Neoway 有方

M590 GPRS Module
Hardware User Guide

Version 1.2

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Notice

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Revision Record

Issue	Changes	Revised By	Date
V1.0	Initial draft	Qiao Naiwei	2013-10
V1.1	Modified the description of VCCIO	Qiao Naiwei	2014-04
V1.2	Added chapter 4.	Weng Peibin	2014-05

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About This Document

This document defines the features, indicators, and test standards of the M590 module and provides reference for the hardware design of each interface. With *M590 GPRS Module AT Command Set*, this user guide can help you complete wireless communication application easily.

1 Introduction to M590

M590 is a compact wireless GPRS module that supports downlink EDGE. It can provide functions of SMS and data services and is widely used in industrial and consumer fields.

1.1 Overview

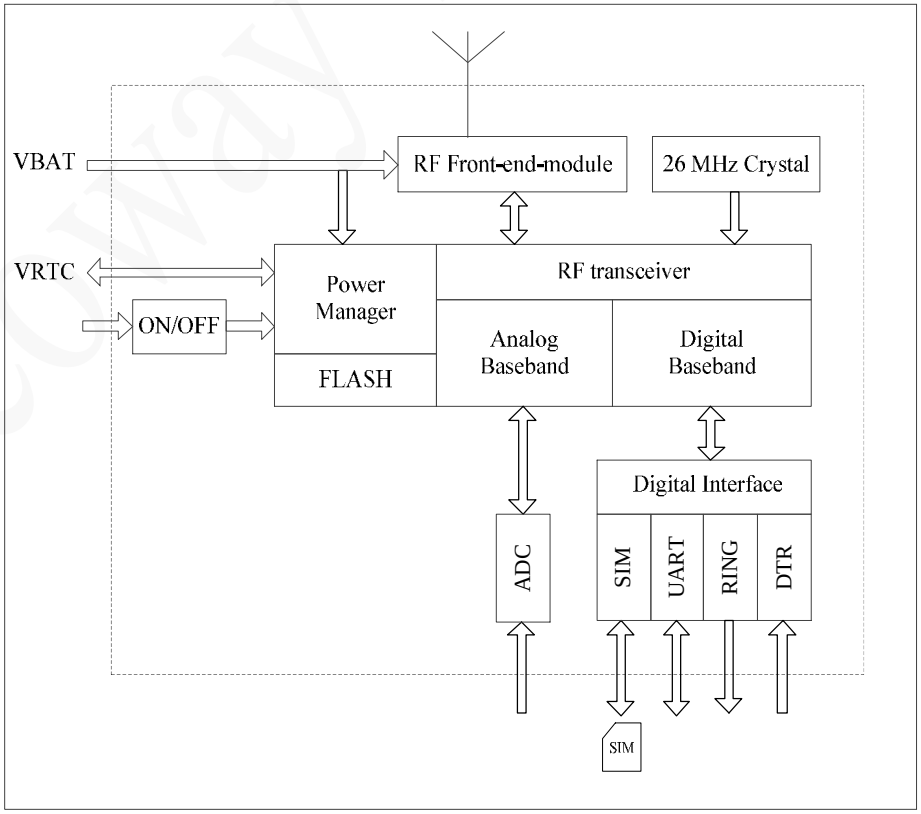
Neoway M590 module adopts 21-pin LCC encapsulation and its dimensions are 27.6 mm x 21.6 mm x 2.6 mm. It provides customers the following hardware resources:

- UART interfaces, used for data communication, firmware updating and commissioning
- 10-bit ADC input, voltage ranging from 0 V to 2.8 V
- Adapting to 1.8 V and 3.0V SIM card
- Supporting RING/LIGHT/DTR (sleep mode) functions
- Supporting time updating

1.2 Block Diagram

The M590 module consists of baseband controller, Flash ROM, RF section, application interfaces, etc. All sections coordinate with each other to provide such communication functions as GPRS data and voice.

The following figure shows the block diagram of M590.



1.3 Specifications

Table 1-1 M590specifications

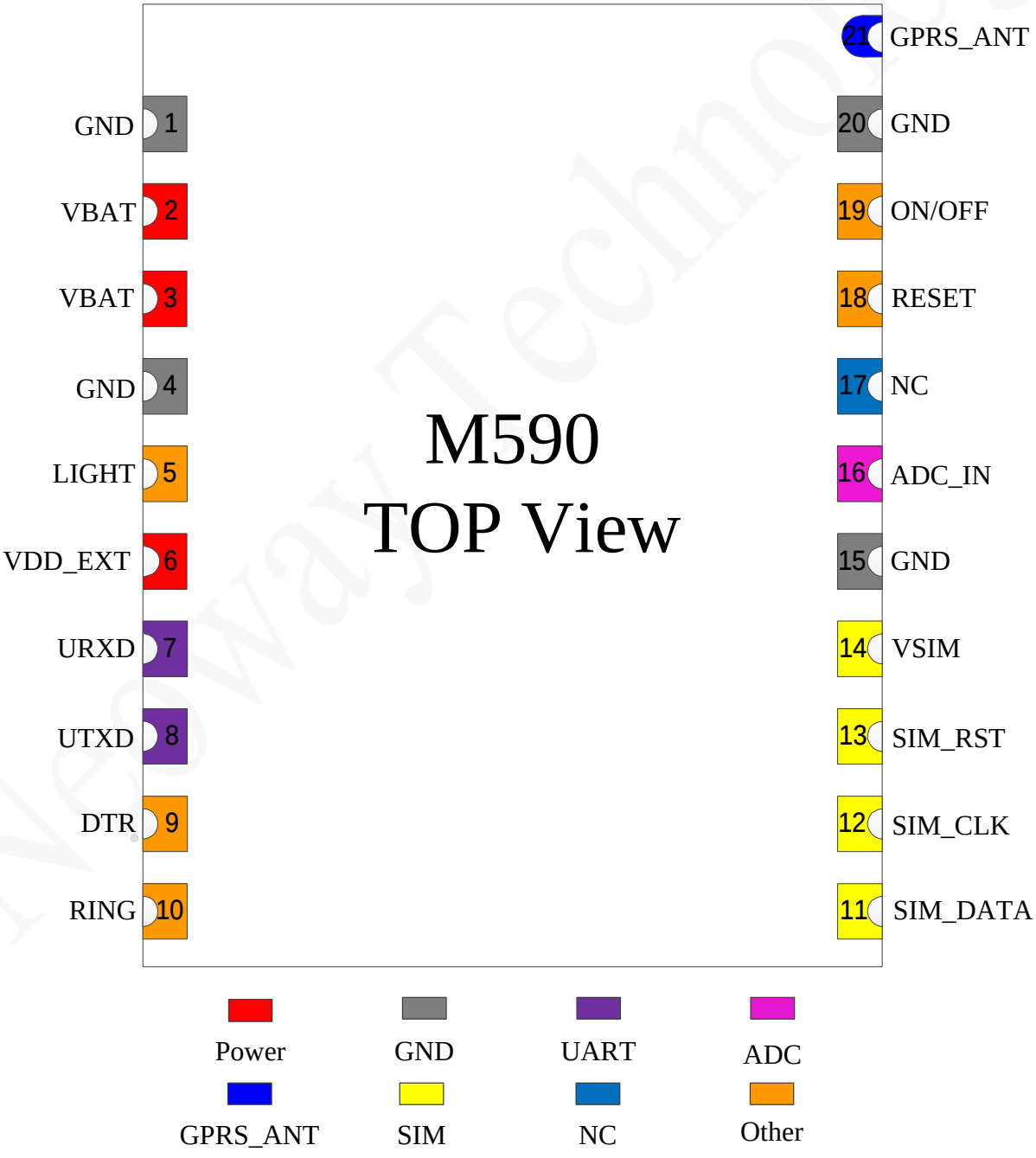
Specifications	Description
Band	EGSM900/DCS1800 MHz dual-band Supporting band locking
Sensitivity	< -107 dBm
Max. transmit power	ı EGSM900 Class4(2W) ı DCS1800 Class1(1W)
Protocol	Compatible with GSM/GPRS Phase 2/2+
AT	ı GSM07.07 ı Extended AT commands
SMS	ı TEXT/PDU ı Supporting SMS message receiving and transmitting and alert for new SMS messages ı Supporting SMS message management: reading/deleting/storage/list
GPRS feature	ı GPRS CLASS 12 ı Max. theoretic uplink rate: 85.6 Kbit/s ı Max. theoretic downlink rate: 85.6 Kbit/s ı Built-in TCP/IP protocol, supporting multiple links ı Supporting server and client modes
Circuit Switch Data	ı CSD data service ı USSD
UART	ı Supporting UART multiplexing ı Supporting AT sending, data transmission, and software download ı Supporting baudrate from 1200 bit/s to 115200 bit/s
CPU	ARM7-EJ@360MHz
Antenna feature	50 Ω impedance
Operating temperature	-40℃to +85℃
Operating voltage	3.5 V to 4.3 V (3.9 V is recommended)
Peak current	Max 2.0 A
Idle current	18 mA
Current in sleep mode	< 2 mA (live network)
	< 1 mA (instrument, DRX=9)

2 Pin Description and PCB Foot Print

2.1 Specifications and Encapsulation

Specifications	M590
Dimensions	27.6 mm x 21.6 mm x 2.6 mm (H x W x D)
Weight	2.6 g
Encapsulation	21-pin LCC

Figure 2-1 Top view of the M590 module



2.2 Pin Definition

Table 2-1 M590 pin definition

Pin	Name	I/O	Function	Reset Status	Level Feature (V)	Remarks
Power Supply and Switch Interfaces						
2, 3	VBAT	P	Main power supply input			3.5 V to 4.3 V (3.9 V is recommended)
6	VDD_EXT	P	2.8 V power supply output			Supply power for IO level shifting circuit. Load capability: less than 50 mA
1, 4, 15, 20	GND	P	Ground			
19	ON/OFF	DI	On/Off input		$0<V_{IL}<0.6$ $2.1<V_{IH}<VBAT$	Low level pulse can change the On/Off state.
18	RESET	DI	Reset input		$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$	Internally pulled up to 2.8V Low level reset
UART Interface						
7	URXD	DI	UART data receive	I/PU	$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$ $0<V_{OL}<0.42$ $2.38<V_{OH}<2.8$	With 47K pull-up inside
8	UTXD	DO	UART data transmit			
SIM Card						
11	SIM_DATA	DI/O	SIM card data IO		$0<V_{IL}<0.25*VSIM$, $0.75*VSIM<V_{IH}<VSIM$ $0<V_{OL}<0.15*VSIM$ $0.85*VSIM<V_{OH}<VSIM$	Compatible with 1.8/3.0 V SIM card
12	SIM_CLK	DO	SIM card clock output			
13	SIM_RST	DO	SIM card reset output			
14	VSIM	P	SIM card power supply output			
LED Indicators						
5	LIGHT	DO	Status LED	I/PD		2.8 V/4 mA output
Sleep Mode Controlling						
9	DTR	DI	Signal for controlling sleep mode	I/PD	$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$ $0<V_{OL}<0.42$	Low level by default Used together with AT commands

					$2.38<V_{OH}<2.8$	
SMS and Incoming Call Ring						
10	RING	DO	Ring output	I/PD	$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$ $0<V_{OL}<0.42$ $2.38<V_{OH}<2.8$	Detect incoming SMS messages or calls
ADCDetecting						
16	ADC_IN	AI	10-bitADC input			Detectable voltage range: 0 V to 2.8 V
GPRS Antenna						
21	GPRS_ANT	AI/O	GPRS antenna interface			50 Ω impedance
Reserved Pins						
17	NC					Must be left disconnected.

NOTE

P: indicates power supply pins

NC: indicates pins that are not supported and must not be connected

DI: indicates digital signal input pins

DO: indicates digital signal output pins

I/PD: indicates digital signal input pins with pull-down

I/PU: indicates digital signal input pins with pull-up

AI: indicates analogy signal input pins

AO: indicates analogy signal output pins

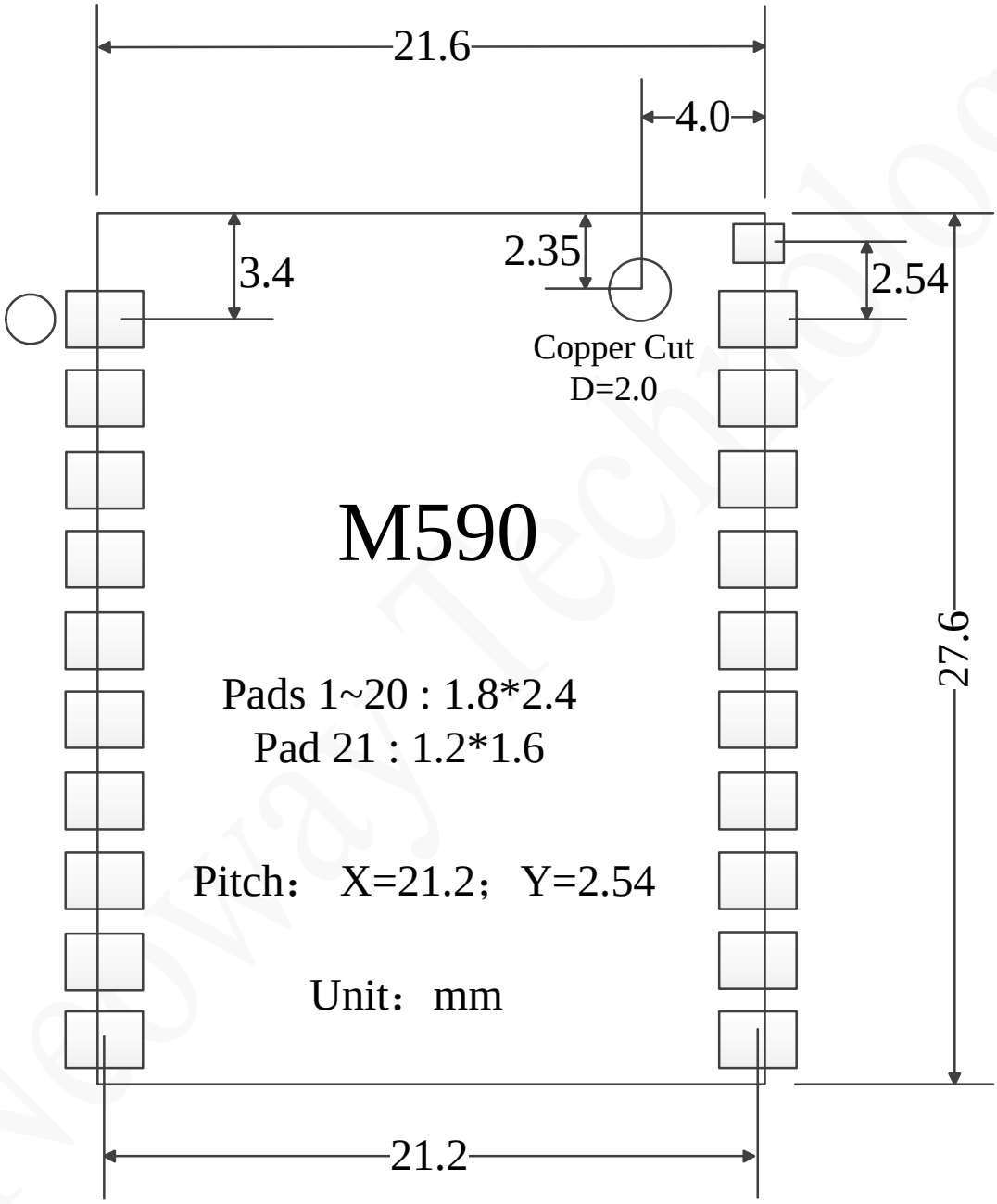
CAUTION

The maximum input voltage at all IO ports (including peak signal current) cannot exceed 3.1 V because the module uses a 2.8 V IO power system. In the application of the module, the IO output voltage from the 3.3 V power supply system of the external circuit might greatly overshoot 3.1 V due to the signal integrity design. In this situation, the IO pins of the module might be damaged if the IO signals are connected to the IO port on the 2.8-V system. To rectify this issue, take measures to match the level. For details, see the Section 3.2 UART.

2.3 PCB Foot Print

LCC packaging is adopted to package the pins of the M590 module. Figure 2-2 shows the recommended PCB foot print.

Figure 2-2 PCBfoot print recommended for M590 (unit: mm)



3 Interface Design

3.1 Power Supply and Switch Interfaces

Table 3-1 Power supply and switch interface

Signal	I/O	Function	Remarks
VBAT	P	Main power supply input	3.5 V to 4.3 V (3.9 V is recommended)
VDD_EXT	P	2.8 V power supply output	Loading capability < 50 mA
RESET	DI	Module reset input	Reset at low level Min. 50 ms 100 ms is recommended
ON/OFF	DI	On/Off input	Low level pulse can change the On/Off state.

3.1.1 Design Requirements

VBAT is the main power supply of the module. Its input voltage ranges from 3.5 V to 4.3 V and the preferable value is 3.9V.It supplies power for baseband controller and RF power amplifier.

The performance of the VBAT power supply is a critical path to module's performance and stability. The peak input current at the VBAT pin can be up to 2 A when the signal is weak and the module works at the maximum transmitting power. The voltage will encounter a drop in such a situation. The module might restart if the voltage drops lower than 3.5 V.

Figure 3-1 Current peaks and voltage drops

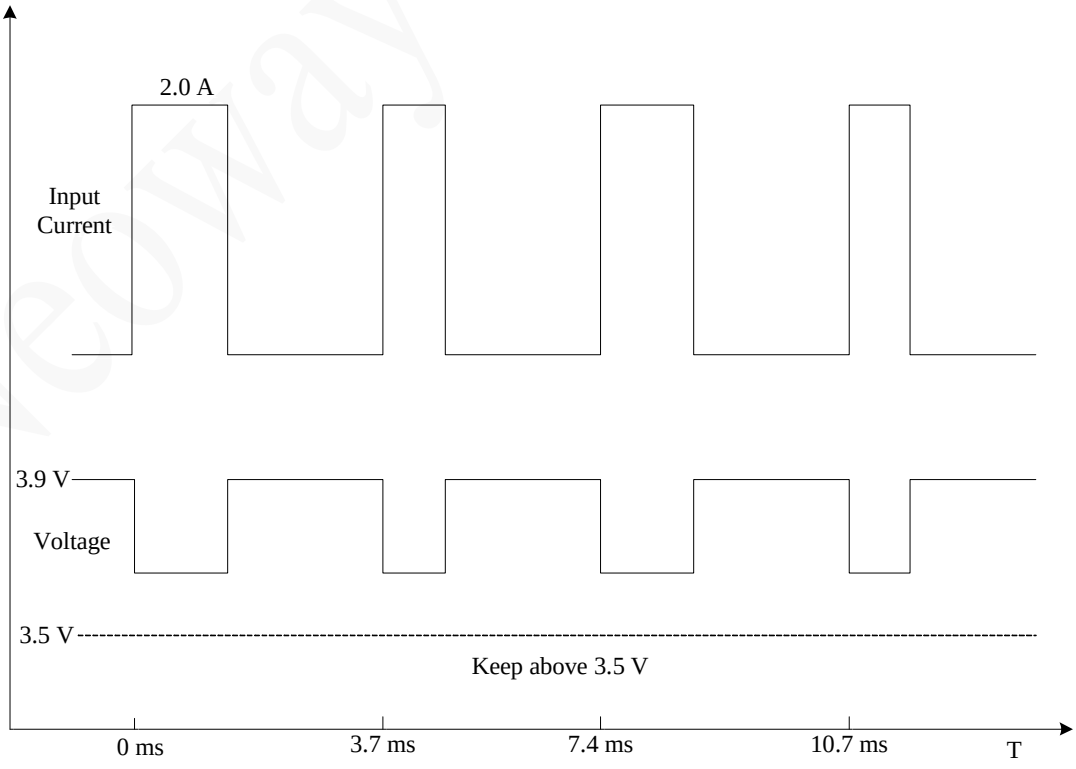
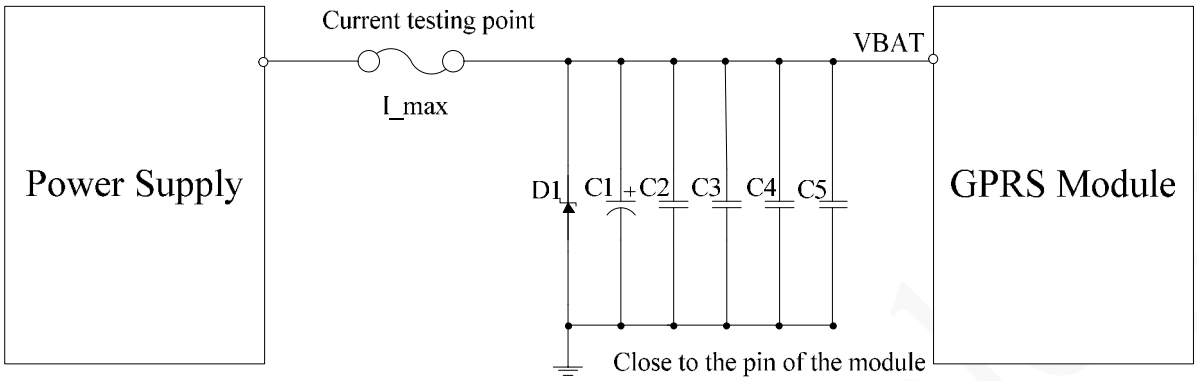


Figure 3-2shows a recommended power supply design for the module.

Figure 3-2 Capacitors used for the power supply

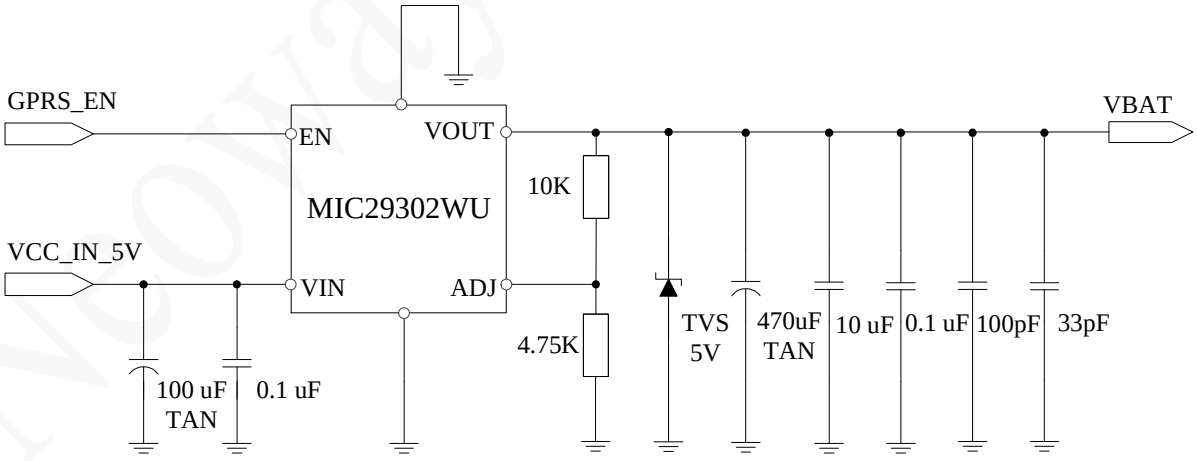


In the circuit, you can use TVS at D1 to enhance the performance of the module during a burst. SMF5.0AG (Vrwm=5V&Pppm=200W) is recommended.A large bypass tantalum capacitor (220 μF or 100μF) or aluminum capacitor (470 μF or 1000 μF) is expected at C1 to reduce voltage drops during bursts together with C2 (10μF capacitor). In addition, you need to add 0.1 μF, 100 pF, and 33 pF filter capacitors to enhance the stability of the power supply.

A controllable power supply is preferable if used in harsh conditions. The module might fail to reset in remote or unattended applications, or in an environment with great electromagnetic interference (EMI). You can use the EN pin on the LDO or DC/DC chipset to control the switch of the power supply as shown in Figure 3-3.

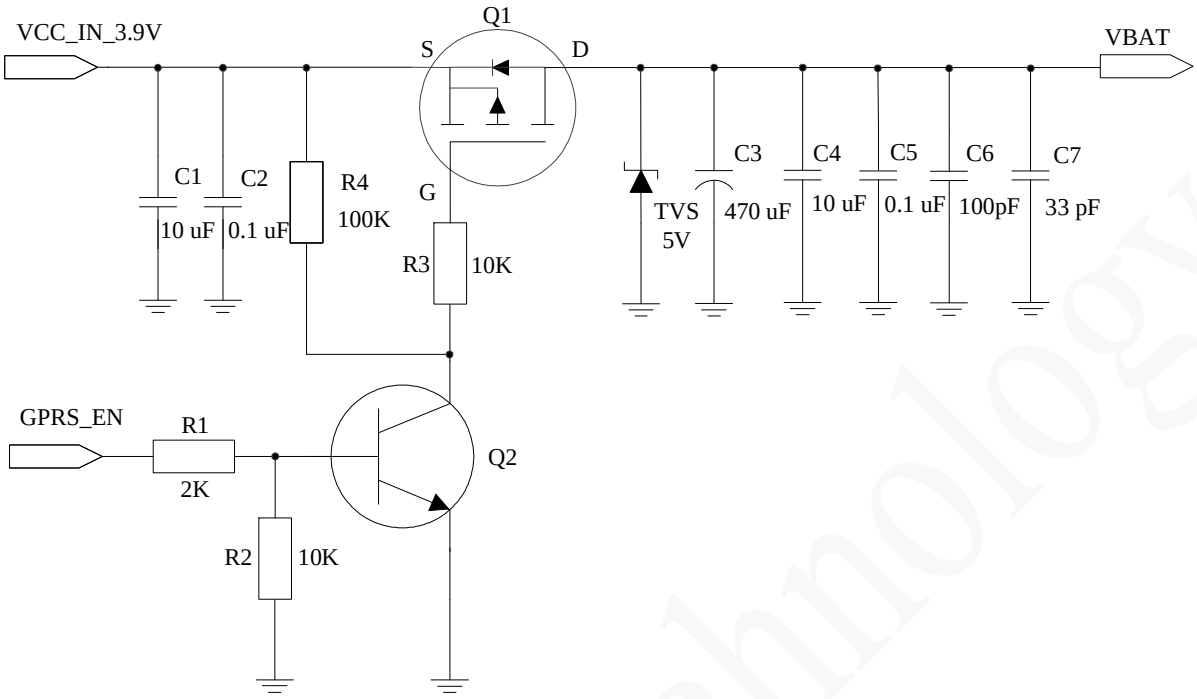
MIC29302WU in the following figure is an LDO and outputs 3 A current to ensure the performance of the module.

Figure 3-3 Reference design of power supply control



The alternative way is to use a p-MOSFET to control the module's power, as shown in Figure 3-4． When the external MCU detects the exceptions such as no response from the module or the disconnection of GPRS, power off/on can rectify the module exceptions.In Figure 3-4, the module is powered on when GPRS_EN is set to high level.

Figure 3-4 Reference design of power supply controlled by p-MOSFET



Q2 is added to eliminate the need for a high enough voltage level of the host GPIO.In case that the GPIO can output a high voltage greater than VCC_IN_3.9V - $|V_{GS(th)}|$, where $V_{GS(th)}$ is the Gate Threshold Voltage, Q2 is not needed.

Reference components:

- Q1 can be IRML6401 or Rds(on) p-MOSFET which has higher withstand voltage and drain current.
- Q2: a common NPN transistor, e.g. MMBT3904; or a digital NPN transistor, e.g. DTC123.If digital transistor is used, delete R1 and R2.
- C3: 470 uF tantalum capacitor rated at 6.3V; or 1000 uF aluminum capacitor.If lithium battery is used to supply power, C3 can be 220 uF tantalum capacitor.

Protection

Place a TVS diode (V_{RWM}=5 V) on the VBAT power supply to ground, especially in automobile applications. For some stable power supplies, zener diodes can decrease the power supply overshoot. MMSZ5231B1T1G from ONSEMI and PZ3D4V2 from Prisemi are options.

Trace

The trace width of primary loop lines for VBAT on PCB must be able to support the safe transmission of 2A current and ensure no obvious loop voltage decrease.Therefore, the trace width of VBAT loop line is required 2 mm and the ground should be as complete as possible.

Separation

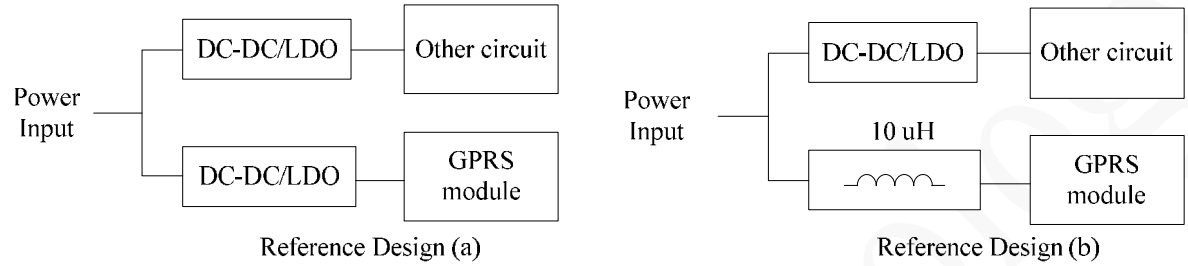
As shown in Figure 3-1, the GPRSmodule works in burst mode that generates voltage drops on power supply. And furthermore this results in a 217Hz TDD noise through power (One of the way generating noise.Another way is through RF radiation). Analog parts, especially the audio circuits, are subjected to this noise, known as a "buzz noise" in GSM systems.To prevent other parts from being affected, it's better to use

separated power supplies.The module shall be supplied by an independent power, like a DC/DC or LDO. See Figure 3-5.

DC/DC or LDO should output rated peak current larger than 2 A.

The inductor used in Reference Design (b), should be a power inductor and have a very low resistance. 10 uH with average current ability greater than 1.2A and low DC resistance is recommended.

Figure 3-5 Reference designs of separated power supply



CAUTION

Never use a diode to make the drop voltage between a higher input and module power. Otherwise, Neoway will not provide warranty for product issues caused by this. In this situation, the diode will obviously decrease the module performances, or result in unexpected restarts, due to the forward voltage of diode will vary greatly in different temperature and current.

EMC Considerations

Place transient overvoltage protection components like TVS diode on power supply, to absorb the power surges. SMAJ5.0A/C could be a choice.

3.1.2 VDD_EXT

It is recommended that VDD_EXT is only used for interface level transformation. VDD_EXT can output 2.8 V and 50 mA. It stops output after the module is shut down.

3.1.3 Power-On/OffControl and Procedure

Prior to turning on the module, power on the host MCU and finish the UART initialization.Otherwise conflictions may occur during initialization, due to unstable conditions.

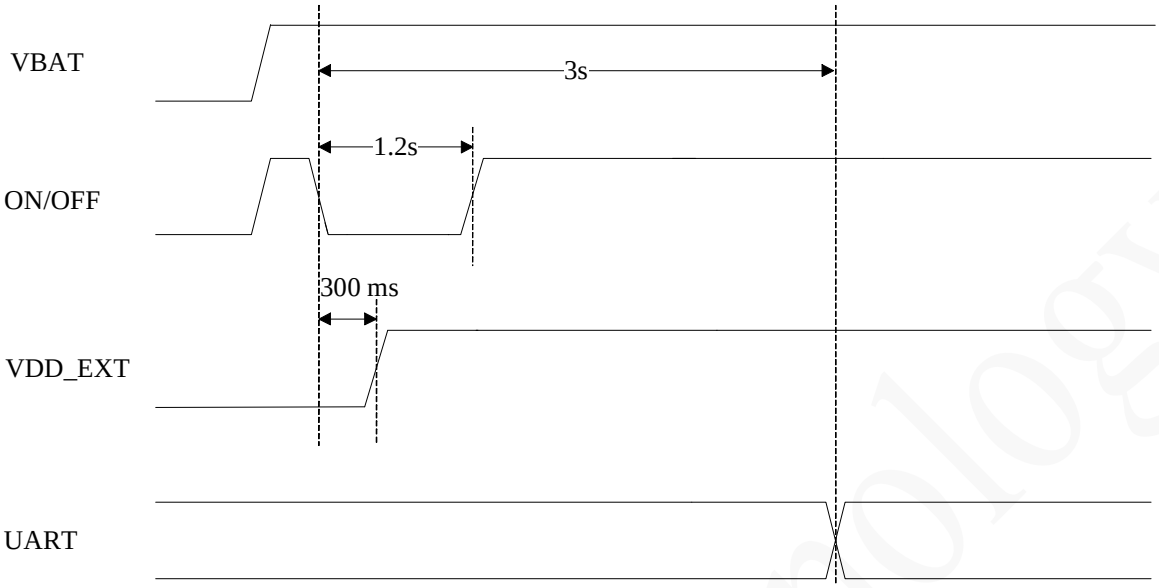
ON/OFF is a low level pulse active input, used to turn on or off the module.

Power-On Procedure

While the module is off, drive the ON/OFF pin to ground for at least **1.2 second** and then release, the module will start. An unsolicited message (+MODEM:STARTUP) will be sent to host through UART port, indicating that the module is powered on and can respond to AT commands.

When you design your program, you can use the unsolicited message (MODEM:STARTUP) to check whether the module is started or reset improperly.

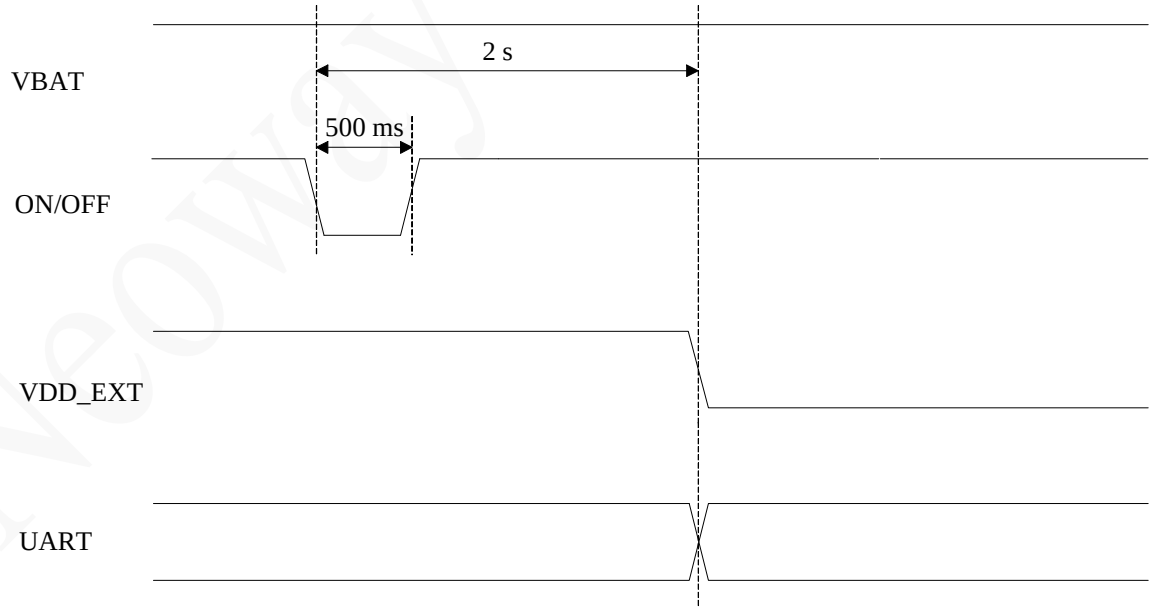
Figure 3-6 Power-on procedure



Power-Off Procedure

While the module is on, drive the ON/OFF pin to ground for at least 5**00 ms** and then release, the module will try to detach to network and normally 2 seconds later it will shut down. Another approach to turn off the module is using AT commands. For details, see *M590 GPRS Module AT Commands.* Figure 3-7 shows the power-off procedure of the module.

Figure 3-7 Power-off procedure



Power-On/Off Control

Figure 3-8 shows a reference circuit for ON/OFF control with inverted control logic.

Figure 3-8 Reference circuit for power-on/off control

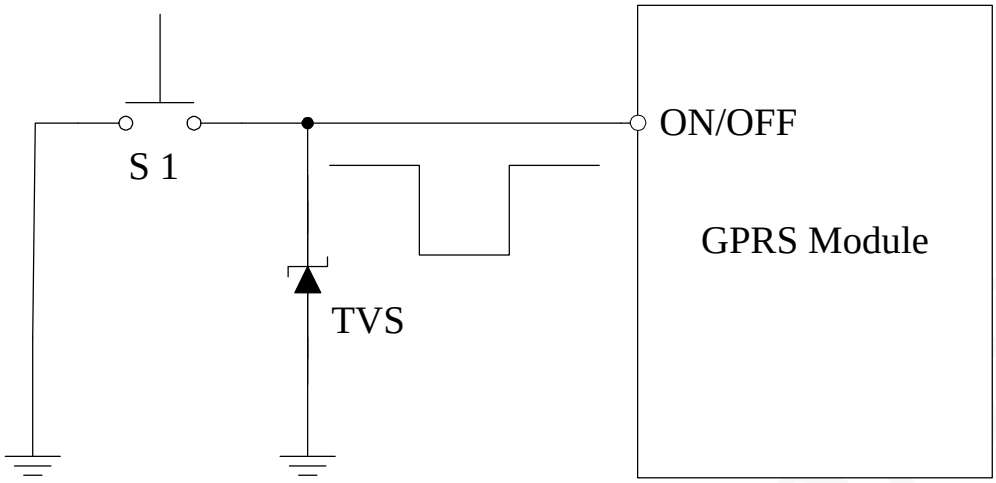
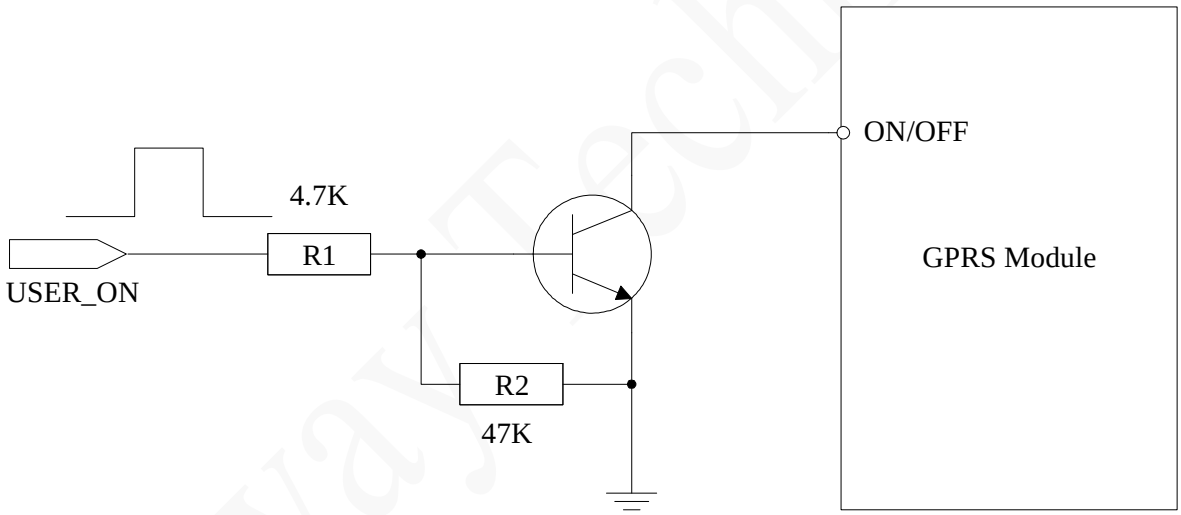


Figure 3-9 Reference circuit for power-on/off controlled by high level



In Figure 3-9, high level takes effect for ON/OFF on the user side (USER_ON) after level shifting.

R1 and R2 can be adjusted according to the driving capability of the USER_ON pin.

Use a common NPN transistor, e.g. MMBT3904; or a digital NPN transistor, e.g. DTC123.If digital transistor is used, delete R1 and R2.

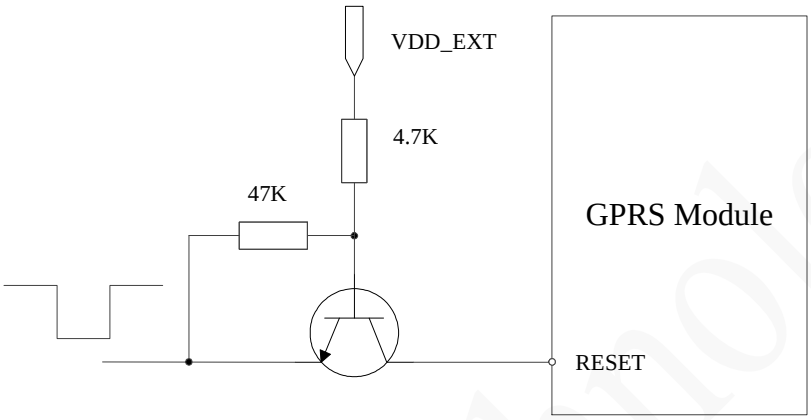
CAUTION

- Level abnormalities at interfaces connected to the external MCU, especially the UART port, might affect the power-on procedure of the module. For example, when a module is turned on, the IO ports of the MCU are still in output status because they have not been initialized completely. The module might fails to start if the UTXD signal (output pin) is forced to pull up or down.
- The better way to rescue the module from abnormal condition, is to apply a power OFF-ON procedure, rather than using the ON/OFF control signal. In fact ON/OFF signal is software-dependent.

3.1.4 RESET

You can reset the module by keeping the RESET pin low level for more than 100 ms.The pin is pulled up by an internal resistor and the typical high level is 2.8 V. The RESET pin can be left disconnected if not used. If you use 3.3 V IO system, you are advised to separate it by using triode. Please refer to Figure 3-10.

Figure 3-10 Reset circuitwith triode separating



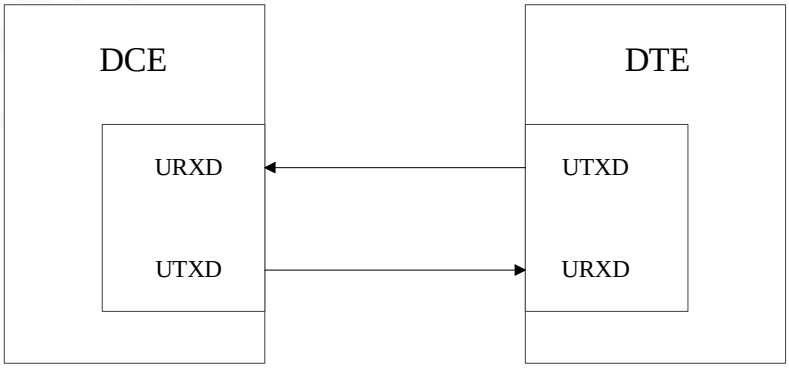
3.2 UART

Table 3-2 UART

Signal	I/O	Function Description	Remarks
URXD	DI	UART data receive	
UTXD	DO	UART data transmit	

UART is used for AT commands, data sending/receiving, firmware updating, etc. Figure 3-11shows the signal connection between the module (DCE) and the terminal (DTE).

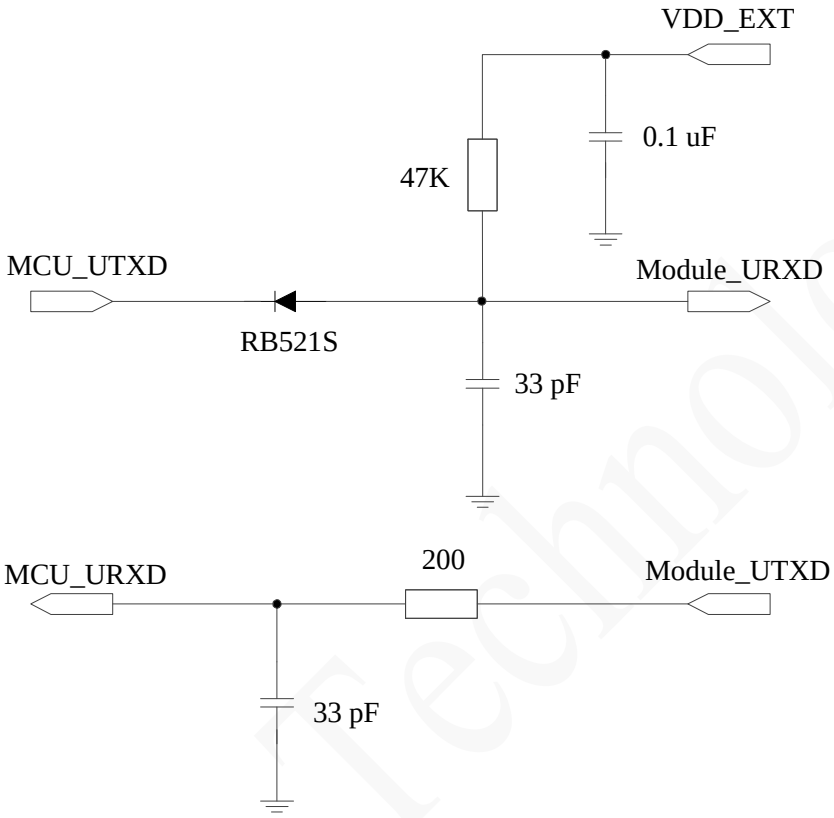
Figure 3-11 Signal connection between DCE and DTE



The UART of M590works at **2.8 V** CMOS logic level. The voltages for input high level should **not** exceed 3.1 V. Supported baud rates are 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200 bit/s, and the default rate is **115200 bit/s**.

If the UART is interfacing with a MCU that has 3.3V logic levels, it is recommended that you add a level shifting circuit outside of the module.

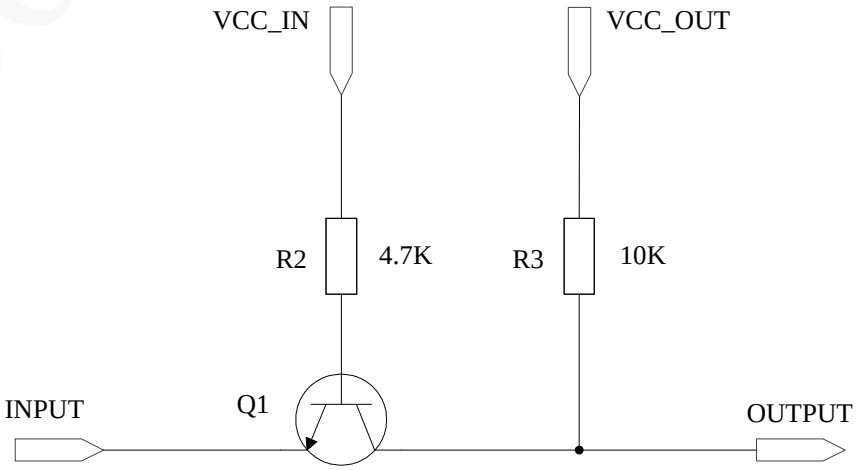
Figure 3-12 Recommended circuit for the communication between 3.3V MCU and UART



In Figure 3-12, 100 pF filter capacitor should be placed near the receive pin of the module. Resistance (200 Ω to 470 Ω) and capacity (100 pF to 470 pF) can be selected based on the tested signal wave. Great serial resistance and filter capacity will decrease the signal level, resulting in great signal wave distortion and the low adaptable UART communication baudrate. RB521S-30TE-61, RB521SM-30GJT2R, and LRB521S-30T1G are recommended for separating diode.

When the external MCU adopts 5 V IO system, level shifting is required for both UART receive and transmit.Figure 3-13shows a reference circuit.

Figure 3-13 Recommended circuit for the communication between 5V MCU and UART



In Figure 3-13, INPUT is connected to UTXD of the MCU and VCC_IN is connected to the 5 V power supply of the MCU. OUTPUT is connected to URXD of the module and VCC_OUT is connected to VDD_EXT(2.8V) of the module.If the circuit is far away from the VDD_EXTpin, add a 0.1 μF decoupling capacitor to VCC_OUT.

Level shifting between URXD of the MCU and UTXD of the module can be implemented in the same way.

The pull-up resistor R3 ranges from 4.7 K to 10 K; R2 ranges from 2 K to 10 K.Resistors are selected based on the voltage of the power supply and UART baudrate. You can select resistors with great resistance to reduce the power consumption when the power supply has great voltage or the baudrate is low. But, the resistance will affect the quality of the square wave.In addition, the circuit performance is affected by the signal traces during PCB layout.

It is recommended that you choose a high-speed NPN transistor because the Q1 switch rate will affect the wave quality after level shifting.MMBT3904 or MMBT2222 is recommended.

CAUTION

Avoid data produced at UART when the module is powered on. You are advised to send data to the UART 3 seconds after the module is powered on so that the module would not respond wrongly.

3.3 DTR and RING

Table 3-3 DTR and RING pins

Signal	I/O	Function	Remarks
DTR	DI	Signal for controlling sleep mode	Left disconnected if not used
RING	DO	Ring output	Left disconnected if not used

3.3.1 DTR Pin

Generally DTR is used for sleep mode control. It works with AT commands. For details, see *M590GPRS Module AT CommandSet*.Based on the setting of the selected mode, pulling DTR low will bring the module into sleep mode. In this mode, the idle current is less than 2 mA, the module can also respond to the incoming call, SMS, and GPRS data.The host MCU can also control the module to exit sleep mode by controlling DTR.

Process of entering the sleep mode:

1. Keep DTR high level in working mode. Activate the sleep mode by using the **AT+ENPWRSAVE=1**command.
2. Pull DTR low, and the module will enter sleep mode, but only after process and pending data finished.
3. In sleep mode, the module can be woken up by the events of incoming voice call, received data, or SMS. Meanwhile the module will send out the unsolicited messages by the interface of RING or UART.

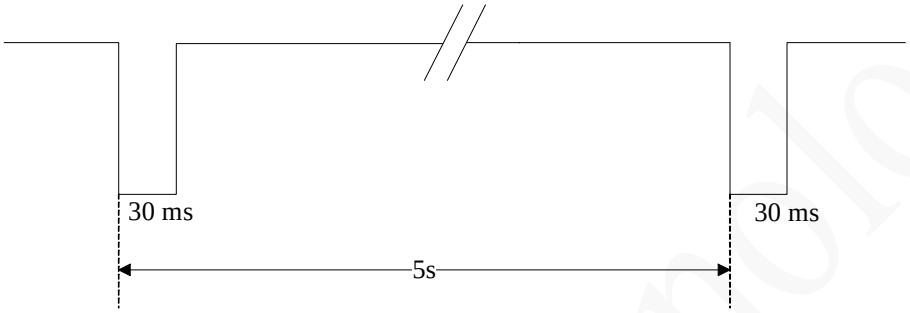
   Upon receipt of the unsolicited messages, the host MCU should pull DTR high firstly, otherwise the module will resume sleep mode shortly. And then the host MCU can process the voice call, received data, or SMS.After processing is finished, pull DTR low again to put the module into sleep mode.

4. Pull DTR high, the module will exit from sleep mode actively, and furthermore enable the UART. Thus the voice call, received data, or SMS can be processed through UART.After processing finished pull it low again, to take the module back to sleep mode.

3.3.2 RING Signal Indicator

- Calling: Once a voice call is coming, UART output "RING" character strings and meanwhile the RING pin outputs 30 ms low pulses at 5s period. After the call is answered, the high level restores.

Figure 3-14 RING indicator for incoming call



- SMS: Upon receipt of SMS, the module outputs one 35ms low pulse.

Figure 3-15 RING indicator for SMS

3.4 SIM Card Interface

Table 3-4 SIM Card Interface

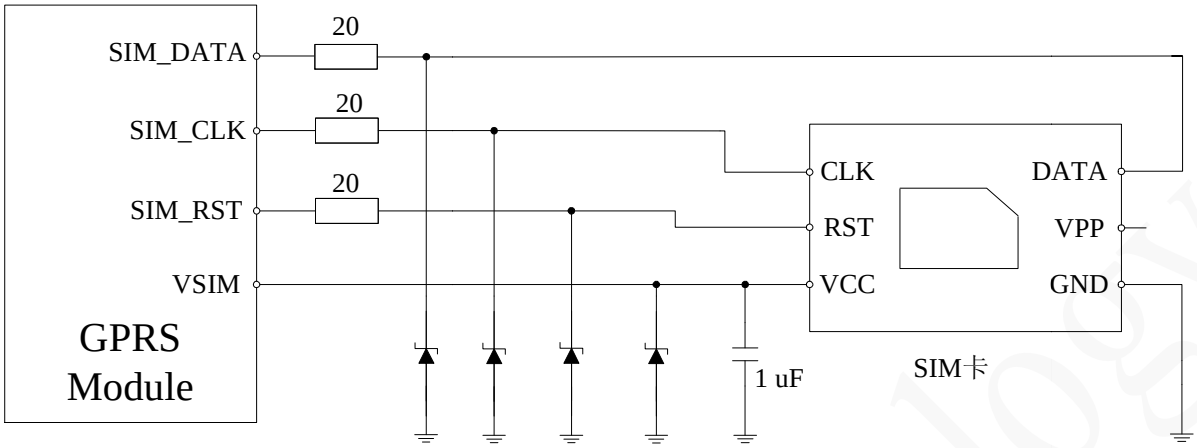
Signal	I/O	Function Description	Remarks
VSIM	P	SIM card power supply output	1.8V/3.0V
SIM_CLK	DO	SIM card clock output	
SIM_RST	DO	SIM card reset output	
SIM_DATA	DI/O	SIM card data IO	Internal pull-up

M590 supports 3.0 V and 1.8 V SIM cards. VSIM supplies power for SIM card with 30mA.

SIM_DATA is internally pulled up by a resistor. External pull-up resistor is not needed.

SIM_CLK can work at several frequenciesat 3.25MHz typically.

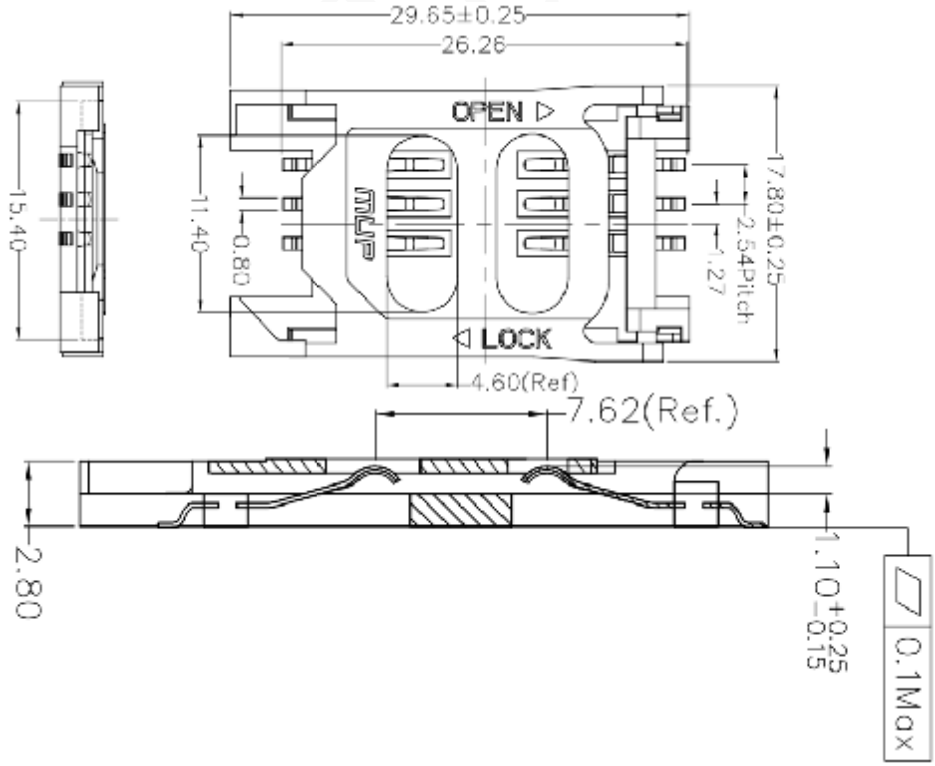
Figure 3-16 Reference design of SIM card interface



ESD protectors, such as ESD diodes (lower than 33 pF) or ESD varistors, are recommended on the SIM signals, especially in automotive electronics or other applications with badly ESD.In other applications, replace ESD diodes with 27 pF to 33 pF grounding capacitors. The ESD diodes or small capacitors should be close to SIM card.

If you use 6-pin SIM card sockets, MCP-C713(H2.8) is recommended. Figure 3-17 shows its encapsulation.

Figure 3-17 Reference of SIM card socket



CAUTION

SIM card is sensitive to GSM TDD noise and RF interference. So, the PCB design should meet the following requirements:

- The antenna should be installed far away from the SIM card and SIM card traces, especially to the build-in antenna.
- The SIM traces on the PCB should be as short as possible and shielded with GND copper.
- The ESD diodes or small capacitors should be closed to SIM card on the PCB.

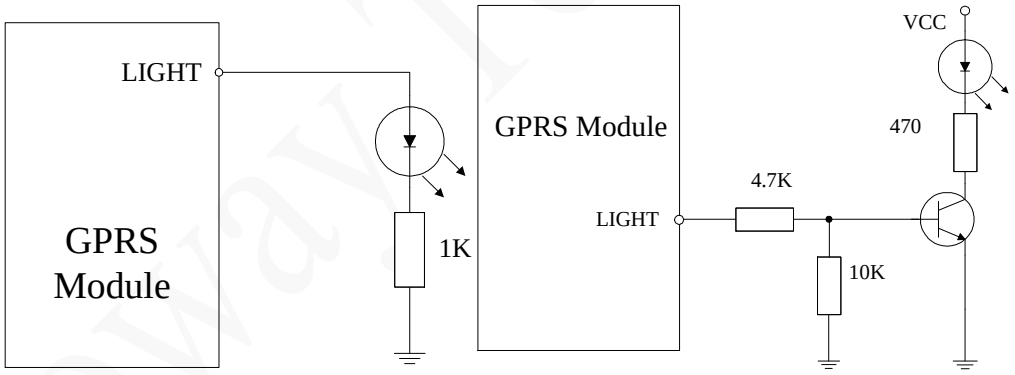
3.5 Running LED Indicator

Table 3-5 LED indicator

Signal	I/O	Function	Remarks
LIGHT	DO	Indicates running status	2.8 V output, max. 4 mA High level drives the LED indicator

The LIGHT pin can output a 4 mA current and 2.8 V voltage, therefore the LED can be directly connected to this pin with a resistor in series.For better luminance, drive the LED with a transistor instead.

Figure 3-18 LED indicator



When the module is running, the LED indicator is driven by the LIGHT to indicate different module status with its various blink behaviors. You can set the blink mode by AT commands. For more details, see *M590 GPRS Module AT Command Set*.

3.6 RF Interface

3.6.1 RF Design and PCB Layout

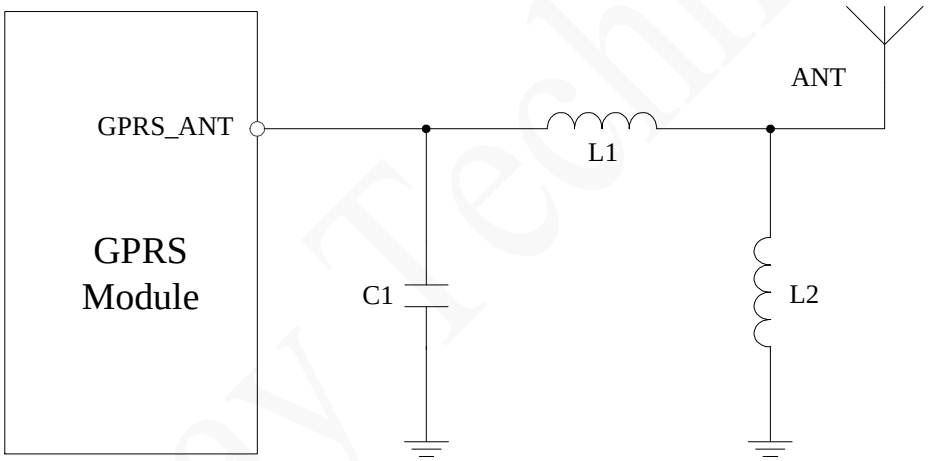
A 50 Ω antenna is required. VSWR ranges from 1.1 to 1.5. The antenna should be well matched to achieve best performance. It should be installed far away from high speed logic circuits, DC/DC power, or any other strong disturbing sources.

For multiple-layer PCB, the trace between the antenna pad of module and the antenna connector, should have a 50 Ω characteristic impedance, and be as short as possible. The trace should be surrounded by ground copper. Place plenty of via holes to connect this ground copper to main ground plane, at the copper edge.

If the trace between the module and connector has to be longer, or built-in antenna is used, a π-type matching circuit should be needed, as shown in Figure 3-19. The types and values of C1, L1, and L2 should be verified by testing using network analyzer instrument. If the characteristic impedance is well matched, and VSWR requirement is met, just use a 0 Ω resistor for L1 and leave C1, L2 un-installed.

Avoid any other traces crossing the antenna trace on neighboring layer.

Figure 3-19 Reference design for antenna interface



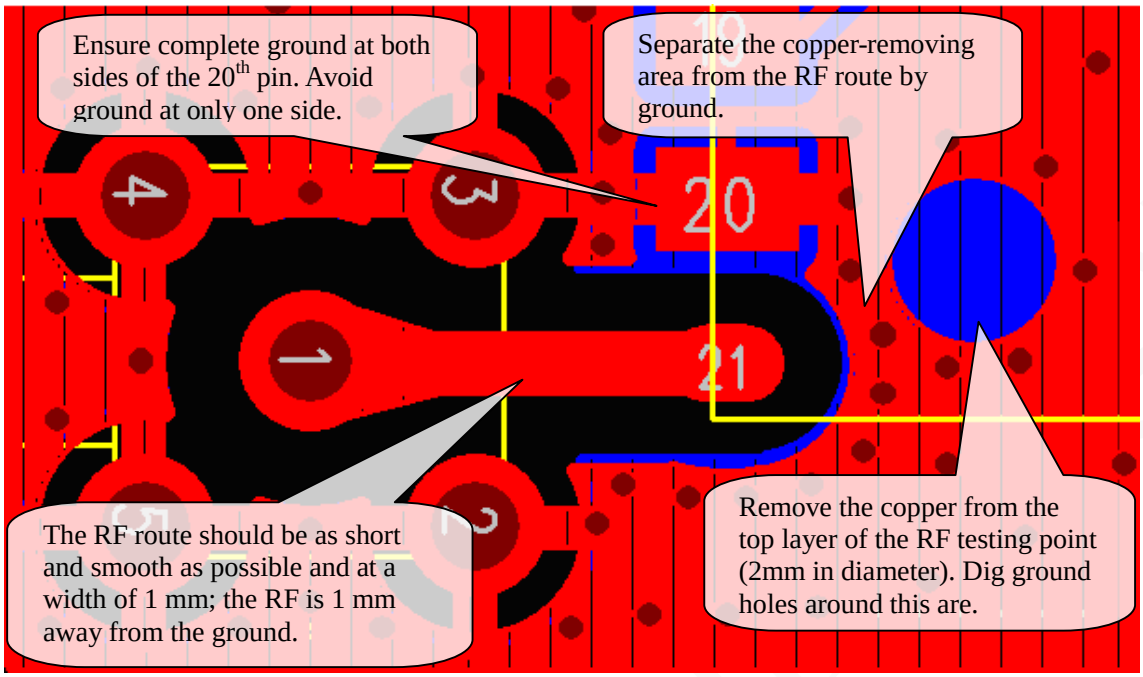
On two-layer boards which cannot control resistance properly, the RF route should be as short and smooth as possible and at a width of 1mm; the RF is 1 mm away from the ground.

Figure 3-20 shows a two-layer board application. The RF is connected to GSC RF connector through traces on PCB, which is connected to the antenna via cable.

Remove the copper from the area of 2 mm in diameter around the RF testing point. Dig ground holes as many as possible. Separate this area from the copper-removing area of the 21st pin by ground.

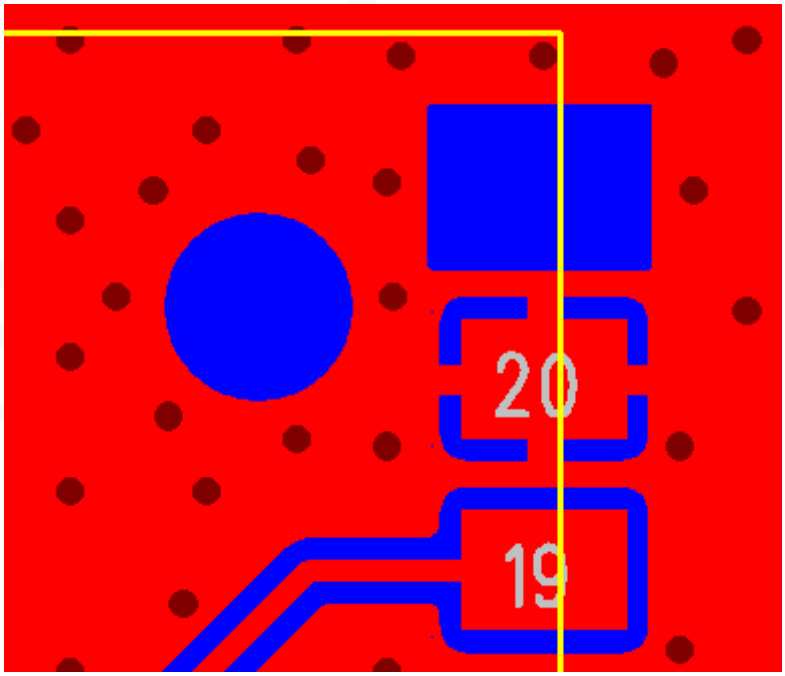
Ensure complete ground around the 20th pin in case that its signal is affected by other high-speed signals (SIM signal, e.g.).

Figure 3-20 RF layout reference



If you use RF feeder to connect the module and the antenna (pin 21 is not used), remove the pad of the 21st pin and its adjuncts. Refer to Figure 3-21.

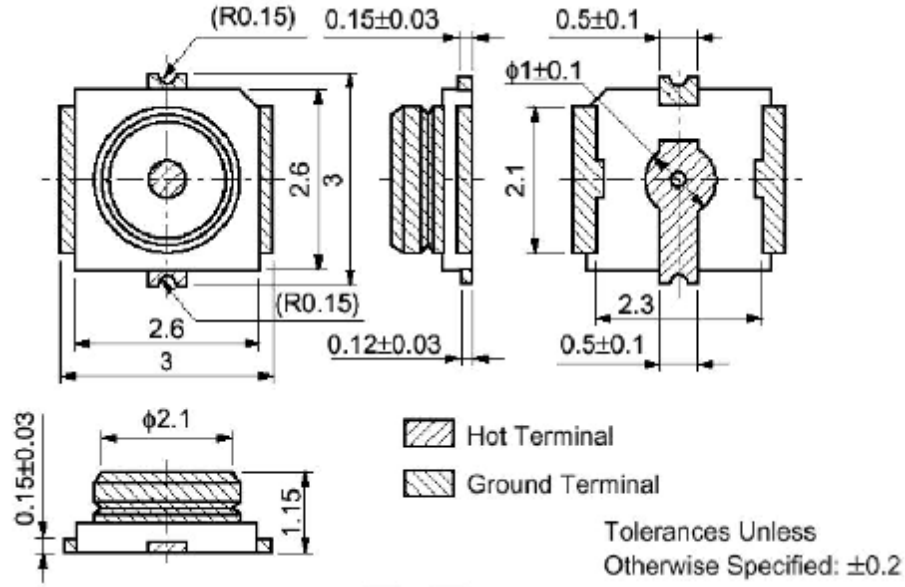
Figure 3-21 Reference RF design when pin 21 is not used



3.6.2 Recommended RF Connection

If you adopts RF cables for connections, the GSC RF connector MM9329-2700RA1 from Murata is recommended. Figure 3-22 shows the encapsulation specifications.

Figure 3-22 Encapsulation specifications of Murata RF connector



4 Electric Features and Reliability

4.1 Electric Feature

Table 4-1 Electric feature of the module

Parameter		Minimum Value	Typical Value	Maximum Value
VBAT	Vin	3.5V	3.9V	4.3V
	Iin	/	/	2A
VDD_EXT	Vout	/	2.8V	/
	Iout	/	/	50mA
DIO	Vout	2.3V	2.8V	3.1V
	Iout	/	/	4mA
	Vin	-0.3V	0V	0.6V
	Iin	/	/	22.5uA

CAUTION

If the voltage is too low, the module might fail to start. If the voltage is too high or there is a voltage burst during the startup, the module might be damaged permanently.

If you use LDO or DC-DC to supply power for the module, ensure that it output at least 2 A current.

4.2 Temperature

Table 4-2 Temperature Feature

Module Status	Minimum Value	Typical Value	Maximum Value
Working	-40℃	25℃	85℃
Storage	-45℃		90℃

CAUTION

If the module works in temperature exceeding the thresholds, its RF performance (e.g. frequency deviation or phase deviation) might be worse but it can still work properly.

4.3 Current

Table 4-3 Current feature

Parameter	Testing Conditions		Testing Result (Average Current)
Testing voltage	3.9 V Agilent power supply		/
Idle mode	Set the instrument and power on the module.		18mA
Off leakage current	Power on the module or use AT command to shut the module down.		50uA
Average network searching current	Set the instrument. Start the module. Wait until the module registers the instrument.		60mA
Sleep mode	On a live network, the module registers the network and then enters the sleep mode.		1.7mA
	Set the instrument properly (DRX=9)		1 mA
Voice service	Maximum power level in full rate mode	EGSM900	197.8mA
		DCS1800	152.6mA
GPRS class 12	4Up/1Down@Gamma=3	EGSM900	417.6mA
		DCS1800	303.1mA
	1Up/4Down@Gamma=3	EGSM900	186.8 mA
		DCS1800	144.2mA

CAUTION

The data in the above table is typical values obtained during tests in lab. It might be a little bit different in manufacturing. Also, the test results might be various due to different settings or testing methods.

4.4 ESDProtection

Electronics need to pass sever ESD tests. The following table shows the ESD capability of key pins of our module. It is recommended that you add ESD protection to those pins in accordance to the application to ensure your product quality when designing your products.

Humility: 45%
Temperature: 25℃

Table 4-4 ESD feature of the module

Testing Point	Contact Discharge	Air Discharge
VBAT	±8KV	±15KV
GND	±8KV	±15KV

ANT	±8KV	±15KV
Cover	±8KV	±15KV
URXD/UTXD	±4KV	±8KV
Others	±4KV	±8KV

5 RF Features

5.1 Work Band

Table 5-1 Work band

Work Band	Uplink	Downlink
EGSM900	880~915MHz	925~960MHz
DCS1800	1710~1785MHz	1805~1880MHz

5.2 Transmitting Power and Receiving Sensitivity

5.2.1 Transmitting Power

Table 5-2 Transmitting power (EGSM900)

PCL	Transmitting Power	Threshold Range
5	33dBm	±2 dBm
6	31dBm	±3dBm
7	29 dBm	±3dBm
8	27 dBm	±3dBm
9	25 dBm	±3dBm
10	23 dBm	±3dBm
11	21 dBm	±3dBm
12	19 dBm	±3dBm
13	17 dBm	±3dBm
14	15 dBm	±3dBm
15	13 dBm	±5dBm
16	11 dBm	±5dBm
17	9 dBm	±5dBm
18	7 dBm	±5dBm
19	5 dBm	±5dBm

Table 5-3 Transmitting power (DCS1800)

PCL	Transmitting Power	Threshold Range
0	30 dBm	±2 dBm
1	28 dBm	±3dBm

2	26 dBm	±3dBm
3	24 dBm	±3dBm
4	22 dBm	±3dBm
5	20 dBm	±3dBm
6	18 dBm	±3dBm
7	16 dBm	±3dBm
8	14 dBm	±3dBm
9	12 dBm	±3dBm
10	10 dBm	±4Bm
11	8 dBm	±4Bm
12	6 dBm	±4Bm
13	4 dBm	±4dBm
14	2 dBm	±5dBm
15	0 dBm	±5 dBm

5.2.2 Receiving Sensitivity

Band	Typical
GSM800&EGSM900	<-107 dBm
DCS1800&PCS1900	<-107 dBm

NOTE

The data in the above tables is obtained by connecting the module to RF test instrument (e.g. CMU200, CWM500, or Agilent8960) in lab tests. It is for reference only.

6 Mounting the Module onto the Application Board

M590 is compatible with industrial standard reflow profile for lead-free SMT process.

The reflow profile is process dependent, so the following recommendation is just a start point guideline:

- Only one flow is supported.
- Quality of the solder joint depends on the solder volume. Minimum of 0.15mm stencil thickness is recommended.
- Use bigger aperture size of the stencil than actual pad size.
- Use a low-residue, no-clean type solder paste.

7 Package

M590modules are packaged in sealed bags on delivery to guarantee a long shelf life. Package the modules again in case of opening for any reasons.

Neoway adopts trays to hold our modules to facilitate mounting. You can just put the tray in fixed direction on your machine. For more details about the storage and mounting of our modules, refer to*Reflow Soldering Guide for Neoway SMD Modules V1.2*.

8 Abbreviations

ADC	**Analog-Digital Converter**
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AMR	Acknowledged multirate (speech coder)
CSD	Circuit Switched Data
CPU	Central Processing Unit
DAI	Digital Audio interface
DAC	Digital-to-Analog Converter
DCE	Data Communication Equipment
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
EMI	Electro Magnetic Interference
ESD	Electronic Static Discharge
ETS	European Telecommunication Standard
FDMA	Frequency Division Multiple Access
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MS	Mobile Station
PCB	Printed Circuit Board
PCS	Personal Communication System

RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-only Memory
RMS	Root Mean Square
RTC	Real Time Clock
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TA	Terminal adapter
TDMA	Time Division Multiple Access
UART	Universal asynchronous receiver-transmitter
VSWR	Voltage Standing Wave Ratio

Modular Approal:

The M590 module is designed to comply with the FCC statement. FCC ID is PJ7-125X. The host system using M590, should have label indicated it contain modular's FCC ID PJ7-125X.

This radio module must not installed to co-locate and operating simultaneously with other radios in host system , additional testing and equipment authorization may be required to operating simultaneously with other radio.

RF warning for Mobile device:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

§ 15.19 Labelling requirements.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

§ 15.21 Information to user.

Any Changes or modifications not expressly approved by the party responsible for compliance could vo id the user's authority to operate the equipment.

§ 15.105 Information to the user.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio f requency energy and, if not installed and used in accordance with the instructions, may cause harmful in

terference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct t he interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.