EG06&EG12&EG18
Difference Introduction

LTE-A Module Series

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About the Document

History

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Contents

Table Index

Figure Index

1 Introduction

EG06, EG12 and EG18 modules are designed as compatible products. This document describes the main differences between EG06, EG12 and EG18 modules in terms of hardware and software designs.

2 Hardware Comparison

2.1. Product Description

The following table compares the general information of EG06, EG12 and EG18 modules.

Table 1: Module General Information

Module	Appearance	Packaging	Dimensions (mm)	Description
EG06		299-pin LGA	37.0 × 39.5 × 2.8	LTE-A **Cat 6** LTE-FDD/ LTE-TDD/ WCDMA
EG12		299-pin LGA	37.0 × 39.5 × 2.8	LTE-A **Cat 12** LTE-FDD/ LTE-TDD/ WCDMA
EG18		299-pin LGA	37.0 × 39.5 × 2.8	LTE-A **Cat 18** LTE-FDD/ LTE-TDD/ WCDMA

2.2. Features Overview

The following table compares general properties and features of EG06, EG12 and EG18 modules.

Table 2: Features Overview

Feature	EG06	EG12	EG18
Power Supply	3.3V~4.3V Typ. 3.8V	3.3V~4.3V Typ. 3.8V	3.3V~4.3V Typ. 3.8V
Peak Current	**VBAT_BB:** Max 0.8A **VBAT_RF:** Max 1.5A	**VBAT_BB:** Max 1.0A **VBAT_RF:** Max 1.5A	**VBAT_BB:** Max 1.2A **VBAT_RF:** Max 1.5A
Sleep Current	**OFF state** 10uA @power down **Sleep state:** 1.54mA @WCDMA PF=512 2.68mA @FDD PF=128 2.69mA @TDD PF=128 **Idle state:** 18mA @WCDMA PF=64 22.3mA @FDD PF=64 21.8mA @TDD PF=64	**OFF state** 20uA @power down **Sleep state:** 1.49mA @WCDMA PF=512 1.72mA @FDD PF=256 1.78mA @TDD PF=256 **Idle state:** 9.23mA @WCDMA PF=64 8.91mA @FDD PF=64 9.13mA @TDD PF=64	**OFF state** 20uA @power down **Sleep state:** 1.49mA @WCDMA PF=512 1.72mA @FDD PF=256 1.78mA @TDD PF=256 **Idle state:** 9.23mA @WCDMA PF=64 8.91mA @FDD PF=64 9.13mA @TDD PF=64
Temperature Range	**Operation temperature range:** -35 ~ +75°C 1) **Extended temperature range:** -40 ~ +85°C 2) **Storage temperature range:** -40 ~ +90°C	**Operation temperature range:** -30~ +75°C 1) **Extended temperature range:** -40 ~ +85°C 2) **Storage temperature range:** -40 ~ +90°C	**Operation temperature range:** -30 ~ +70°C 1) **Extended temperature range:** -40 ~ +85°C 2) **Storage temperature range:** -40 ~ +90°C
Main UART Interface	**Baud rates:** 4800bps; 9600bps; 19200bps; 38400bps; 57600bps; 115200bps(default); 230400bps; 460800bps; 921600bps **Flow control:** RTS/CTS **Signal level:** 1.8V	**Baud rates:** 4800bps; 9600bps; 19200bps; 38400bps; 57600bps; 115200bps(default); 230400bps; 460800bps; 921600bps **Flow control:** RTS/CTS **Signal level:** 1.8V	**Baud rates:** 4800bps; 9600bps; 19200bps; 38400bps; 57600bps; 115200bps(default); 230400bps; 460800bps; 921600bps **Flow control:** RTS/CTS **Signal level:** 1.8V
Debug UART Interface	**Debug UART interface:** ● Used for Linux console	**Debug UART interface:** ● Used for Linux console	**Debug UART interface:** ● Used for Linux console

	and log output ● 115200bps baud rate	and log output ● 115200bps baud rate	and log output ● 115200bps baud rate
BT UART Interface	● Used for Bluetooth communication and can be multiplexed into SPI interface ● 115200bps baud rate	● Used for Bluetooth communication and can be multiplexed into SPI interface ● 115200bps baud rate	● Used for Bluetooth communication and can be multiplexed into SPI interface ● 115200bps baud rate
Antenna Interface	ANT_MAIN ANT_DIV ANT_GNSS	ANT_MAIN ANT_DIV ANT_MIMO1 ANT_MIMO2 ANT_GNSS	ANT_MAIN ANT_DIV ANT_MIMO1 ANT_MIMO2 ANT_GNSS
USB Interface	USB 2.0 & USB 3.0	USB 2.0 & USB 3.0	USB 2.0 & USB 3.0
PCIe Interface*	Not supported	● Supported and used for date transmission ● Comply with PCI Express Specification Revision 2.1 and support 5Gbps per lane	● Supported and used for data transmission ● Comply with PCI Express Specification Revision 2.1 and support 5Gbps per lane
Digital Audio	PCM	PCM	PCM
I2C Interface	Supported	Supported	Supported
ADC	Two ADCs	Two ADCs	Two ADCs
Voltage at ADC	0.15V~VBAT_BB	0V~1.875V	0V~1.875V
(U)SIM Card	Single (U)SIM Card 1.8V/3.0V	Dual (U)SIM Cards 1.8V/3.0V Dual SIM Single Standby	Dual (U)SIM Cards 1.8V/3.0V Dual SIM Single Standby
(U)SIM Card Detection	Supported	Supported	Supported
Firmware Upgrade	USB, DFOTA	USB, DFOTA	USB, DFOTA

NOTES

1. "*" means under development.
2. [1] Within operating temperature range, the module is 3GPP compliant.
3. [2] Within extended temperature range, proper mounting, heating sinks and active cooling may be required to make certain functions of the module such as voice, SMS, data transmission, emergency call to be realized. Only one or more parameters like Pout might reduce in their value and exceed the specified tolerances. When the temperature returns to normal operating temperature levels, the module will meet 3GPP specifications again.

2.3. Power Supply

The following table describes the peak current difference between EG06, EG12 and EG18.

Table 3: Peak Current Difference

Feature	EG06	EG12	EG18
Peak Current	**VBAT_BB:** Max 0.8A **VBAT_RF:** Max 1.5A	**VBAT_BB:** Max 1.0 A **VBAT_RF:** Max 1.5A	**VBAT_BB:** Max 1.2A **VBAT_RF:** Max 1.5A

Power design for EG06/EG12/EG18 module is very important, as the performance of the module largely depends on the power source. The power supply should be able to provide sufficient current up to 2.7A at least. If the voltage drop between the input and output is not too high, an LDO is suggested to be used to supply power for the module. If there is a big voltage difference between the input source and the desired output (VBAT), a buck converter is preferred to be used as the power supply.

The following figure shows a reference design for +5V input power source. In this design, output of the power supply is about 3.8V and the maximum load current is 3A.

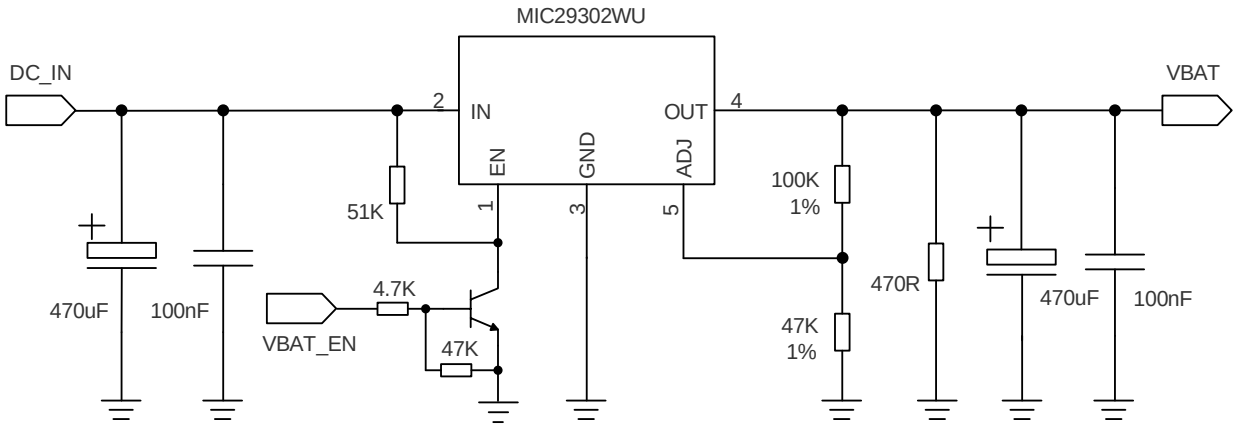

Figure 1: Reference Circuit of Power Supply

NOTE

In order to avoid damaging internal flash, please do not switch off the power supply when the module works normally. Only after the module is shut down by PWRKEY or AT command, the power supply can be cut off.

2.4. Pin Definition Differences

The following figure shows the pin assignment of EG06, EG12 and EG18.

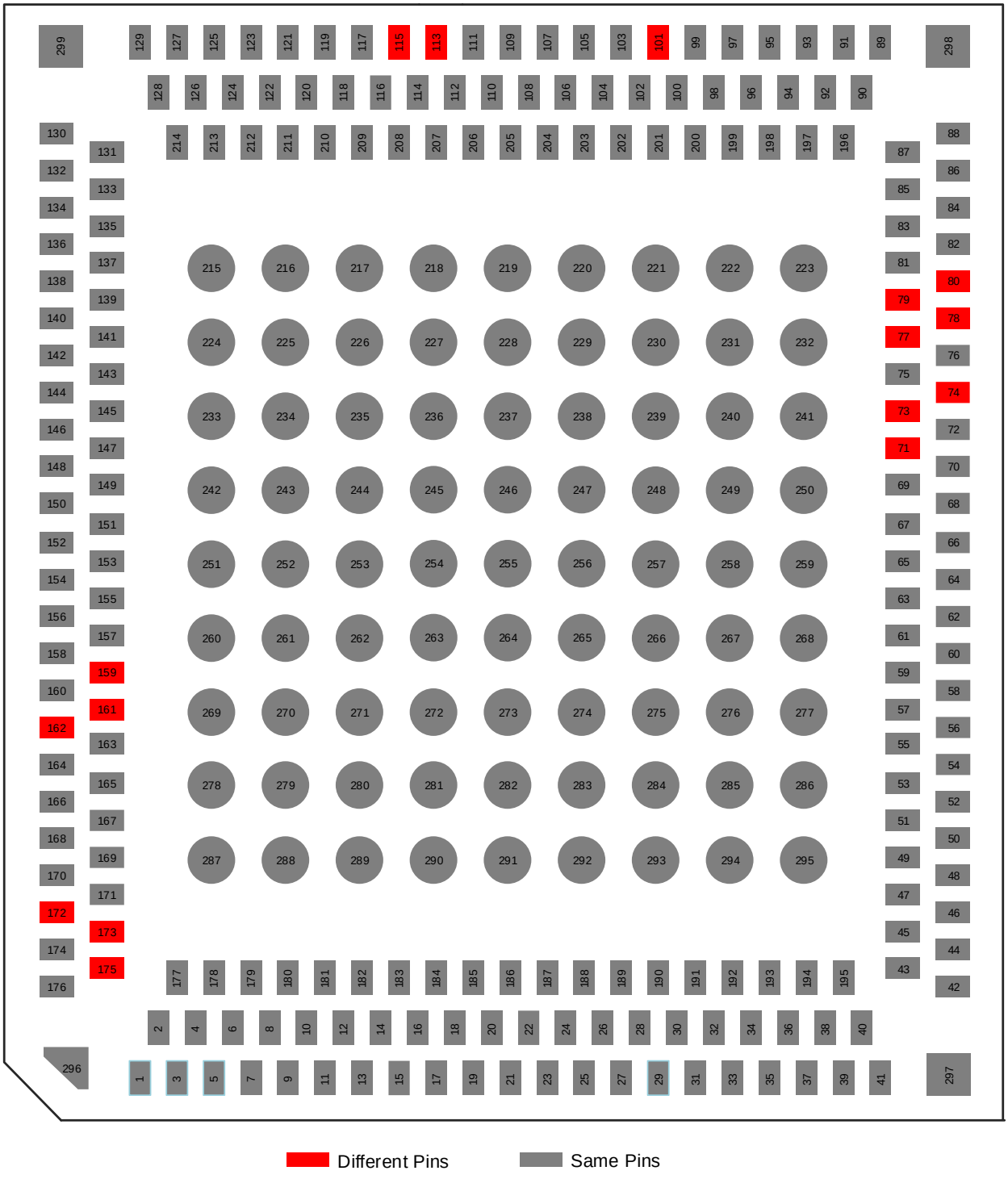

Figure 2: Pin Assignment (Top View)

The following table describes the pin definition differences between EG06 and EG12/EG18.

Table 4: Pin Definition Differences

Pin No.	EG06	EG12/EG18	Comment
	Pin Name	Pin Name	
71	RESERVED	RFFE_CLK	EG12/EG18 supports RFFE serial interface used for external antenna tuner control.
73	RESERVED	RFFE_DATA	
74	RESERVED	USIM2_VDD	EG12/EG18 supports (U)SIM2 interface. Either 1.8V or 3.0V is supported.
77	RESERVED	USIM2_DATA	
78	RESERVED	USIM2_DET	
79	RESERVED	USIM2_RST	
80	RESERVED	USIM2_CLK	
101	RESERVED	ANT_MIMO1	EG12/EG18 supports all-band 4x4 MIMO antenna interface.
113	RESERVED	ANT_MIMO2	
115	RESERVED	GND	This pin of EG12/EG18 should be connected to ground.
159	RESERVED	GPIO_3	GPIO interface of EG12/EG18 dedicated for external antenna tuner control.
161	RESERVED	GPIO_4	
162	RESERVED	VDD_RF	
172	RESERVED	GPIO_5	
173	ADC0	ADC0	Voltage range: EG06: 0.15V~VBAT_BB EG12/EG18: 0V~1.875V
175	ADC1	ADC1	

2.4.1. (U)SIM Interfaces

EG06 provides one (U)SIM interface, while EG12/EG18 provides two (U)SIM interfaces.

The circuitry of (U)SIM interfaces meets ETSI and IMT-2000 requirements. Either 1.8V or 3.0V (U)SIM cards are supported.

For EG12/EG18, Dual SIM Single Standby function is supported and (U)SIM card switching is enabled by **AT+QUIMSLOT** command. For more details, please refer to ***document [4]***. The following table illustrates the pin definition of (U)SIM2 interface for EG12 and EG18.

Table 5: Pin Definition of (U)SIM2 Interface (EG12/EG18)

EG06			EG12/EG18		
Pin No.	**Pin Name**	**Comment**	**Pin No.**	**Pin Name**	**Comment**
74	RESERVED	Keep these pins unconnected.	74	USIM2_VDD	Power supply for (U)SIM2 card
77	RESERVED		77	USIM2_DATA	Data signal of (U)SIM2 card
78	RESERVED		78	USIM2_DET	(U)SIM2 card insertion detection
79	RESERVED		79	USIM2_RST	Reset signal of (U)SIM2 card
80	RESERVED		80	USIM2_CLK	Clock signal of (U)SIM2 card

For compatible design among EG06, EG12 and EG18 modules, please refer to the following figure. It shows a reference design for (U)SIM2 with an 8-pin (U)SIM card connector.

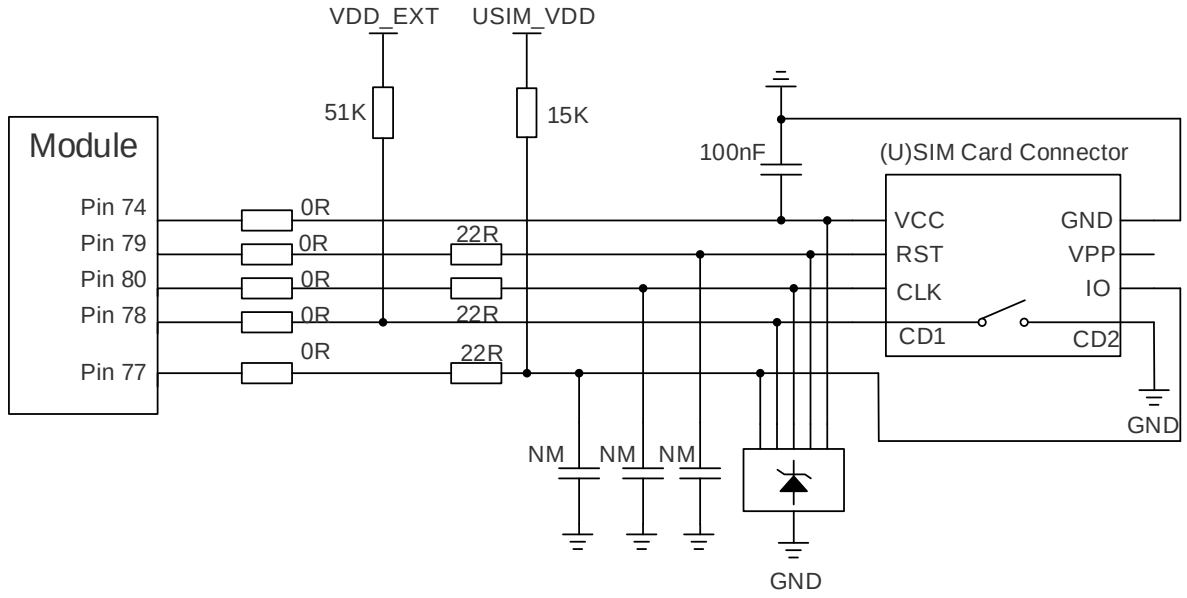

Figure 3: Reference Circuit of a (U)SIM2 Interface with an 8-Pin (U)SIM Card Connector

Please note that the five 0Ω resistors are not mounted for EG06. For EG12&EG18, if the (U)SIM2 card is used, the five 0Ω resistors should be mounted; if unused, the resistors should not be mounted.

In order to enhance the reliability and availability of the (U)SIM card in applications, please refer to ***document [1]***, ***document [2]*** and ***document [3]*** for more design guidelines.

2.4.2. Antenna Tuner Control Interfaces*

EG12/EG18 provides two methods to control external antenna tuner: through RFFE signals or GPIO signals. Customers can choose either one according to their tuner design. The following table illustrates the pin definition of antenna tuner control interfaces for EG12/EG18.

Table 6: Pin Definition of the Antenna Tuner Control Interfaces (EG12/EG18)

EG06			EG12/EG18		
Pin No.	**Pin Name**	**Comment**	**Pin No.**	**Pin Name**	**Comment**
71	RESERVED	Keep these pins unconnected.	71	RFFE_CLK	RFFE serial interface used for external tuner control.
73	RESERVED		73	RFFE_DATA	
159	RESERVED		159	GPIO_3	GPIO interface dedicated for external tuner control.
161	RESERVED		161	GPIO_4	
172	RESERVED		172	GPIO_5	
162	RESERVED		162	VDD_RF	Provide 2.85V for external RF circuit.

For compatible design among EG06, EG12 and EG18 modules, please refer to the following two figures. A reference design for RFFE/GPIO interface which is used to control antenna tuner is provided separately.

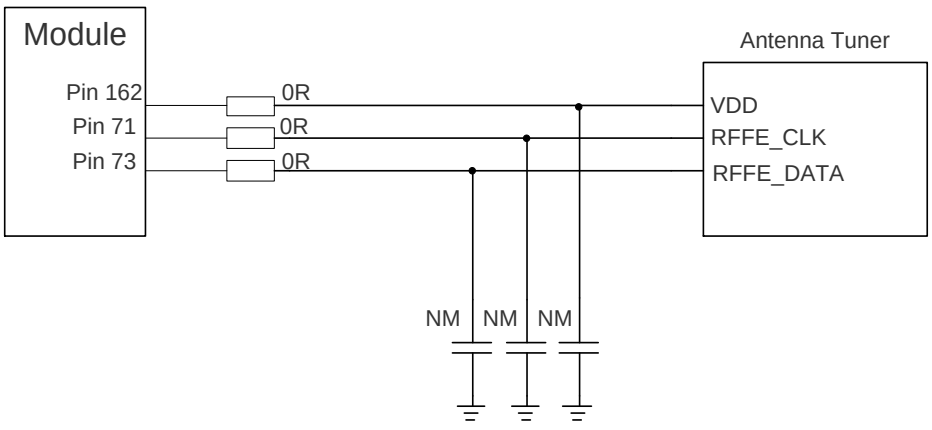

Figure 4: Reference Circuit of a RFFE Interface Used to Control Antenna Tuner

Please note that the three 0Ω resistors are not mounted for EG06. For EG12&EG18, if the RFFE interface is used, the three 0Ω resistors should be mounted; if unused, the resistors should not be mounted.

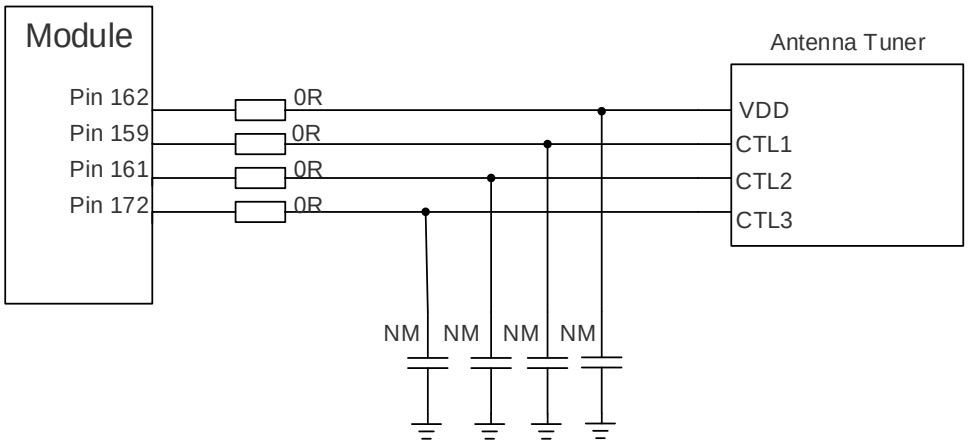

Figure 5: Reference Circuit of GPIO Interface Used to Control Antenna Tuner

Please note that the four 0Ω resistors are not mounted for EG06. For EG12&EG18, if the GPIO interface is used, the four 0Ω resistors should be mounted; if unused, the resistors should not be mounted.

NOTE

"*" means under development.

2.4.3. MIMO Antenna Interfaces

EG12/EG18 provides two 4×4 MIMO antenna interfaces with 50Ω impedance. The following table illustrates the pin definition of MIMO Antenna interfaces for EG12/EG18.

Table 7: Pin Definition of the MIMO Antenna Interfaces (EG12/EG18)

EG06			EG12/EG18		
Pin No.	**Pin Name**	**Comment**	**Pin No.**	**Pin Name**	**Comment**
101	RESERVED	Keep these pins unconnected.	101	ANT_MIMO1	50Ω impedance
113	RESERVED		113	ANT_MIMO2	

A reference design of ANT_MIMO1 and ANT_MIMO2 interfaces is shown as below. A π-type matching circuit should be reserved for better RF performance. The π-type matching components (R1/C1/C2, R2/C3/C4) should be placed as close to the antennas as possible and are mounted according to the actual debugging. C1~C4 are not mounted and a 0Ω resistor is mounted on R1 and R2 respectively by default.

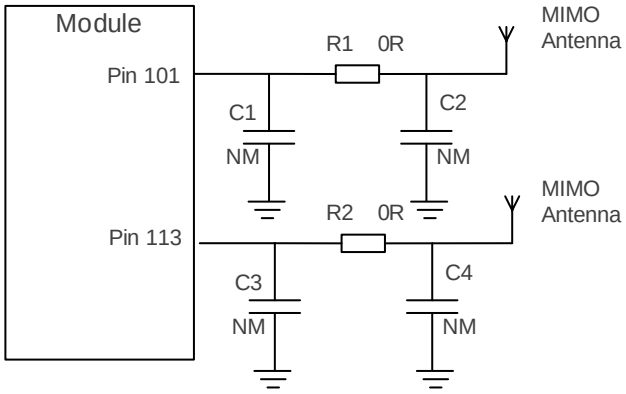

Figure 6: Reference Circuit of MIMO Antenna Interfaces

Please note that when conducting compatible design among EG06, EG12 and EG18 modules, R1 and R2 are not mounted for EG06 module. For EG12&EG18, if the MIMO antenna is used, the two 0Ω resistors should be mounted; if unused, the resistors should not be mounted.

2.4.4. ADC Interfaces

EG06/EG12/EG18 provides two Analog-to-Digital Converters (ADC) interfaces. **AT+QADC=0** command can be executed to read the voltage value on ADC0. **AT+QADC=1** command can be executed to read the voltage value on ADC1. For more details about these **AT+QADC** commands, please refer to ***document [4]***.

In order to improve the accuracy of ADC, ADC traces should be surrounded by ground.

Table 8: Pin Difference of the ADC Interfaces

EG06			EG12/EG18		
Pin No.	**Pin Name**	**Comment**	**Pin No.**	**Pin Name**	**Comment**
173	ADC0	Voltage range: 0.15V~VBAT_BB	173	ADC0	Voltage range: 0V~1.875V
175	ADC1		175	ADC1	

The following figure shows a reference design for an ADC interface.

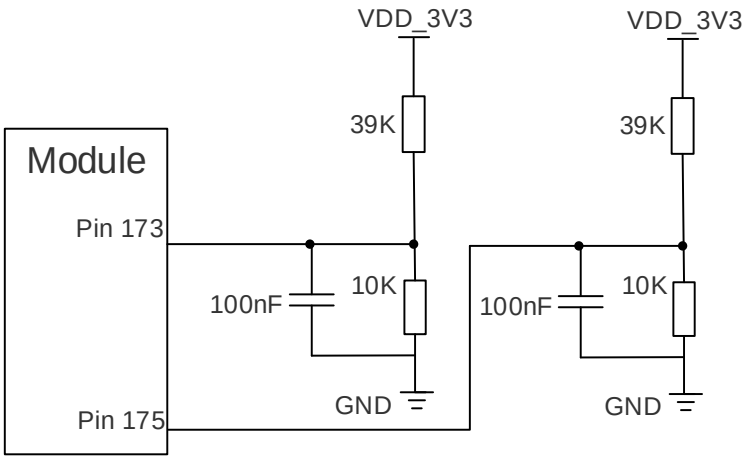

Figure 7: Reference Circuit of an ADC Interface

NOTES

1. The input voltage of ADC should not exceed 1.875V.
2. It is prohibited to supply any voltage to ADC pins when VBAT is removed.
3. It is recommended to use resistor divider circuit for ADC application.

2.4.5. Pin 115

Table 9: Difference of Pin 115

EG06			EG12/EG18		
Pin No.	**Pin Name**	**Comment**	**Pin No.**	**Pin Name**	**Comment**
115	RESERVED	Keep these pins unconnected.	115	GND	This pin of EG12/EG18 should be connected to ground.

The following figure shows a reference design for Pin 115.

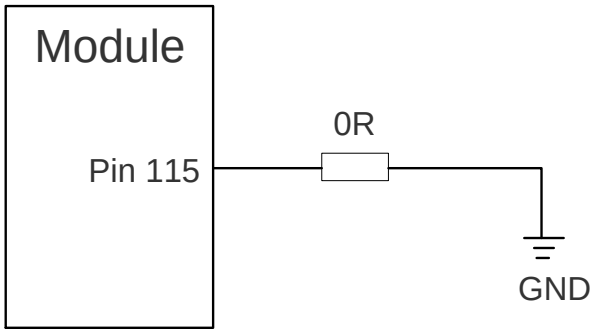

Figure 8: Reference Circuit of Pin 115

For EG12&EG18, if the PIN115 is used, the 0Ω resistor should be mounted; if unused, the resistor should not be mounted.

3 Software Comparison

3.1. AT Command Differences

Table 10: AT Command Differences

EG06	EG12/EG18
Read Command **AT+QTEMP**	Read Command **AT+QTEMP**
Response **<temp>,<temp>,<temp>** **OK**	Response **OK** After URC reports the temperature **[+QTEMP:<sensor>,<temp>** **[…]]**

Parameter

<sensor>	Sensor type
<temp>	Temperature

Difference Description: Response of **AT+QTEMP** are different.

- **EG06**

Only the temperature values of XO crystals, BB chip and PA chip are returned without **<sensor>**.

- **EG12/EG18**

Besides the temperature values of XO crystal, PA chip and BB chip are returned, the temperature values of five temperature detection points on PCB board are also returned. The **<sensor>** are returned at the same time.

NOTE

For more details of the above-mentioned AT commands, please refer to ***document [4]*** and ***document [5]***.

3.2. Additional AT Commands of EG12/EG18

The following table lists the additional AT commands of EG12/EG18 when comparing with that of EG06.

Table 11: Additional AT Commands of EG12/EG18

No.	AT Commands	Description
1	AT+QUIMSLOT	Switch (U)SIM Slot
2	AT+QPMUGPIO	Set the PMU GPIO Output Value

NOTE

For more details of the above-mentioned AT commands, please refer to ***document [4]***.

4 Appendix A References

Table 12: Related Documents

SN	Document Name	Comment
[1]	Quectel_EG06_Hardware_Design	EG06 Hardware Design
[2]	Quectel_EG12_Hardware_Design	EG12 Hardware Design
[3]	Quectel_EG18_Hardware_Design	EG18 Hardware Design
[4]	Quectel_EM12&EG12&EG18_AT_Commands_Manual	AT Commands Manual for EM12, EG12 and EG18
[5]	Quectel_EP06&EG06&EM06_AT_Commands_Manual	AT Commands Manual for EP06, EG06 and EM06

Table 13: Terms and Abbreviations

Abbreviation	Description
3GPP	3rd Generation Partnership Project
CTS	Clear To Send
DFOTA	Delta Firmware Upgrade Over The Air
DTE	Data Terminal Equipment
FDD	Frequency Division Duplex
GNSS	Global Navigation Satellite System
LDO	Low Dropout Regulator
LED	Light Emitting Diode
LGA	Land Grid Array
LTE	Long Term Evolution

PCB	Printed Circuit Board
PCM	Pulse Code Modulation
RF	Radio Frequency
RTS	Request To Send
SMS	Short Message Service
TDD	Time Division Duplexing
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
WCDMA	Wideband Code Division Multiple Access