



AMA-03R

User Manual

Version: 1.1

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1 Introduction

This document defines the AMA-03R series module and describes its air interface and hardware interfaces which are connected with your applications.

This document can help you quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. Associated with application notes and user guides, you can use the module to design and set up wireless applications easily.

2 Product Overview

ATEL AMA-03R is a series of LTE Cat 1Bis modules optimized specially for M2M and IoT applications. Adopting the 3GPP Rel-9 LTE technology, it delivers maximum data rates up to 10 Mbps downlink and 5 Mbps uplink. Designed in a compact and unified form factor.

Table 1: Brief Introduction

AMA-03R Series	
Packaging	LGA
Pins count	100
Dimensions	(17 ±0.2) mm ×(16.3 ±0.2) mm ×(2.3 ±0.2) mm
Weight	Approx. 2.58 g

2.1. Frequency Bands and Functions

Table 2: Frequency Bands

3GPP Band	Transmit	Receive	Unit
LTE-FDD B2	1850-1910	1930-1990	MHz
LTE-FDD B4	1710-1755	2110-2155	MHz
LTE-FDD B12	699-716	729-746	MHz
LTE-FDD B17	704-716	734-746	MHz
LTE-FDD B13	777-787	746-756	MHz
LTE-FDD B14	788-798	758-768	MHz
LTE-FDD B66	1710-1780	2110-2180	MHz

2.2. Key Features

The following table describes the detailed features of the module.

Features	Details
Power Supply	● Supply voltage: 3.4-4.5 V ● Typical supply voltage: 3.8 V
Transmitting Power	● Class 3 (23 dBm $\pm$2 dB) for LTE-FDD bands
LTE Features	● Supports up to 3GPP Rel-9 non-CA Cat 1bis FDD ● Supports 1.4/3/5/ 10/ 15/20 MHz RF bandwidth ● LTE-FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL)
Internet Protocol Features	● Supports TCP/UDP/PPP/FTP/HTTP/NTP/PING/NITZ/CMUX/HTTPS/SMTP/FTPS/SMTPS/SSL/FILE/MQTT protocols ● Supports PAP and CHAP for PPP connections

SMS	● Text and PDU modes ● Point-to-point MO and MT ● SMS cell broadcast ● SMS storage: (U)SIM card and ME, ME by default
Audio Features	● Supports one digital audio interface: PCM interface ● HR/FR/EFR/AMR/AMR-WB ● Supports echo cancellation and noise suppression
USB Interface	● Compliant with USB 2.0 specification (slave mode only), with data transmission rate up to 480 Mbps ● Used for AT command communication, data transmission, software debugging, firmware upgrade ● Supports USB serial drivers for: Windows 7/8/8.1/10/11, Linux 2.6–6.5, Android 4.x–13.x, etc.
(U)SIM Interfaces	● Supports (U)SIM card: 1.8/3.0 V ● Supports Dual SIM Single Standby
UART	CP UART: ● Used for AT command communication and data transmission ● Baud rate: 115200 bps by default ● Supports RTS and CTS hardware flow control AUX UART: ● Used for communication with peripherals ● Baud rate: 115200 bps AP UART: ● Used for the output of partial logs ● Baud rate: 115200 bps
PCM Interface	● Used for audio function with an external codec ● Short frame mode: module can only be used as master device
I2C Interface	● One I2C interface ● Complies with I2C bus specification version
AT Commands	Compliant with <i>3GPP TS 27.007</i> , <i>3GPP TS 27.005</i>
Network Indication	NET_STATUS to indicate the network connectivity status
Antenna Interfaces	● Main antenna interface (ANT_MAIN) ● 50 Ω impedance

Operating Temperature	● Operating temperature range: -25 °C to +55 °C ² Extended temperature range: -35 °C to +80 °C ³ ● Storage temperature range: -35 °C to +85 °C ●
Firmware Upgrade	Via USB interface or DFOTA
RoHS	All hardware components are fully compliant with EU RoHS directive

2.3. Functional Diagram

The following figure shows a block diagram of the module and illustrates the major functional parts.

- Power management
- Baseband
- Memory
- Radio frequency
- Peripheral interfaces

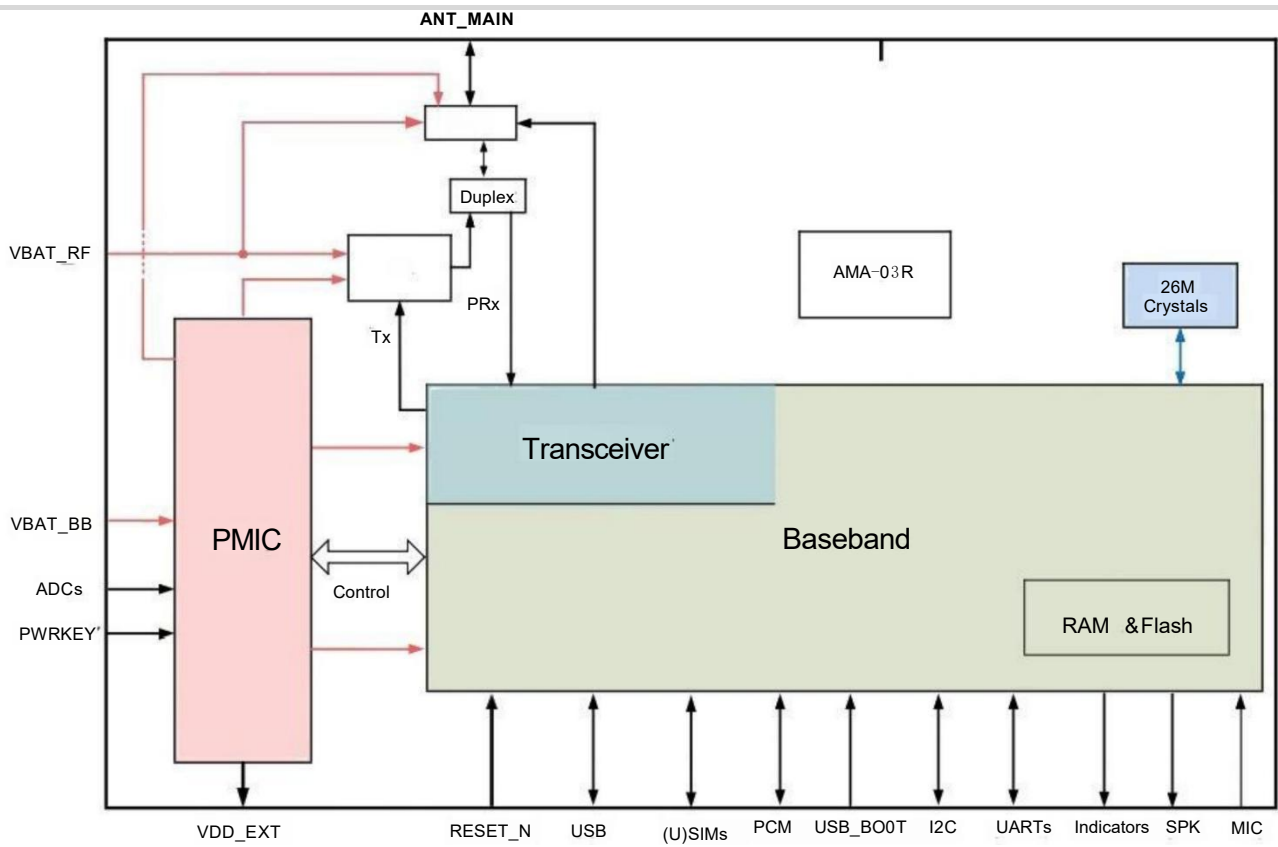


Figure 1:Functional Diagram of AMA-03R Series

3 Application Interfaces

3.1. General Description

The module is equipped with 100 LGA pins that can be connected to cellular application platform. The subsequent chapters will provide detailed descriptions of the following interfaces.

- Power supply
- (U)SIM interfaces
- USB interface
- UART interfaces
- PCM and I2C interfaces
- Network status indication
- USB_BOOT interface

3.2. Pin Assignment

The following figure shows the pin assignment of the module.

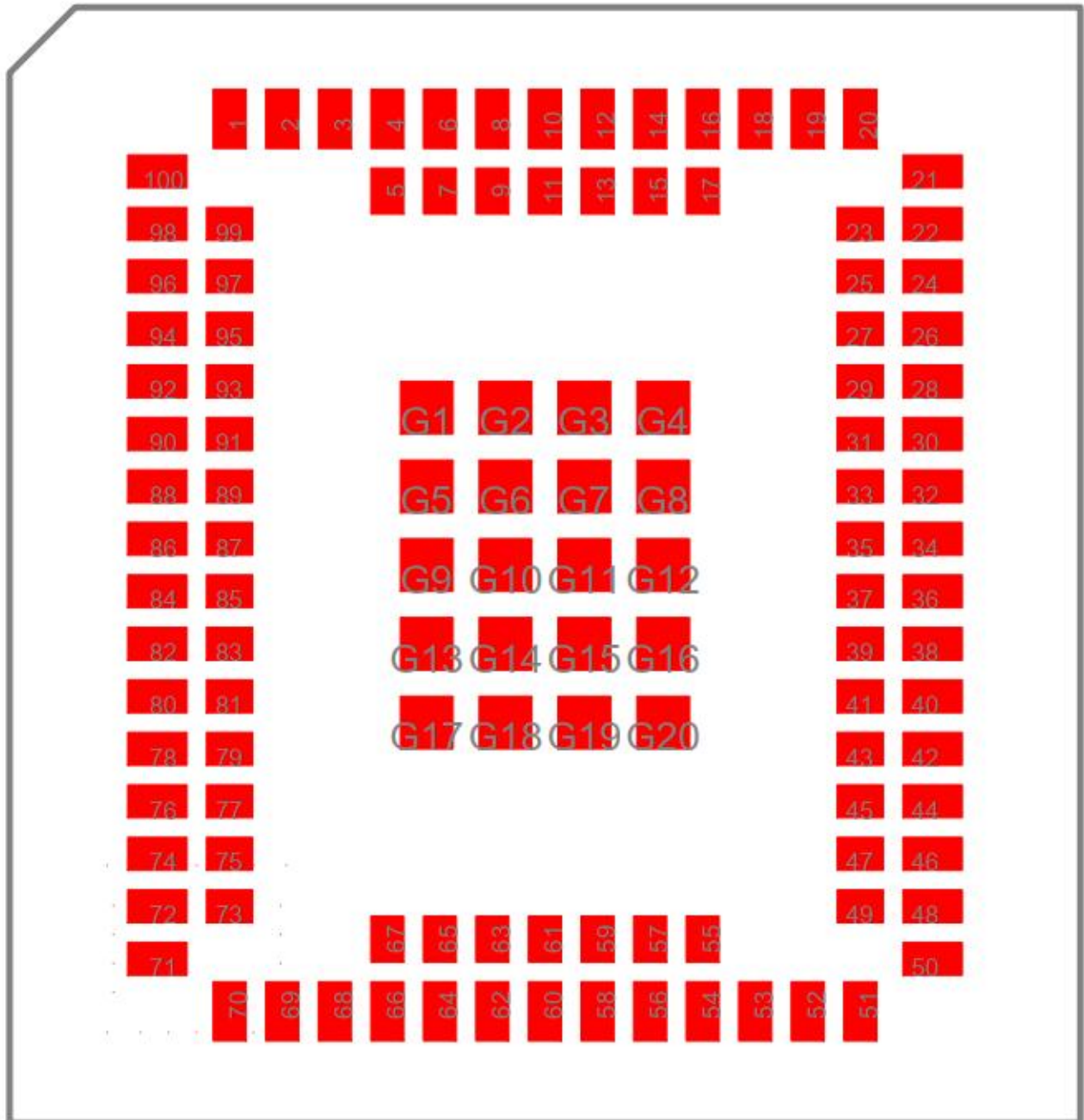


Figure 2: Pin Assignment (Top View)

3.3. Pin Description

The following tables show the pin definition and description of the module.

Table 3: Parameter Definition

Parameter	Description
AI	Analog Input
AIO	Analog Input/Output
AO	Analog Output
DI	Digital Input
DO	Digital Input/Output
DIO	Digital Output
OD	Open Drain
PI	Power Input
PO	Power Output

DC characteristics include power domain and rated current.

Table 4: Pin Description

Power Supply Input					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VBAT	60,62,63	PI	Power supply for the module's baseband part	Vmax = 4.5 V Vmin = 3.4 V Vnom = 3.8 V	External power supply must be provided with sufficient current of at least 0.8 A. It is
GND	1, 6, 37, 38, 50, 51,52,54,56, 58, 59, 61, 64,65, 67,78, 79,80–89, 91–93				

Power Supply Output

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VLDO_1V8	8	PO	Provide 1.8 V for external circuit	Vnom = 1.8 V I _o max = 50 mA	Power supply for external GPIO's pull-up circuits. A test point is recommended to be reserved.

Turn On/Off

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PWRKEY	66	DI	Turn on/off the module	V _{IL} max = 0.5 V Vnom = VBAT	VBAT power domain. A test point is recommended to be reserved.
RESET_N	46	DI	Reset the module	V _{IL} max = 0.5 V Vnom = 1.8 V	Active low. 1.8 V power domain. A test point is recommended to be reserved if unused.

USB Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USB_VBUS	70	AI	USB connection detect	Vmax = 5.25 V Vmin = 3.0 V Vnom = 5.0 V	A test point must be reserved.
USB_DP	68	AIO	USB differential data (+)		Requires differential impedance of 90 Ω.
USB_DM	69	AIO	USB differential data (-)		USB 2.0 compliant. Test points must be reserved.

(U)SIM Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USIM_DET	45	DI	(U)SIM1 card hot-plug detect	1.8 V	If unused, keep it open.
USIM_VCC	73	PO	(U)SIM1 card power supply	I _o max = 50 mA 1.8/3.0 V	Either 1.8 V or 3.0 V (U)SIM card is supported and can be identified automatically by the module.
USIM_RST	43	DO	(U)SIM1 card reset	USIM1_VDD 1.8/3.0 V	
USIM_DATA	44	DIO	(U)SIM1 card data		
USIM_CLK	42	DO	(U)SIM1 card clock		

Main UART

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
CP_UART_DTR	14	DI	Main UART data terminal ready		If unused, keep them open.
CP_UART_RXD	36	DI	Main UART receive		
CP_UART_TXD	34	DO	Main UART transmit		
CP_UART_DCD	27	DO	Main UART data carrier detect		If unused, keep them open.
CP_UART_DSR	25	DO	Output for Data Set Ready (DSR) to DTE		
CP_UART_RI_N	16	DO	Main UART ring indication		

Auxiliary UART*

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
AUX_UART_TX D	26	DO	Auxiliary UART transmit		If unused, keep them open.
AUX_UART_RX D	28	DI	Auxiliary UART receive		

Debug UART

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
AP_UART_RXD	32	DI	Debug UART receive	1.8 V	Test points must be reserved.
AP_UART_TXD	30	DO	Debug UART transmit		

PCM Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PCM_CLK	96	DO	PCM clock	1.8 V	If unused, keep them open.
PCM_FS	99	DO	PCM data frame sync		
PCM_RXD	98	DI	PCM data input		
PCM_TXD	100	DO	PCM data output		

I2C Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
I2C_SCL	97	OD	I2C serial clock	1.8 V	An external 1.8 V pull-up resistor is required. If unused, keep them open.
I2C_SDA	95	OD	I2C serial data		

Antenna Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
LTE_ANT	90	AIO	Main antenna interface		50 Ω impedance.

Antenna Tuner Control Interfaces*

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ATC0	10	DO	Generic RF Controller		If unused, keep them open.
ATC1	11	DO			

Other Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ADC1	72	AI	Analog/Digital Converter Input 1		
FDL_BOOT	20	DI	FORCED_USB_BOOT		Pull down to GND to enter emergency download mode

Reserved Pins

Pin Name	Pin No.	Comment
RESERVED	71,74,75,76,77, 94	Keep them open.

3.4. Operating Modes

Table 5: Overview of Operating Modes

Modes	Details	
Full Functionality Mode	Idle	Software is active. The module remains registered on the network, and it is ready to send and receive data.
	Voice/Data	Network connection is ongoing. Power consumption is decided by network setting and data transmission rate.
Minimum Functionality Mode	AT+CFUN=0 can set the module into a minimum functionality mode without removing the power supply. In this case, both RF function and (U)SIM card will be invalid.	
Airplane Mode	AT+CFUN=4 can set the module to airplane mode. In this case, RF function will be invalid.	
Sleep Mode	Power consumption of the module is reduced to the minimal level. During this mode, the module can still receive paging message, SMS, voice call and TCP/UDP data from the network normally.	
Power Down Mode	In this mode, the module's power supply is cut off by its power management IC. The software is inactive, while the VBAT pins are still powered.	

3.5. Sleep Mode

With DRX technology, power consumption of the module will be reduced to an ultra-low level.

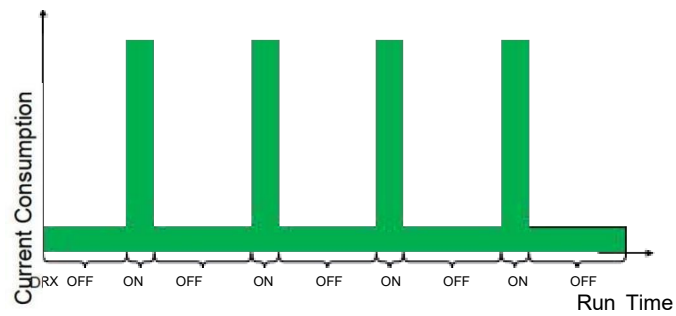


Figure 3: DRX Run Time and Current Consumption in Sleep Mode

3.5.1. UART Application Scenario

If the MCU communicates with module via UART interfaces, the following preconditions should be met at the same time to let the module enter sleep mode.

- Drive MAIN_DTR high or keep it open.

The following figure shows the connection between the module and the MCU.

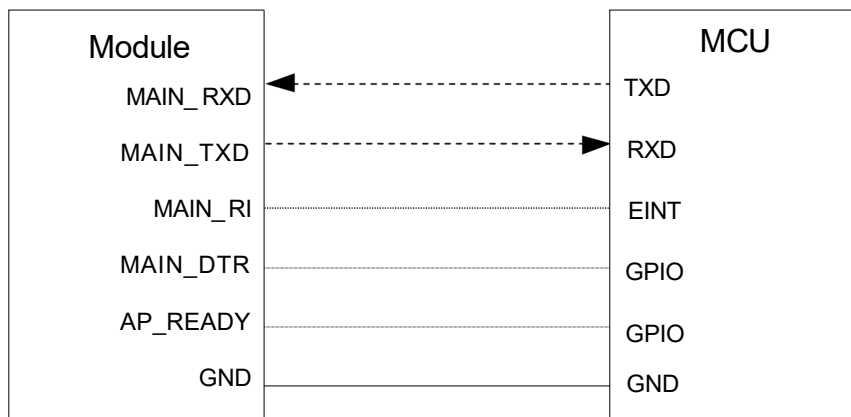


Figure 4: Sleep Mode Application via UART

- Drive MAIN_DTR low by the MCU will wake up the module.
- When the module has a URC to report, the URC will trigger the behavior of MAIN_RI pin.

3.5.2. USB Application Scenario

For the two situations (USB application with USB Suspend/Resume and USB remote wakeup function and USB application with USB Suspend/Resume and RI function) below, three preconditions must be met to set the module into sleep mode:

- Ensure the host's USB bus, which is connected to the module's USB interface, enters Suspend state.

3.5.2.1. USB Application with USB Remote Wakeup Function

If the host supports USB Suspend/Resume and remote wakeup functions. The following figure shows the connection between the module and the host.

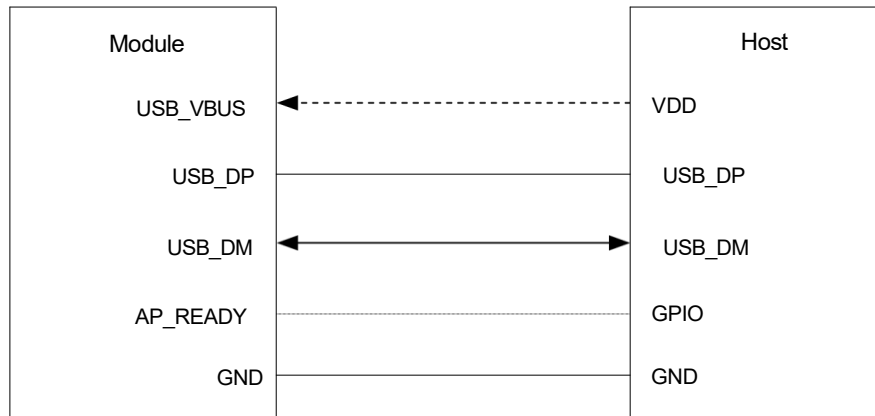


Figure 5: Sleep Mode Application with USB Remote Wakeup Function

- Sending data to the module through USB will wake up the module.
- When the module has a URC to report, the module sends remote wake-up signals to wake up the host via USB bus.

3.5.2.2. USB Application with USB Suspend/Resume and RI Function

If the host supports USB Suspend/Resume, but does not support remote wakeup function, the MAIN_RI signal is needed to wake up the host.

The following figure shows the connection between the module and the host.

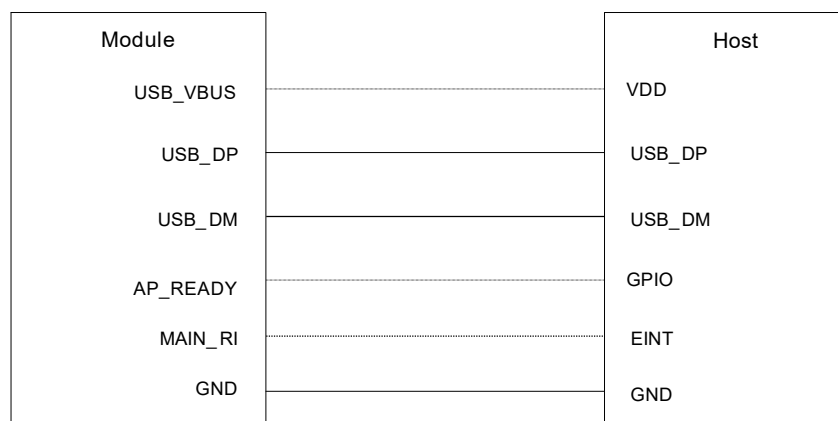


Figure 6: Sleep Mode Application with MAIN_RI

- Sending data to the module through USB will wake up the module.
- When the module has a URC to report, the URC will trigger the behavior of MAIN_RI pin.

3.5.2.3. USB Application without USB Suspend Function

If the host does not support USB Suspend function, disconnect USB_VBUS with an external control circuit to let the module enter sleep mode.

The following three preconditions must be met at the same time to let the module enter sleep mode.

- Ensure the MAIN_DTR is held at high level or keep it open.
- Disconnect the USB_VBUS power supply.

The following figure shows the connection between the module and the host.

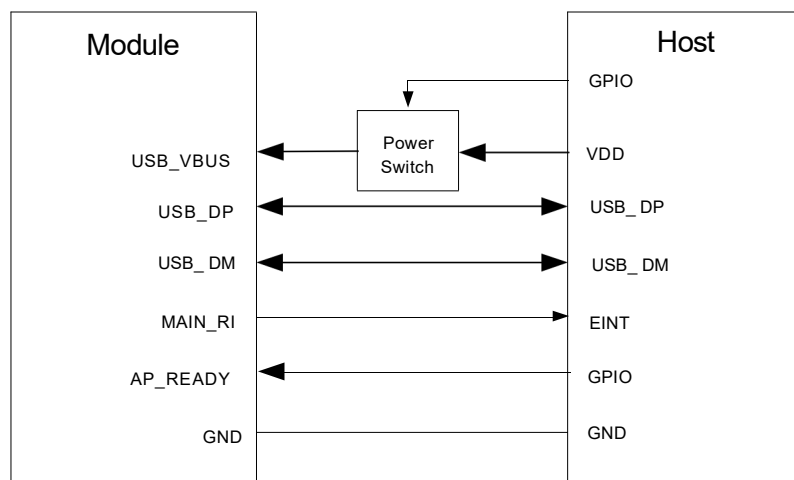


Figure 7: Sleep Mode Application without USB Suspend Function

You can wake up the module by turning on the power switch to supply power to USB_VBUS.

NOTE

1. Pay attention to the level match shown in dotted line between the module and the MCU/host in the circuit diagrams.

3.6. Airplane Mode

When the module enters airplane mode, the RF function does not work and all AT commands related to the RF function are inaccessible. The following ways can be used to let the module enter airplane mode.

Software:

AT+CFUN=<fun> provides the choice of the functionality level through setting **<fun>** into 0, 1 or 4.

- **AT+CFUN=0:** Minimum functionality mode (disable (U)SIM and RF functions).
- **AT+CFUN=1:** Full functionality mode (by default).
- **AT+CFUN=4:** Airplane mode (disable RF function).

3.7. Power Supply

3.7.1. Power Supply Pins

The module provides three VBAT pins dedicated to connecting with the external power supply. There are two separate voltage domains for VBAT.

Table 6: Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Comment
VBAT	60, 62, 63	PI	Power supply for the module's RF part and baseband part	External power supply must be provided with sufficient current of at least 3.0 A. It is recommended to add a TVS diode externally. Test points are recommended to be reserved.

3.7.2. Voltage Stability Requirements

The power supply range of the module is from 3.4 V to 4.5 V. Please make sure that the input voltage never drops below 3.4 V. The following figure shows the voltage drop during burst transmission in 2G network. The voltage drop will be less in 4G networks.

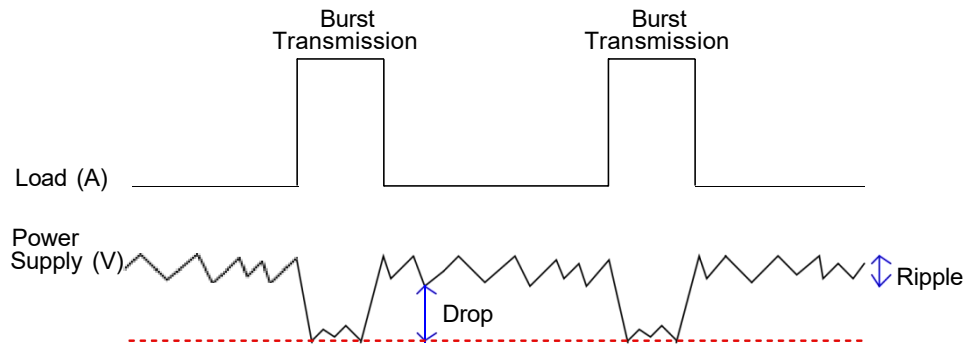


Figure 8: Power Supply Limits during Burst Transmission

To decrease voltage drop, a bypass capacitor of about 100 μF with low ESR ($\text{ESR} \leq 0.7 \Omega$) should be used. It is recommended to reserve three multi-layer ceramic chip (MLCC) capacitors (100 nF, 33 pF and 10 pF) with the best ESD performance, and place these capacitors close to the VBAT pins. The main power supply from an external application has to be a single voltage source and can be expanded to two sub paths with star configuration. The width of VBAT trace should be not less than 2 mm. In principle, the longer the VBAT trace is, the wider it will be.

In order to avoid the ripple and surge and ensure the stability of the power supply to the module, add a TVS diode with $V_{\text{RWM}} = 4.7 \text{ V}$, low-clamp voltage and peak pulse current I_{pp} at the front end of the power supply.

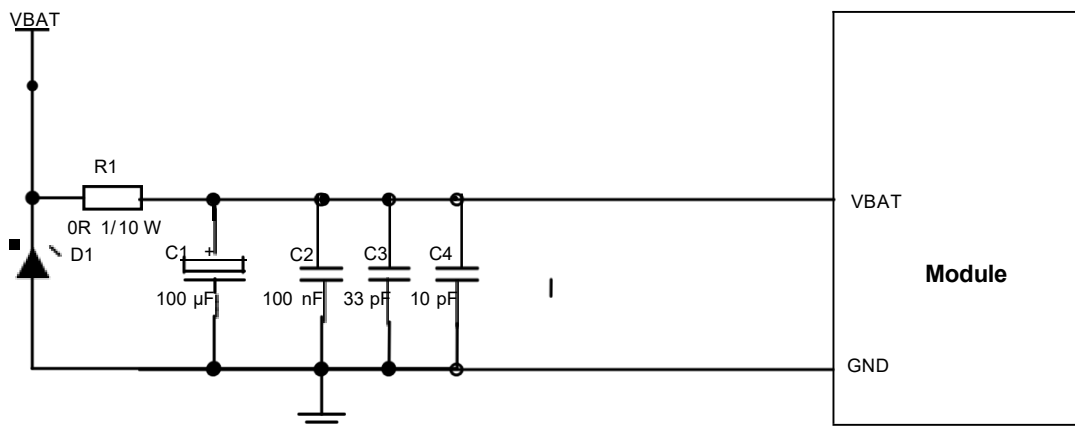
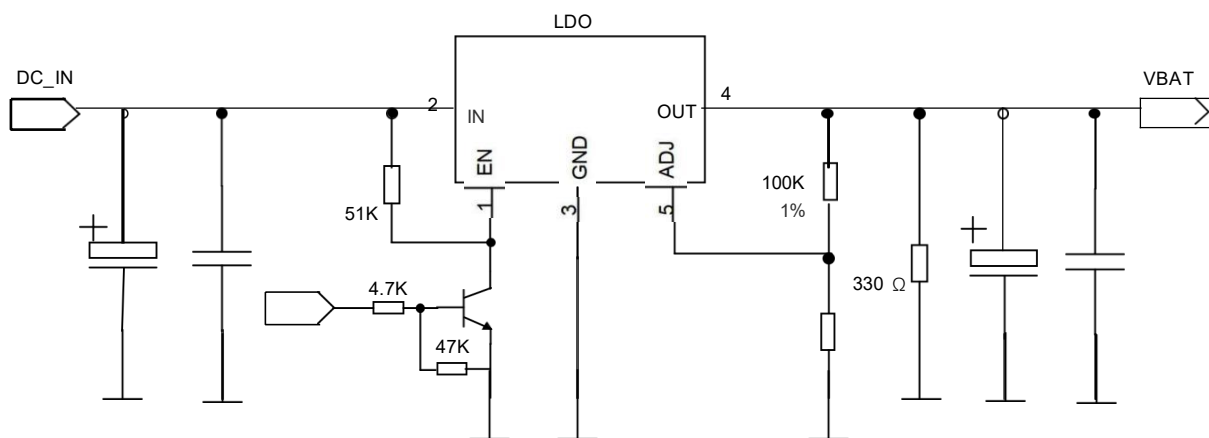


Figure 9: Star Configuration of Power Supply

3.7.3. Reference Design for Power Supply

Power design for the 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 3.0 A to the module. If the voltage drop between the input and output is not too high, it is suggested that an LDO should be used. If there is a big voltage difference between the input source and the desired output (VBAT), a buck converter is preferred to be used.

The following figure shows a reference design for 5 V input power source. The circuit is designed using the LDO of Microchip. The typical output of the power supply is about 3.8 V and the maximum load current is 3.0 A.

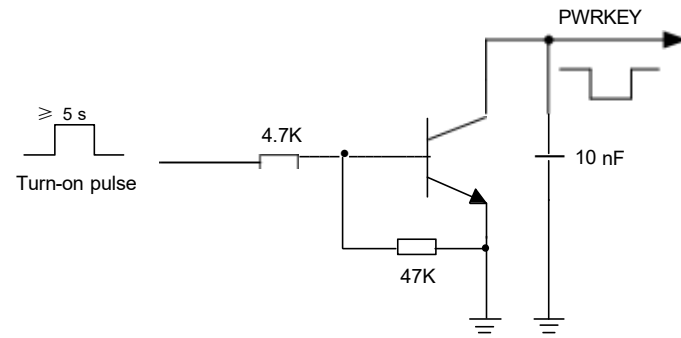


3.7.4 Turn on the Module with PWRKEY

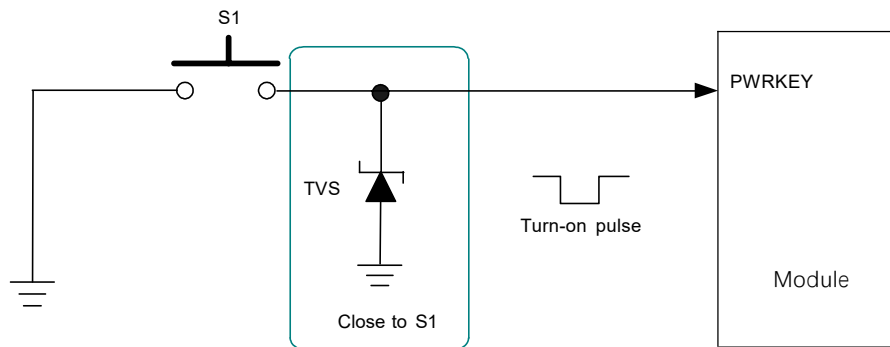
Table 7: Turn On/Off

Turn On/Off					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PWRKEY	66	DI	Turn on/off the module	$V_{ILmax} = 0.5\text{ V}$ $V_{nom} = V_{BAT}$	VBAT power domain. A test point is recommended to be reserved.
RESET_N	46	DI	Reset the module	$V_{ILmax} = 0.5\text{ V}$ $V_{nom} = 1.8\text{ V}$	Active low. 1.8 V power domain. A test point is recommended to be reserved if unused.

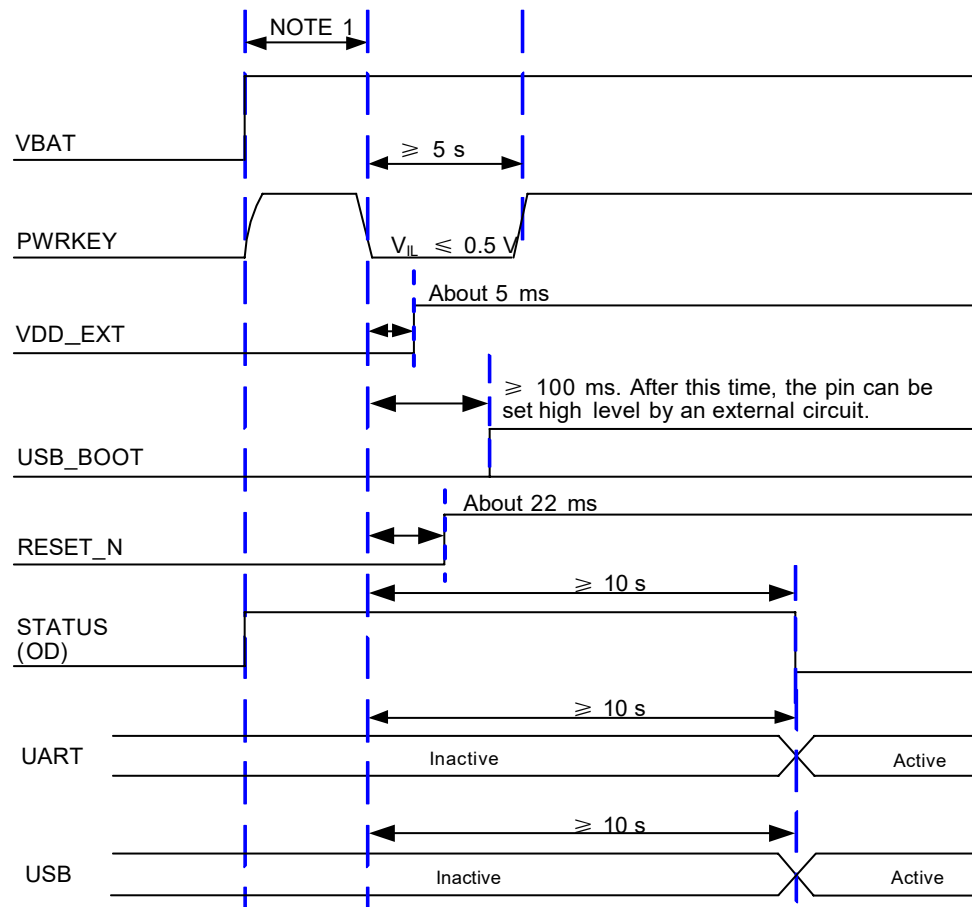
When the module is in power down mode, it can be turned on to normal mode by driving the PWRKEY pin to a low level for at least 5 s. It is recommended to use an open drain/collector driver to control the PWRKEY. A simple reference circuit is illustrated in the following figure.



The other way to control the PWRKEY is using a button directly. When pressing the button, electrostatic strike may generate from finger. Therefore, a TVS component is indispensable to be placed nearby the button for ESD protection. A reference circuit is shown in the following figure.

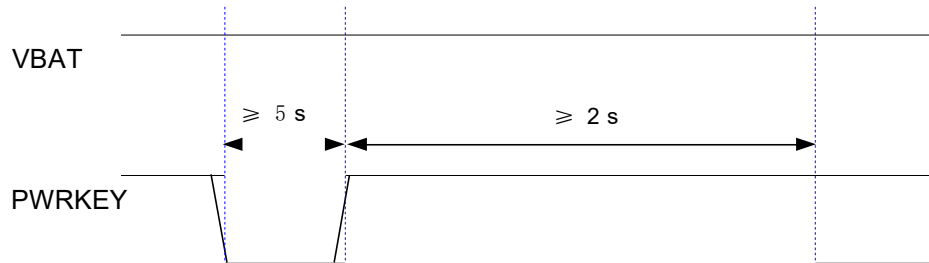


The power-up scenario is illustrated in the following figure.



3.7.5 Turn off the Module with PWRKEY

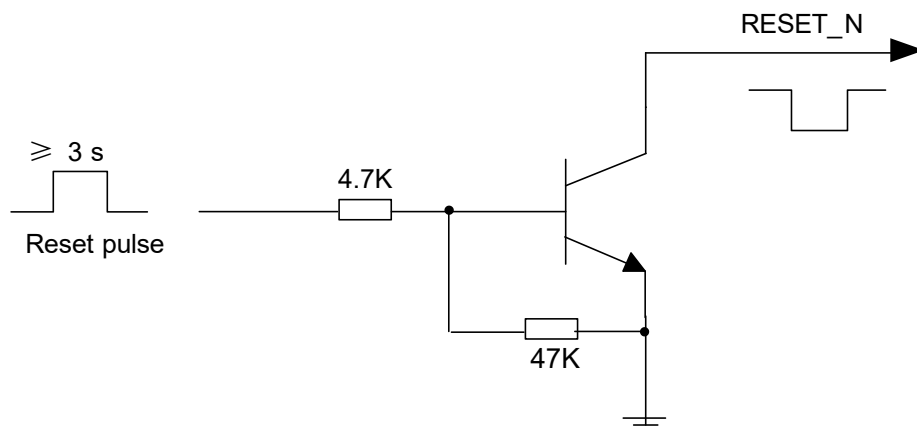
Driving the PWRKEY to a low-level voltage for at least 5 s, then the module will execute power-down procedure after the PWRKEY is released. The timing of turning off the module is illustrated in the following figure.

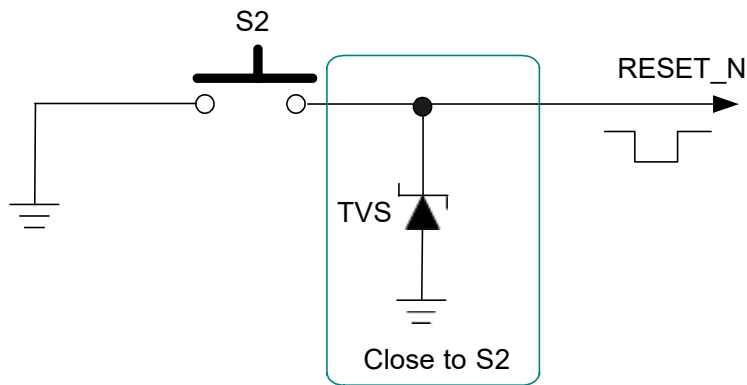


3.7.6 Reset

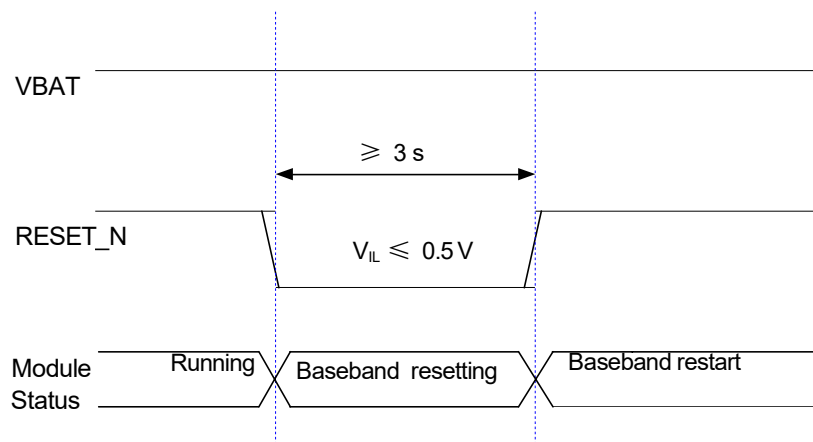
The module can be reset by driving the RESET_N low for at least 3 s and then releasing it. The RESET_N signal is sensitive to interference, so it is recommended to route the trace as short as possible and surround it with ground.

The recommended circuit is equal to the PWRKEY control circuit. An open drain/collector driver or button can be used to control the RESET_N.





The timing of resetting module is illustrated in the following figure.



3.7.7 ADC Interface

The module provides Analog-to-Digital Converter (ADC) interfaces. In order to improve the accuracy of ADC, the trace of ADC interfaces should be surrounded by ground.

Table 8: Pin Definition of ADC Interface

Pin Name	Pin No.	I/O	Description	Comment
ADC1	72	AI	General-purpose ADC interface	If unused, keep it open.

The resolution of the ADC is up to 12 bits. The following table describes the characteristic of the ADC interface.

Table 9: Characteristics of ADC Interface

Name	Min.	Typ.	Max.	Unit
ADC1 Voltage Range	0		VBAT_BB	V

4 RF Specifications

Appropriate antenna type and design should be used with matched antenna parameters according to specific application. It is required to perform a comprehensive functional test for the RF design before mass production of terminal products. The entire content of this chapter is provided for illustration only. Analysis, evaluation and determination are still necessary when designing target products.

4.1. Cellular Network

4.1.1. Main Antenna Interface

Table 10: Pin Definition of Main Antenna

ANT_MAIN	90	AIO	Main antenna interface	50 Ω impedance.
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4.1.2. Antenna Tuner Control Interfaces*

The module can use ATC interfaces to control external antenna tuner.

Table 11: Pin Definition of GRFC Interfaces

Pin Name	Pin No.	I/O	Description	Comment
ATC0	10	DO	Generic RF Controller	If unused, keep them open.
ATC1	11	DO		

Table 12: AMA-03R Truth Table of GRFC Interface (Unit: MHz)

ATC0 Level	ATC1 Level	Bands
Low	Low	TBD
Low	High	TBD
High	Low	TBD
High	High	TBD

4.1.3. Transmitting Power

The following tables show the RF output power of the module

Table 13: AMA-03R RF Transmitting Power

Frequency Bands	Max.	Min.
LTE-FDD B2/B4/B12/B17/B13/B14/B66	23 dBm $\pm$ 2 dB	< -39 dBm

4.1.4. Receiver Sensitivity

The following tables show conducted RF receiver sensitivity of the module.

Table 14: AMA-03R Conducted RF Receiver Sensitivity

Frequency Bands	Receiver Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO	
LTE-FDD B2 (10 MHz)	-98.4 dBm	-	-	-94.3 dBm
LTE-FDD B4 (10 MHz)	-98.5 dBm	-	-	-9.3 dBm
LTE-FDD B12 (10 MHz)	-99.8 dBm	-	-	-94.3 dBm
LTE-FDD B17 (10 MHz)	-99.8 dBm	-	-	-94.3 dBm
LTE-FDD B13 (10 MHz)	-97.4 dBm	-	-	-93.3 dBm
LTE-FDD B14 (10 MHz)	-97.6 dBm	-	-	-94.8 dBm
LTE-FDD B66 (10 MHz)	-98.6 dBm	-	-	-96.5 dBm

4.1.5. Reference Design

A reference design of ANT_MAIN antenna is shown as below. A π -type matching circuit should be reserved for better RF performance. The capacitors are not mounted by default.

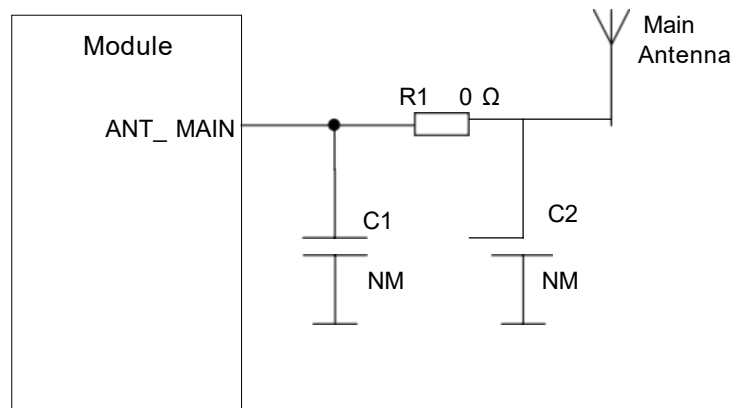


Figure 10 : Reference Design for Main Antenna Interface

NOTE

Place the π -type matching components (R1 , C1 and C2) as close to the antenna as possible.

5 Electrical Characteristics & Reliability

5.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the module are listed in the following table.

Table 15: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT	-0.3	6.0	V
USB_VBUS	-0.3	5.5	V
Peak Current of VBAT_BB	-	0.8	A
Peak Current of VBAT_RF	-	2.2	A
Voltage at Digital Pins	-0.3	2.3	V

5.2. Power Supply Ratings

Table 16: Power Supply Ratings

Paramete	Description	Conditions	Min.	Typ.	Max.	Unit
VBAT	VBAT_BB and VBAT_RF	The actual input voltages must be kept between the minimum and maximum values.	3.4	3.8	4.5	V
	Voltage drop during burst transmission	Maximum power control level			400	mV
I _{VBAT}	Peak supply current	Maximum power control level		2.0	2.5	A
USB_VBUS	USB connection detect		3.0	5.0	5.25	V

5.4. Digital I/O Characteristics

Table 17: 1.8 V Digital I/O Requirements

Parameter	Description	Min.	Max.	Unit
V _{IH}	Input high voltage	0.7 × VDDIO	VDDIO + 0.2	V
V _{IL}	Input low voltage	-0.3	0.3 × VDDIO	V
V _{OH}	Output high voltage	VDDIO - 0.2	-	V
V _{OL}	Output low voltage	-	0.2	V

Table 18: (U)SIM 1.8 V I/O Requirements

Parameter	Description	Min.	Max.	Unit
USIM_VDD	Power supply	1.62	1.98	V
V _{IH}	Input high voltage	0.7 × USIM_VDD	USIM_VDD	V
V _{IL}	Input low voltage	0	0.2 × USIM_VDD	V
V _{OH}	Output high voltage	0.7 × USIM_VDD	USIM_VDD	V
V _{OL}	Output low voltage	0	0.15 × USIM_VDD	V

Table 19: (U)SIM 3.0 V I/O Requirements

Parameter	Description	Min.	Max.	Unit
USIM_VDD	Power supply	2.7	3.3	V
V _{IH}	Input high voltage	0.7 × USIM_VDD	USIM_VDD	V
V _{IL}	Input low voltage	0	0.15 × USIM_VDD	V
V _{OH}	Output high voltage	0.7 × USIM_VDD	USIM_VDD	V
V _{OL}	Output low voltage	0	0.15 × USIM_VDD	V

5.5. ESD Protection

Static electricity occurs naturally and it may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the ESD sensitive interfaces and points in the product design.

The following table shows the module electrostatics discharge characteristics.

Table 20: Electrostatics Discharge Characteristics (Temperature: 25-30 °C, Humidity: 40 ±5 %)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VBAT, GND	±5	±10	kV
All Antenna Interfaces	±4	±8	kV
Other Interfaces	±0.5	±1	kV

5.6. Operating and Storage Temperatures

Table 21: Operating and Storage Temperatures

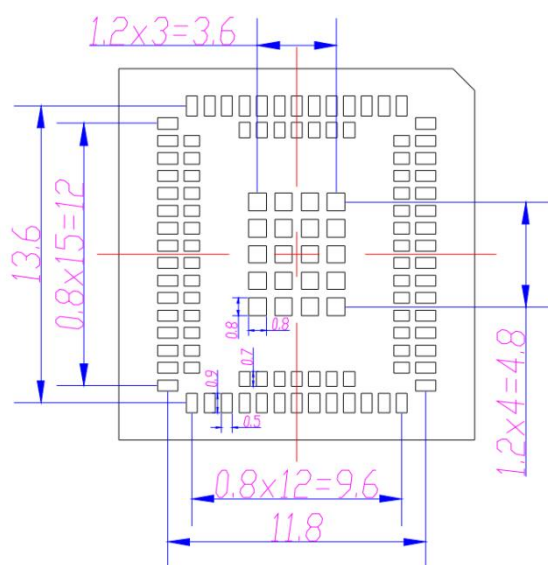
Parameter	Min.	Typ.	Max.	Unit
Operating Temperature Range ⁴	-25	+25	+55	°C
Extended Operation Range ⁵	-35	-	+80	°C
Storage Temperature Range	-35	-	+85	°C

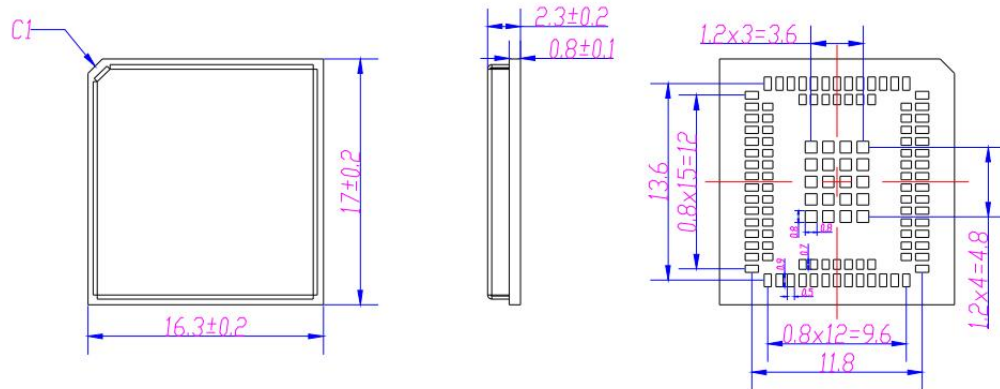
⁴ Within operating temperature range, the module is 3GPP compliant.

⁵ Within extended temperature range, the module remains the ability to establish and maintain functions such as voice, SMS, data transmission and emergency call, without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

6 Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ± 0.2 mm unless otherwise specified.





FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Requirement per KDB996369 D03**2.2 List of applicable FCC rules**

This module is not support WiFi/BT

2.3 Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

The module is not a limited module.

2.5 Trace antenna designs

Not application

2.6 RF exposure considerations

This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2BPYK-AMA03.

2.7 Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

2.8 Label and compliance information

This module should have label in a visible area indicated the following texts: "Contains FCC ID: 2BPYK-AMA03".

2.9 Information on test modes and additional testing requirements5

Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable. As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.