MC65&MC60

Difference Comparison

GSM/GPRS/GNSS Module Series

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About the Document

Revision History

Version	Date	Author	Description
1.0	2019-12-19	Andy ZHAO	Initial
2.0	2020-07-30	Tia WEI	Added software differences between MC65 and MC60 (Chapter 3).

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1 Introduction

This document mainly introduces the main differences between Quectel MC65 and MC60 modules in terms of hardware and software, for example, differences between main functions, pin assignments, software functions, current consumption and sensitivity, precautions for compatible designs, AT commands and application features.

MC60 currently includes the following models:

1) OC: MC60CA-04-STD (with BT 3.0 supported);
2) OC: MC60ECA-04-BLE (with BT 4.0 supported).

2 Hardware Differences

2.1. Main Function Differences

Table 1: Main Function Differences Between MC65 and MC60 Modules

Modules	(U)SIM2	BT 3.0	BT 4.0	AlwaysLocate™/ GLP/EASY™/ LOCUS
MC65				
MC60 (MC60CA-04-STD)	√	√		√
MC60 (MC60ECA-04-BLE)	√	√	√	√

2.2. Pin Assignment

The pins of MC65 are completely compatible with those of MC60. The pin assignments of the two modules are shown below.

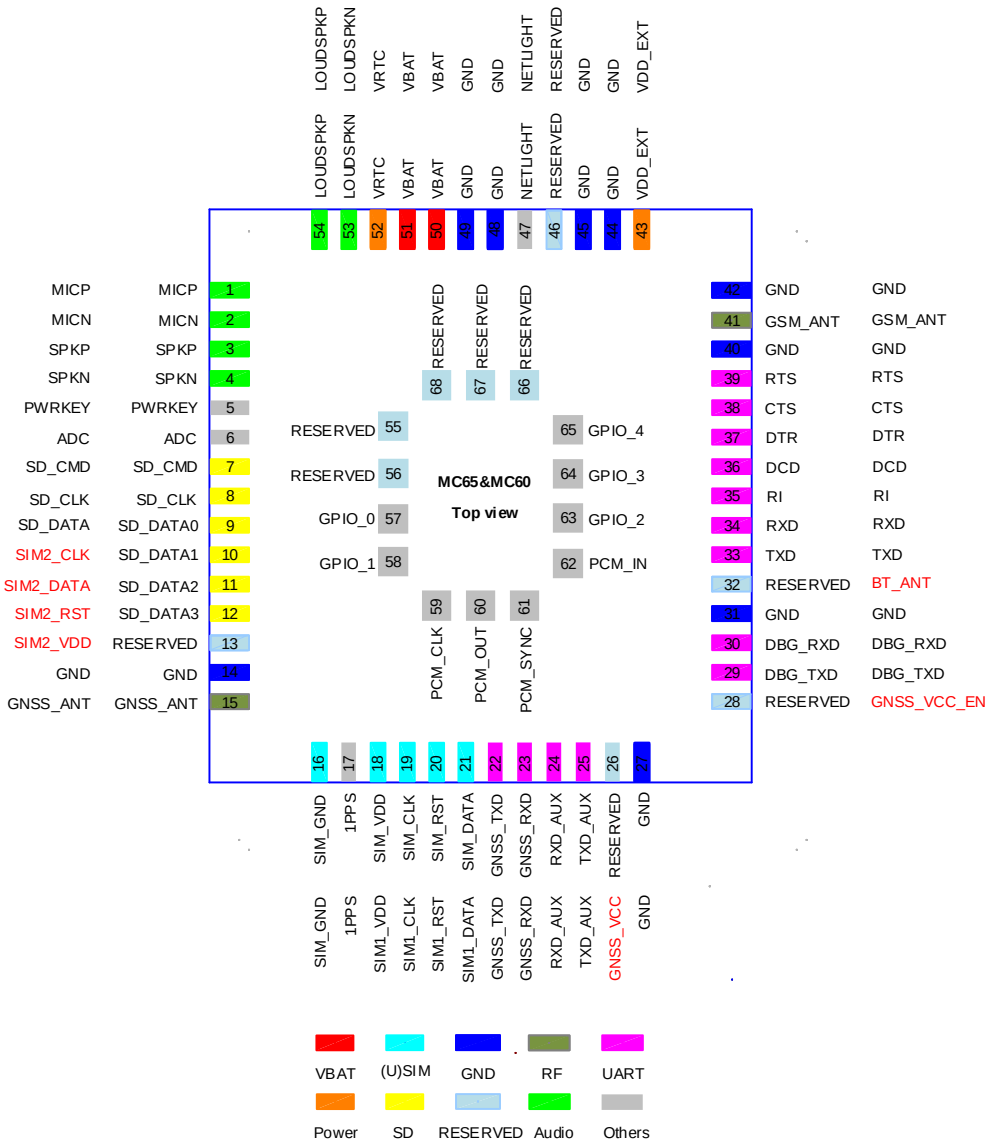

Figure 1: Pin Assignments of MC65 and MC60

NOTE

The above figure shows the pin assignments of MC65 and MC60 (MC60CA-04-STD and MC60ECA-04-BLE) from the inner block to the outer block in order.

2.3. Pin Difference Description

Table 2: Pin Difference Description

Pin No.	MC65	MC60 (MC60CA-04-STD/ MC60ECA-04-BLE)	Difference Description
	Pin Name	Pin Name	
1	MICP	MICP	/
2	MICN	MICN	/
3	SPKP	SPKP	/
4	SPKN	SPKN	/
5	PWRKEY	PWRKEY	**Pull-down Time Required for Power-on:** **MC65:** > 1.2 s **MC60:** > 1 s
6	ADC	ADC	**Voltage Input Range:** **MC65:** 0–1.8 V **MC60:** 0–2.8 V
7	SD_CMD	SD_CMD	**SD Card:** **MC65:** Under development **MC60:** Supports 1-bit mode **(U)SIM Card:** **MC65:** Not support (U)SIM2 **MC60:** Supports (U)SIM2
8	SD_CLK	SD_CLK	
9	SD_DATA0	SD_DATA	
10	SD_DATA1	SIM2_CLK	
11	SD_DATA2	SIM2_DATA	
12	SD_DATA3	SIM2_RST	
13	RESERVED	SIM2_VDD	
14	GND	GND	/
15	GNSS_ANT	GNSS_ANT	/
16	SIM_GND	SIM_GND	/
17	1PPS	1PPS	/

18	SIM_VDD	SIM1_VDD	/
19	SIM_CLK	SIM1_CLK	/
20	SIM_RST	SIM1_RST	/
21	SIM_DATA	SIM1_DATA	/
22	GNSS_TXD	GNSS_TXD	/
23	GNSS_RXD	GNSS_RXD	/
24	RXD_AUX	RXD_AUX	/
25	TXD_AUX	TXD_AUX	/
26	RESERVED	GNSS_VCC	**GNSS Power Supply:** **MC65:** Internal LDO power supply. **MC60:** External power supply.
27	GND	GND	/
28	RESERVED	GNSS_VCC_EN	**GNSS Power Control:** **MC65:** No hardware enablement pin required. **MC60:** Controls the enablement of external LDO.
29	DBG_TXD	DBG_TXD	**Function and Baud Rate:** **MC65:** Used for firmware download, upgrade and low-level log output, and only supports baud rate 921600 bps. **MC60:** Used for low-level log output, and only supports baud rate 460800 bps.
30	DBG_RXD	DBG_RXD	
31	GND	GND	/
32	RESERVED	BT_ANT	**Bluetooth Function:** **MC65:** Unsupported **MC60:** Supported
33	TXD	TXD	**MC65:** Serves as AT port **MC60:** Serves as download port and AT port
34	RXD	RXD	

35	RI	RI	/
36	DCD	DCD	/
37	DTR	DTR	/
38	CTS	CTS	/
39	RTS	RTS	/
40	GND	GND	/
41	GSM_ANT	GSM_ANT	/
42	GND	GND	/
43	VDD_EXT	VDD_EXT	/
44	GND	GND	/
45	GND	GND	/
46	RESERVED	RESERVED	/
47	NETLIGHT	NETLIGHT	/
48	GND	GND	/
49	GND	GND	/
50	VBAT	VBAT	**Power Supply Range:** **MC65:** 3.45–4.25 V **MC60:** 3.3–4.6 V
51	VBAT	VBAT	
52	VRTC	VRTC	Description of the difference between VRTC pins of MC60 and MC65 can be referred to in ***Chapter 2.6.5***.
53	LOUDSPKP	LOUDSPKP	**MC65:** Not support single-ended output **MC60:** Supports single-ended output for earphones
54	LOUDSPKN	LOUDSPKN	
55	RESERVED	RESERVED	/
56	RESERVED	RESERVED	
57	GPIO_0 [1)]	GPIO_0 [1)]	

58	GPIO_1 [1)]	GPIO_1 [1)]
59	PCM_CLK	PCM_CLK
60	PCM_OUT	PCM_OUT
61	PCM_SYNC	PCM_SYNC
62	PCM_IN	PCM_IN
63	GPIO_2 [1)]	GPIO_2 [1)]
64	GPIO_3 [1)]	GPIO_3 [1)]
65	GPIO_4 [1)]	GPIO_4 [1)]
66	RESERVED	RESERVED
67	RESERVED	RESERVED
68	RESERVED	RESERVED

NOTES

1. The pin names in red indicate the pins of MC65 and MC60 are different.
2. [1)] These pins are only used as GPIO for MC65 QuecOpen and MC60 QuecOpen. In standard modules, these pins are kept as RESERVED.

2.4. Differences Between Pin Multiplexing Functions

Table 3: Multiplexing Functions of MC60 Pins

Pin Name	Pin No.	Mode 1 (by default)	Mode 2	Mode 3	Mode 4
SD_CMD	7	SD_CMD	GPIO		
SD_CLK	8	SD_CLK	GPIO		
SD_DATA	9	SD_DATA	GPIO		
SIM2_CLK	10	SIM2_CLK	GPIO		
SIM2_DATA	11	SIM2_DATA	GPIO		

SIM2_RST	12	SIM2_RST	GPIO		
RI	35	RI	GPIO	I2SCL	
DCD	36	DCD	GPIO	I2SDA	
DTR	37	DTR	GPIO	EINT	SIM_PRESENCE
CTS	38	CTS	GPIO	EINT	
RTS	39	RTS	GPIO		
NETLIGHT	47	NETLIGHT	GPIO	PWM_OUT	EINT
PCM_CLK	59	PCM_CLK	GPIO	SPI_CS	
PCM_OUT	60	PCM_OUT	GPIO	SPI_MOSI	
PCM_SYNC	61	PCM_SYNC	GPIO	SPI_MISO	
PCM_IN	62	PCM_IN	GPIO	SPI_CLK	

Table 4: Multiplexing Functions of MC65 Pins

Pin Name	Pin No.	Mode 1 (by default)	Mode 2	Mode 3	Mode 4
SD_CMD	7	SD_CMD	GPIO	EINT	SPI_CS
SD_CLK	8	SD_CLK	GPIO	EINT	SPI_CLK
SD_DATA0	9	SD_DATA0	GPIO	EINT	
SD_DATA1	10	SD_DATA1	GPIO	EINT	SPI_MOSI
SD_DATA2	11	SD_DATA2	GPIO	EINT	SPI_MISO
SD_DATA3	12	SD_DATA3	GPIO	EINT	
RI	35	RI	GPIO	I2SCL	EINT
DCD	36	DCD	GPIO	I2SDA	EINT
DTR	37	DTR	GPIO	EINT	SIM_PRESENCE
CTS	38	CTS	GPIO	EINT	EINT
RTS	39	RTS	GPIO	EINT	

NETLIGHT	47	NETLIGHT	GPIO	EINT
PCM_CLK	59	PCM_CLK	GPIO	EINT
PCM_OUT	60	PCM_OUT	GPIO	EINT
PCM_SYNC	61	PCM_SYNC	GPIO	EINT
PCM_IN	62	PCM_IN	GPIO	EINT

NOTES

1. The pin multiplexing functions are only used for QuecOpen design and can be ignored in the design of standard modules.
2. All pins of MC65 that can be multiplexed as GPIO functions have external interrupt functions.

2.5. Current Consumption and Sensitivity Difference

2.5.1. Current Consumption Difference

Table 5: Differences Between Current Consumption in Different Modes of GSM

Module Status	MC65	MC60
Power down mode	38 μA	220 μA
Sleep mode @ DRX=5	1.15 mA	1.2 mA
AT+CFUN=0 @ Idle mode	9.0 mA	13 mA
AT+CFUN=0 @ Sleep mode	0.9 mA	0.68 mA
AT+CFUN=4 @ Idle mode	9.0 mA	13 mA
AT+CFUN=4 @ Sleep mode	0.9 mA	0.73 mA

Table 6: Differences Between Current Consumption in Different Modes of GNSS

Module Status	Condition	MC65	MC60
I_{VCC} @ Acquisition	GPS	23.8 mA	25 mA

I_{VCC} @ Tracking	GPS	22.6 mA	19 mA
I_{VCC} @ Acquisition	GPS+GLONASS	25.3 mA	29 mA
I_{VCC} @ Tracking	GPS+GLONASS	24.7 mA	22 mA
I_{BCKP} @ Backup	@ V_BCKP = 2.8 V	25 μA	14 μA

NOTE

The current consumption of the GNSS part in the tracking mode is calculated based on the following conditions:

- Cold start and10 minutes after the first positioning
- Hot start and 15 seconds after the first positioning

Table 7: Differences Between GPRS Current Consumption

Condition	Current Consumption	
Voice Call	**MC65**	**MC60**
GSM850	@ power level 5, < 300 mA, typical 247 mA @ power level 12, typical 106 mA @ power level 19, typical 75 mA	@ power level 5, < 300 mA, typical 174 mA @ power level 12, typical 83 mA @ power level 19, typical 62 mA
EGSM900	@ power level 5, < 300 mA, typical 247 mA @ power level 12, typical 107 mA @ power level 19, typical 77 mA	@ power level 5, < 300 mA, typical 175 mA @ power level 12, typical 83 mA @ power level 19, typical 63 mA
DCS1800	@ power level 0, < 250 mA, typical 169 mA @ power level 7, typical 86 mA @ power level 15, typical 66 mA	@ power level 0, < 250 mA, typical 153 mA @ power level 7, typical 73 mA @ power level 15, typical 60 mA
PCS1900	@ power level 0, < 250 mA, typical 152 mA @ power level 7, typical 87 mA @ power level 15, typical 69 mA	@ power level 0, < 250 mA, typical 151 mA @ power level 7, typical 76 mA @ power level 15, typical 61 mA
GPRS Data		
DATA Mode, GPRS (3 Rx, 2Tx) Class 12		
GSM850	@ power level 5, < 550 mA, typical 372 mA	@ power level 5, < 550 mA, typical 363 mA
EGSM900	@ power level 5, < 550 mA, typical 387 mA	@ power level 5, < 550 mA, typical 356 mA
DCS1800	@ power level 0, < 450 mA, typical 253 mA	@ power level 0, < 450 mA, typical 234 mA

PCS1900	@ power level 0, < 450 mA, typical 223 mA	@ power level 0, < 450 mA, typical 257 mA
GPRS Data		
DATA Mode, GPRS (4 Rx, 1Tx) Class 12		
GSM850	@ power level 5, < 350 mA, typical 248 mA	@ power level 5, < 350 mA, typical 216 mA
EGSM900	@ power level 5, < 350 mA, typical 254 mA	@ power level 5, < 350 mA, typical 222 mA
DCS1800	@ power level 0, < 300 mA, typical 174 mA	@ power level 0, < 300 mA, typical 171 mA
PCS1900	@ power level 0, < 300 mA, typical 156 mA	@ power level 0, < 300 mA, typical 169 mA

2.5.2. Sensitivity Difference

Table 8: Differences Between GSM Receiving Sensitivity

Frequency	MC65	MC60
GSM850	< -108 dBm	< -110 dBm
EGSM900	< -108 dBm	< -110 dBm
DCS1800	< -107.5 dBm	< -109 dBm
PCS1900	< -107.5 dBm	< -109 dBm

Table 9: Differences Between GNSS Receiving Sensitivity (GPS + GLONASS)

Status	MC65	MC60
Acquisition	-144 dBm	-148 dBm
Reacquisition	-157 dBm	-160 dBm
Tracking	-156 dBm	-165 dBm

2.6. Compatible Design Considerations

2.6.1. Firmware Upgrade

MC60:
Firmware is upgraded via the main UART port.

MC65:
Firmware is upgraded via the debug UART port. Therefore, test points of debug UART port need to be reserved in compatible design and only the baud rate of 921600 bps is supported.

2.6.2. GNSS Power Supply Design

MC60:
The GNSS part of MC60 is powered by an external LDO. The recommended reference circuit is shown below.

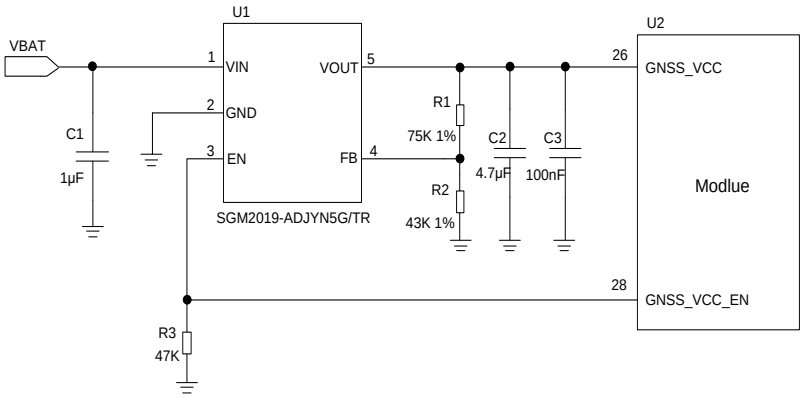

Figure 2: Power Supply Reference Circuit for MC60 GNSS Part

MC65:
The GNSS part of MC65 is powered by the internal LDO of the module, so pins 26 and 28 are retained as RESERVED. The power-on and power-off of the GNSS part can be controlled under the corresponding AT command, so no external LDO power supply circuit is required during designing.

2.6.3. GNSS Active Antenna Design

The designs of passive antennas for MC65 and MC60 are the same, and an LNA is disposed in either of the modules. It is recommended to use the passive antenna.

For active antenna, MC60's active antenna can be powered by GNSS_VCC, and MC65's active antenna needs to be powered by the module's external 3.3 V power supply.

2.6.4. SPI Function Design

MC60's SPI interface is multiplexed with pins 59, 60, 61 and 62, and MC65's SPI interface is multiplexed with pins 7, 8, 10, and 11. For more details, please refer to the differences between pin multiplexing functions in ***Chapter 2.4***. If the SPI function is required, the differences between pin multiplexing functions need to be considered during designing of the hardware.

2.6.5. RTC Function Design

Both MC65 and MC60 support the RTC (real-time clock) function. VRTC can be powered by VBAT via the internal LDO, and can also be connected to a coin cell battery or an ultra-capacitor to maintain the RTC (real-time clock). When the RTC function is required, it is recommended that both VBAT and VRTC pins be powered.

When the VBAT is powered off, VRTC can power the backup domain of the GNSS part, which is used to back up the necessary information and a small number of user configuration parameters required for quick startup. However, MC65 does not support this.

3 Software Differences

3.1. Differences Between Software Functions

This chapter describes the differences between software functions of MC65 and MC60 modules.

Table 10: Differences Between Software Functions

Module	MC60	MC65
Chip	**MT2503**	**RDA8955L**
SMS	Supported	Supported
Voice Call	Supported	Supported
USSD	Supported	Not supported
PHB	Supported	Not supported
STK	Supported	Not supported
CMUX	Supported	Supported
Dual UART	Not supported	Supported
UFS	Supported	Supported
RAM	Supported	Supported
SD	Supported	Not supported
Triple UART	Supported	Not supported
TCP/UDP	Supported	Supported
PPP	Supported	Supported
FTP	Supported	Supported

HTTP	Supported	Supported
NITZ	Supported	Supported
PING	Supported	Supported
NTP	Supported	Supported
HTTPS	Supported	Supported
TCPSSL	Supported	Supported
MQTT	Supported	Supported
Jamming Detection	Supported	Not supported
DTMF	Supported	*
Audio Record	Supported	Supported
Audio Play	Supported	Supported
QuecFOTA®	Supported	Supported
DFOTA	Not supported	Supported (core & app)
QuecOpen FOTA	Supported	Not supported
QuecOpen®	Supported	Supported
AGPS	Off-line Mode (Download EPO files with data of 6 days each time and store them in Modem file system.)	On-line Mode (The downloaded file can only be used for 2 hours each time; and the auxiliary data is lost after the GSM part powers off.)
GNSS	Accept the ASCII commands (PMTK and PQ commands)	Mainly accept the HEX commands.
QuecLocator®	Supported	Supported
DSSS	Supported	Not supported
eCall	Supported	Not supported
BT	Supported	Not supported
(U)SIM Detection	Supported	Supported
Alarm	Supported	Not supported
Watchdog	Supported	Supported

NOTES

1. "*" means under development.
2. For SMS function, MC65 does not support excessively long messages.
3. For audio record, MC65 supports only the AMR format, while MC60 supports AMR and WAV formats. However, MC65 does not support audio bin or PCM function.
4. For TCPSSL function, MC65 does not support transparent mode.
5. For TCP/UDP function, MC65 does not support these AT commands, such as **AT+QIAUTOS**, **AT+QISCON** and **AT+QITCFG**.
6. For **AT+QENG**, the parameters for MC60 have different value ranges from those for MC65, and MC65 does not support either of dump values: 3 and 4.
7. For **AT+QLOCKF**, in the process of locking the correct effective frequency point, no GPRS network loss occurs when executing **AT+QLOCKF** on MC60, but the GPRS network loss occurs and network camping is reselected when the AT Command is executed on MC65.

3.2. Differences Between AT Commands

This chapter provides the contrasting differences between AT commands of MC65 and MC60 modules.

Table 11: Differences Between AT Commands

AT Commands	MC60	MC65
AT+GCAP=? **AT+GCAP** **AT+QIURC=?** **AT+QEXTUNSOL=?** **AT+QINISTAT=?** **AT+QNSTATUS=?** **AT+CTZR=?** **AT+QCGTIND=?** **AT+CIMI?** **AT+QCSPWD=?** **AT+QSIMVOL=?** **AT+QDSIM=?** **ATP** **ATS6?** **ATS7?** **ATS8?** **ATS10?** **ATT**	Supported	Not Supported

AT+CSTA=? **AT+CR=?** **AT+CRC=?** **AT+CSNS=?** **AT+QSFR=?** **AT+QSPCH=?** **AT+QSMSCODE=?** **AT+QISSTAT=?** **AT+QISCON=?** **AT+CCUG=?** **AT+QCLIP=?** **AT+QCOLP=?** **ATL<value>** **ATM<value>** **AT+QTONEP=?** **AT+QPCMON=?** **AT+QPCMVOL=?** **AT+QALARM=?** **AT+QTEMP?** **AT+QMSDC=?** **AT+CRES** **AT+CSAS** **AT+QIAUTOS** **AT+QISERVER** **AT+QISRVC** **AT+QISCON** **AT+QITCFG** **AT+CPBF** **AT+CNUM**		
AT+IPR=? **AT+CMUX?** **AT+QEAUART?** **AT+QSEDCB?** **AT+CSCB?** **AT+QNTP?** **AT+CBC**	The default values of AT commands are different from those of MC65.	The default values of AT commands are different from those of MC60.
AT+CSCS=? **AT+IFC=?** **AT+QEAUART=?** **AT+QSEDCB=?** **AT+CLCK=?** **AT+CPWD=?** **AT+CRES=?** **AT+CSAS=?**	The supported parameters are different from those of MC65.	The supported parameters are different from those of MC60.

AT+CPBS=?
AT+CPBW=?
AT+CPBR=?
AT+CGCLASS=?
AT+QIFGCNT=?
AT+QMIC=?
AT+QAUDCH=?
AT+QLEDMODE=?

3.3. Differences Between Application Features

3.3.1. GPIO

MC65 does not support obtaining of the GPIO's pull status.

3.3.2. EINT

- MC65: Edge triggered. 0 to 2.8 V.
- MC60: Level triggered. 0 to 2.8 V.

3.3.3. PWM

MC65: PWM unsupported.
MC60: PWM supported.

3.3.4. UART

Number of common serial ports:

- MC65: 2
- MC60: 3

3.3.5. Watchdog

Both MC65 and MC60 provide software watchdog logic, and an external watchdog IC is needed.

- MC65 can use PINNAME_RI, PINNAME_DCD, PINNAME_CTS and PINNAME_RTS.
- MC60 can use any GPIO as a dog feeding pin.

3.3.6. Wake-up Methods

- MC65 module can be woken up by EINT, timer, GPRS data, incoming call and short message. But MC65 module does not enter the sleep mode automatically after being woken up by the timer and EINT, and *Ql_SleepEnable* needs to be called to enable the module to enter the sleep mode.
- MC60 module can be woken up by EINT, timer, GPRS data, incoming call and short message.

3.3.7. Usage of Ql_Debug_Trace

- MC65: The text format data is not supported by its debug port. Therefore, the debug log can only be received via tool Coolwatcher.
- MC60: When ADVANCE is configured as the debug port, a tool Catcher needs to be connected to receive the debug logs. With ADVANCE configured as the debug port, the debug logs can be received via ordinary debugging tool of the serial ports, such as SecureCRT.

3.3.8. APP Upgrading (For QuecOpen® Solution)

- MC65 QuecOpen is upgraded via DFOTA through which firmware is upgraded by upgrading only a part (that is, the differential firmware package) of a target firmware package that is different from the original firmware package.
- MC60 QuecOpen is upgraded via FOTA and the whole APP package will be upgraded.

Regardless of what solution the module uses, finally, the same results are obtained.

3.3.9. Firmware and APP Downloading Tools

- MC65: Coolwatcher or QFlash
- MC60: QFlash

3.3.10. Debugging Methods

- MC65: Fetch the kernel debug logs with tool Coolwatcher.
- MC60: Fetch the kernel debug logs with tool Catcher.

3.3.11. Standard Library

- MC65: *Ql_sscanf* does not support regular expression.
- MC60: *Ql_sscanf* supports regular expression.

4 Appendix A References

Table 12: Reference Documents

SN	Document Name	Remarks
[1]	Quectel_MC65_Hardware_Design	MC65 Hardware Design
[2]	Quectel_MC60_Hardware_Design	MC60 Hardware Design

Table 13: Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted Global Positioning System
ASCII	American Standard Code for Information Interchange
DFOTA	Delta Firmware Upgrade Over-the-Air
EPO	Extended Prediction Orbit
FTP	File Transfer Protocol
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
LDO	Low Dropout Regulator
LNA	Low Noise Amplifier
MQTT	Message Queuing Telemetry Transport
NITZ	Network Identity and Time Zone
NTP	Network Time Protocol

HTTPS	Hyper Text Transfer Protocol
PPP	Point-to-Point Protocol
RTC	Real-Time Clock
SPI	Serial Peripheral Interface
SSL	Security Socket Layer
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UTC	Coordinated Universal Time