FIBOCOM
Perfect Wireless Connection

G620 GPRS Module
Hardware User Manual

Version: V1.0.7

Date: 2013-06-04

Confidential Material

This document contains information highly confidential to Fibocom Wireless Inc. (Fibocom). Fibocom offers this information as a service to its customers, to support application and engineering efforts that use the products designed by Fibocom. The information provided is based upon requirements specifically provided to Fibocom by the customers. All specifications supplied herein are subject to change. Disclosure of this information to other parties is prohibited without the written consent of Fibocom.

Copyright

Trademarks Notice

The FIBOCOM Logo is registered by Fibocom Wireless Inc. All other product or service names or logos are the property of their respective owners.

Revision History

Version	Date	Remarks
V1.0.3	2012-09-14	Modify some description error
V1.0.4	2012-12-04	Modify G620 PCB RECOMMENDED LAYOUT and update Architecture
V1.0.5	2013-01-07	Add reliability features in specifications
V1.0.6	2013-02-01	Add information about G620 A50-01
V1.0.7	2013-06-04	Update Figure3-2

Contents

1 Introduction

1.1 Scope

This manual provides the electrical, mechanical and environmental requirements for properly integrating the G620 GPRS module in a host application.

This manual gives a complete set of hardware features and functions that may be provided by G620. The availability of any feature or function, which is described in this manual, depends on the hardware revision and software version of a specific G620 GPRS module.

1.2 Audience

This manual is intended for all members of the integration team who are responsible for integrating the G620 module into the host OEM device, including representatives from hardware, software and RF engineering disciplines.

1.3 Applicable Documents

- G620 GPRS Module brief
- G620 GPRS Module Description
- G620 GPRS Module AT Command User Manual
- G620 GPRS Module AT Command Examples and Steps
- G620 GPRS Module Developer's Kit
- G620 GPRS Module Developer's Kit User Manual
- G620 GPRS Module Developer's Kit Schematics
- G620 Flash Tool Software (for Windows XP)
- G620 Mobile Analyzer Software (for Windows XP)
- G620 Modem Demo Software (for Windows XP)

1.4 Standards

ETSI ETS 300 916 (GSM 07.07 version 5.9.1 Release 1996)

ETSI TS 100 585 (GSM 07.05 version 7.0.1 Release 1998)

ETSI ETS 300 901 (GSM 03.40 version 5.8.1 Release 1996)

ETSI TS 100 900 (GSM 03.38 version 7.2.0 Release 1998)

ETSI EN 300 607-1 (GSM 11.10-1 version 8.1.1 Release 1999)

ETSI TS 100 907 (GSM 02.30 version 6.1.0 Release 1997)

ETSI TS 100 549 (GSM 03.90 version 7.0.0 Release 1998)

ETSI TS 101 267 (GSM 11.14 version 6.3.0 Release 1997)

ETSI TS 100 977 (GSM 11.11 version 6.3.0 Release 1997)

ITU-T V.25ter

ETSI EN 300 908 (GSM 05.02 version 8.5.1 Release 1999)

ETSI TS 101 356 (3GPP TS 07.60 version 7.2.0 Release 1998)

2 Overview

This chapter gives a general description of the G620 module.

2.1 Description

G620 GPRS Module supports GSM/GPRS bands 850/900/1800/1900 MHz with GPRS multi-slot class 10, G620 can operate on any GSM/GPRS network to provide data communications.

- G620 A50-00: Dual Band 900/1800 MHz
- G620 Q50-00: Quad Band850/900/1800/1900 MHz
- G620 A50-01: Dual Band 900/1800 MHz

The G620 is similar to a condensed cellular phone core, which can be integrated into any system or product that needs to transfer voice or data information over a cellular network. Thus, it significantly enhances the system's capabilities, transforming it from a standalone, isolated product to a powerful high-performance system with global communications capabilities.

The G620 is designed as a complete GSM/GPRS communications solution with all the controls, interfaces and features to support a broad range of applications:

- Low cost
- Wider voltage operate range
- A variety set of indicators and control signals
- Lower power consumption
- A variety of serial communications solutions

All these features and interfaces are easily controlled and configured using a versatile AT command interface that provides full control over the G620 operation.

The G620 control and indication interface extends its capabilities beyond GSM communications. This includes a regulated output voltage for supplying external circuits. With these interfaces, the G620 can operate and control external applications and receive feedback from external environment and circuits.

The G620 interface design, using a single 26 pin SMT, through which all application interfaces are managed, facilitates fast and easy integration. It significantly shortens the development process, and minimizes the product's time to market.

The G620 is extremely compact in size with a slim mechanical design, which makes it space saving on the application board and easily fitted into any board design.

The advanced power supply management significantly reduces power consumption to a necessary minimum and prolongs battery life.

2.2 Specifications

Product Features	
Operating Bands	G620 A50-00: Dual Band 900/1800 MHz
	G620 Q50-00: Quad Band850/900/1800/1900 MHz
	G620 A50-01: Dual Band 900/1800 MHz
Physical Characteristics	
Dimensions	24 mm x 24.5 mm x 2.6 mm
Mounting	SMT
Weight	<4g
Operational Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Performance	
Operating Voltage	3.3 – 4.5 V (4.0V is recommended)
Current Consumption (Typical Value)	1.6 mA @ Sleep mode
	24 mA @ Idle mode
	260 mA @ on call or CSD
	420 mA @ on GPRS data
	MAX 2.0 A @ Burst
	80uA@ Power off
	12uA @ RTC only
Tx Power	2 W, 850/900 MHz
	1 W, 1800/1900 MHz
Rx Sensitivity (Typical Value)	850/900MHz: -108dBm 1800/1900MHz: -107dBm
Interfaces	
SIM Card	External SIM connectivity
	1.8V / 3.0 V
Serial Ports	UART: BR from 1200 bps to 230400 bps Auto BR from 1200 bps to 230400 bps
Data Features	
GPRS	Class 10 Compliant (2Rx / 4 Tx / 5 Sum)
	Coding scheme CS1-CS4 Class B GSM 07.10 multiplexing protocol

CSD	Max BR 9.6 kbps	
SMS	MO/MT Text and PDU modes	
	Cell broadcast	
FAX	Group3 Class 2 (TS 61/62)	
Reliability Features		
Item	Test Condition	Standard
Low-temperature Storage	Temperature: –40±2ºC Test Duration: 24 h	IEC60068
High-temperature Storage	Temperature: 85±2ºC Test Duration: 24 h	IEC60068
Low-temperature Working	Temperature: –40±2ºC Test Duration: 24 h	IEC60068
High-temperature Working	Temperature: 85±2ºC Test Duration: 24 h	IEC60068
Damp Heat Cycling	High Temperature: 55±2ºC Low Temperature: 25±2ºC Humidity: 95% Repetition Times: 4 Test Duration: 12 h + 12 h	IEC60068
Temperature Shock	Low Temperature: –40±2ºC High Temperature: 85±2ºC Temperature Change Interval: < 30s Test Duration: 15 min Repetition Times: 100	IEC60068
Sine Vibration	Frequency Range: 5 Hz to 200 Hz Acceleration: 10 m/s2 Frequency Scan Rate: 1 oct/min Test Period: 3 axial directions. Five circles for each axial direction.	IEC60068
Shock Test	Half-sine Wave Shock Peak Acceleration: 300 m/s2 Shock Duration: 11 ms Test Period: 6 axial directions. One shock for each axial direction.	IEC60068
Clash Test	Half-sine Wave Peak Acceleration: 180 m/s2	IEC60068

	Pulse Duration: 6 ms Repetition Time: 6 directions. 1000 times for each direction.	
Others		
RTC inside		
Flexible status indicator		
Extend reset		

3 Hardware Interface Description

The following section describes in details the hardware requirements for properly interfacing and operating the G620 module.

3.1 Block Diagram

The G620 consists of the following blocks:

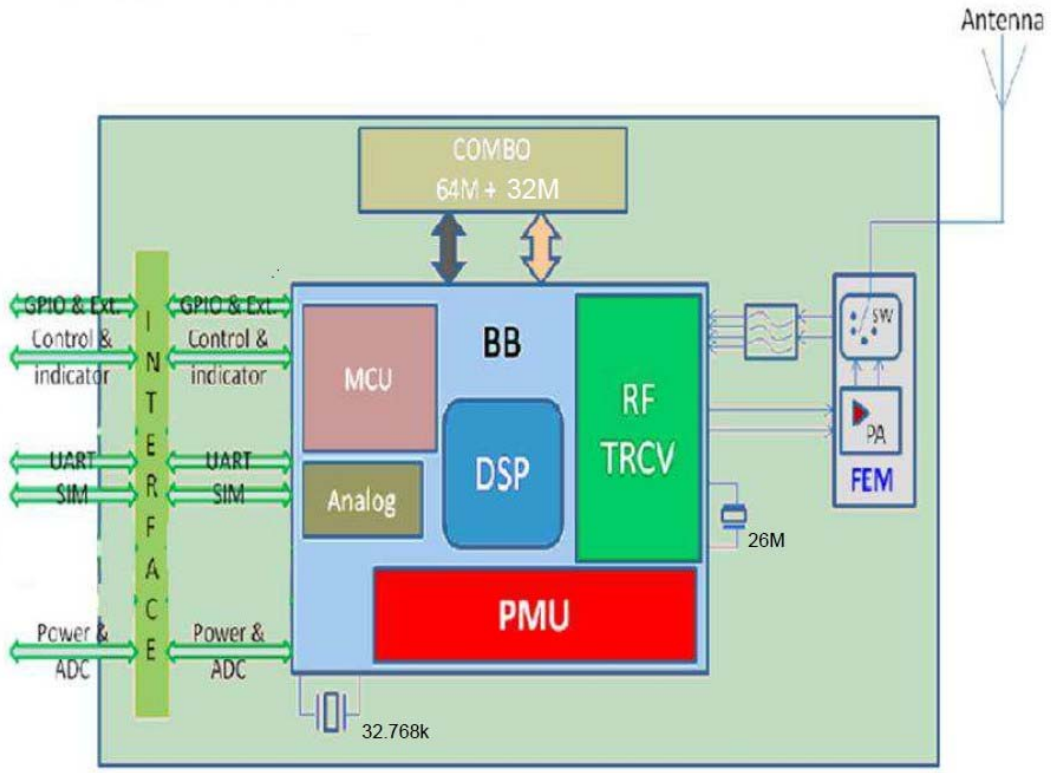

Figure 3-1

Digital Block

- Micro-controller Unit (MCU) for system and application code execution
- Digital Signal Processor (DSP) for voice and data processing
- Serial communications interfaces
- SIM card
- Real Time Clock (RTC) subsystem

Analog Block

- Power management inside
- Internal regulators

GSM Transceiver Block

- 3 gain stages for the low GSM band and high GSM band
- 850/900/1800/1900 MHz

- RF receiver, which includes LNAs, Mixers, VCOs, I/O outputs and buffers
- Signal processing IC for transmit and receive GSM data processing
- FEM - Front End Module
- Includes a harmonic filter and antenna switch
- Filter - Dual-band SAW filter that selects the required receive band

3.2 Operating Modes

The module incorporates several operating modes. Each operating mode is different in the active features and interfaces. The following table summarizes the general characteristics of the module operating modes and provides general guidelines for operation.

Operating Modes	Description	Features
Not Powered	BATT & Vbackup supply is disconnected.	The G620 is off. Any signals connected to the interface connector must be set low or tri-state.
Power off Mode	Valid BATT supply but not power on. After reset module. Vbackup output and VDD is off.	The G620 MCU/DSP/RF is Off. The PMU is operating in RTC mode. Any signals connected to the interface connector must be set low or tri-state.
RTC Mode	Power off mode BATT supply is disconnected. But valid Vbackup supply	The G620 MCU/DSP/RF is Off. The PMU is operating in RTC mode. Any signals connected to the interface connector must be set low or tri-state.
Idle Mode	Power on is succeeded and VDD output. CTS_N and DSR_N signals are enabled (low).	The G620 is fully active, registered to the GSM/GPRS network and ready to communicate. **Note:** This is the default power-on mode.
Sleep Mode	CTS_N signal is wave.	The G620 is in low power mode. The application interfaces are disabled, but, G620 continues to monitor the GSM network.
Call or CSD call or GPRS data	LPG signal is toggling.	A GSM voice or data call is in progress. When the call terminates, G620 returns to the last operating state (Idle or Sleep).

3.3 Power Supply

The G620 power supply must be a single external DC voltage source of 3.3V to 4.5V. The power supply must be able to sustain the voltage level during a GSM transmit burst current serge, which may reach 2.0A.

The G620 interface connector has 2 pins for the main power supply, as described in the table. All these contacts must be used for proper operation.

Pin #	Signal Name	Description
17	BATT	DC power supply. BATT = 3.3 V to 4.5 V 4.0V is recommended
18		
6	GND	Ground
12		
13		
15		
16		

3.3.1 Power Supply Design

Special care must be taken when designing the power supply of the module. The single external DC power source indirectly supplies all the digital and analog interfaces, but also directly supplies the RF power amplifier (PA). Therefore, any degradation in the power supply performance, due to losses, noises or transients, will directly affect the module performance.

The burst-mode operation of the GSM transmission and reception draws instantaneous current surges from the power supply, which causes temporary voltage drops of the power supply level. The transmission bursts consume the most instantaneous current, and therefore cause the largest voltage drop. If the voltage drops are not minimized, the frequent voltage fluctuations may degrade the module performance.

It is recommended that the voltage drops during a transmit burst will not exceed 300mV, measured on the module interface connector. In any case, the module supply input must not drop below the minimum operating level during a transmit burst. Dropping below the minimum operating level may result in a low voltage detection, which will initiate an automatic power-off.

To minimize the losses and transients on the power supply lines, please follow these guidelines:

- Use a 1000 uF, or greater, low ESR capacitor on the G620 supply inputs. The capacitor should be located as near to the G620 interface connector as possible.
- Use low impedance power source, cabling and board routing.
- Use cabling and routing as short as possible.
- Filter the module supply lines using filtering capacitors, as described in the table.

Recommended Capacitor	Usage	Description
1000 uF	GSM Transmit current serge	Minimizes power supply losses during transmit bursts. Use maximum possible value.
10 nF, 100 nF	Digital switching noise	Filters digital logic noises from clocks and data sources.
8.2 pF, 10 pF	1800/1900 MHz GSM bands	Filters transmission EMI.
33 pF, 39 pF	850/900 MHz GSM bands	Filters transmission EMI.

3.3.2 Power Consumption

The table specifies typical module current consumption ratings in various operating modes. The current ratings

refer to the overall module current consumption over the BATT supply.

Measurements were taken under the following conditions:

- BATT = 4.0 V
- Operating temperature 25°C
- Registered to a GSM/GPRS network

The actual current ratings may vary from the listed values due to changes in the module's operating and environment conditions. This includes temperature, power supply level and application interface settings.

Parameter	Description	Conditions	Min	Typical	Max	Unit
I off	Power off mode			80	90	μA
I idle	Idle mode	GSM only, DRX=2, -85dBm GSM850/900 DSC/PCS		24		mA
I sleep	Low power mode	DRX=2 5 9		3.6 2.0 1.6		mA
I gsm-avg	Average current GSM voice 1 TX slot 1 Rx slot	GSM850/900 PCL=5 10 15 19 DCS/PCS PCL=0 5 10 15		260 150 115 110 230 140 115 110		mA
I gsm-max	Average current GSM voice	GSM850/900 PCL=5		1800	2000	mA
	1 TX slot 1 Rx slot	19 DCS/PCS PCL=0 15		300 1400 300		
I gprs-avg	Average current GPRS Class 10 2 TX slot 2 Rx slot	GSM850/900 PCL=5 19 DCS/PCS PCL=0 15		420 150 380 150		mA

3.4 Power On/Off Operation

The module power on and off is the two primary phases, which are related at the interface connector by the hardware signals POWER_ON, VDD.

G620 A50-00 and G620 Q50-00 can start up automatically after power is on.

G620 A50-01cannot start up automatically after powered up, it boots up by Power_ON signal.

The POWER_ON signal is main controller.

The VDD signal indicates whether G620 is powered on or off. When this signal is disabled (0V), G620 is powered-off. When it is output (2.85V), G620 is powered-on.

Note:

- When the VBAT power supplied, the G620 module will be turn on automatically.
- The VDD would be flowed backwards by other IOs which be connected extend voltage. So DSR/CTS/LPG can be indicated the powered on process replaced.
- The TXD should be pulled up continuously between the G620 turn on process.

Pin #	Signal Name	Description
3	POWER_ON	Power on and off module Low level activated
11	VDD	Illustrating module start up LDO power output 0V : G620 is power off LDO power output 2.85V : G620 is start up

3.4.1 Turning on the module

When the module is powered off, the PMU operates at low power mode, with only the RTC timer active. The module will power on again when the POWER_ON signal is falling edge. Asserting the POWER_ON signal low for a minimum of 800 milliseconds will turn module on.

The following figure illustrates power on succeeded.

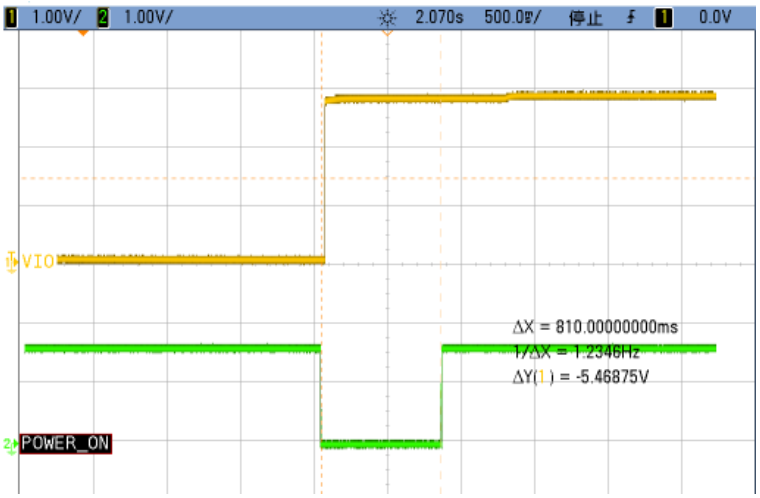

Figure 3-2

The following figure illustrates the power on is failed.

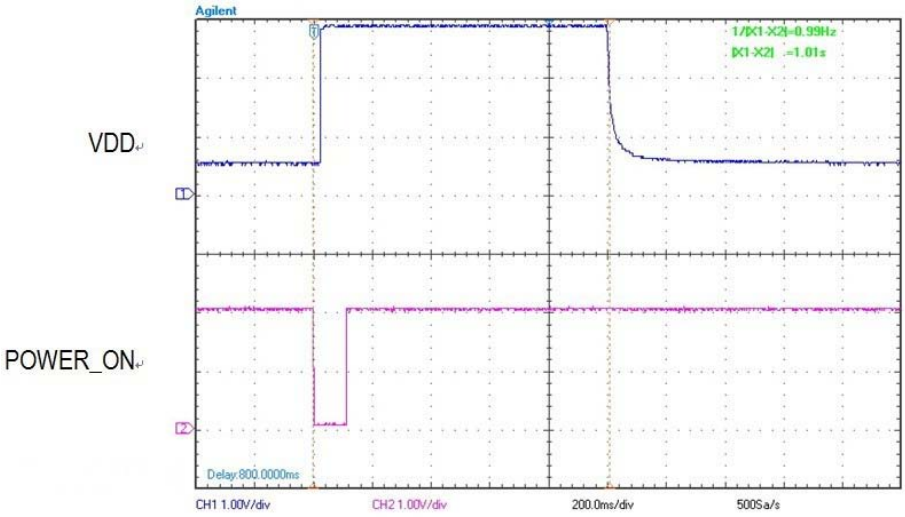

Figure 3-3

3.4.2 Turning off the Module

There are three ways to turn off the module: Asserting the POWER_ON signal low for a minimum of 3 seconds, under voltage automatic shutdown or using AT Command, please refer to *G620 GPRS Module AT Command User Manual.*

1. POWER_ON Signal

The POWER_ON signal is set high using an internal pull up resistor when power is applied to module. When the POWER_ON signal is falling edge and keeping low for a minimum of 3 seconds will turn module off. This will initiate a normal power-off process, which includes disabling of all applications interfaces (UART, SIM card, etc.) and logout the network connection.

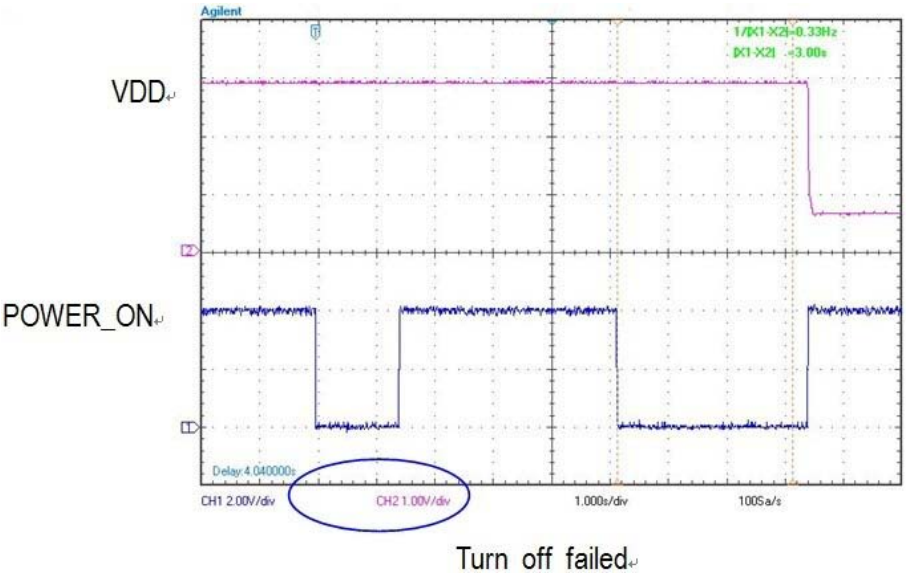

Figure 3-4

2. Under voltage Automatic Shutdown

A low power shut down occurs when G620 senses the external power supply is below the minimal operating

limit (VBAT≤3.2V). The module will respond by powering down automatically without notice.

This form of power-down is not recommended for regular use since the unexpected power loss may result in loss of data.

3. AT Command

+MRST

The AT+MRST command initiates a G620 power off operation, which powers off directly.

+CFUN

The AT+CFUN=0 command initiates a G620 power off operation, which de-registration first, and then powers off.

3.5 Sleep Mode

The module incorporates an optional low power mode, called Sleep Mode, in which it operates in minimum functionality, and therefore draws significantly less current.

During Sleep Mode the module network connection is not lost. The module will be waked up cycled and monitored the GSM network constantly for any incoming calls or data. During Sleep mode, all of the G620 interface signals are inactive and are kept in their previous state, prior to activating low power mode. To save power, all the G620 internal clocks and circuits are shut down, and therefore serial communications is limited.

The CTS_N signal is alternately enabled (LOW level) and disabled (HIGH level) synchronously with Sleep Mode and Idle mode. At the same time this indicates the G620 serial interfaces are active.

G620 will not enter Sleep mode in any case when there is data present on the serial interface or incoming from the GSM network or an internal system task is running. Only when processing of any external or internal system task has completed, G620 will enter Sleep mode according to the ATS24 command settings.
All of the description about CTS_N, it must be set the UART to HW control by AT command.

3.5.1 Activating Sleep Mode

By default, the module powers on in Idle Mode. The ATS24 default is 0. In this mode the module interfaces and features are functional and the module is fully active. Sleep mode is activated by the ATS24 command. Such as ATS24 would be activated Sleep mode at soon.

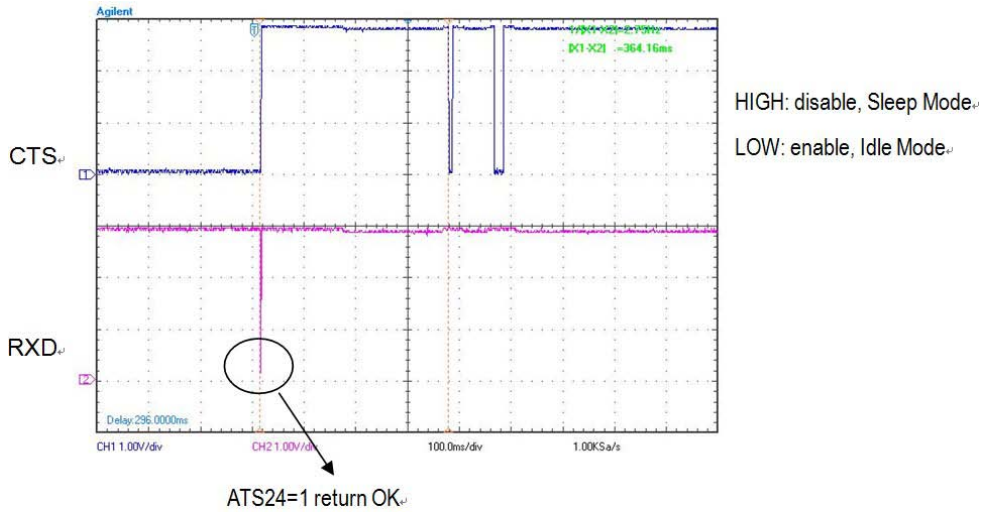

Figure 3-5

3.5.2 Serial Interface during Sleep Mode

The module wakes up periodically from Sleep mode to page the GSM network for any incoming calls or data. After this short paging is completed, G620 returns to sleep mode. During this short awake period, the serial interfaces are enabled and communications with the module is possible.

The CTS_N signal is alternately enabled and disabled synchronously with the network paging cycle. CTS_N is enabled whenever G620 awakes to page the network. The period based on the DRX parameter of the network.

4.615 ms (TDMA frame duration) * 51 (number of frames) * DRX value.

At the same time, the CTS_N indicates the G620 serial interfaces are active or inactive.

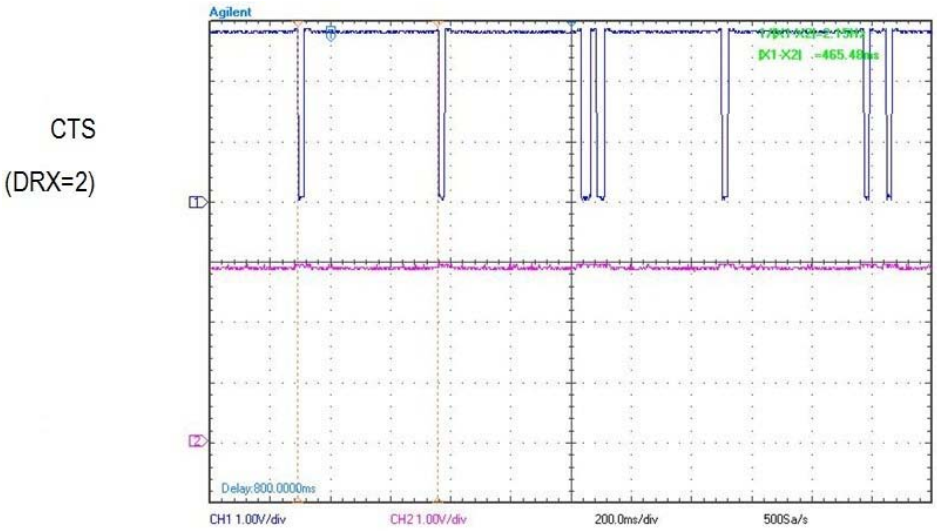

Figure 3-6

3.5.3 Terminating Sleep Mode

Terminating the Sleep mode, or wake-up, is defined as the transition of the G620 operating state from Sleep mode to Idle mode. There are several ways to wake-up G620 from Sleep mode as described below.

During Sleep mode the G620 internal clocks and circuits are disabled, in order to minimize power consumption. When terminating the Sleep mode, and switching to Idle mode, G620 requires a minimal delay time to reactivate and stabilize its internal circuits before it can respond to application data. This delay is typically of 5 ms, and is also indicated by the CTS_N signal inactive (high) state. The delay guarantees that data on the serial interface is not lost or misinterpreted.

3.5.3.1 Temporary Termination of Low Power Mode

Temporary termination of Sleep mode occurs when the module switches from Sleep mode to Idle mode for a defined period, and then returns automatically to Sleep mode.

Low power mode may be terminated temporarily by several sources, some of which are user initiated and others are initiated by the system.

Incoming Network Data

During Sleep mode, module continues monitoring the GSM network for any incoming data, message or voice calls. When module receives an indication from the network that an incoming voice call, message or data is available, it automatically wakes up from Sleep mode to alert the application. When module wakes up to Idle

mode all its interfaces are enabled.

Depending on the type of network indication and the application settings, module may operate in several methods, which are configurable by AT commands, to alert the application of the incoming data:

a) Enable the serial interface's CTS_N

b) Send data to the application over the serial interface.

c) Enable the serial interface's Ring Indicator (RING_N) signal.

d) LPG status indicator

Data on the Serial interface

During Sleep mode, serial communications is limited to short periods, while module is paging the network. When the serial interface is active, data can be exchanged between the application and the module. The module will not return to Sleep mode until the serial interface transmission is completed and all the data is processed.

Only when the serial interface transfer is completed and the data is processed, the module will return to Sleep mode automatically, according to the ATS24 settings.

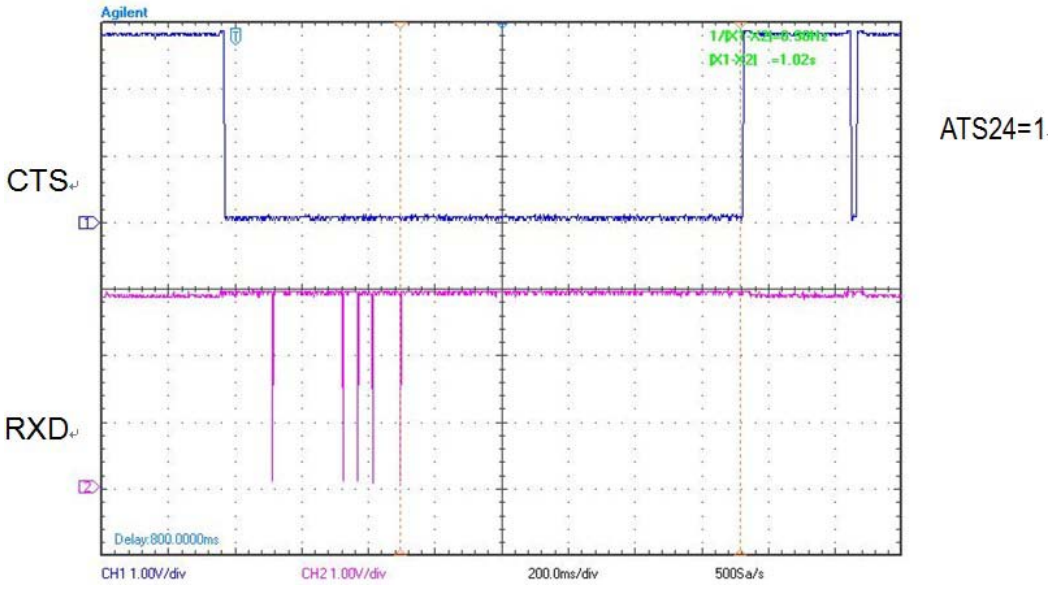

Figure 3-7

a) The module serial interfaces be set HARDWARE FLOW (AT+IFC=2,2)

If the module serial interfaces be set HARDWARE FLOW by AT+IFC command, and the DTE serial interfaces was running with HARDWARE FLOW, the TXD data will be sent to the module by CTS_N enabled, the data will not be lost. And module will go back to Idle mode for response.

b) The module serial interfaces be set NONE FLOW (AT+IFC=0,0)(The default value)

If the module serial interfaces be set NONE FLOW by AT+IFC command, and the DTE serial interfaces was running with NONE FLOW, the TXD data will be sent to module anytime, the data will be lost. But then module will go back to idle mode if data and CTS_N enabled at the same time.

3.5.3.2 Permanent Termination of Sleep Mode

The G620 Sleep mode is enabled and disabled by the ATS24 command.

- ATS24: ATS24 = 0 disables Sleep mode. The value of ATS24 (>0) will be saved but the mode will not be save by re-power G620.

3.6 Real Time Clock

The main function of Real Time Clock (RTC) is keeping time. The RTC subsystem is embedded in the PMU and operates in the entire module operating modes (Off, Idle, Sleep), as long as power is supplied above the minimum operating level.

If the main power is not available, the backup battery or capacitor can be supplied to RTC by interface connector VBACKUP.

When the main power supply and VBACKUP is disconnected from module, the RTC timer will reset and the current time and date will be lost. When the module power on again, please reconfigure the time and date.

3.6.1 VBACKUP description

Pin #	Signal Name	Description
1	VBACKUP	Real time clock power

- When main power BATT is supplied. The VBACKUP output 2.0V/0.3mA current for external battery or capacitor charging
- When main power BATT is disconnected. The VBACKUP supply the RTC by. External battery or capacitor. The RTC power consumption is about 12uA. The voltage cannot be over 2.2V.
- The VBACKUP is supplied by a capacitor. The backup time can be calculated by capacitance approximately.

$T(s) \approx C(uF)/1.3$

3.6.2 RTC Application

Here are the methods to set the time and date of the module:

- Automatically retrieved from the GSM network. In case module is operated in a GSM network that supports automatic time zone updating, it will update the RTC with the local time and date upon connection to the network. The RTC will continue to keep the time from that point.
- Using the AT+CCLK command. Setting the time and date manually by this AT commands overrides the automatic network update. Once the time and date are manually updated, the RTC timer will keep the time and date synchronized regardless of the module operating state.

3.7 UART

The module includes one completely independent serial communications interface (UART).

The module UART is a standard 8-signal bus. This UART is used for all the communications with G620 - AT commands interface, GPRS/EGPRS data and CSD data, programming and software upgrades.

The UART signals are active low CMOS level signals. For standard RS232 communications with a PC, an external transceiver is required.

The module is defined as a DCE device, and the user application is defined as the DTE device. These definitions apply for the UART signals naming conventions, and the direction of data flow, as described in the figure.

Pin #	Signal Name	Description	Feature	Direction
19	CTS_N	Module Clear To Send	DCE Switch To Received Mode	DCE→DTE
20	RTS_N	Request To Send	DTE Notice DCE Requested To Send	DTE→DCE
21	TXD_N	Module Received Data	DTE Transmitted Data	DTE→DCE
22	RXD_N	Module Transmitted Data	DTE Received Data	DCE→DTE
23	DSR_N	Module Data Set Ready	DCE Was Ready	DCE→DTE
24	RING_N	Module Ring indicator	Notice DTE Remote Call	DCE→DTE
25	DTR_N	Data Terminal Ready	DTE Was Ready	DTE→DCE
26	DCD_N	Data Carrier Detect	Data Carrier Was Online	DCE→DTE

Recommended connection:

Application MCU	Direction	Module	
RXD	←	Pin 22	RXD_N
TXD	→	Pin 21	TXD_N
RI	←	Pin 24	RING_N
DSR	←	Pin 23	DSR_N
RTS	→	Pin 20	RTS_N
DTR	→	Pin 25	DTR_N
CTS	←	Pin 19	CTS_N
DCD	←	Pin 26	DCD_N

The UART supports baud rates 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps. Auto baud rate detection is supported for baud rates up to 230400 bps.

All flow control handshakes are supported: hardware or none.

The UART default port configuration is 8 data bits, 1 stop bit and no parity, with none flow control and auto baud rate detect enabled.

Note: The auto baud will be availability at the first time after power on. The UART will be no answer probably if switch to another baud rate at working.

3.7.1 Ring Indicate

The RING_N signal serves to indicate incoming calls and other types of URCs (Unsolicited Result Code). It can also be used to send pulses to the host application, for example to wake up the application from power saving state.

In IDLE mode, the RING_N is high. It is only indicating a type of event at a time:

1) When a voice call comes in, the RING_N line goes low for 1 second and high for another 4 seconds. Every 5 seconds as a cycle.

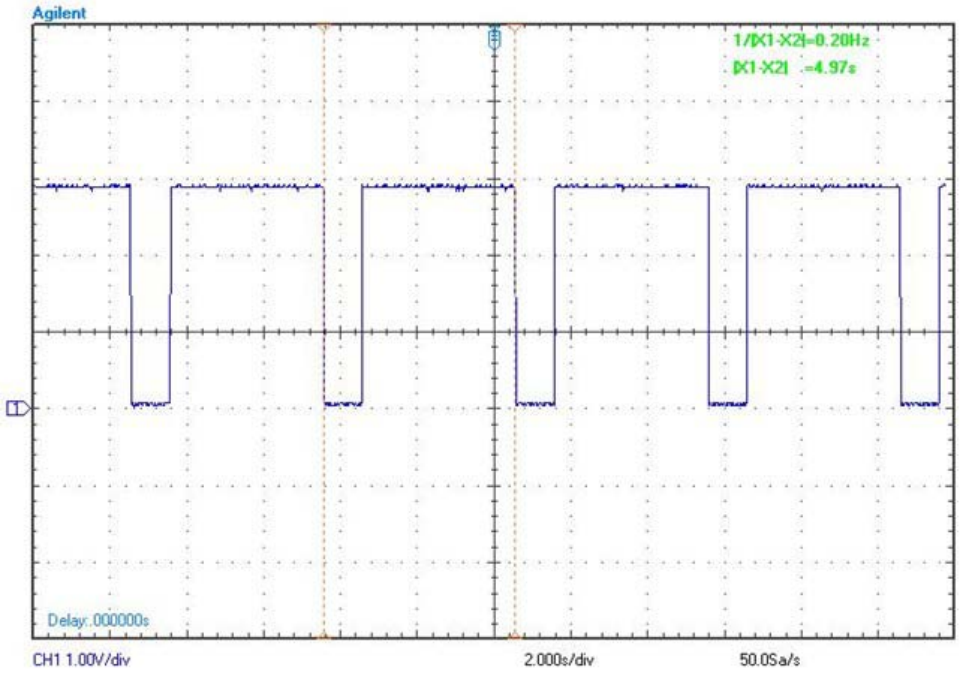

Figure 3-8

2) When a FAX call comes in, the RING_N line low for 1s and high for another 4s. Every 5 seconds as a cycle.

3) When a Short massage comes in, the RING_N line to low for 150 mS, and always high.

3.7.2 DCD Indicate

The DCD_N signal serves to indicate CSD call or GPRS data mode. The detail definition refers to AT&C command.

3.8 SIM Interface

The module incorporates a SIM interface, which conforms to the GSM 11.11 and GSM 11.12 standards, which are based on the ISO/IEC 7816 standard. These standards define the electrical, signaling and protocol specifications of a GSM SIM card.

The module does not incorporate an on-board SIM card tray for SIM placement. The SIM must be located on the user application board, external to the G620. The G620 SIM interface includes all the necessary signals, which are routed to the interface connector, for a direct and complete connection to an external SIM.

The module supports 1.8V or 3.0V SIM card automatic. While the G620 turn on by POWER_ON. At first SIM_VCC output 1.8V voltage for external SIM card communication. If it is not successful SIM_VCC output 2.85V voltage and communicated SIM card again.

Note: If SIM_VCC is supplied, remove SIM card is prohibited. In case, it would damage both SIM card and G620.

Pin #	Signal Name	Description
7	SIM_CLK	Serial 3.25 MHz clock
9	SIM_VCC	2.85V Supply to the SIM
8	SIM_DATA	Serial input and output data
10	SIM_RST	Active low SIM reset signal

3.8.1 SIM Connection

The figure illustrates a typical SIM interface connection to the module. This connection type is implemented on the module Developer Board, using an MOLEX SIM tray, PN 912283001 & 912360001.

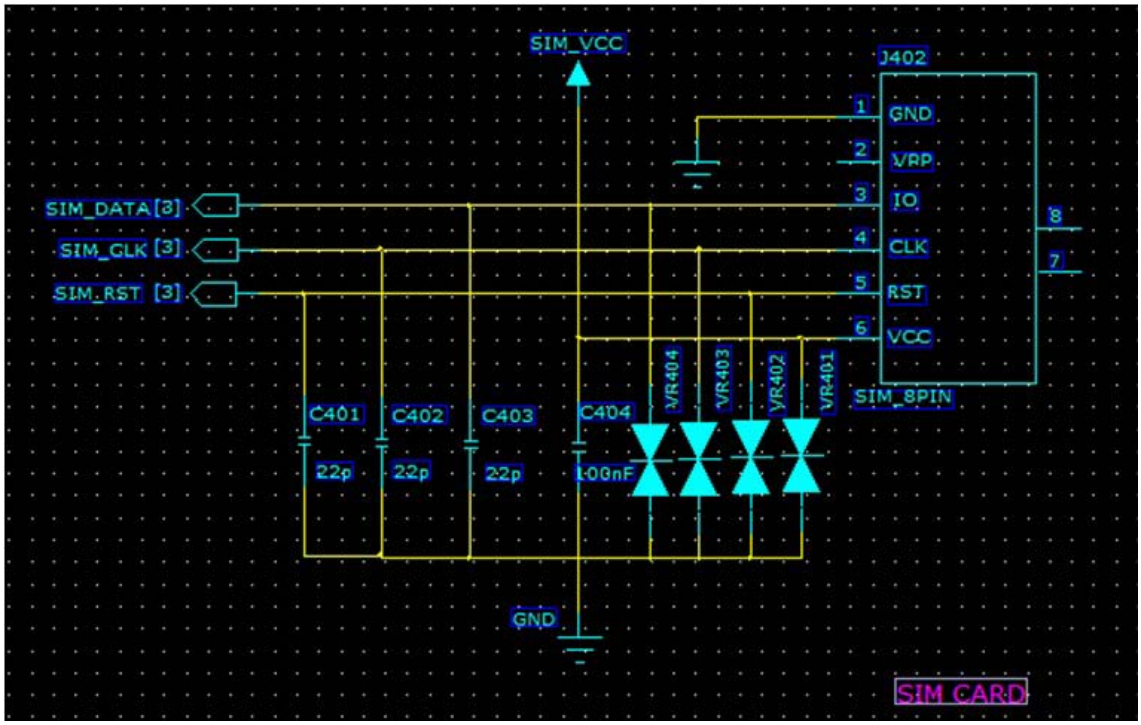

Figure 3-9

3.8.2 SIM Design Guidelines

The SIM interface and signals design is extremely important for proper operation of the module and the SIM card. There are several design guidelines that must be followed to achieve a robust and stable design that meets the required standards and regulations.

- The SIM should be located, and its signals should be routed, away from any possible EMI sources, such as the RF antenna and digital switching signals.
- The SIM interface signals length should not exceed 100 mm between the G620 interface connector and the SIM tray. This is to meet with EMC regulations and improve signal integrity.
- To avoid crosstalk between the SIM clock and data signals (SIM_CLK and SIM_DATA), it is recommended to rout them separately on the application board, and preferably isolated by a surrounding ground plane.
- The SIM card signals should be protected from ESD using very low capacitance protective elements (zener diodes, etc.). The recommended part no of ESD is AVR-M1005C080MTAAB (TDK). We also recommended the ESD component should layout with SIM hold closely.

3.9 Controls and Indicators Interface

The module incorporates several interface signals for controlling and monitoring the module's operation. The following paragraph describes these signals and their operation.

Pin #	Signal Name	Description
11	VDD	LDO power output Illustrating module start up
5	LPG	Module work status indicator
2	RESET_N	Extend reset module Low level activated

3.9.1 VDD Reference Regulator

The module incorporates a regulated voltage output VDD. The regulator provides a 2.85V output for use by the customer application. This regulator can source up to 30 mA of current to power any external digital circuits.

When the module started up by power on signal, The VDD is output. So it can be Illustrating module start up.

Note: The VDD regulator is powered from the G620's main power supply, and therefore any current sourced through this regulator originates from the G620 BATT supply. The overall BATT current consumed by G620 is directly affected by the VDD operation. The G620 current consumption raises with respect to the current sourced through VDD.

Parameter	Conditions	Min	Typical	Max	Unit
Vout	Iout=30mA	-3%	2.85	3%	V
Iout			10	30	mA
Imax	Current pulled down from LDO to GND until LDO voltage is 50% of nominal value			150	mA
External Capacitor		-35%	1	35%	uF
PSRR	50 Hz - 20 kHz		35		dB

3.9.2 External Reset

The RESET_N input signal would be power off the G620 immediately. This signal is set high after power up, when G620 is operating. It is set low when G620 is powered off.

When the RESET_N signal is low, the G620 is powered off without the work net logging out.

Note: It's recommended that it should connect he 1nF capacitor to GND on external circuit.

Parameter	Conditions	Min	Typical	Max	Unit
T width		100	200	400	mS

3.9.3 LPG

As an alternative to generating the synchronization signal, the control pin can be used to drive a status LED on application platform. The timing of LPG, it can be indicated the module status straight.

Referenced circuits:

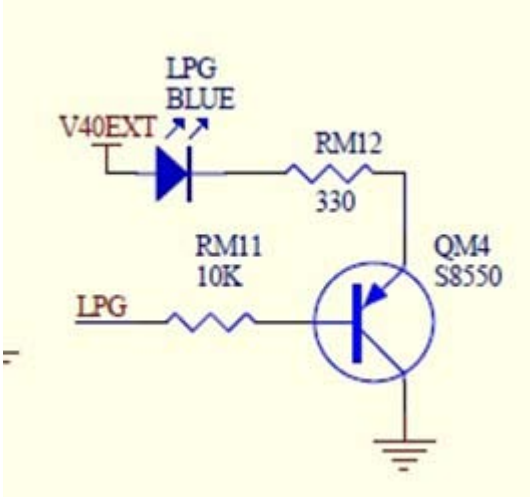

Figure 3-10

States of the LED vs PIN: LED Off = HIGH. LED On = LOW.

LED state	Operating status of the module
Permanently off	The module is in one of the following modes: • Power off mode • SLEEP mode
600 ms on / 600 ms off	The module is in one of the following status: • NO SIM card • SIM PIN • Register network (T<15S) • Register network failure (always)
3 s on / 75 ms off	The module is in one of the following status: • IDLE mode
75 ms on / 75 ms off	The module is in one of the following status: • One or more GPRS contexts activated.
Permanently on	The module is in one of the following status: • Voice call • CSD or FAX call

When the module is POWER ON, the LPG timing see as below:

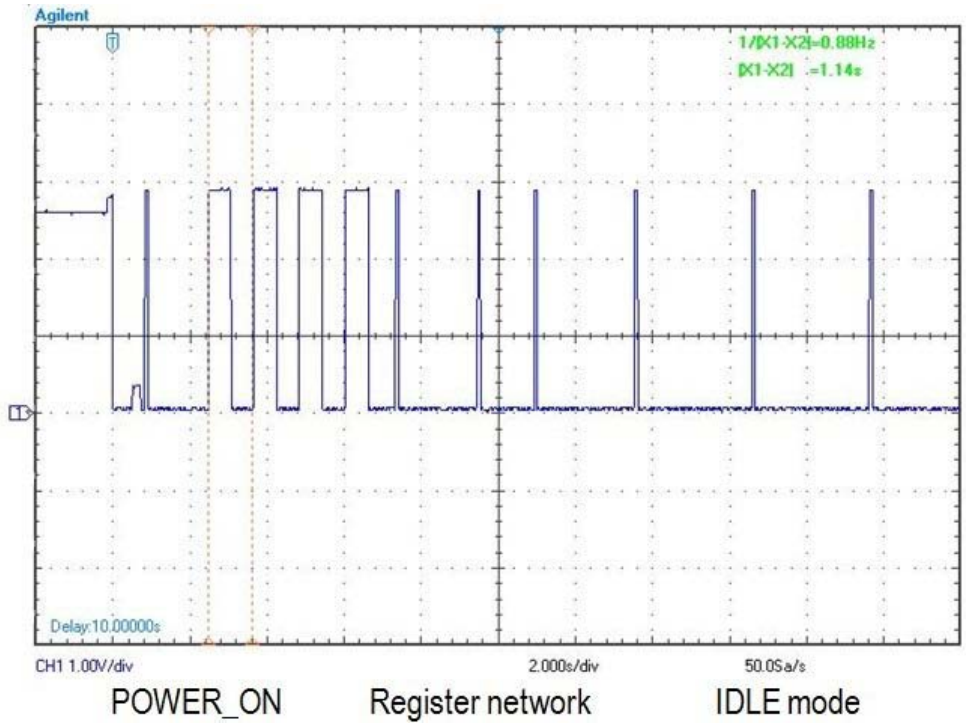

Figure 3-11

4 Electrical and Environmental Features

4.1 Absolute Maximum Ratings

The table gives the maximum electrical characteristics of the module interface signals.

Note: Using the G620 module beyond these conditions may cause permanent damage to the module.

Parameter	Conditions	Min	Max	Unit
BATT Supply		-0.2	4.5	V
Digital Input Signals	G620 powered on VDD Domain	-0.2	3.3	V

4.2 Environmental Specifications

The table gives the environmental operating conditions of the G620 module.

Note: Using the G620 module beyond these conditions may cause permanent damage to the module.

Parameter	Conditions	Min	Max	Unit
Ambient Operating Temperature		-40	85	℃
Storage Temperature		-40	85	℃
ESD	At antenna port Contact Air At plane		± 8 ± 15	KV KV

4.3 Application Interface Specifications

The table summarizes the DC electrical specifications of the application interface connector signals.

Note: Interface signals that are not used by the customer application must be left unconnected. G620 incorporates the necessary internal circuitry to keep unconnected signal in their default state. Do not connect any components to, or apply any voltage on, signals that are not used by the application.

G620 Pin#	G620 Signal Name	Description	I/O	Reset Level	Idle Level	Level Character
Power						
17	BATT	DC power supply	I			3.3V ~ 4.5V
18						
6	GND	Ground				
12						
13						
15						
16						
1	VBACKUP	Real time clock power	I/O	2.0V	2.0V	1.86V ~ 2.14V Output current <3mA Input current <12uA
Control & Status						
5	LPG	Work mode indicator	O	CP	Wave	VOL_{MAX}=0.35V VOH_{MIN}=VDD-0.35V
11	VDD	LDO power output Illustrating start up	O	0.3V	2.85V	±3% Output current <10mA
2	RESET_N	Extend reset** Low level activated	I	PU/HZ	H	VIL_{MAX}=0.2V VIH_{MIN}=0.7*VDD
3	POWER_ON	Turn on module Low level activated	I	PU/HZ	H	VIL_{MAX}=0.2V VIH_{MIN}=0.7*VDD 220K PU to VBACKUP
UART (Modem DCE)						
22	RXD_N	Received Data	O	CP	H	VOL_{MAX}=0.35V VOH_{MIN}=VDD-0.35V VIL_{MAX}=0.2V VIH_{MIN}=0.7*VDD
21	TXD_N	Transmitted Data	I	CP	H	
24	RING_N	Ring indicator	O	CP	H	
23	DSR_N	Data Set Ready	O	CP	H	
20	RTS_N	Request To Send	I	CP	H	
25	DTR_N	Data Terminal Ready	I	CP	H	
19	CTS_N	Clear To Send	O	CP	L	
26	DCD_N	Data Carrier Detect	O	CP	H	
SIM Interface (3.0V)						
9	SIM_VCC	SIM power	O	0.3V	1.8V 2.85V	±3% Output current <10mA
7	SIM_CLK	SIM clock	O	T	3.58MHz	VOL_{MAX}=0.35V VOH_{MIN}=VSIM-0.35V VIL_{MAX}=0.2*VSIM VIH_{MIN}=0.7*VSIM
8	SIM_DATA	SIM data	I/O	OD/PD	Wave	
10	SIM_RST	SIM reset	O	T	L	
Others						
14	RF_ANT	RF antenna port				
4	NC					

Note： CP=Center Pin; T= 3 Status; PD= Pull Down; PU=Pull Up; OD=Open Drain

4.4 Pin Definitions

Figure 4-1

Pin No.	Signal Name	Pin No.	Signal Name
1	VBACKUP	14	RF_ANT
2	RESET_N	15	GND
3	POWER_ON	16	GND
4	NC	17	BATT
5	LPG	18	BATT
6	GND	19	CTS_N
7	SIM_CLK	20	RTS_N
8	SIM_DATA	21	TXD_N
9	SIM_VCC	22	RXD_N
10	SIM_RST	23	DSR_N
11	VDD	24	RING_N
12	GND	25	DTR_N
13	GND	26	DCD_N

5 Mechanical Design

5.1 Mechanical Specifications

The following figure shows the mechanical specifications of the module in details:

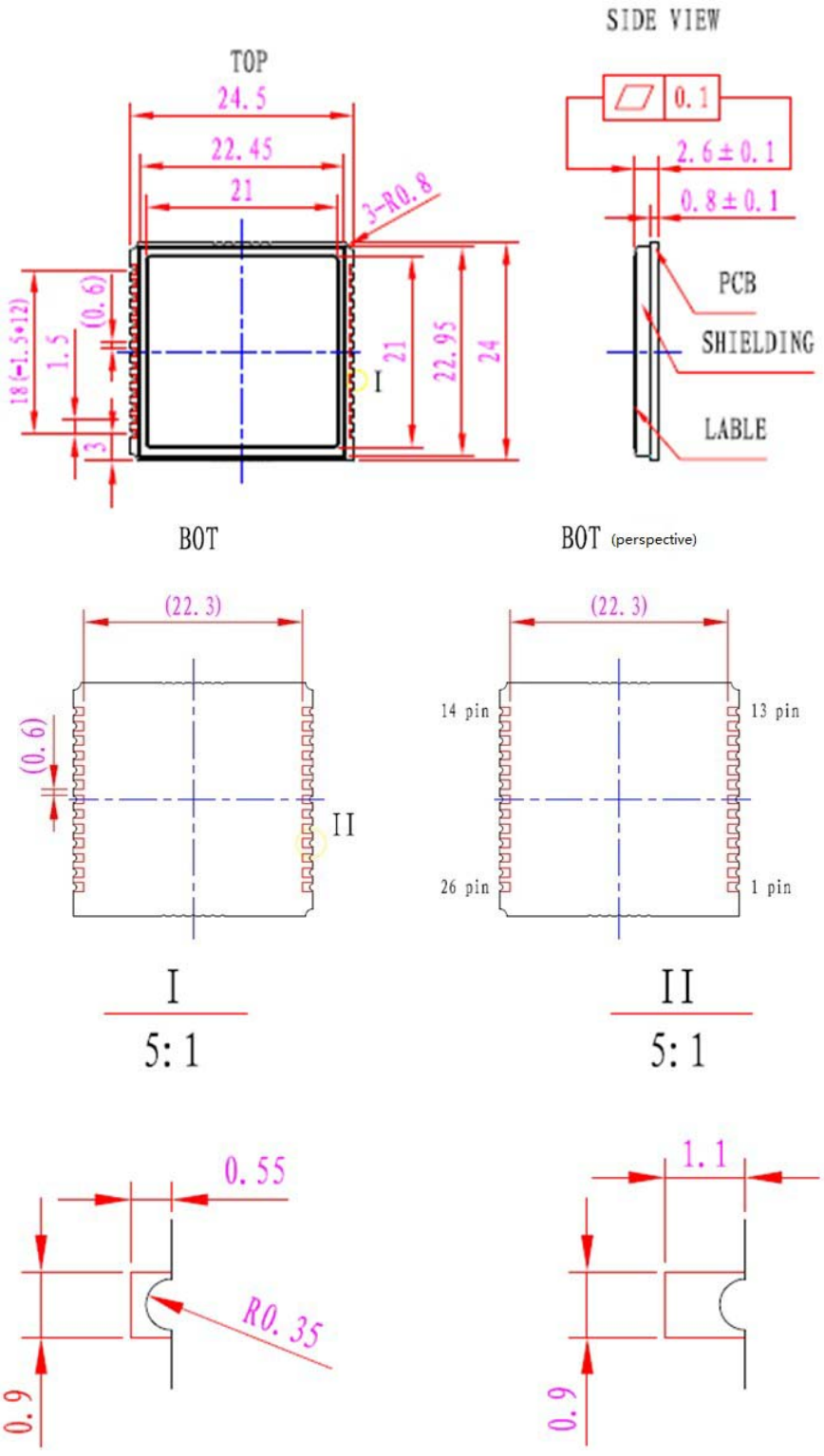

Figure 5-1

5.2 Recommended PCB Layout

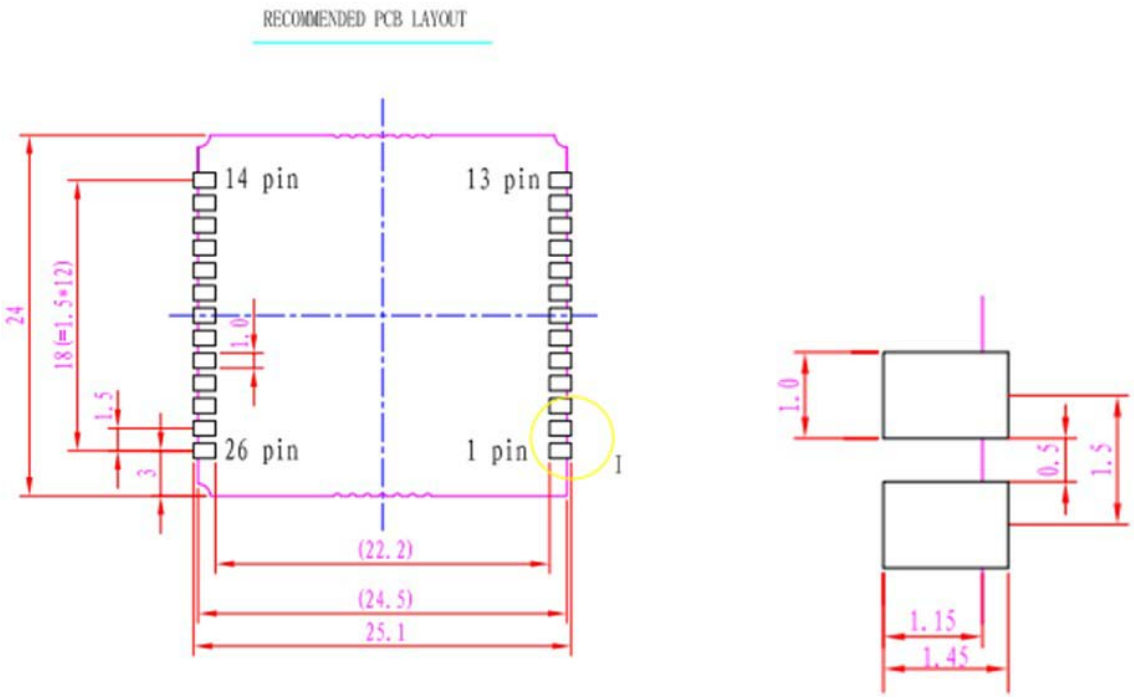

Figure 5-2

5.3 Antenna Design

The RF I/O Antenna signal is by default provided to 50 ohm antenna interface. In user's main board, the Antenna layout should be design 50 ohm Microstrip Transmission Line.

The Microstrip Transmission Line is better handled by PCB vendor. We also provide a sample 50 ohm unbalanced transmission system.

Here are some PCB parameters which will affect impedance:

- Track width (W)
- PCB substrate thickness (H)
- PCB substrate permittivity (εr)
- To a lesser extent, PCB copper thickness (T) and proximity of same layer ground plane.

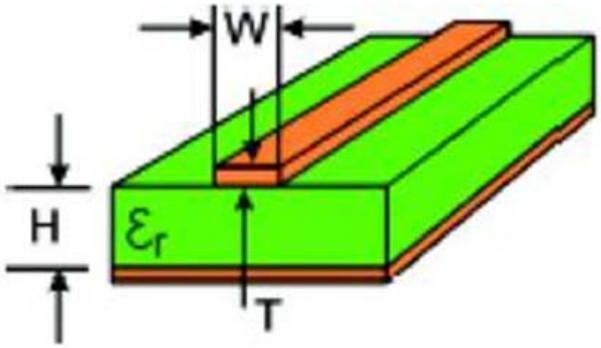

Figure 5-3

Typical Track Widths for an FR4 material PCB Substrate in Microstrip Topology

Substrate Material	Permittivity ε_r	Substrate Thickness H (mm)	Track Width W (MM)
FR4	4.6	1.6	2.91
		1.2	2.12
		1.0	1.81
		0.8	1.44
		0.6	1.07
		0.4	0.71
		0.2	0.34

Antenna characteristics are essential for good functionality of the module. The radiating performance of antennas has direct impact on the reliability of connection over the Air Interface. Bad termination of the antenna can result in poor performance of the module.

The antenna should fulfill the following requirements:

Antenna Requirements	
Impedance	50 Ω
Frequency Range	Depends on the Mobile Network used. GSM900: 880~960 MHz GSM1800: 1710~1880 MHz GSM850: 824~894 MHz GSM1900: 1850~1990 MHz
Input Power	>2 W peak
V.S.W.R	<2:1 recommended, <3:1 acceptable
Return Loss	S11<-10 dB recommended, S11<-6 dB acceptable
Gain	<3 dBic

Typically GSM antennas are available as:

Linear monopole: typical for fixed application. The antenna extends mostly as a linear element with a dimension comparable to lambda/4 of the lowest frequency of the operating band. Magnetic base may be available. Cable or direct RF connectors are common options. The integration normally requires the fulfillment of some minimum guidelines suggested by antenna manufacturer.

Patch-like antenna: better suited for integration in compact designs (e.g. mobile phone). They are mostly custom designs where the exact definition of the PCB and product mechanical design is fundamental for tuning of antenna characteristics.

For integration observe these recommendations:

Ensure 50 Ω antenna termination minimize the V.S.W.R. or return loss, as this will optimize the electrical performance of the module.

Select antenna with best radiating performance.

If a cable is used to connect the antenna radiating element to application board, select a short cable with minimum insertion loss. The higher the additional insertion loss due to low quality or long cable, the lower the connectivity will be.

Follow the recommendations of the antenna manufacturer for correct installation and deployment

Do not include antenna within closed metal case.

Do not place antenna in close vicinity to end user since the emitted radiation in human tissue is limited by S.A.R. regulatory requirements.

Do not use directivity antenna since the electromagnetic field radiation intensity is limited in some countries.

Take care of interaction between co-located RF systems since the GSM transmitted power may interact or disturb the performance of companion systems.

Place antenna far from sensitive analog systems or employ countermeasures to reduce electromagnetic compatibility issues that may arise.

The modules are designed to work on a 50 Ω load. However, real antennas have no perfect 50 Ω load on all the supported frequency bands. To reduce as much as possible performance degradation due to antenna mismatch, the following requirements should be met:

Measure the antenna termination with a network analyzer: connect the antenna through a coaxial cable to the measurement device; the |S11| indicates which portion of the power is delivered to antenna and which portion is reflected by the antenna back to the modem output.

A good antenna should have a |S11| below -10 dB over the entire frequency band. Due to miniaturization, mechanical constraints and other design issues, this value will not be achieved. A value of |S11| of about -6 dB - (in the worst case) - is acceptable.

5.4 Reflow Temperature Profile

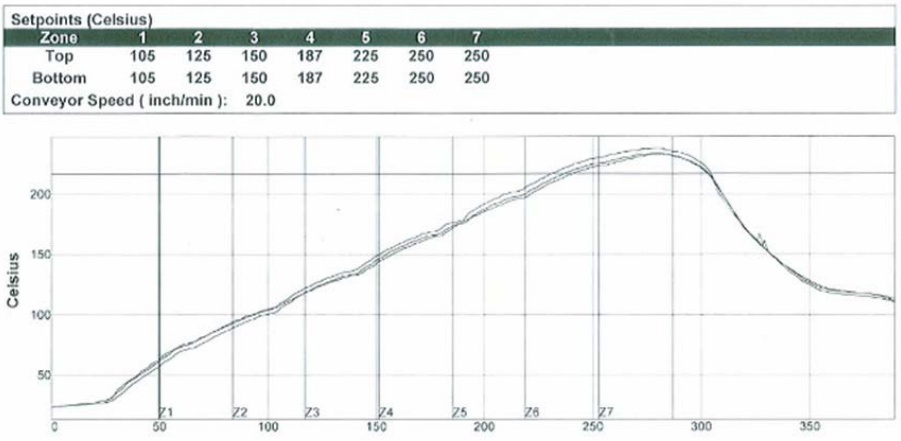

Figure 5-4

Appendix: Glossary

Name	Description
ADC	Analog-Digital Converter
ETS	European Telecommunication Standard
ESD	Electronic Static Discharge
EMC	Electromagnetic Compatibility
EMI	Electro Magnetic Interference
FEM	Front end module
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
LNA	Low Noise Amplifier
PCB	Printed Circuit Board
PCL	Power Control Level
PMU	Power manager unit
RTC	Real Time Clock
SIM	Subscriber Identification Module
SMS	Short Message Service
SMD	Surface Mounted Devices
UART	Universal Asynchronous Receiver Transmitter, asynchronous serial port
VCO	Voltage Controlled Oscillator