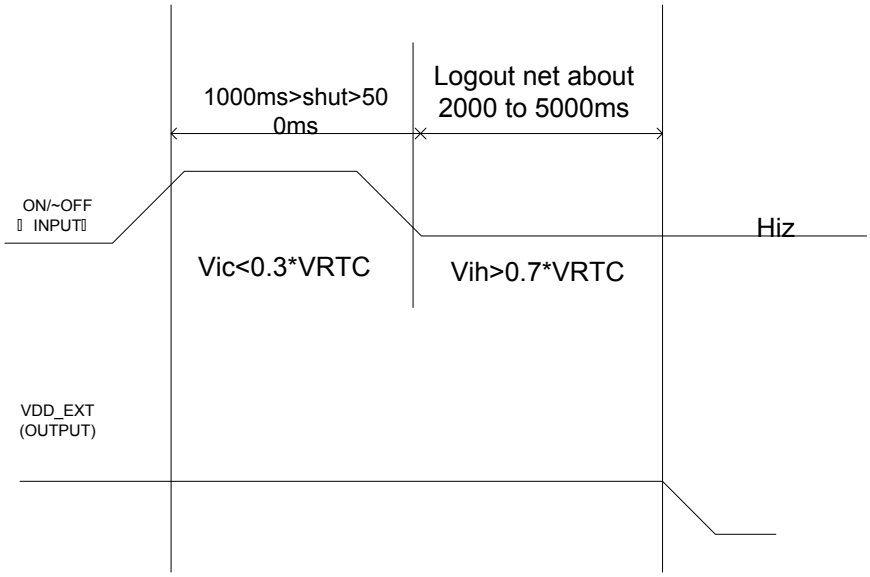


Figure 4：Timing of turn off system

3.4.2.2. Under-voltage automatic shutdown

Software constantly monitors the voltage level applied on the VBAT, if the measured battery voltage does not exceed 3.4V, the following URC is presented:

POWER LOW WARNNING

If the measured battery voltage does not exceed 3.4V, the following URC is presented:

POWER LOW DOWN

After this moment AT commands can be executed. The module will log off from the network and enters POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

3.4.3. Restart GC868-DUAL using the PWRKEY pin

You can restart GC868-DUAL by driving the PWRKEY to a high level voltage for a time period, the same as turning on GC868-DUAL using the PWRKEY pin. Before restarting the GC868-DUAL, you need to wait at least 500ms after detecting the VDD_EXT low level on. The restart scenarios are illustrated in the following figure.

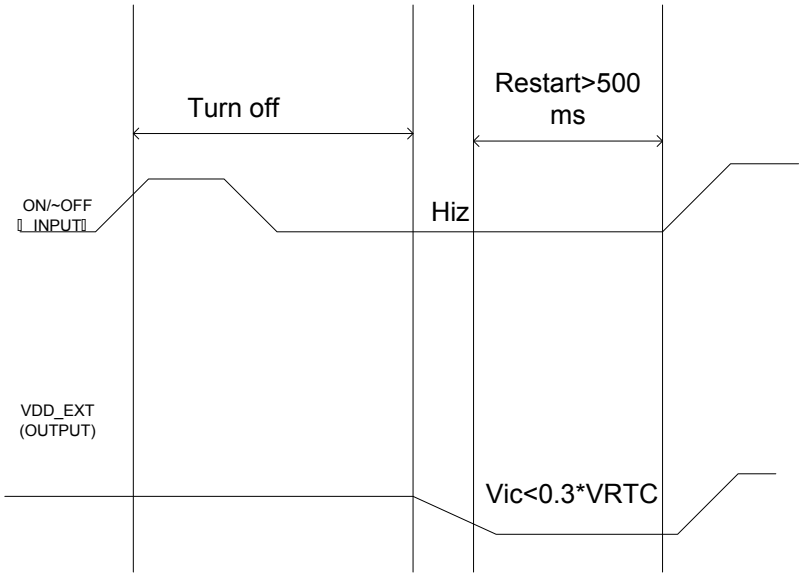


Figure 5：Timing of restart system

3.5. Power saving

3.5.1. Sleep mode (Slow Clocking mode)

When there is no on air or audio activity is required and no hardware interrupt (such as GPIO interrupt or data on serial port), GC868-DUAL enters into SLEEP mode automatically. In this mode, GC868-DUAL can still receive paging or SMS from network.

In SLEEP mode, the serial port is not accessible.

3.5.2. Wake up GC868-DUAL from SLEEP mode

When GC868-DUAL is in SLEEP mode, the following method can wake up the module.

- Receive a voice or data call from the network to wake up GC868-DUAL;
- Receive an SMS from the network to wake up GC868-DUAL
- RTC alarm expired to wake up GC868-DUAL;

3.6. RTC backup

The Real Time Clock (RTC) power supply of module can be provided by an external battery or a battery (rechargeable or non-chargeable) through PIN 15 on the board-to-board connector. You need only a coin-cell battery or a super-cap to PIN 15 to backup power supply for RTC.

The following figures show various sample circuits for RTC backup.

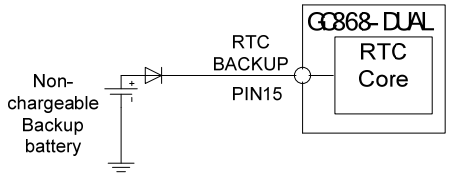


Figure 6 : RTC supply from non-chargeable battery

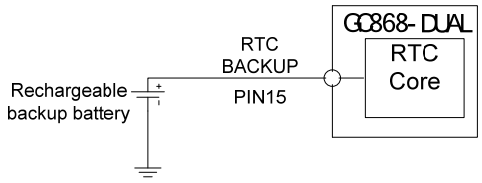


Figure 7 : RTC supply from rechargeable battery

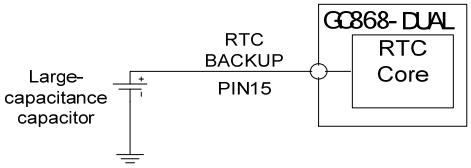


Figure 8 : RTC supply from capacitor

Li-battery backup

Rechargeable Lithium coin cells such as the TC614 from Maxell, or the TS621 from Seiko, are also small in size, but have higher capacity than the double layer capacitors resulting in longer backup times.

Typical charge curves for each cell type are shown in the following figures. Note that the rechargeable Lithium type coin cells generally come pre-charged from the vendor.

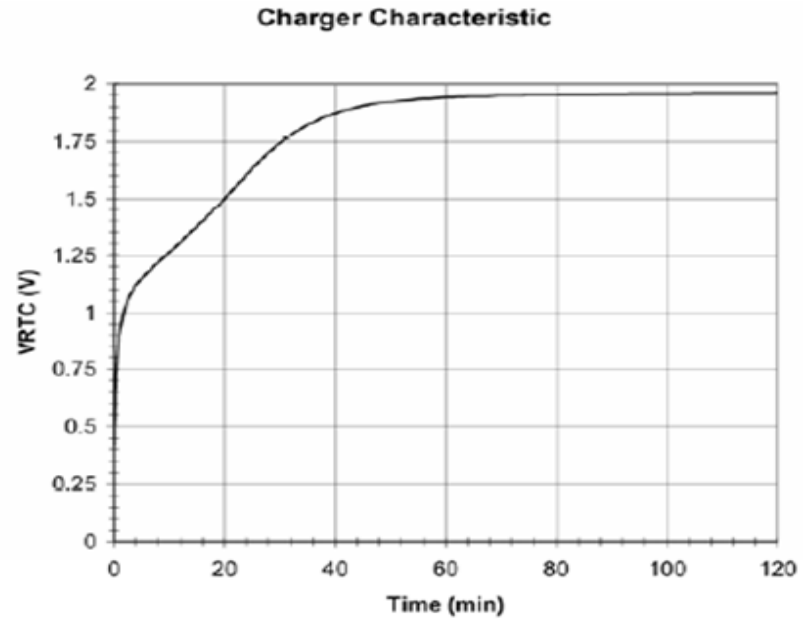


Figure 9 : Panasonic EECEMOE204A Charge Characteristic

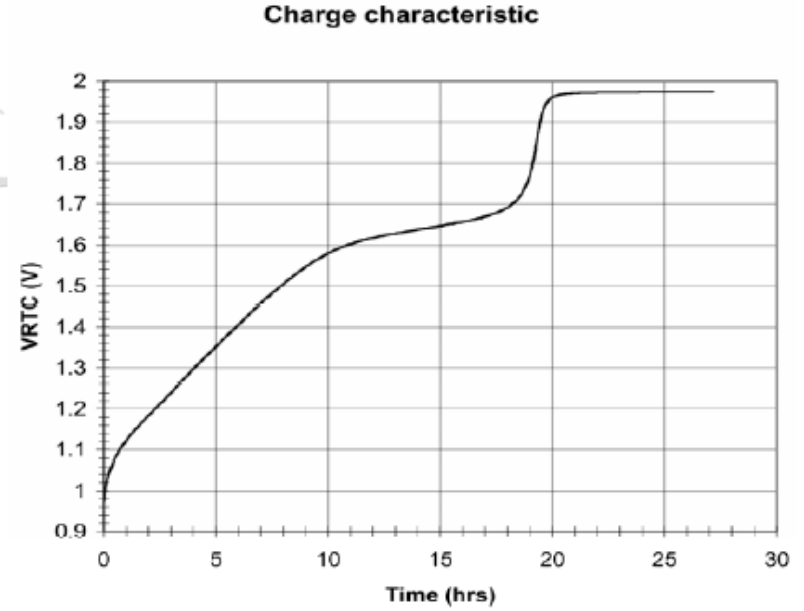


Figure 10 : Maxell TC614 Charge Characteristic

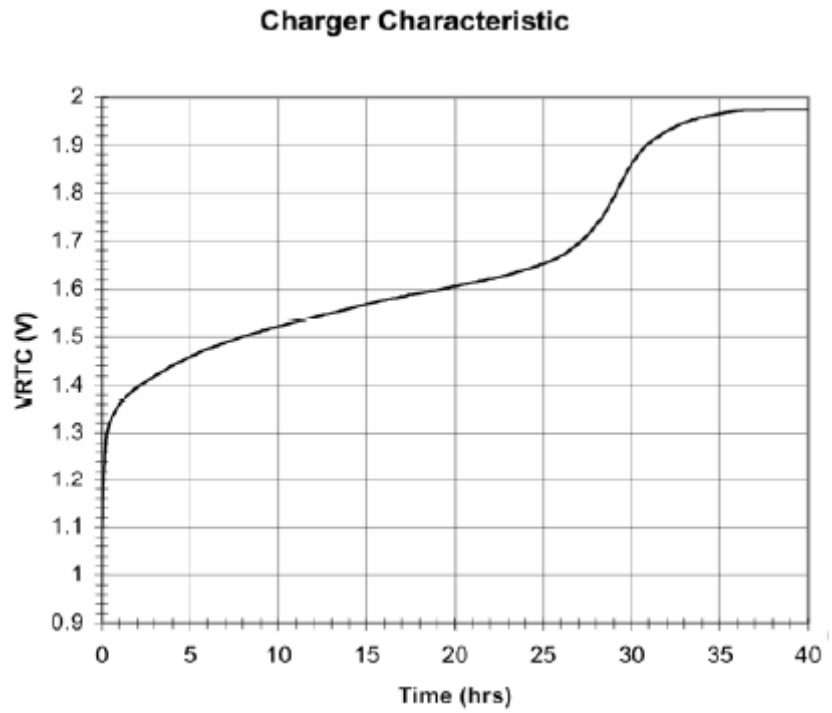


Figure 11 : Seiko TS621 Charge Characteristic

NOTE: Gold-capacitance backup:

Some suitable coin cells are the electric double layer capacitors available from Seiko (XC621), or from Panasonic (EECEM0E204A). They have a small physical size (6.8 mm diameter) and a nominal capacity of 0.2 F to 0.3 F, giving hours of backup time.

3.7. Serial interfaces

GC868-DUAL provides one serial ports. The GSM module is designed as a DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection, the module and the client (DTE) are connected through the following signal (as following figure shows).

Serial port

- Port/TXD @ Client sends data to the RXD signal line of module
- Port/RXD @ Client receives data from the TXD signal line of module

All pins of serial ports have 8mA driver, the logic levels are described in the following table

Table 6: Logic levels of serial ports pins

Parameter	Min	Max	Unit
Logic low input	0	0.3*VDD_EXT	V
Logic high input	0.7 *VDD_EXT	VDD_EXT +0.3	V
Logic low output	GND	0.2	V
Logic high output	VDD_EXT -0.2	VDD_EXT	V

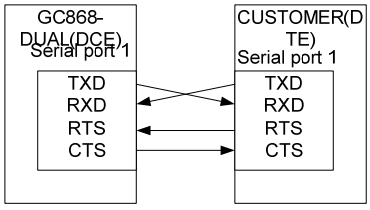


Figure 12：Interface of serial ports

3.7.1. Function of Serial Port

Serial port

- Four lines on Serial Port Interface
- Contains Data lines /TXD and /RXD, State lines /RTS and /CTS;
- Serial Port can be used for CSD FAX, and send AT command of controlling module; Port can use multiplexing function;
- Serial port supports the communication rate as following: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

  Default is 115200bps.

3.8. Audio interface

Table 7：Audio interface signal

	Name	Pin	Function
(AIN1/AOUT1)	MIC1P	53	Microphone1 input +
	MIC1N	55	Microphone1 input -
	SPK1P	54	Audio1 output+
	SPK1N	56	Audio1 output-
(AIN2/AOUT2)	MIC2P	57	Microphone2 input +
	MIC2N	59	Microphone2 input -
	SPK2P	58	Audio2 output+
	SPK2N	60	Audio2 output-

The module provides two Analogy input channels, AIN1 and AIN2, which may be used for both microphone and line inputs. The AIN1 and AIN2 channels are identical. One of the two channels is typically used with a microphone built into a handset. The other channel is typically used with an external microphone or external line input. The Module Analogy input configuration is determined by control register settings and established using Analogy multiplexes.

It is suggested that you adopt one of the following two matching circuits in order to satisfy speaker effect. The difference audio signals have to be layout according to different signal layout rules. If you want to adopt an amplifier circuit for audio, we commend National semiconductor's LM4890. But you can select it according to your needs.

3.8.1. Speaker interface configuration

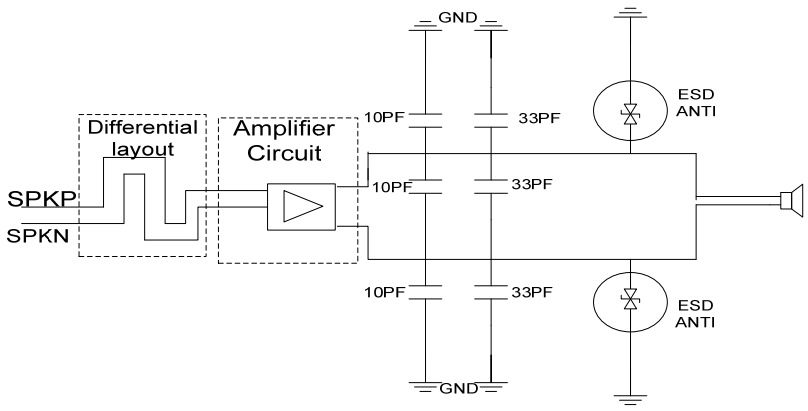


Figure 13：Speaker interface with amplifier configuration

3.8.2. Microphone interfaces configuration

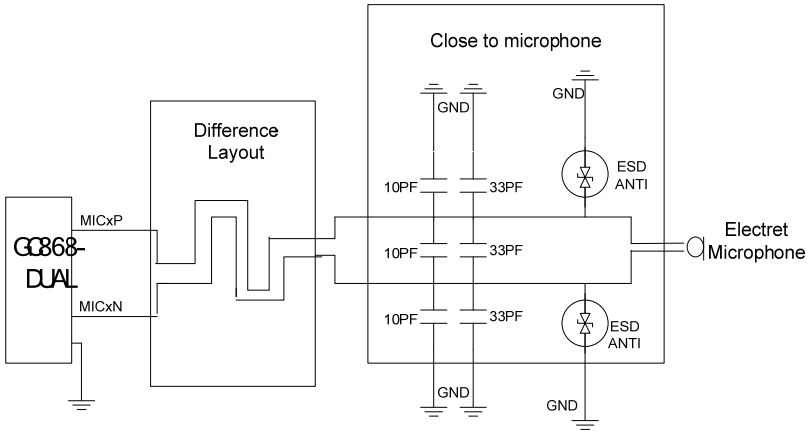


Figure 14：Microphone interface configuration

3.8.3. Referenced Electronic Characteristic

Table 8：MIC Input DC Characteristics

Parameter	Min	Typ	Max	Unit
Working Voltage		2.0	2.5	V
Working Current			2.0	mA
External Microphone Load Resistance	1.2	2.2		k Ohms

Table 9：Audio Output Characteristics

Parameter			Min	Typ	Max	Unit
Normal Output (SPK_1)	Differential	load Resistance		16		Ohm
		Ref level	1.65	1.85	2.05	Vpp
Auxiliary Output (SPK_2)	Differential	load Resistance		32		Ohm
		Ref level	1.65	1.85	2.05	Vpp

3.9. SIM card interface

3.9.1. SIM card application

You can use AT Command to get information about the SIM card. For more information, see [1].

The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit). Both 1.8V and 3.0V SIM Cards are supported.

The SIM interface is powered by an internal regulator in the module having 2.8V nominal voltage. All pins reset as outputs driving low. Logic levels are described in the table below:

Table 10：Signal of SIM interface (board-to-board connector)

Pin	Signal	Description
19	SIM_VDD	SIM Card Power output automatic output on SIM mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
21	SIM_I/O	SIM Card data I/O
23	SIM_CLK	SIM Card Clock
25	SIM_RST	SIM Card Reset

Following is a reference circuit about SIM interface. We recommend an Electrostatic discharge device ST (www.st.com) ESDA6V1W5 or ON SEMI (www.onsemi.com) SMF05C for “ESD ANTI”.

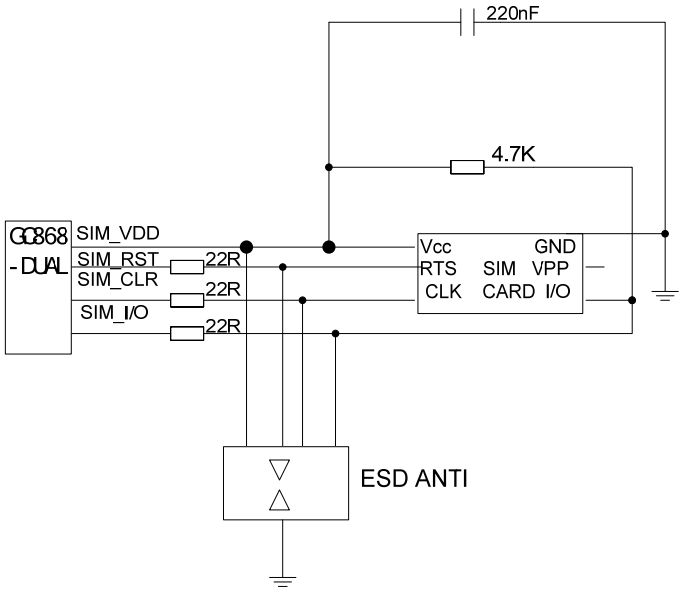


Figure 15 : SIM interface reference circuit with 6pin SIM card

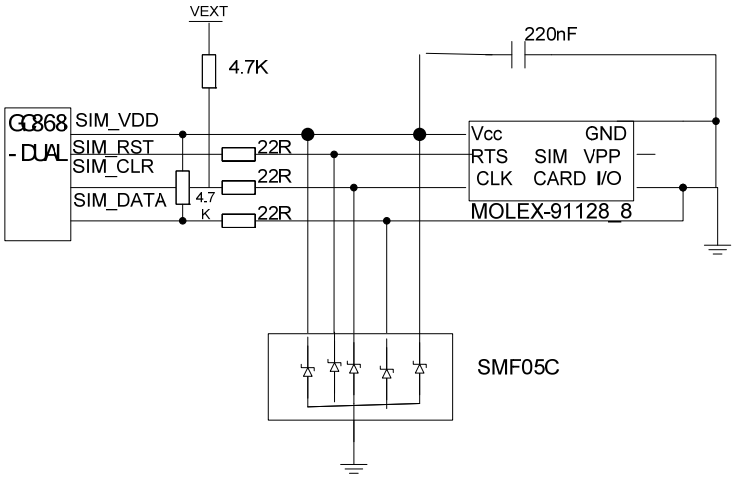


Figure 16 : SIM interface reference circuit with 8pin SIM card

3.9.2. Design considerations for SIM card holder

For 6 pin SIM card, we recommend to use Amphenol C707 10M006 049 2. For more information about the holder, see http://www.amphenol.com

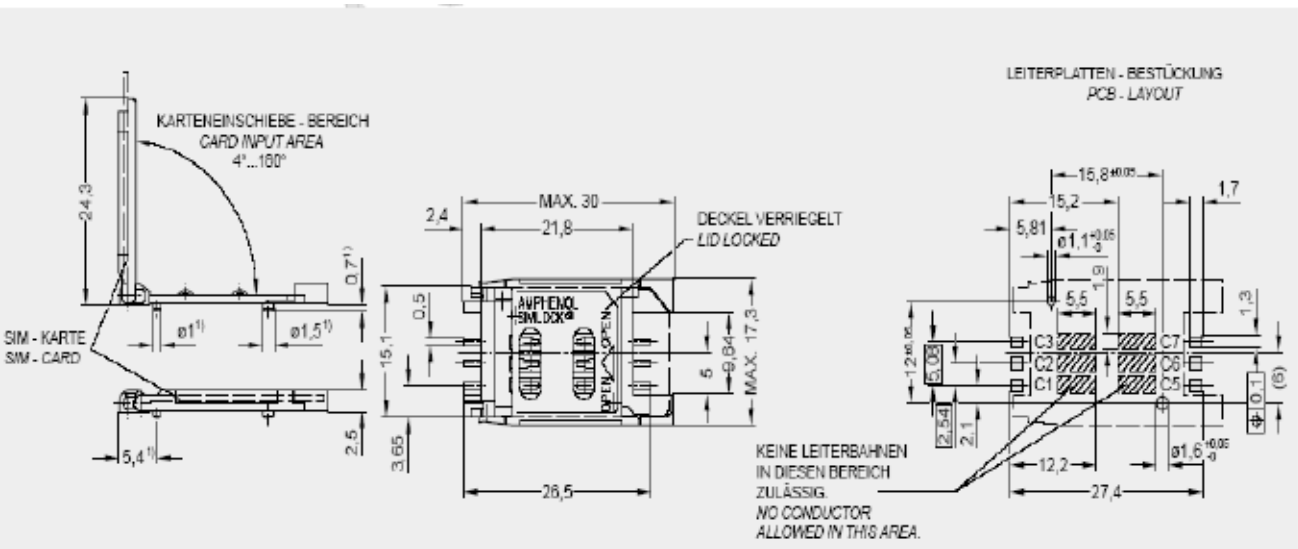


Figure 17：Amphenol C707 10M006 049 2 SIM card holder

Table 11：Pin description (Amphenol SIM card holder)

Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset.
C3	SIM_CLK	SIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	Not connect.
C7	SIM_I/O	SIM Card data I/O.

For 8 pin SIM card, we recommend to use Molex 91128. For more information about the holder, see http://www.molex.com.

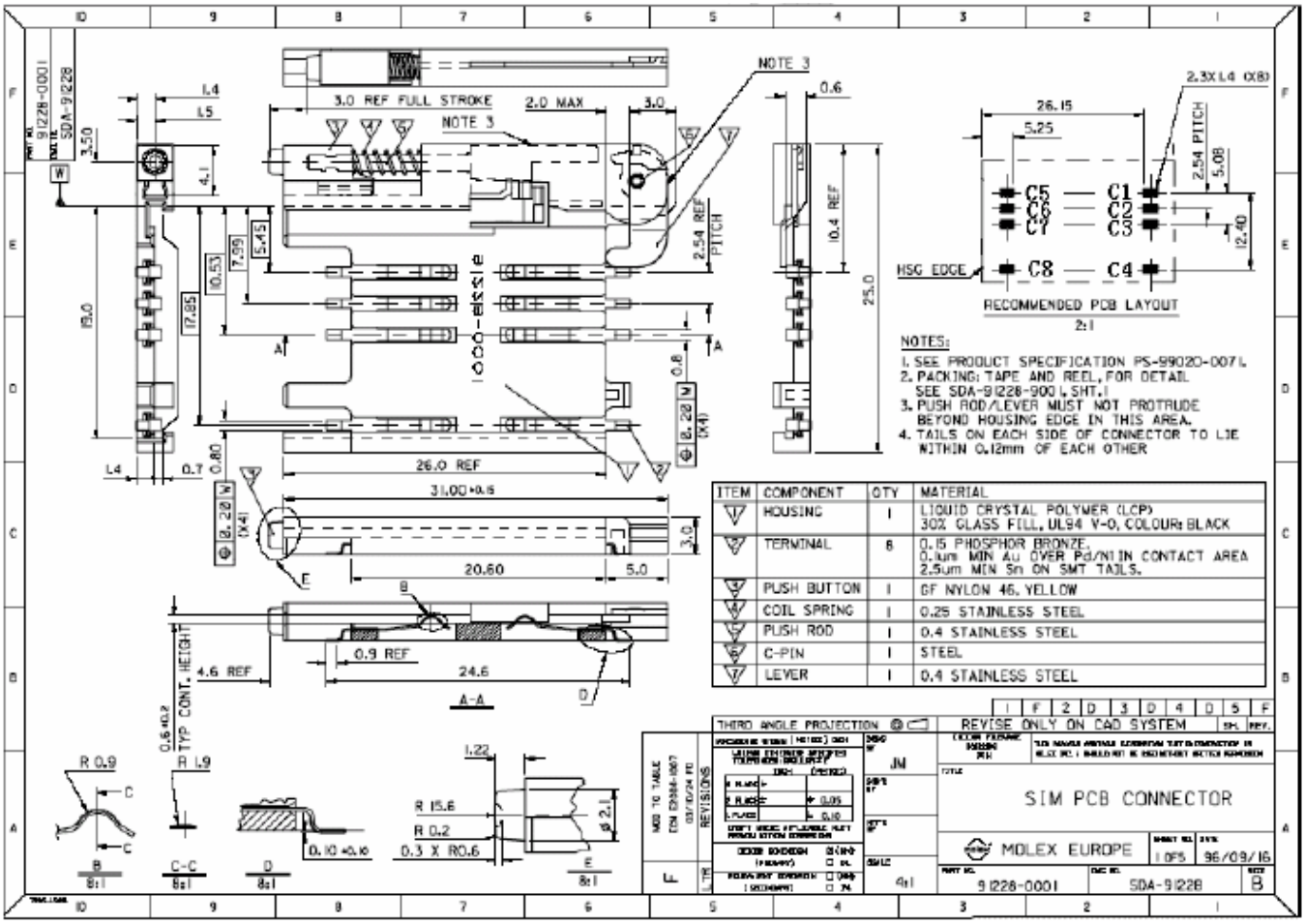


Figure 18：Molex 91128 SIM card holder

Table 12：Pin description (Molex SIM card holder)

Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset.
C3	SIM_CLK	SIM Card Clock.
C4	GND	Connect to GND.
C5	GND	Connect to GND.
C6	VPP	Not connect.
C7	SIM_I/O	SIM Card data I/O.

3.10. General Purpose Input Output (GPIO)

GC868-DUAL provides a limited number of General Purpose Input/Output signal pins

Table 13：GPIO Pins of GC868-DUAL

Pin	Name	Type	Function
29	GPIO1	I/O	General Purpose Input/Output Port
37	GPIO2	I/O	General Purpose Input/Output Port
39	GPIO3	I/O	General Purpose Input/Output Port
41	GPIO4	I/O	General Purpose Input/Output Port
45	GPIO5	I/O	General Purpose Input/Output Port
35	GPIO6	I/O	General Purpose Input/Output Port
32	GPIO7	I/O	General Purpose Input/Output Port
36	GPIO8	I/O	General Purpose Input/Output Port

4. Antenna interface

The RF interface has an impedance of 50Ω. To suit the physical design of individual applications GC868-DUAL offers two alternatives:

- Recommended approach: antenna connector in the component side of the PCB
- Antenna pad and grounding plane placed at the bottom.

To minimize the loss on the RF cable, the insertion loss should meet the following requirements:

- EGSM900<1dB
- DCS1800<1.5dB

4.1. Antenna installation

4.1.1. Antenna connector

GC868-DUAL uses MURATA's MM9329-2700 RF connector in the module side. The user should use MURATA's MXTK as a matching connector on the application side. For more information about MURATA's MXTK, see the 6.4 RF Adapter cabling.

4.1.2. Antenna pad

The antenna can be soldered to the pad, or attached via contact springs. To help you with grounding the antenna, GC868-DUAL comes with a grounding plane located close to the antenna pad.

GC868-DUAL material properties:

- GC868-DUAL PCB Material: FR4
- Antenna pad: Gold plated pad

Antenna pad soldering temperature (less than 10 seconds): 260°C

4.2. Module RF output power

Table 14：GC868-DUAL RF output power

Frequency	Max	Min
EGSM900	33dBm ±2db	5dBm ±5db
DCS1800	30dBm ±2db	0dBm±5db

4.3. Module RF receive sensitivity

Table 15：GC868-DUAL RF receive sensitivity

Frequency	Receive sensitivity
EGSM900	< -108dBm
DCS1800	< -107dBm

4.4. Module receive/transmit frequency

Table 16：GC868-DUAL receive/transmit frequency

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels (ARFC)	TX - RX offset
E-GSM-900	890.0 - 914.8	935.0 - 959.8	0 – 124	45 MHz
	880.2 - 889.8	925.2 - 934.8	975 - 1023	45 MHz
DCS-1800	1710.2 - 1784.8	1805.2 - 1879.8	512 – 885	95 MHz

4.5. Antenna gain

Table 17：Antenna gain

Item	Parameter	
Gain(dBi)	EGSM900	DCS1800
	0.5	1
Pattern	Omni-directional antenna	

5. Electrical, reliability and radio characteristics

5.1. Absolute maximum ratings

Absolute maximum rating for power supply and voltage on digital and analog pins of GC868-DUAL are listed in the following table:

Table 18 : Absolute maximum ratings

Parameter	Min	Max	Unit
Peak current of power supply	0	4.0	A
RMS current of power supply (during one TDMA- frame)	0	0.7	A
Voltage at digital pins	-0.3	3.3	V
Voltage at analog pins	-0.3	3.0	V
Voltage at digital/analog pins in POWER DOWN mode	-0.25	0.25	V

5.2. Operating temperatures

The operating temperature is listed in the following table:

Table 19 : GC868-DUAL operating temperature

Parameter	Min	Typ	Max	Unit
Ambient temperature	-20	+25	+55	□
Restricted operation*	-20 to -30		+55 to +80	□
Storage temperature	-40		+85	□

* GC868-DUAL is fully functional, but a deviation than GSM specification may be occurred.

5.3. Power supply ratings

Table 20：GC868-DUAL power supply ratings

Description	Conditions	Min	Typ	Max	Unit
Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple, and spikes.	3.4	4.0	4.5	V
Voltage drop during transmit burst	Normal condition, power control level for Pout max			400	mV
Voltage ripple	Normal condition, power control level for Pout max @ f<200kHz @ f>200kHz			50 2	mV

5.4. Current Consumption

Table 21：GC868-DUAL current consumption

Description	Conditions	Min	Typ	Max	Unit
Average supply current	POWER DOWN mode SLEEP mode		35 2.9		uA mA
	IDLE mode EGSM 900 GSM 1800		 23 23		 mA
	TALK mode EGSM 900 GSM 1800		 240 200		 mA
Peak supply current (during transmission slot every 4.6ms)	Power control level		2	3	A

5.5. Electrostatic discharge

Normally the module is designed inside customer terminal, so about Electrostatic Discharge (ESD) should be considered based on the terminal product requirements. The module is protected against Electrostatic Discharge in conveyance and customer production, and some second level ESD protection is designed inside the module.

The remaining ports are not equipped with special ESD protection in the module, and they are only protected according to the Human Body Model requirements.

Table 22：The ESD endure statue measured table

(Temperature: 25□, Humidity: 45%)

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

6. Mechanics

This chapter describes the mechanical dimensions of GC868-DUAL.

6.1. Mechanical dimensions of GC868-DUAL

In the following GC868-DUAL is described in the top view, side view and the bottom view. These show you Mechanical dimensions of GC868-DUAL.

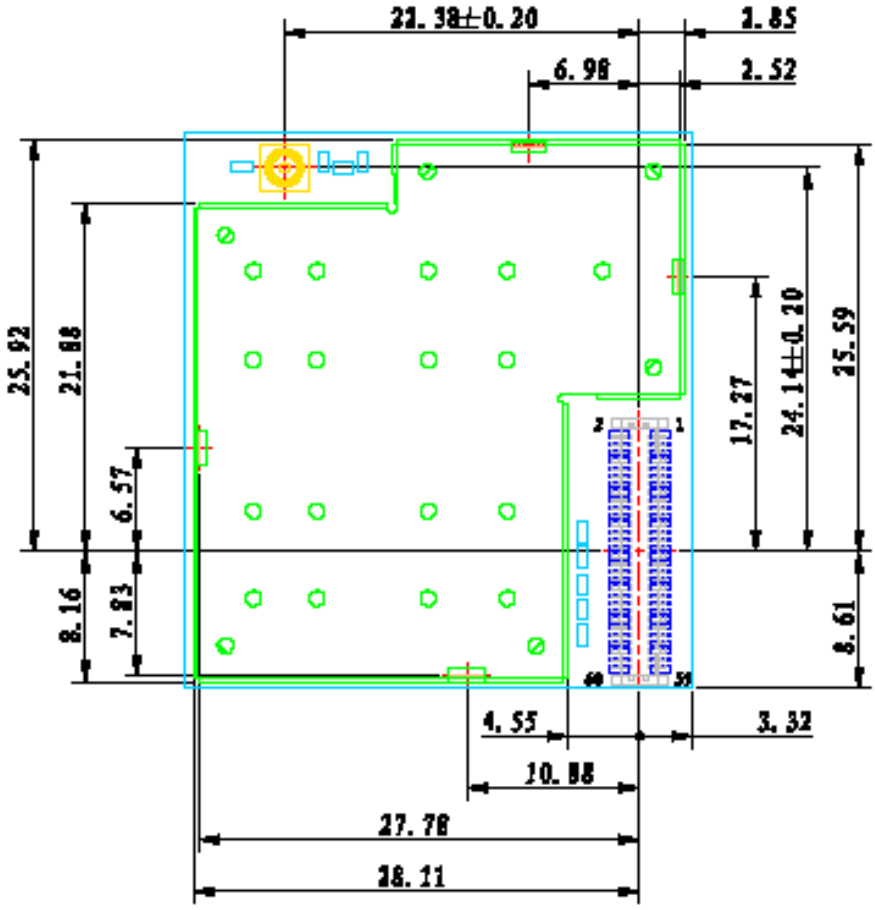


Figure 19 : Mechanical dimensions of top view in mm

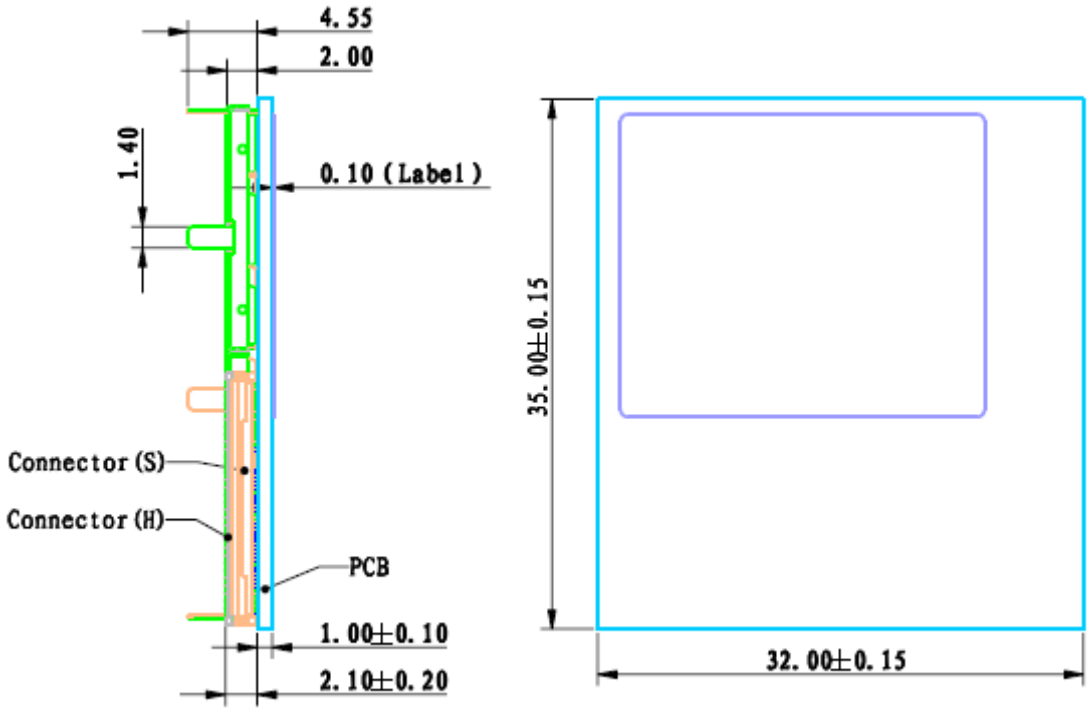


Figure 20：Mechanical dimensions of Bottom and side view in mm

6.2. Mounting GC868-DUAL onto the application platform

Use the connector ENTERY 1008-G60N-01R and four mounting pads fix the GC868-DUAL onto customer platform.

6.3. Board-to-board connector

The connector ENTERY 1009-G60N-01R is used in socket side and the connector ENTERY 1008-G60N-01R is used in user side. These high density SMT connectors are designed for parallel PCB-to-PCB applications. They are ideal for use in VCRs, notebook PCs, cordless telephones, mobile phones, audio/visual and other telecommunications equipment where reduced size and weight are important. The parameter of 1008-G60N-01R is displayed in the following. For more information, see http://www.entery.com.tw.

6.3.1. Mechanical dimensions of B2B connector

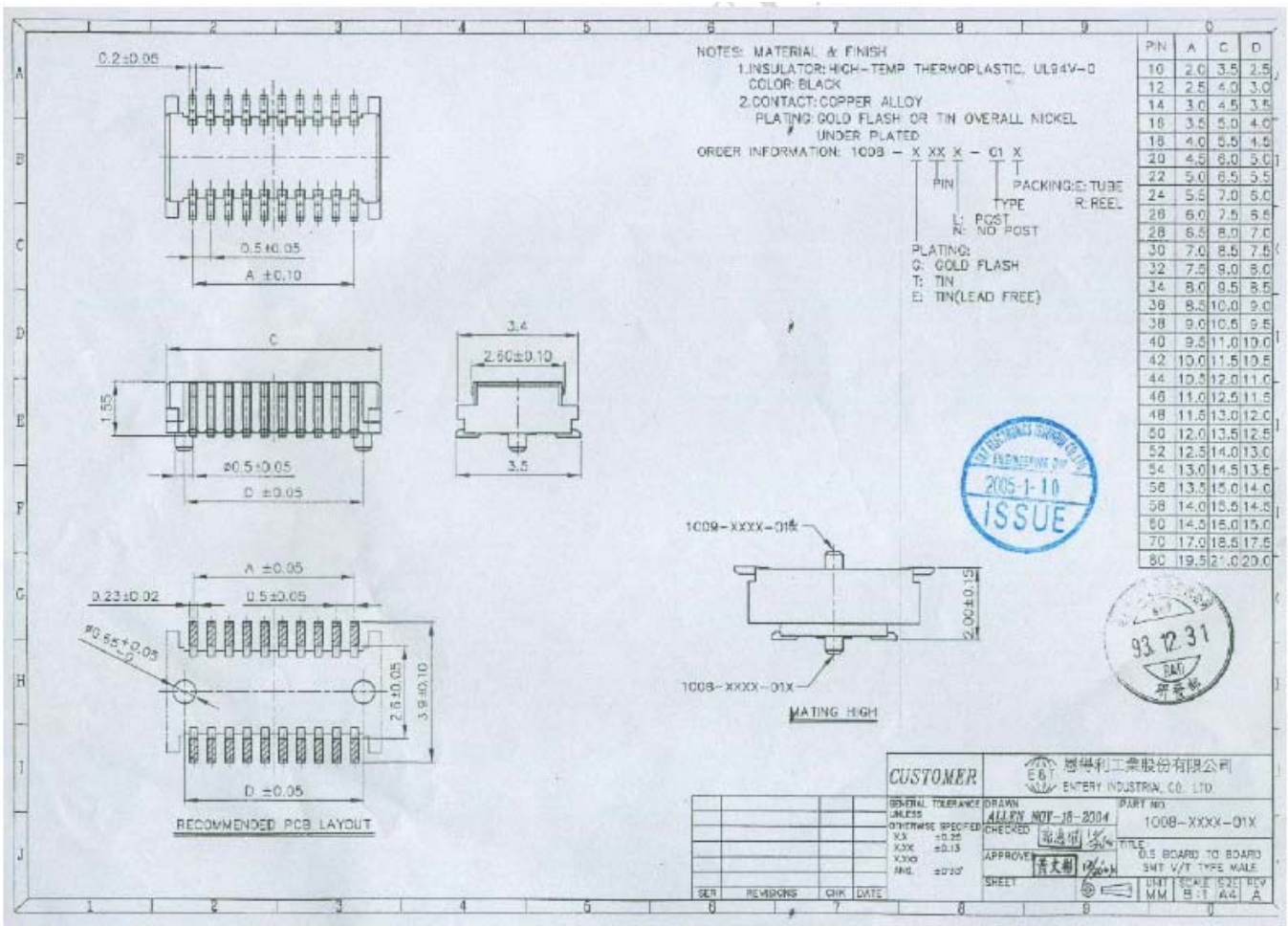


Figure 21 : Mechanical dimension of 1008-G60N-01R

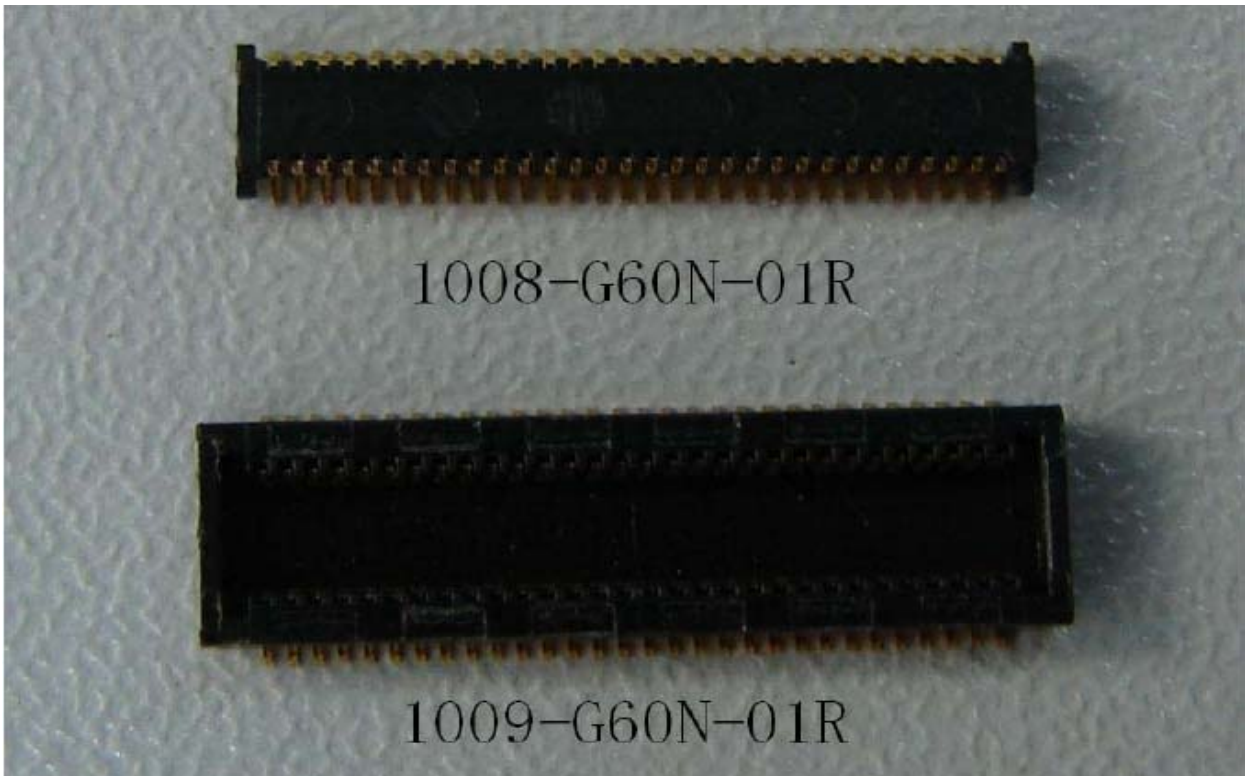


Figure 22：ENTERY board to board connector physical photo

NOTE: The connector ENTERY 1009-G60N-01R is used in socket side (GC868-DUAL module) and ENTERY 1008-G60N-01R is used in pin side (user side).

6.4. RF Adapter cabling

The RF connector in module side is Murata Company Microwave Coaxial Connectors MM9329-2700, which makes a pair with Murata Company RF connector MXTK. It has high performance with wide frequency range, surface mountable and reflow solderable. For more information about the RF connector, refer to http://www.murata.com/catalog/o30e8.pdf

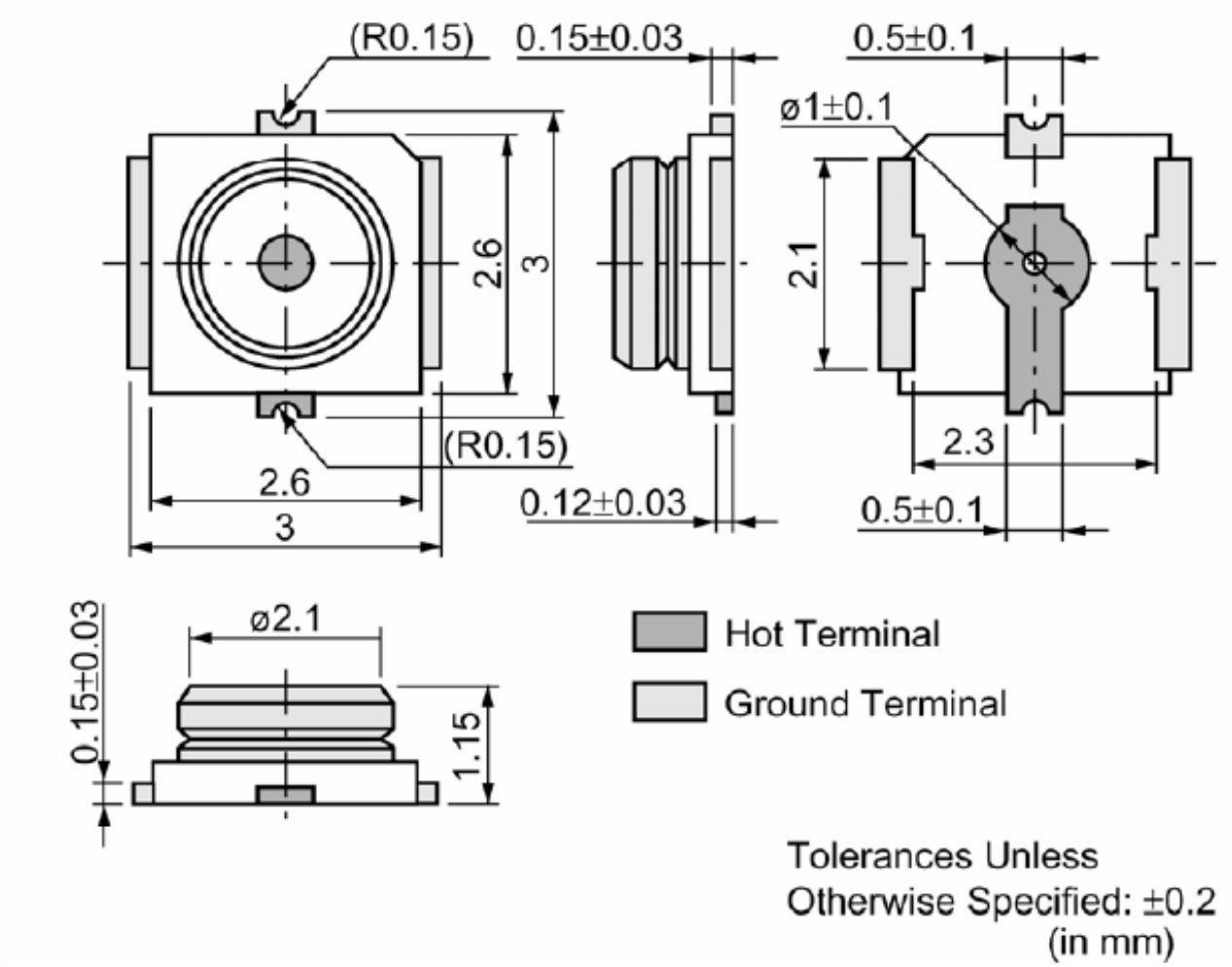


Figure 23：Mechanical dimension of MM9329-2700

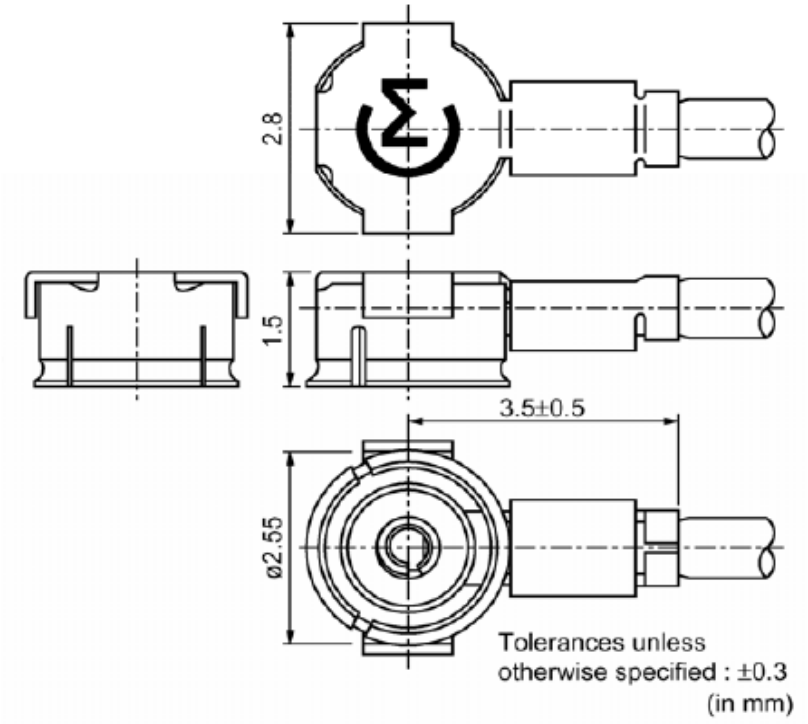
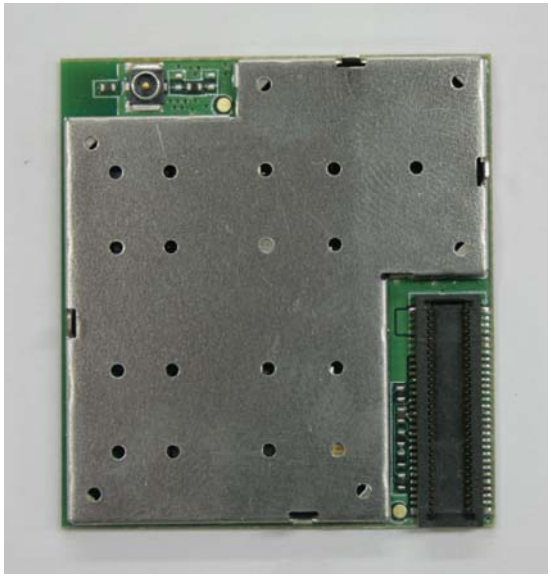


Figure 24 : Mechanical dimension of RF connector MXTK

For more information about the RF connector, refer to
http://www.murata.com/catalog/o30e8.pdf



Bottom

Top

6.5. PIN assignment of board-to-board connector of GC868-DUAL

Table 23：Connection diagrams

Pin	Signal (Telit name)	I/O	Function	Internal Pull up	Type
1	VBAT	-	Main power supply		Power
2	VBAT	-	Main power supply		Power
3	VBAT	-	Main power supply		Power
4	VBAT	-	Main power supply		Power
5	VBAT	-	Main power supply		Power
6	VBAT	-	Main power supply		Power
7	VBAT	-	Main power supply		Power
8	VBAT	-	Main power supply		Power
9	GND	-	Ground Main power supply		Power
10	GND	-	Ground Main power supply		Power
11	GND	-	Ground Main power supply		Power
12	GND	-	Ground Main power supply		Power
13	GND	-	Ground Main power supply		Power
14	GND	-	Ground Main power supply		Power
50	GND	-	Ground Audio		Audio
51	GND	-	Ground Audio		Audio
58	SPK2P	AO	Handsfree ear output, phase +		Audio
60	SPK2N	AO	Handsfree ear output, phase -		Audio
54	SPK1P	AO	Handset earphone signal output, phase +		Audio
56	SPK1N	AO	Handset earphone signal output, phase -		Audio

Pin	Signal (Telit name)	I/O	Function	Internal Pull up	Type
57	MIC2P	AI	Handsfree microphone input; phase +		Audio
59	MIC2N	AI	Handsfree microphone input; phase -		Audio
53	MIC1P	AI	Handset microphone signal input; phase+		Audio
55	MIC1N	AI	Handset microphone signal input; phase-		Audio
19[1]	SIM_VDD	-	External SIM signal – Power supply for the SIM		1.8/3V
25	SIM_RST	O	External SIM signal – Reset		1.8/3V
21	SIM_I/O	I/O	External SIM signal - Data I/O		1.8/3V
23	SIM_CLK	O	External SIM signal – Clock		1.8/3V
42	TXD	O	Serial data input to DTE		CMOS 2.8V
40	RXD	I	Serial data output from DTE		CMOS 2.8V
46	CTS	O	Output for Clear to send signal (CTS) to DTE		CMOS 2.8V
44	RTS	I	Input for Request to send signal (RTS) from DTE		CMOS 2.8V
33	DSR	O	Output for Data set ready signal (DSR) to DTE		CMOS 2.8V
43	DTR	I	Input for Data terminal ready signal (DTR) from DTE		CMOS 2.8V
31	DCD	O	Output for Data carrier detect signal (DCD) to DTE		CMOS 2.8V

Pin	Signal (Telit name)	I/O	Function	Internal Pull up	Type
27	RING	O	Output for Ring indicator signal (RI) to DTE		CMOS 2.8V
17	VDD_EXT	-	Internal I/O stage voltage – Power ON Monitor		CMOS 2.8V
34	PWRKEY*	I	Input command for switching power ON or OFF (toggle command). The pulse to be sent to the GC868 must be equal or greater than 1 second.		
15	VRTC	AI	Internal Clock Backup (don't load this imput!) VRTC Backup capacitor		Power
29	TGPIO_01	I/O	Telit GPIO1 I/O pin		CMOS 2.8V
37	TGPIO_02 / JDR	I/O	Telit GPIO2 Configurable GPIO / Jammer detect report		CMOS 2.8V
39	TGPIO_03	I/O	Telit GPIO3 Configurable GPIO		CMOS 2.8V
41	TGPIO_04	I/O	Telit GPIO4 Configurable GPIO		CMOS 2.8V
45	TGPIO_05	I/O	Telit GPIO5 Configurable GPIO		CMOS 2.8V
35	TGPIO_06 / ALARM	I/O	Telit GPIO6 Configurable GPIO /ALARM		CMOS 2.8V
32	TGPIO_07 /BUZZER	I/O	Telit GPIO7 Configurable GPIO /BUZZER		CMOS 2.8V
36	TGPIO_08	I/O	Telit GPIO8 Configurable GPIO		CMOS 2.8V
30	STAT_LED	O	Status indicator output		

Pin	Signal (Telit name)	I/O	Function	Internal Pull up	Type
18	Reserved	I/O	SSC MTSR		
20	Reserved	O	SSC CLK		
24	Reserved	O	SSC MRST		
16	Reserved				
22	Reserved				
26	Reserved				
28	Reserved				
38	Reserved				
47	Reserved				
48	Reserved				
49	Reserved				
52	Reserved				

NOTE: P : Power G : GND I : Input O : Output I/O : Digital input/output.