UC20 SD
Application Note

UMTS/HSPA Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2014-01-09	Mountain ZHOU	Initial.
1.1	2014-03-28	Jonathan WEN/ Nina WANG	1. Added AT command and example of SD card operation. 2. Optimized the description of SD card detection mechanisms.

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1 Introduction

This document briefly introduces UC20 SD (Secure Digital) interface's features, pin definition, reference design, layout recommendations and AT commands.

2 Application

UC20 provides one SD Memory Card interface which has the following features:

- Support 4-bit bidirectional data bus
- 2.85V operations on SD interface
- Support SDIO host mode only
- Support SDHC (Secure Digital High Capacity), up to 32GB memory card
- Clock output up to 52MHz

The following table shows the supported protocols.

Table 1: Supported Protocols

Protocol	4-bit	Max Speed (MHz)
SD V2.0	YES	50
SDIO V2.0	YES	50
MMC V4.2	YES	52

2.1. Pin Definition

The following figure shows the pin assignment of UC20 module.
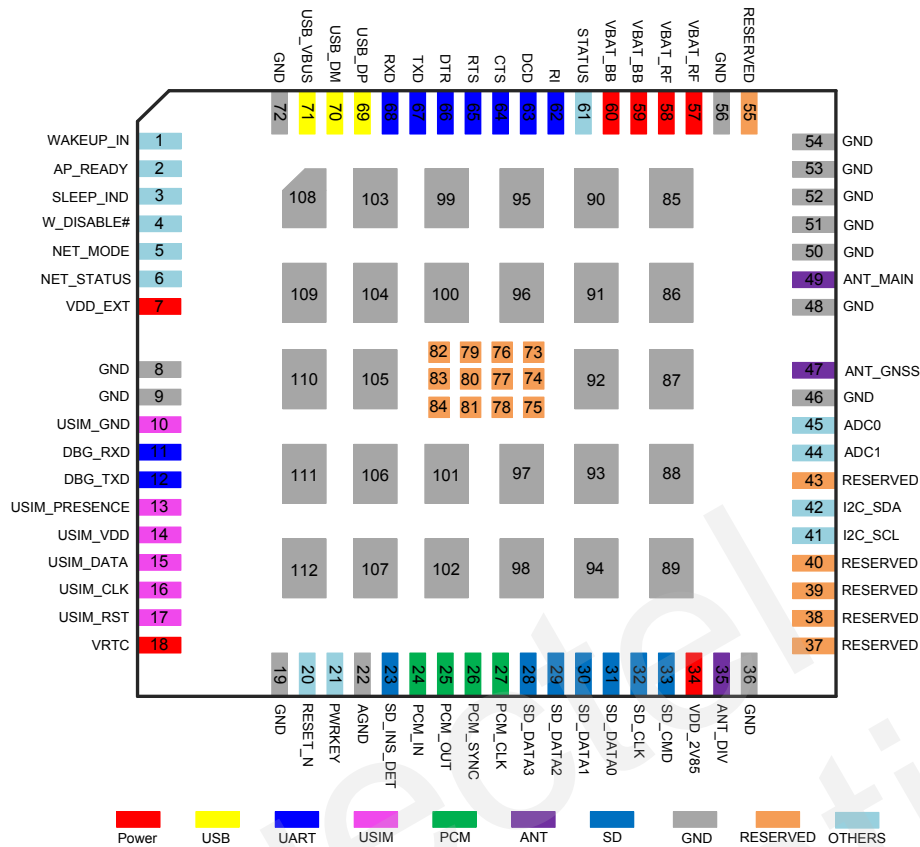
Figure 1: Pin Assignment

The following table shows the SD pin definition.

Table 2: Pin Definition of SD Interface

Pin Name	Pin No.	I/O	Description	Comment
VDD_2V85	34	PO	Power supply for SD card	2.85V power domain
SD_CMD	33	IO	Command pin of SD interface	2.85V power domain
SD_CLK	32	DO	Clock pin of SD interface	2.85V power domain
SD_DATA0	31	IO	Data bit0 of SD interface	2.85V power domain
SD_DATA1	30	IO	Data bit1 of SD interface	2.85V power domain
SD_DATA2	29	IO	Data bit2 of SD interface	2.85V power domain
SD_DATA3	28	IO	Data bit3 of SD interface	2.85V power domain
SD_INS_DET	23	DI	SD card input detection	1.8V power domain

Table 3: Digital I/O Characteristics

Parameter	Min.	Max.	Unit
V_{IL}	-0.3	$0.35^* V_{DD}$	V
V_{IH}	$0.65^* V_{DD}$	$V_{DD} +0.3$	V
V_{OL}	0	0.45	V
V_{OH}	$V_{DD} -0.45$	V_{DD}	V

NOTE

V_{DD}=1.8V for SD_INS_DET pin, and V_{DD}=2.85V for other SD interface pins.

2.2. SD Card Detection

Two ways of SD card detection mechanisms are supported as below:

1. **Software-based Polling Detection Mechanism.**

Software-based polling detection mechanism can be enabled by AT command **AT+QSDMOUNT=1** or **AT+QSDMOUNT=2**. After it is enabled, module will automatically detect the SD card state at the interval of 10s. If SD card is inserted, SD card will be mounted and if SD card is removed, SD card will be unmounted. URC will be automatically returned when SD card is inserted or removed.

2. **GPIO Interrupt Detection Mechanism.**

GPIO interrupt detection mechanism can be enabled by **AT+QSDMOUNT=2**. Pull up the SD_INS_DET pin with 51KR resistor, and module will check the SD card state when there is an edge trigger on this pin.

2.3. Reference Design

The following figures show the reference design of UC20 SD interface and SD card.
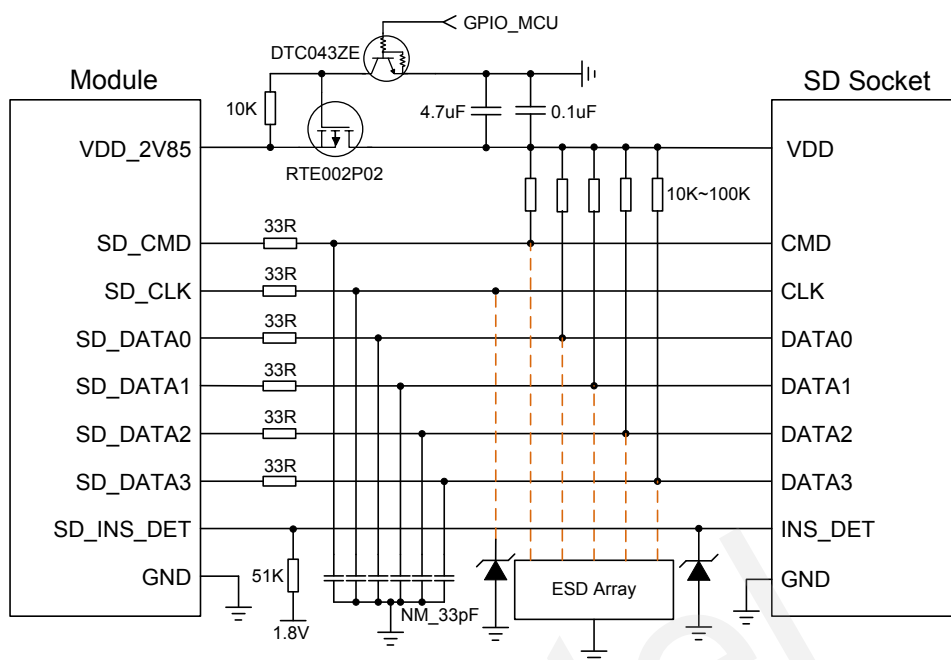
Figure 2: Reference Design

NOTES

1. Reserve 33ohm resistors and 33pF capacitors on data, command and clock lines of SD card.
2. SD card data and command lines should be pulled up to VDD_2V85 with 10K~100K ohm resistors.
3. Turn off the VDD_2V85 power supply with GPIO_MCU when SD card is not used.
4. It is recommended to keep TVS components on SD interface to get good ESD performance, and the parasitic capacitance of the components should be smaller than 15pF.

2.4. Layout Recommendations

The following section provides some layout recommendations for SD card that must be followed in the design of your applications.

- For adequate isolation, please avoid routing SD signals on the surface layer (its 52MHz clock rate and harmonics affect sensitive functions).
- Isolate SD signals from others to avoid crosstalk problems. In particular, stay away from RF, XO, and audio components.
- Route the SD data signals as a bus to limit the affected area, and provide at least 8-mil spacing to adjacent traces.
- Provide ground isolation for SD_CLK.
- Use ground plane on each side to isolate SD signals from other traces.

3 AT Command

You need to mount SD card before operation via command **AT+QSDMOUNT=1** or **AT+QSDMOUNT=2**. When URC **+QIND: "SDINS", 1** is returned, you can read from or write to SD card with File AT command. If the file name begins with "SD:", it means the file is located in SD card. The following section provides you the example on how to operate SD card through File AT command.

3.1. AT+QSDMOUNT Mount/Unmount SD Card

AT+QSDMOUNT is used to mount and unmount SD card.

AT+QSDMOUNT Mount/Unmount SD Card	
Test Command **AT+QSDMOUNT=?**	Response **+QSDMOUNT: (0-2)** **OK**
Read Command **AT+QSDMOUNT?**	Response **+QSDMOUNT : <mode>** **OK**
Write Command **AT+QSDMOUNT=<mode>**	Response **OK** or **ERROR**
Related URC	**+QIND: "SDINS",<inserted>** If AT+QSDMOUNT=1 or 2, and the SD card has been removed or inserted, this URC will be reported.
Reference	

Parameter

<mode>	The mode of SD card	
	0	Unmount SD card (Default)
	1	Mount SD card (Only support software-based polling detection)
	2	Mount SD card (Support software-based polling detection and SD_INS_DET interrupt detection)

<inserted>	0	SD card has been removed
	1	SD card has been inserted

3.2. Example of SD File Operation

3.2.1. Get the SD Space and List SD Files

AT+QFLDS="SD"   //Get the space information of SD card.
+QFLDS: 7801912768,7802925056

OK

AT+QFLST="SD:*"   //List all files in SD card.
+QFLST: "1.txt",17

OK

3.2.2. Upload and Download Files

AT+ QFUPL="SD:test.txt",10   //Upload the text file "test.txt" to SD.
CONNECT

<Input file bin data>

+QFUPL: 10,613e

OK

AT+QFDWL="SD:test.txt"   //Download the text file "test.txt" from SD.
CONNECT

<Output data>

+QFDWL: 10,613e   //Get the bytes of the downloaded data and the checksum.

OK

3.2.3. Write and Read the File

```
AT+QFOPEN="SD:test",0          //Open the file to get the file handle.
+QFOPEN: 0

OK

AT+QFWRITE=0,10                //Write 10 bytes to the file.
CONNECT

<Write data>

+QFWRITE: 10,10                //The actual written bytes and the size of the returned files.

OK

AT+QFSEEK=0,0,0                //Set the file pointer to the beginning of the file.
OK

AT+QFREAD=0,10                 //Read 10 bytes from the file.
CONNECT 10

<Read data>

OK

AT+QFCLOSE=0                   //Close the file.
OK
```

NOTE

For more details of the AT commands related with SD card, please refer to *Quectel_UC20_FILE_AT_Commands_Manual.*

4 Appendix A Reference

Table 3: Related Documents

SN	Document Name	Remark
[1]	Quectel_UC20_FILE_AT_Commands_Manual	UC20 FILE AT commands