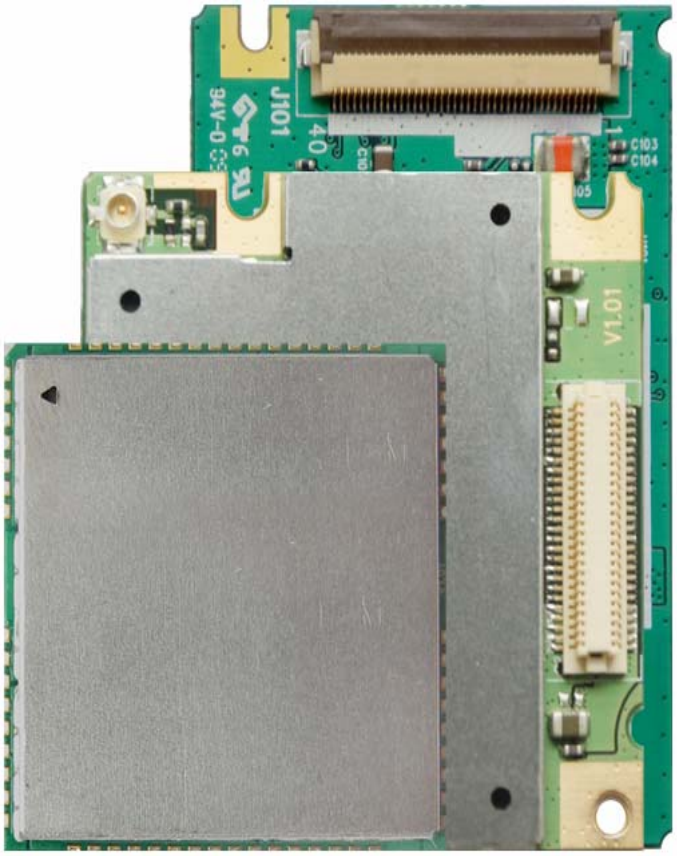
GSM Wireless Module

Upgrade Firmware

GSM_FW_Upgrade_AN01_V1.01



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0. Revision History

Revision	Date	Author	Description of change
1.00	2009-10-29	Yong AN	Initial
1.01	2010-02-25	Tracy ZHANG	Add recommendation of resistance-distributing shift circuit between MCU TXD and module RXD

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1. Introduction

In application design, the firmware of GSM module might need to be upgraded due to certain reasons. Therefore, it is necessary to add redundancy design for firmware upgrade in the host board.

Quectel GSM modules can be upgraded through serial interface. This document offers reference circuits for firmware upgrade in host board.

1.1. Related Documents

Table 1: Related documents

SN	Document name	Remark
[1]	Mxx_HD	Mxx hardware design document
[2]	GSM_UART_AN	The document of UART port application notes
[3]	Upgrade_FW_Tools_UGD	User guide of firmware upgrade tools
[4]	Mxx_EVB_UGD	The document of Mxx EVB user guide application notes

1.2. Terms and Abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
DTE	Data Terminal Equipment (typically computer, external controller)
GSM	Global System for Mobile Communications
I/O	Input/Output
PC	Personal Computer
PCB	Print Circuit Board
UART	Universal Asynchronous Receiver & Transmitter
VIHmax	Maximum Input High Level Voltage Value
VIHmin	Minimum Input High Level Voltage Value
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value

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2. Recommended Design for Upgrade

There are five pins involved in the firmware upgrade of module. They are VBAT, GND, PWRKEY, TXD and RXD.

Table 3: Pin definition of firmware upgrade

Name	IO	Function
VBAT	I	Power supply for module if the host board can't power the module.
PWRKEY	I	Power on/off the module
RXD	I	Receive data
TXD	O	Transmit data
GND		Ground

2.1. Schematic Design

There are two serial ports in most models of Quectel modules. Only the serial port which provides AT command and GPRS transfer functions can be used for firmware upgrade. Two ways are recommended to design in customer's host board. One is to reserve a special connector on the shell, such as DB9, RJ11, or other interfaces. The other way is to reserve five test points following the recommended design of this document in host board. Quectel will provide specific fixture to connect these test points to PC for firmware upgrade.

2.1.1. Direct Connection Application

In this design, the serial port of GSM module does not communicate with serial port of other DTE, such as an external microcontroller. The TXD and RXD can be connected directly to the special IO connector or test points for firmware upgrade purpose. The reference circuit is shown in Figure 1.

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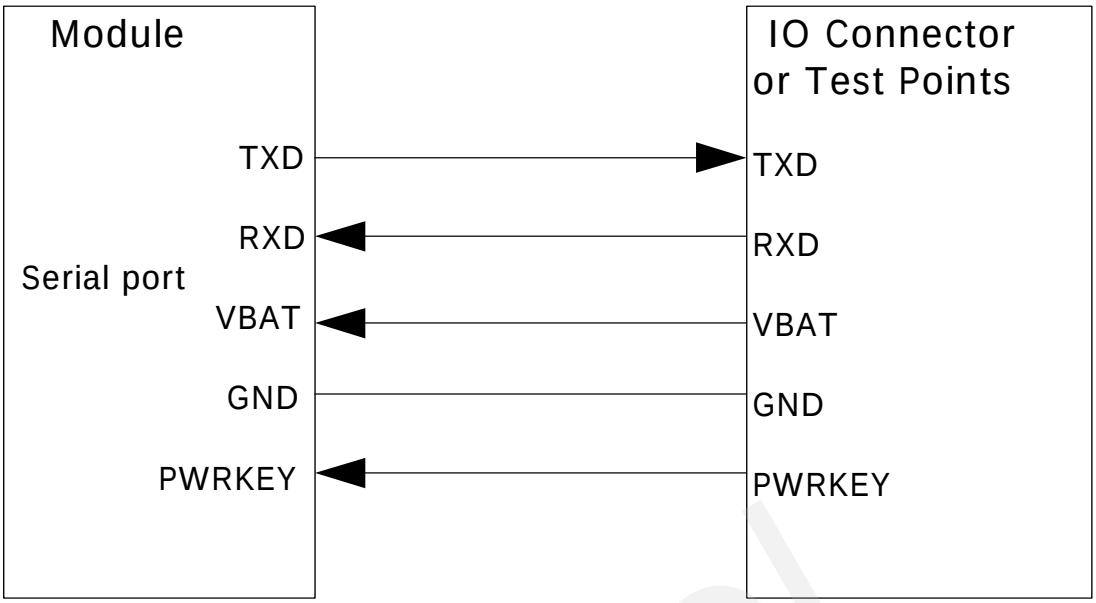

Figure 1: Direct connection for firmware upgrade

2.1.2. Common Application

In most applications, there is an external MCU controlling the module. In this case, a suitable resistor should be inserted between the TXD of the external MCU and the RXD of the module as shown in Figure 2. The resistor is used to block the signal of TXD in the external MCU when the firmware upgrade connection is established in the IO connector or the test points. The PWRKEY should be pulled down during firmware upgrade period. If the module to be upgraded can't be powered by the host board, an external power supply from the VBAT pin of the IO connector or the test points would be required.

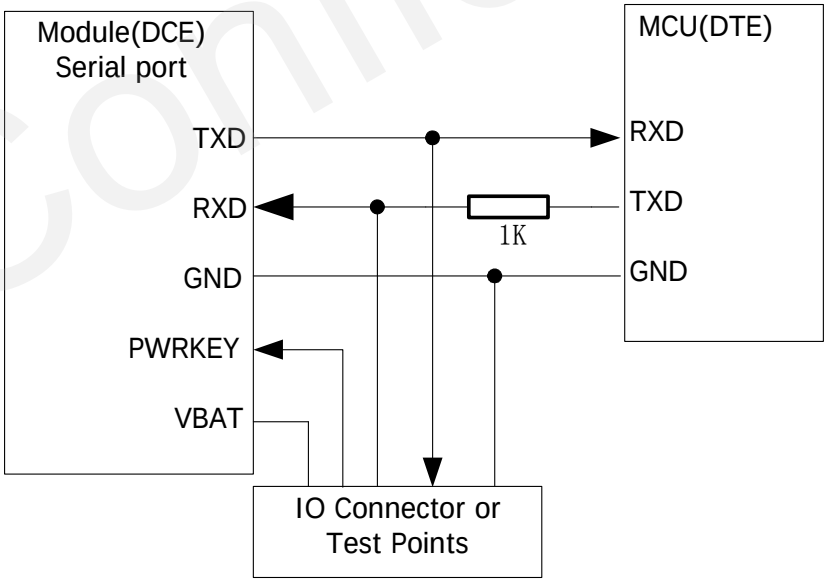

Figure 2: Blocking TXD of MCU by inserting a 1kΩ resistor

If the voltage levels of the serial port of external MCU don't meet the requirements in Table 4, a level shift circuit should be inserted between the GSM module and the external MCU. The reference circuit is shown in Figure 3 and Figure 4.

The voltage levels of the serial port are described in the Table 4.

Table 4: Logic levels of the serial port

Parameter	Min	Max	Unit
V_{IL}	0	0.67	V
V_{IH}	1.67	VDD_EXT +0.3	V
V_{OL}	GND	0.34	V
V_{OH}	2.0	VDD_EXT	V

Note: VDD_EXT is 2.8V.

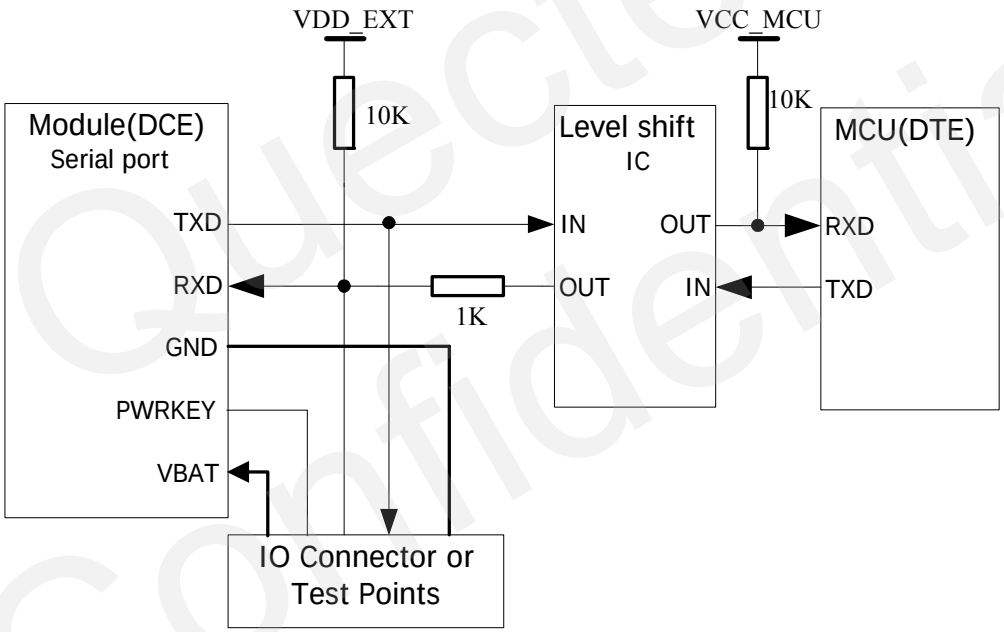

Figure 3: Level shift circuit with tri-state logic gate

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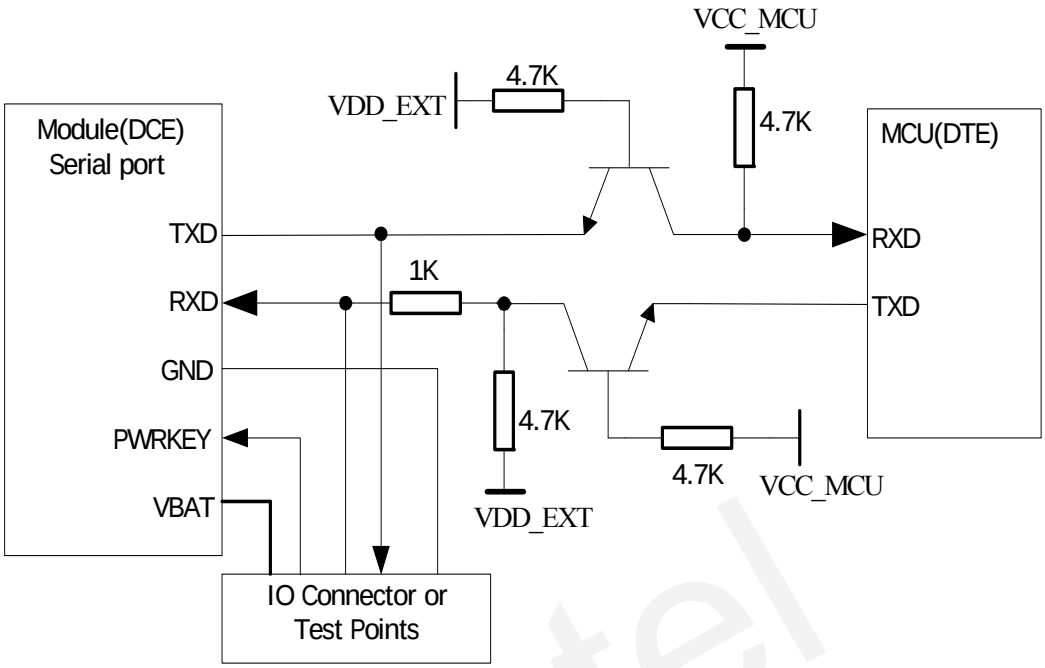

Figure 4: Level shift circuit with NPN transistor

Another simpler circuit for voltage level shift is shown in Figure 5. It is resistance voltage-distributing mode, which will cause additional current consumption (V_{TXD}/(R1+R2)) of system.

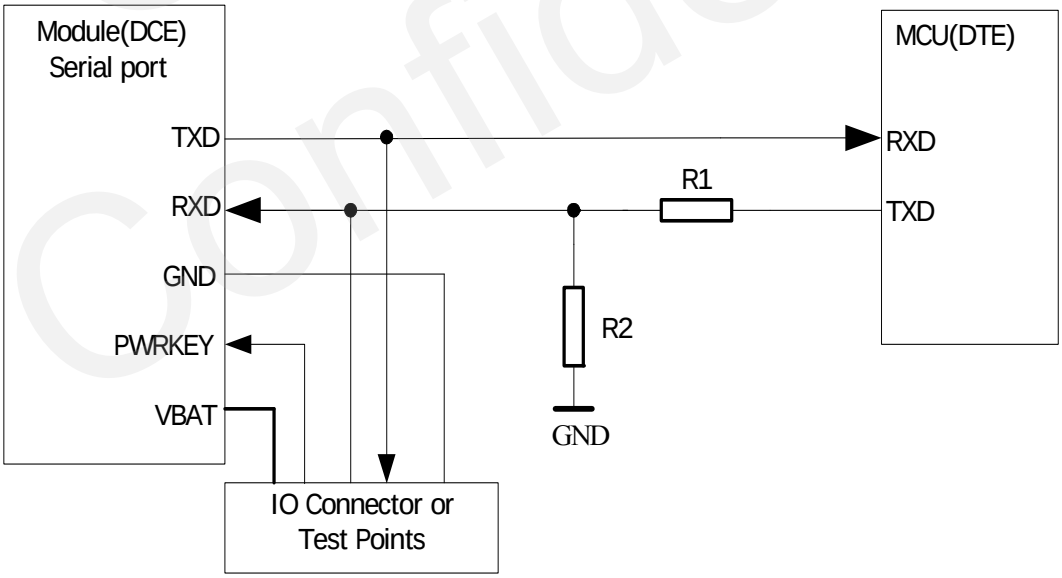

Figure 5: Level shift circuit with resistors

If the VCC_MCU is 3.3V, R1 is recommended to be 2KΩ, R2 is recommended to be 11KΩ.
If the VCC_MCU is 5V, R1 is recommended to be 2KΩ, R2 is recommended to be 2.7KΩ.

2.2. PCB Design

2.2.1. Connector on the Shell

According to the product shape and structure, customer can reserve a special IO connector on the shell, like RJ11 or DB9 connector, connecting the upgrade pins of module to the IO connector. The interface voltage levels between the module and the firmware upgrade fixture should match with each other. An RS232 level shift circuit must be inserted when connecting the IO connector to a COM port of PC. When a USB-to-UART cable is applied, the voltage levels of the UART interface should be checked.

2.2.2. Test Points on the PCB

The second method is to reserve 5 test points in host PCB and customer can implement the firmware upgrade through specific upgrade fixture provided by Quectel. The test points occupy an area of 17mm*6.6mm. The assignment and footprint required are shown in Figure 6 and Figure 7.

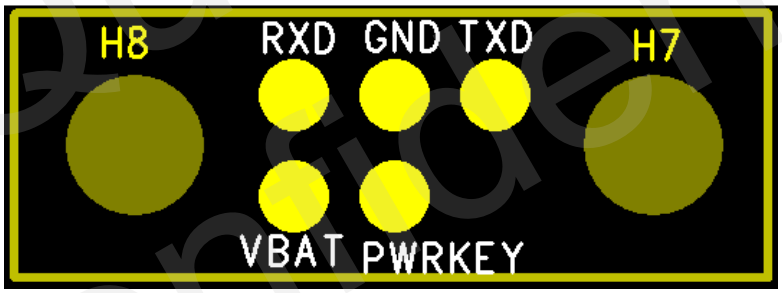

Figure 6: Assignment photos of test points

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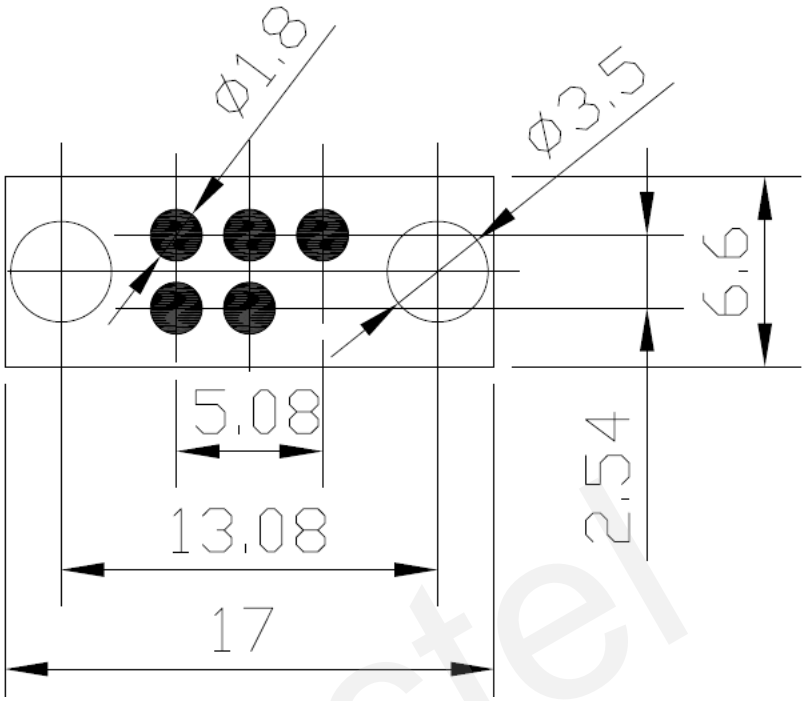

Figure 7: Footprint recommendation of test points

Figure 8: Physical photos of test points

In Figure 8, the RXD, TXD, VBAT, PWRKEY and GND test points are laid on top solder mask layer, while H7, H8 are two through holes which are used to fix upgrade fixture. The probes of the fixture will be contacted with these test points in the PCB. This customized upgrade fixture has been prepared by Quectel, as shown in Figure 9.

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3. Application

3.1. Assembly

The customized upgrade fixture is shown in Figure 9.

Figure 9: Photo of the upgrade fixture

Figure 10: Terminals of the upgrade fixture

In Figure 10, the terminal of the USB interface is used to connect directly to PC, while the other terminal is to be connected to host board. The 2 Red and black lines are used to supply for the GSM module by external power source when the internal power supply is not available. The Red line is for VBAT, and the black line is for GND. The voltage must meet the range of VBAT

described in the hardware design documents.

Assembly diagram is shown in Figure 11.

Figure 11: Assembly diagram of upgrade fixture

3.2. Firmware Upgrade

When the upgrade hardware connection between PC and the module in host board is established, customer can do the firmware upgrade process for GSM module by using the firmware upgrade software tool and the module firmware from Quectel. For more details about the PC tool of software upgrade, please refer to document [3].

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