Neoway 有方

Neo_M590E V1 GPRS Module Hardware User Guide

Version 1.0

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Notice

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Revision Record

Issue	Changes	Revised By	Date
V1.0	Initial draft	Weng	2015-12

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About This Document

This document defines the features, indicators, and test standards of the M590E V1 module and provides reference for the hardware design of each interface. With *Neo_M590E V1 GPRS Module AT Command Set*, this user guide can help you complete wireless communication application easily.

1 Introduction to M590E V1

M590E V1 is a compact wireless GPRS module. It provides SMS and data services and is widely used in industrial and consumer fields.

1.1 Overview

Neoway M590E V1 module adopts 27-pin LGA 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,

HOST interfaces, firmware updating and commissioning

10-bit ADC input, voltage ranging from 0 V to 1.8 V

Adapting to 1.8 V and 3.0 V SIM card,

Supporting embedded M2M SIM card

Supporting LIGHT (working status indicator)

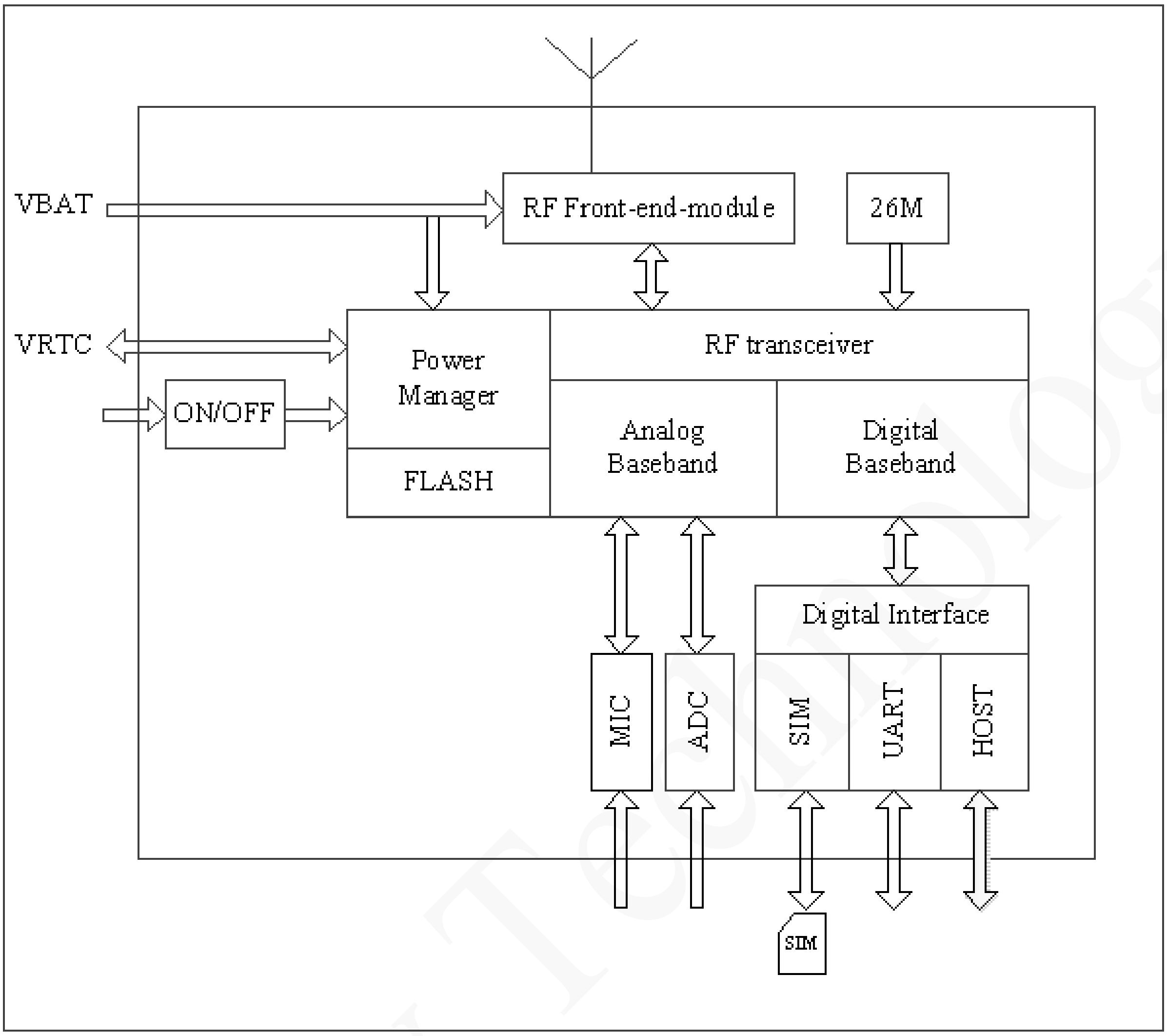
RING output

MIC input

1.2 Block Diagram

The M590E V1 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 M590E V1.



1.3 Specifications

Table 1-1 M590E V1 specifications

Specifications	Description
Band	EGSM900/DCS1800 MHz dual-band Supporting band locking
Sensitivity	< -107 dBm
Max. transmit power	• EGSM900 Class4(2W) • DCS1800 Class1(1W)
Protocol	Compatible with GSM/GPRS Phase 2/2+
AT	• GSM07.07 • Extended AT commands

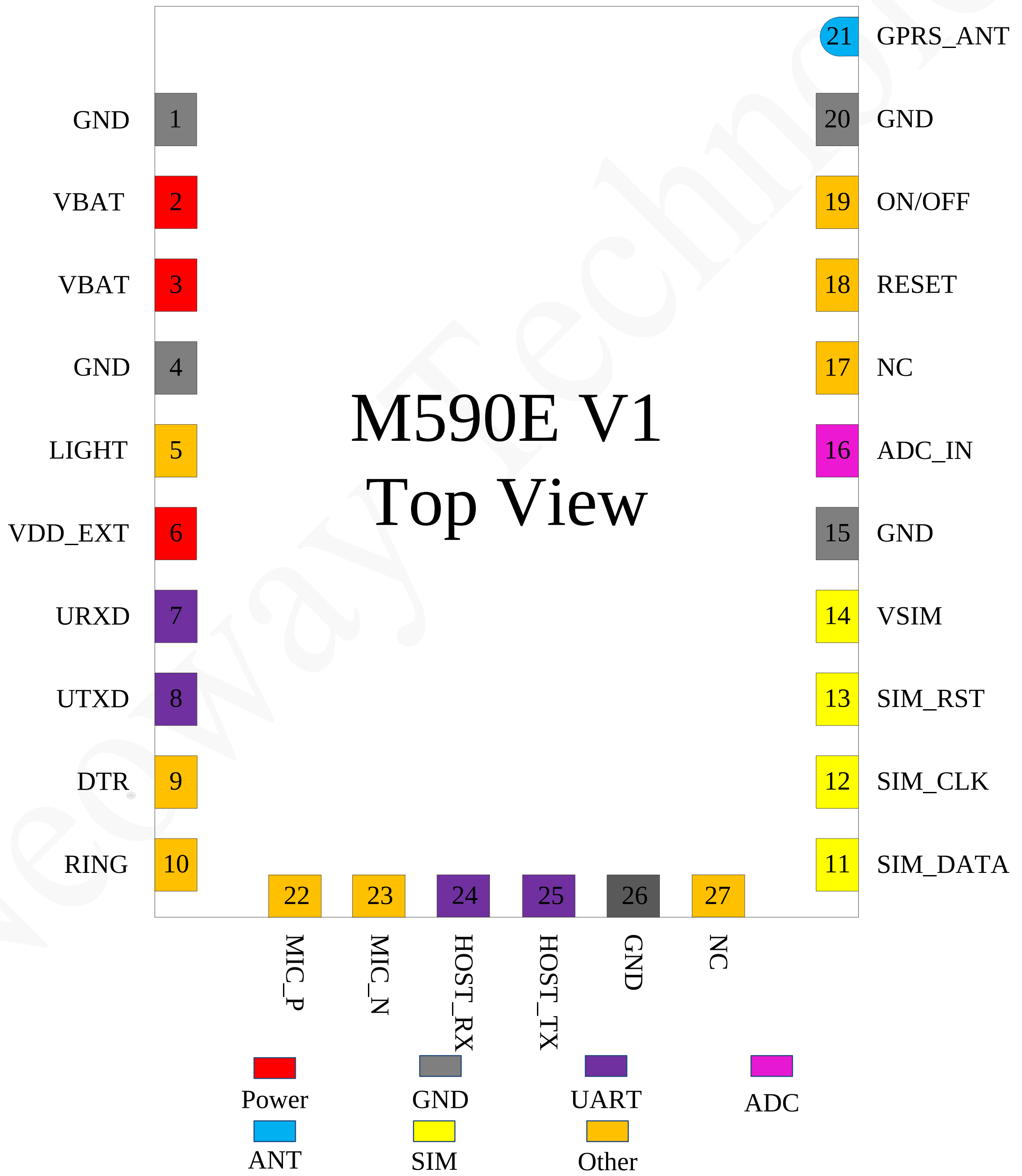
SMS	• TEXT/PDU • Supporting SMS message receiving and transmitting and alert for new SMS messages • Supporting SMS message management: reading/deleting/storage/list
GPRS feature	• GPRS CLASS 10 • Max. theoretic downlink rate: 85.6 Kbit/s • Built-in TCP/IP protocol, supporting multiple links • Supporting server and client modes
UART	• Supporting UART multiplexing • Supporting AT sending, data transmission, and software download • Supporting baudrate from 9600 bit/s to 115200 bit/s
CPU	X-CPU 312MHz
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	11 mA
Current in sleep mode	< 1.5 mA (DRX2)

2 Pin Description and PCB Foot Print

2.1 Specifications and Encapsulation

Specifications	M590E V1
Dimensions	27.6 mm x 21.6 mm x 2.6 mm (H x W x D)
Weight	2.7 g
Encapsulation	27-pin LGA

Figure 2-1 Top view of the M590E V1 module



2.2 Pin Definition

Table 2-1 M590E V1 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, 26	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		$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$	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			
24	HOST_RX	DI	HOST data receive			Used for module upgrade
25	HOST_TX	DO	HOST 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
SMS and Incoming Call Ring						
10	RING	DO	Ring output	I/PD		Output 2.8V/4mA

ADC Detecting						
16	ADC_IN	AI	10-bit ADC input			Detectable voltage range: 0 V to 1.8 V
GPRS Antenna						
21	GPRS_ANT	AI/O	GPRS antenna interface			50 Ω impedance
Sleep Mode Controlling						
9	DTR	AI	Signal for controlling sleep mode	I/PD	$0<V_{IL}<0.6$ $2.1<V_{IH}<3.1$	Low level by default Used together with AT commands
Audio						
22	MIC_P	AI	Positive electrode of MIC input			Vpp≤200 mV
23	MIC_N	AI	Negative electrode of MIC output			
Reserved Pins						
17, 27	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

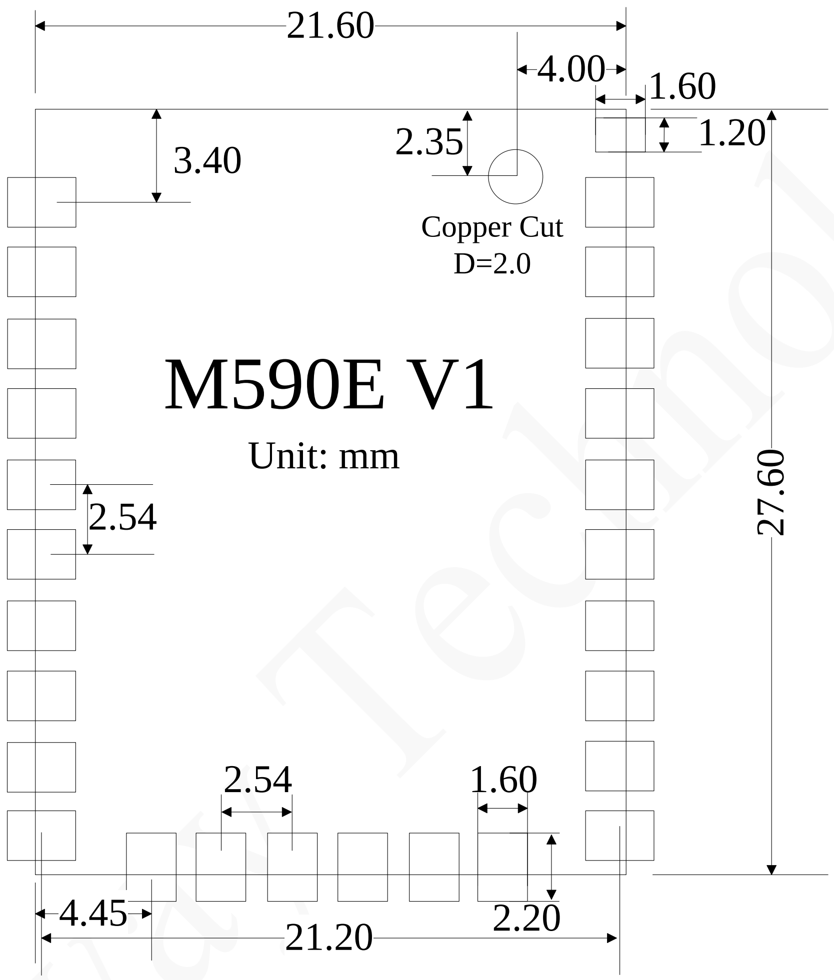
CAUTION

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

LGA packaging is adopted to package the pins of the M590E V1 module. Figure 2-2 shows the recommended PCB foot print.

Figure 2-2 PCB foot print recommended for M590E V1 (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	Used only for level shift Loading capability < 50 mA
RESET	DI	Module reset input	Reset at low level
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

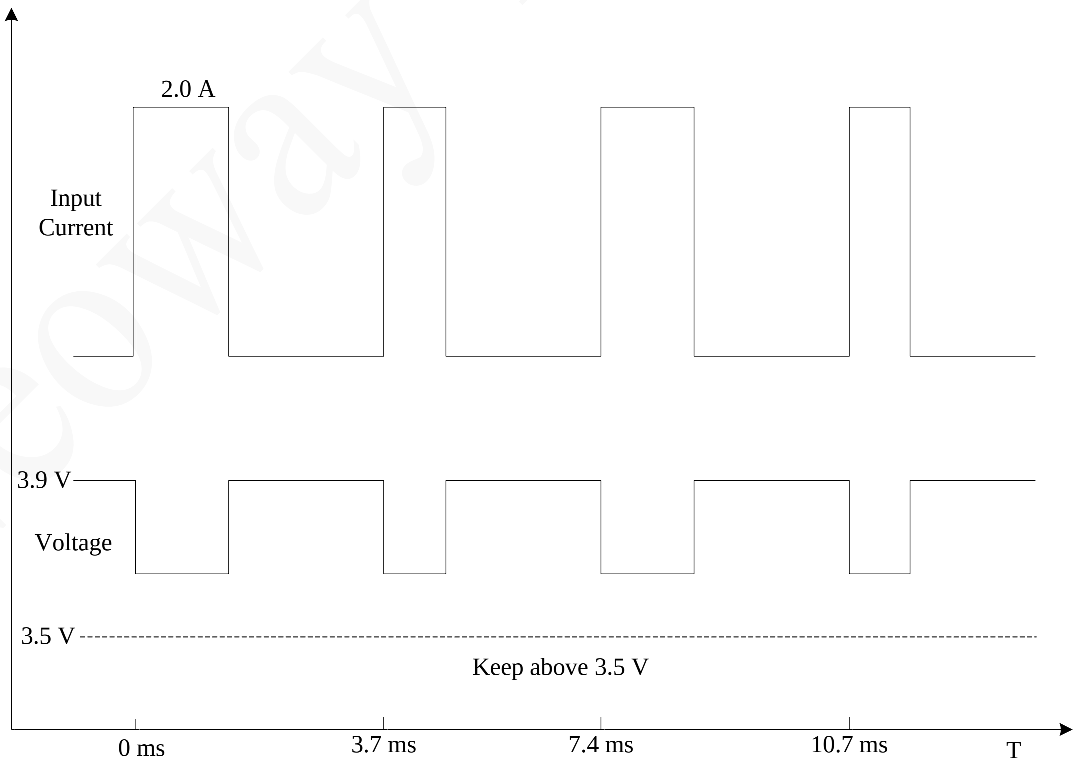
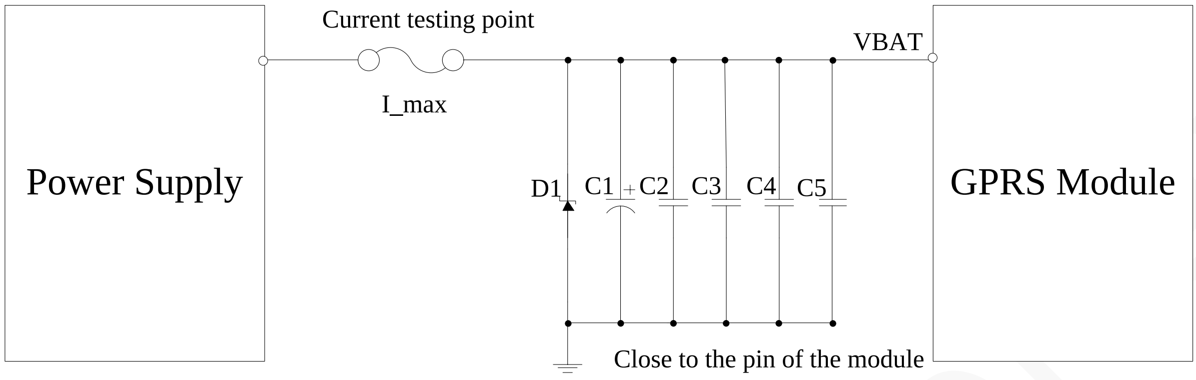


Figure 3-2 shows a recommended power supply design for the module.

Figure 3-2 Capacitors used for the power supply

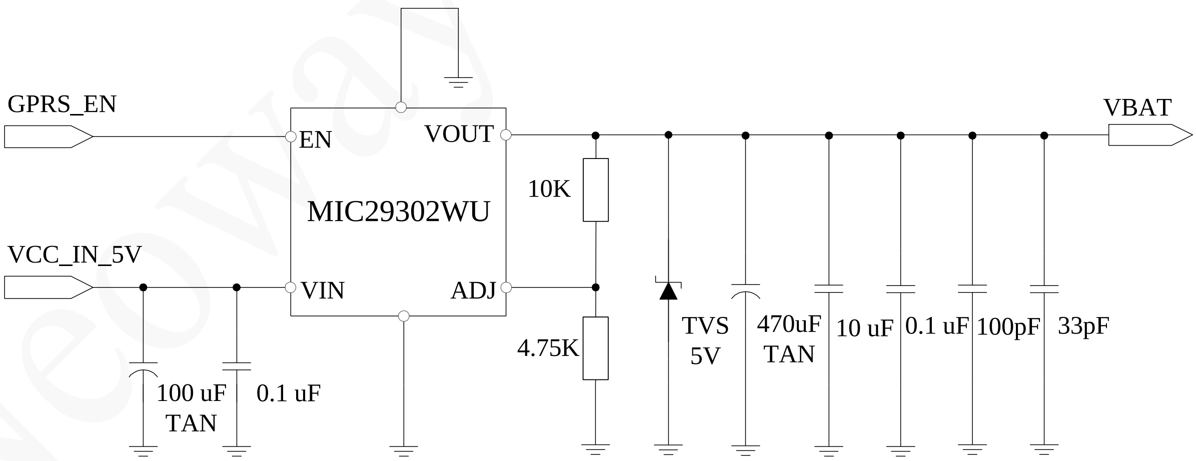


In the circuit, you can use TVS at D1 to enhance the performance of the module during a burst. SMF5.0AG (Vrwm=5V&Pppm=200W) is recommended. A large bypass tantalum capacitor (220 µF or 100 µF) or aluminum capacitor (470 µF or 1000 µF) is expected at C1 to reduce voltage drops during bursts together with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

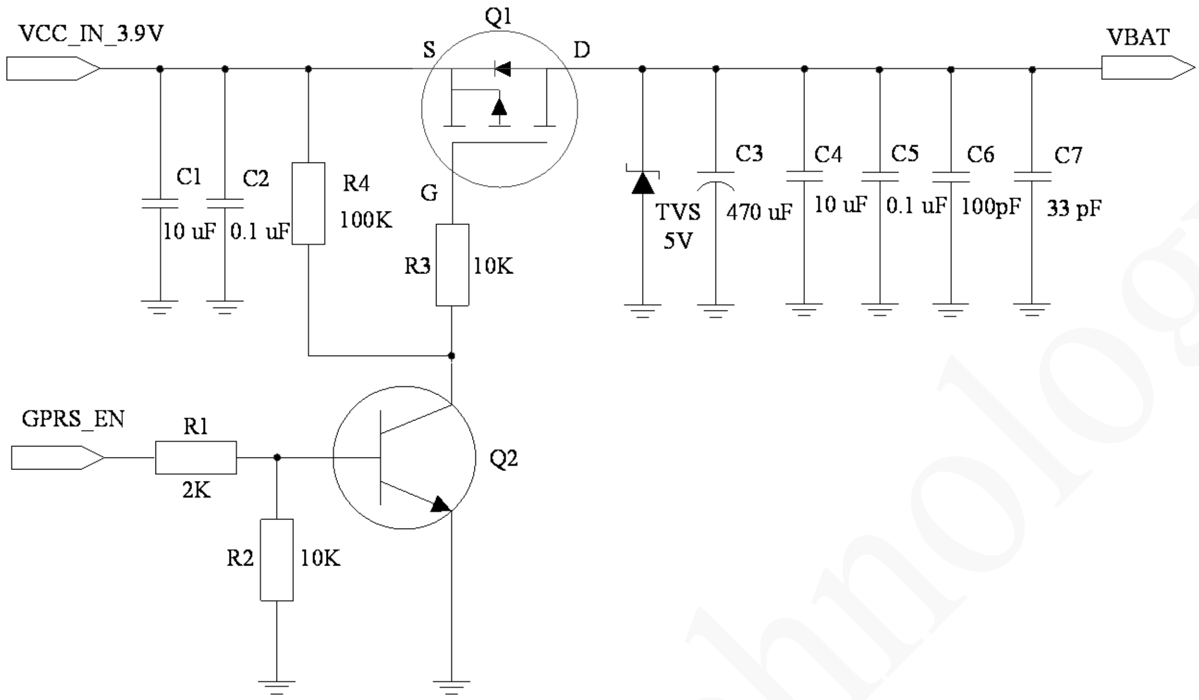
MIC29302WU in the following figure is an LDO and outputs 3 A current to ensure the performance of the module.

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.

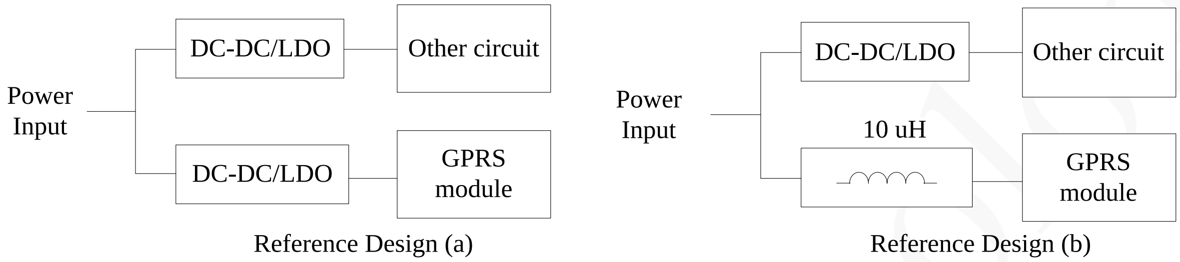
Separation

As shown in Figure 3-1, the GPRS module works in burst mode that generates voltage drops on power supply. Furthermore, this results in a 217 Hz 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/Off Control 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.

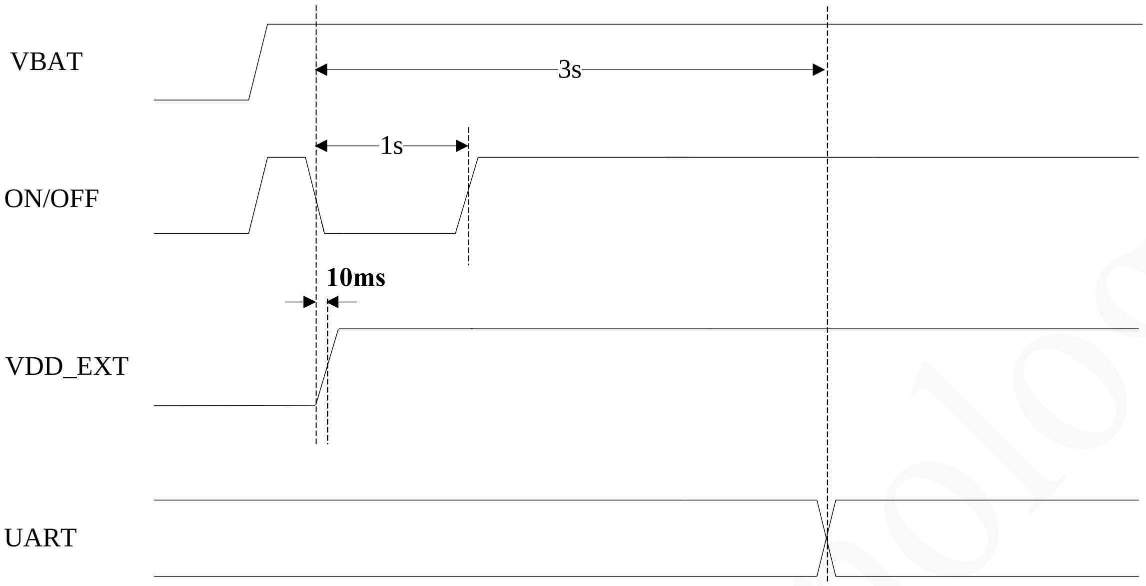
ON/OFF is a low level pulse active input, used to turn on or off the module.

Power-On Procedure

While the module is off, drive the ON/OFF pin to ground for at least **1 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.

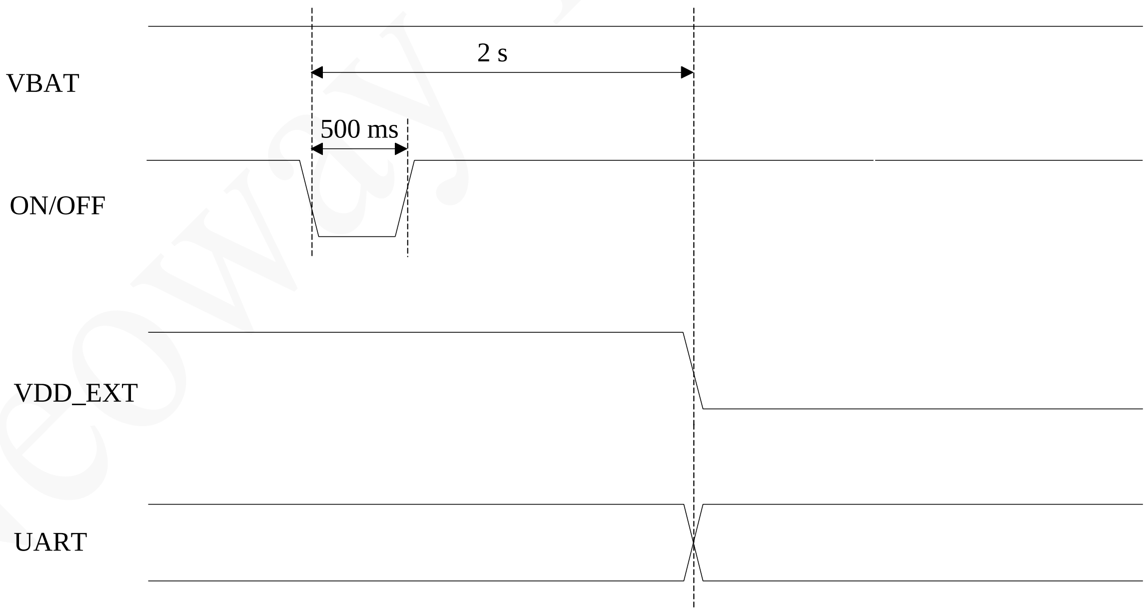
Figure 3-6 Power-on procedure



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 *Neo_M590E V1 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

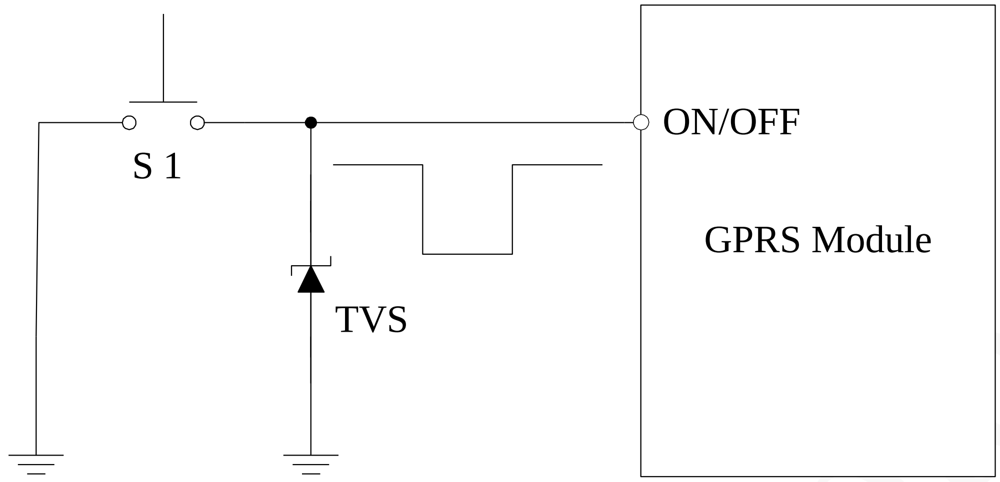
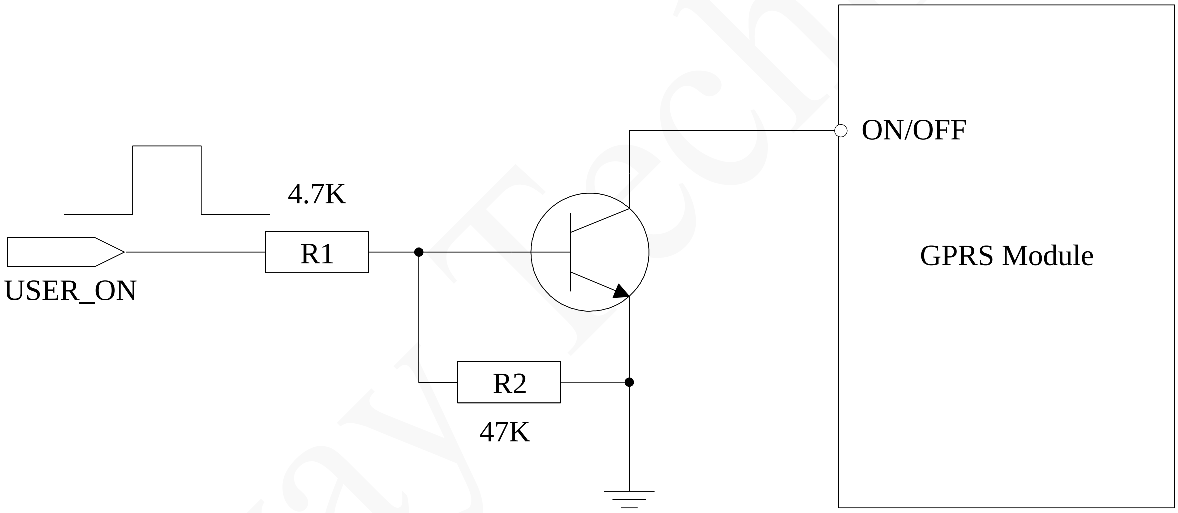


Figure 3-9 Reference circuit for power-on/off controlled by high level



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.

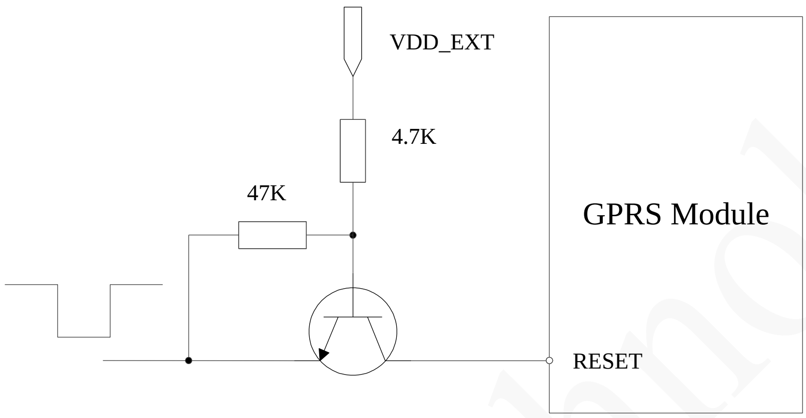
CAUTION

- 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 circuit with triode separating



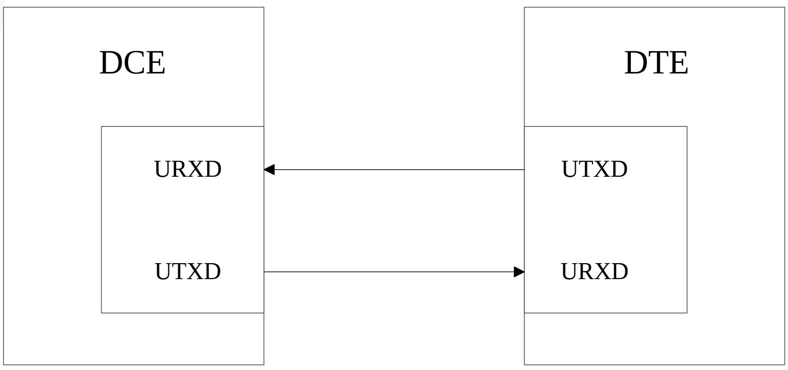
3.2 UART

Table 3-2 UART

Pin No.	Signal	I/O	Function Description	Remarks
7	URXD	DI	UART data receive	Internal 47K pullup
8	UTXD	DO	UART data transmit	
24	HOST_RX	DI	UART data receive	
25	HOST_TX	DO	UART data transmit	

UART is used for AT commands. Figure 3-11 shows the signal connection between the module (DCE) and the terminal (DTE).

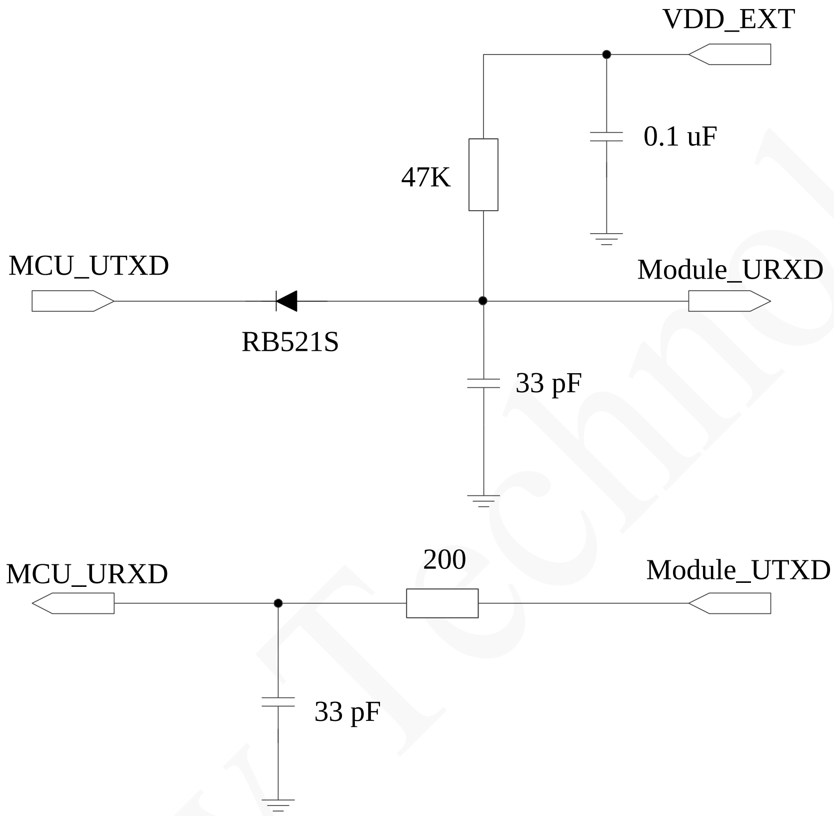
Figure 3-11 Signal connection between DCE and DTE



The UART of M590E V1 works at **2.8 V** CMOS logic level. The voltages for input high level should **not** exceed 3.1 V. Supported baud rates are 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 3.3 V logic levels, it is recommended that you add a level shifting circuit outside of the module.

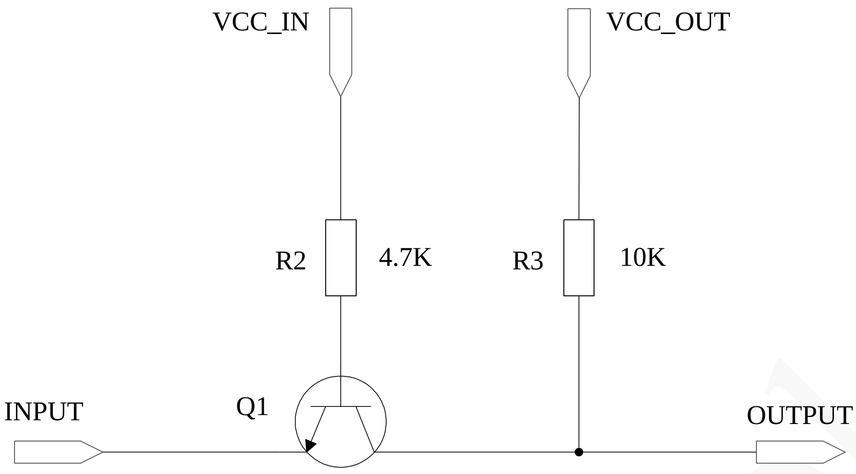
Figure 3-12 Recommended circuit for the communication between 3.3V MCU and UART



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 3-13 shows 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_EXT pin, 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 SIM Card Interface

M590E V1 supports embedded SIM card (data only). If you use an embedded SIM card, you should leave the SIM card interface disconnected.

If you do not use the embedded SIM card, you can design the SIM card interface following this section.

NOTE

The encapsulation of embedded SIM card is QFN 5*6.

Table 3-3 SIM Card Interface

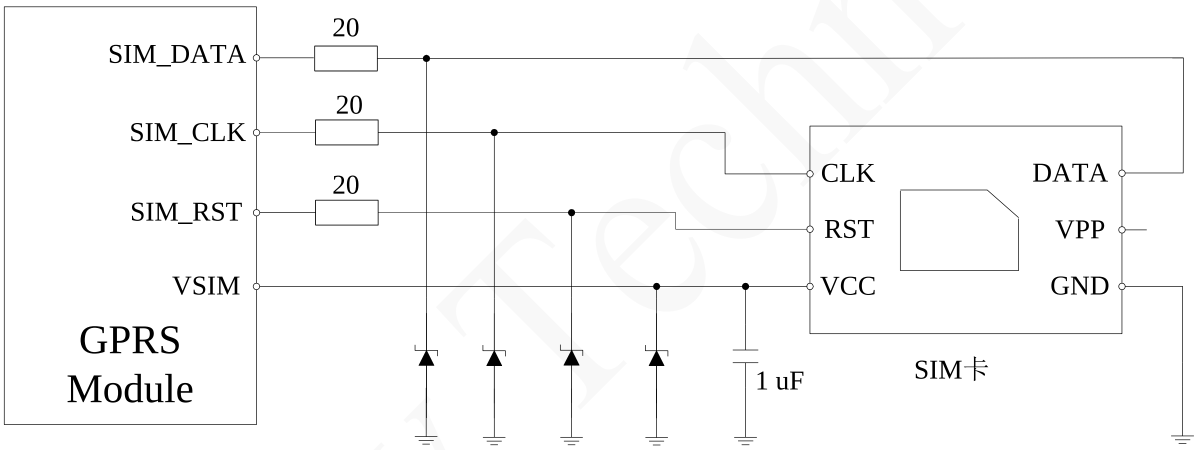
Signal	I/O	Function Description	Remarks
VSIM	P	SIM card power supply output	1.8V/3.0V
SIM_CLK	DO	SIM card clock output	
SIM_RST	DO	SIM card reset output	
SIM_DATA	DI/O	SIM card data IO	Internal pull-up

M590E V1 supports 3.0 V and 1.8 V SIM cards. VSIM supplies power for SIM card with 30 mA.

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

SIM_CLK can work at several frequencies at 3.25 MHz typically.

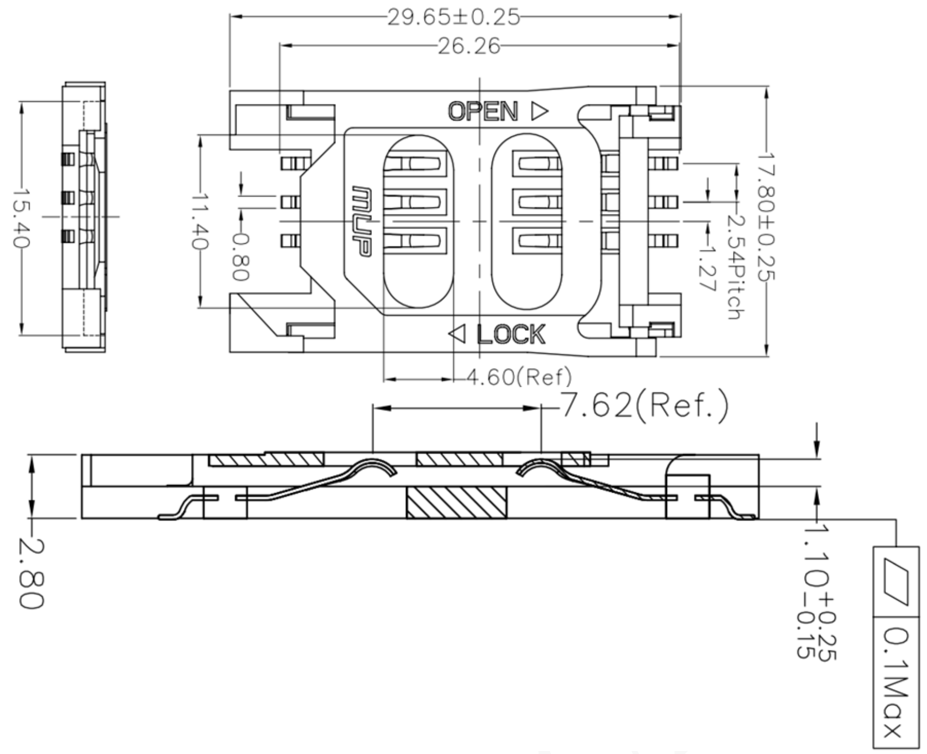
Figure 3-14 Reference design of SIM card interface



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 3-15 shows its encapsulation.

Figure 3-15 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.

3.4 DTR Pin

Generally DTR is used for sleep mode control. It works with AT commands. For details, see *M590E V1 GPRS Module AT Command Set*. 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. 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.

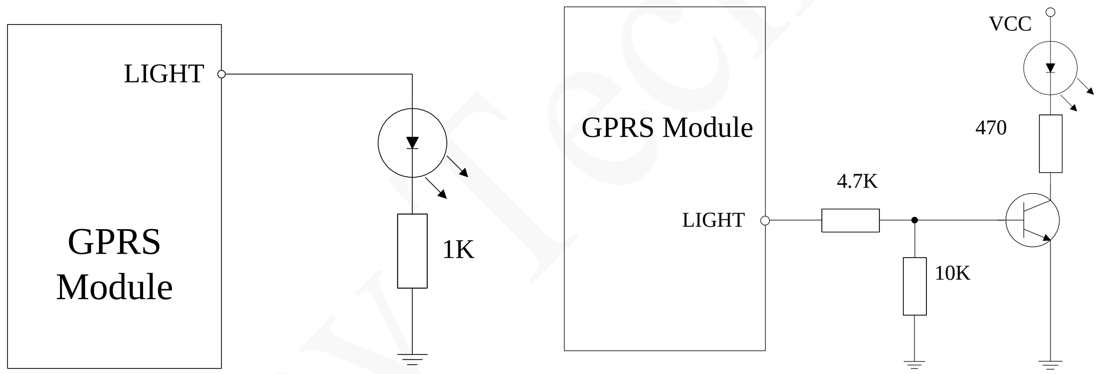
3.5 Running LED Indicator

Table 3-4 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 3-16 LED indicator

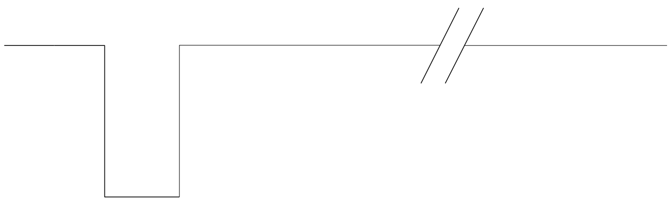


When the module is running, the LED indicator is driven by the LIGHT to indicate different module status with its various blink behaviors. You can set the blink mode by AT commands. For more details, see *Neo_M590E V1 GPRS Module AT Command Set*.

3.6 RING Signal Indicator

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

Figure 3-17 RING indicator for SMS



3.7 RF Interface

3.7.1 RF Design and PCB Layout

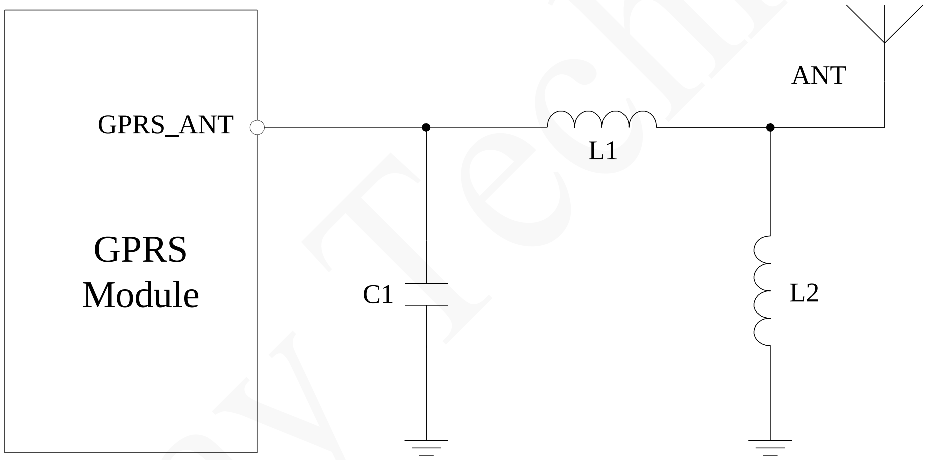
A 50 Ω antenna is required. VSWR ranges from 1.1 to 1.5. The antenna should be well matched to achieve best performance. It should be installed far away from high speed logic circuits, DC/DC power, or any other strong disturbing sources.

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 3-18. 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 3-18 Reference design for antenna interface



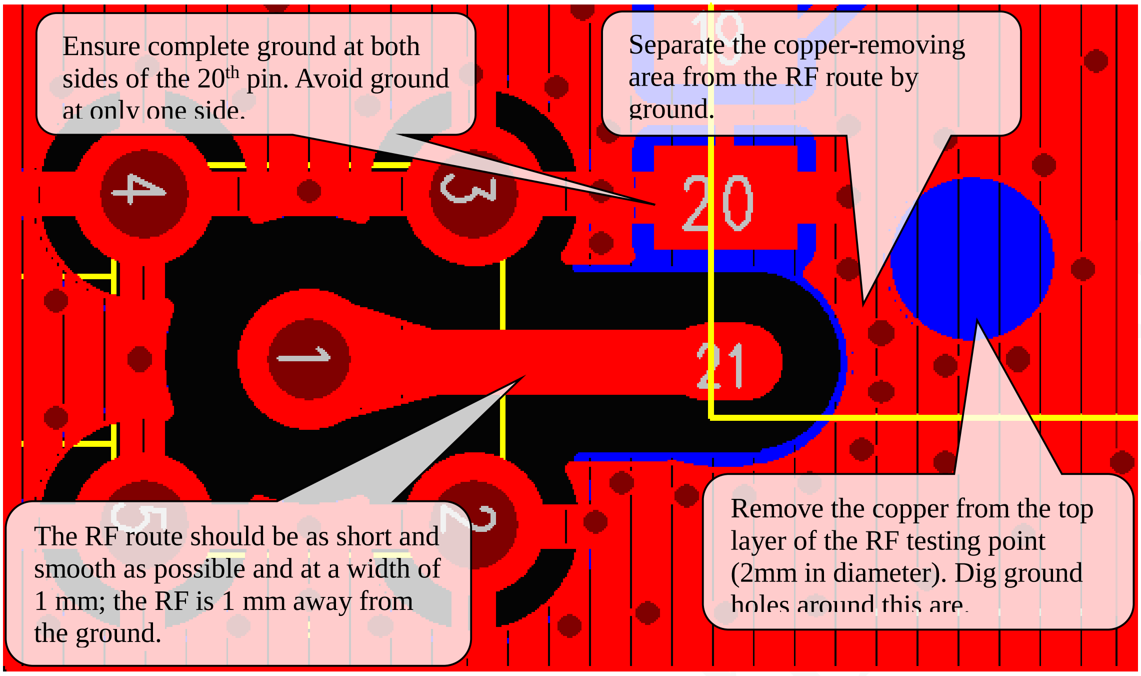
On two−layer boards which cannot control resistance properly, the RF route should be as short and smooth as possible and at a width of 1 mm; the RF is 1 mm away from the ground.

Figure 3-19 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.

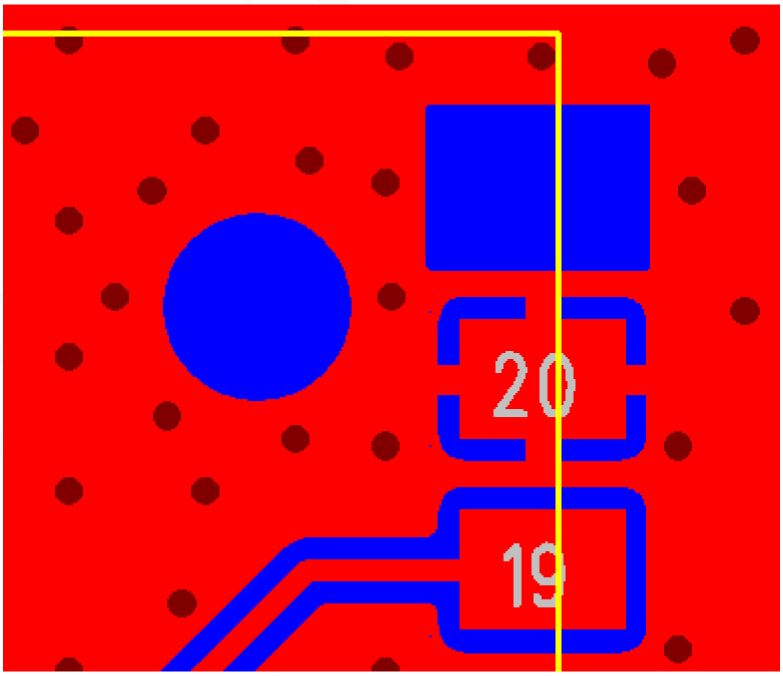
Ensure complete ground around the 20^{th} pin in case that its signal is affected by other high-speed signals (SIM signal, e.g.).

Figure 3-19 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 3-20.

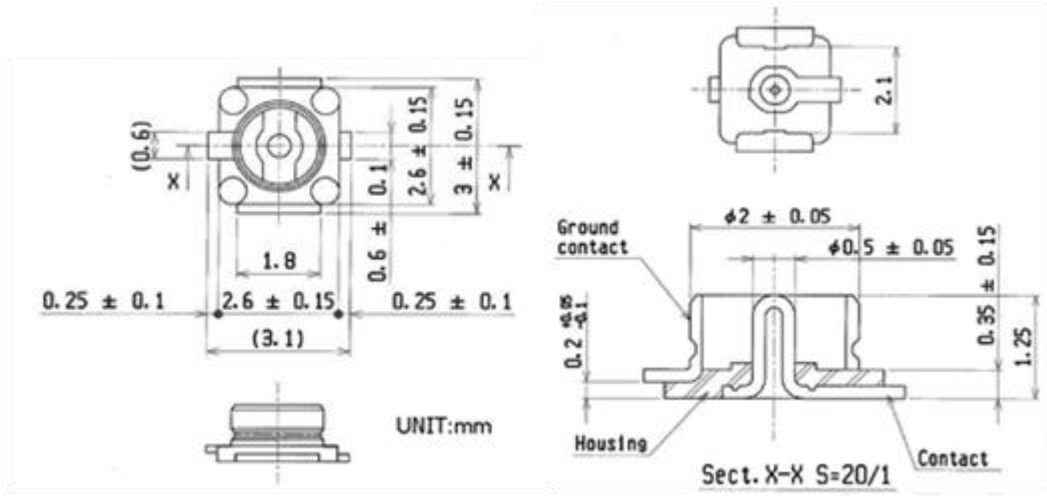
Figure 3-20 Reference RF design when pin 21 is not used



3.7.2 Recommended RF Connection

If you adopts RF cables for connections, the I-PEX connector 20279 (MHF) is recommended. Figure 3-21 shows the encapsulation specifications.

Figure 3-21 I-PEX 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	3.5 V	3.9 V	4.3 V
	Iin	/	/	2 A
VDD_EXT	Vout	/	2.8 V	/
	Iout	/	/	50 mA
DIO	Vout	2.3 V	2.8 V	3.1 V
	Iout	/	/	4 mA
	Vin	-0.3 V	0 V	0.6 V
	Iin	/	/	22.5 uA

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		/
Off leakage current	Power on the module or use AT command to shut the module down.		190 µA
Idle mode	Set the instrument and power on the module.		11 mA
Sleep mode	Set the instrument properly (DRX=5)		1.5mA
Average network searching current	Set the instrument. Start the module. Wait until the module registers the instrument.		35 mA
Voice service	Maximum power level in full rate mode	EGSM900	220 mA
		DCS1800	155 mA
GPRS class 12	2Up/3Down@Gamma=3	EGSM900	350 mA
		DCS1800	230 mA
	1Up/4Down@Gamma=3	EGSM900	224 mA
		DCS1800	160 mA

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 ESD Protection

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	±8 KV	±15 KV
GND	±8 KV	±15 KV
ANT	±8 KV	±15 KV

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

5 RF Features

5.1 Work Band

Table 5-1 Work band

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

5.2 Transmitting Power and Receiving Sensitivity

5.2.1 Transmitting Power

Table 5-2 Transmitting power (EGSM900)

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

Table 5-3 Transmitting power (DCS1800)

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

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

M590E V1 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 0.15 mm 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

M590E V1 modules 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