RL62M01A

Bluetooth® Low Energy Module

■ INTRODUCTION

RL62M01A is an ultra-low-power SoC module for Bluetooth® 5.0 low energy applications that combines the excellent performance of a leading RF transceiver with a low-power ARM® Cortex-M4F. RL62M01A supports transport mode that user can easily develop BLE related applications. The RL62M01A also supports piconet which can connect one smart phone and three peripheral devices or connect 4 peripheral devices at the same time.

■ FEATURES

- Bluetooth® Core Spec v5.0 compliant
- Supports 2Mbps LE, LE advertising extension and LE long range
- Supports GAP, ATT/GATT, SMP, L2CAP
- Supports OTA (Over-the-Air) for firmware upgrade
- Battery Supply Voltage 1.8V to 3.6V
- Operational Temperature -20˚C to +65˚C
- Current Consumptions
  - Power Down Mode 450nA (Typ.)
  - Deep LPS (with 160K SRAM retention) Mode 2.5 – 2uA (Typ.)
  - TX Mode (+0dBm) 8.5 mA (Typ.)
  - TX Mode (+4dBm) 10.5 mA (Typ.)
  - TX Mode (+8dBm) 12.8 mA (Typ.)
  - RX Mode 6.7 mA (Typ.)
- Radio Bluetooth® Qualification (End Product, QDID: TBD)
- Meets Radio Certification FCC, RED, KCC and MIC Japan
- Dimension 11.05mm(W) x 17mm(L) x 2.05mm(H)
- Pb Free, RoHS Compliant

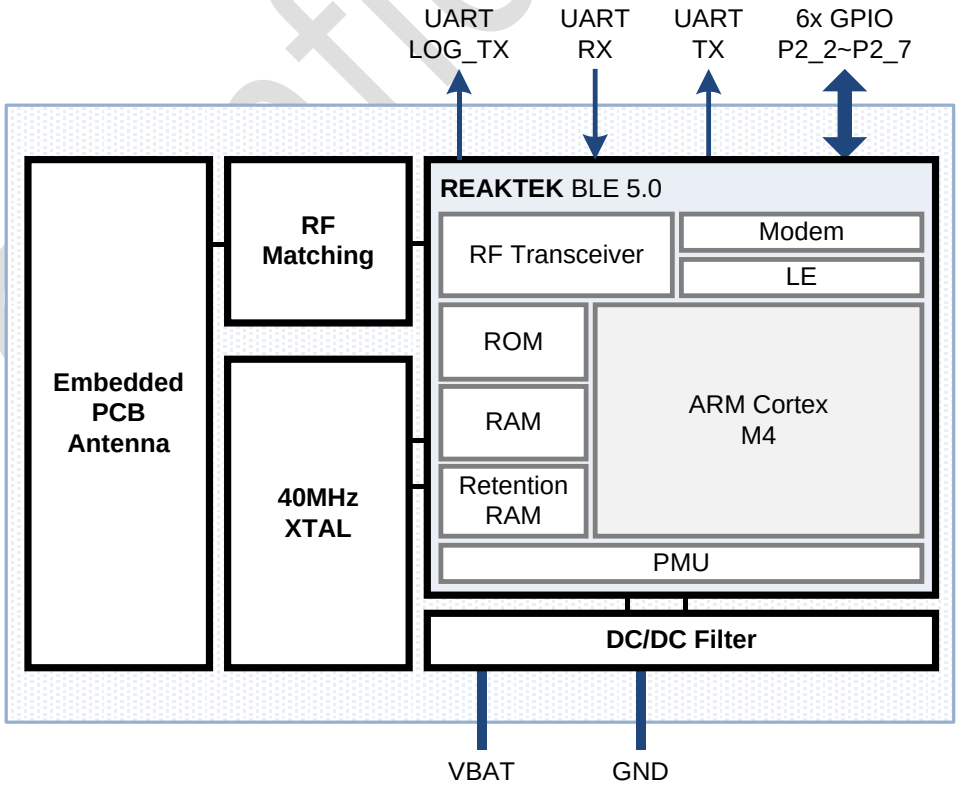
■ REVERSION HISTORY

Version Code	Date	Descriptions
0.1 BETA	23-JUL-20	Preliminary release

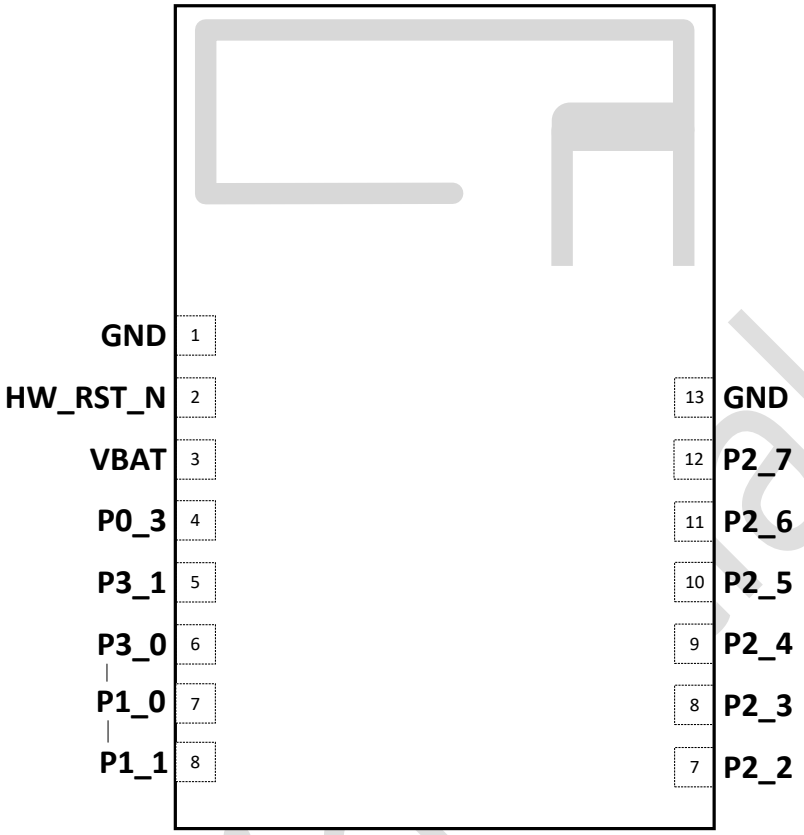
■ MODULE SPECIFICATIONS

Specification Name		Descriptions
Module Dimension		11.05mm(W) x 17mm(L) x 2.05mm(H)
BLE Core Compliant		V5.0
Operation Distance		Up to 50 Meters (*LE 1M, apple to apple testing results)
Power Supply		1.8V – 3.6V
Power Consumption	Power Down Mode	450nA
	Deep LPS	2.5uA
	TX mode (+0dBm)	8.4mA
	TX mode (+4dBm)	10.4mA
	TX mode (+8dBm)	12.7mA
	RX mode	6.8mA
Antenna Type		embedded PCB antenna
GPIO Numbers:		Up to 8x (including P3_0 and P3_1)
PWM Numbers:		Up to 6x (P2_2 to P2_7)
12bit ADC Numbers:		Up to 6x (P2_2 to P2_7)
Support interfaces		UART/4-wire SPI master or slave/I²S master/PCM master

■ BLOCK DIAGRAM



■ PIN ASSIGNMENTS (TOP VIEW)



■ PIN DEFINITIONS

Note: *INOUT* (digital bidirectional), *ANA*(analog pin), *DIG*(digital pin).

#	Pin Name	I/O	Ana/Dig	Function
1	GND	-	GND	GND
2	HW_RST_N	IN	DIG	Hardware reset pin; low active;
3	VBAT	-	PWR	Power Supply, 1.8V to 3.6V;
4	P0_3	OUT	DIG	LOG_UART_TX (default)
5	P3_1	INOUT	DIG	HCI_UART_RX (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
6	P3_0	INOUT	DIG	HCI_UART_TX (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;

7	P2_2	INOUT		AUXADC input 2 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
8	P2_3	INOUT	ANA/DIG	AUXADC input 3 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
9	P2_4	INOUT	ANA/DIG	AUXADC input 4 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
10	P2_5	INOUT	ANA/DIG	AUXADC input 5 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
11	P2_6	INOUT	ANA/DIG	AUXADC input 6 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
12	P2_7	INOUT	ANA/DIG	AUXADC input 7 (default) General purpose IO, 8mA driving capability; With wakeup function, internal strong/weak pull-up and pull-down;
13	GND	-	GND	GND

■ INTERFACE DESCRIPTIONS

● UART

RL62M01A provides multiple UART baud-rate. The common baud-rate is shown in below table. **The UART clock error between two devices should be less than +/- 2.5%**.

RL62M01A UART Features:

- Supports 7/8 data format.
- 1/2 bit stop bit.
- Configurable parity bit: odd/even.
- Programmable baud rate (maximum baud rate=4Mbps).
- Support hardware flow control.
- RX line idle state detect.
- DMA supported.

Baud-rate (bps)	Error (%)	Baud-rate (bps)	Error (%)
1200	-0.23	460800	0.17
9600	< 0.01	500000	< 0.01
14400	< 0.01	921600	0.18
19200	< 0.01	1000000	< 0.01
28800	< 0.01	1382400	0.17
38400	< 0.01	1444400	-0.31
57600	< 0.01	1500000	< 0.01
76800	0.01	1843200	-0.35
115200	< 0.01	2000000	0.02
128000	0.02	2764800	0.14
153600	-0.1	3000000	0.06
230400	0.03	4000000	0.03

Table : UART Baud Rate

■ ELECTRICAL CHARACTERISTICS

● Temperature Limit Ratings

Parameter	Description	Note	Min.	Typ.	Max.	Unit
T_{STORE}	Storage temperature		-45		100	℃
T_{AOP}	Operational Temperature		-20		65	℃

● Power Supply DC Characteristics

Parameter	Description	Note	Min.	Typ.	Max.	Unit
V_{BAT}	Supply Voltage		1.8	3	3.6	V

● ESD Characteristics

Parameter	Description	Note	Min.	Typ.	Max.	Unit
ESD_{HBM}	ESD, human body mode	All pins, test method: JESD22			3500	V
ESD_{MM}	ESD, machine mode	All pins, test method: JESD22			200	V
ESD_{CDM}	ESD, charged device mode	All pins, test method: JESD22			500	V

● 12bit-AUX ADC Characteristics

Parameter	Description	Note	Min.	Typ.	Max.	Unit
ADC_{BIT}	Resolution	Bypass mode		12		BITS
		Divided mode (1/3.3)		12		BITS
F_{CLK_ADC}	Clock Source	From digital			400	kHz
ADC_{DNL}	DNL	Single-ended mode (Bypass mode)		±1.5		LSB
		Differential mode (Bypass mode)		±3.0		LSB
ADC_{INL}	INL	Single-ended mode (Bypass mode)		±1.0		LSB
		Differential mode (Bypass mode)		±2.0		LSB
ADC_{VIN_RANGE}	Input Voltage Range	External channel (Divided Mode)	0		VBAT	V
		External channel (Bypass Mode)	0		1	-
		Internal channel (VBAT)	1.8		3.63	V

ADC_{R_IN}	Input Impedance	Bypass mode		10M		Ohm
		Resistor divider mode (1/4)		500k		Ohm
ADC_{C_Sample}	Input Impedance	Bypass mode		1.9		pF
		Resistor divider mode (1/4)		1.9		pF

● Radio Characteristics

General Radio Characteristics

Parameter	Description	Note	Min.	Typ.	Max.	Unit
F_{RANGE}	Frequency range		2402		2480	MHz

RX Performance

Condition: VBAT=3V, ambient temperature=25°C

Parameter	Description	Note	Min.	Typ.	Max.	Unit
P_{RX_MIN}	Sensitivity (LE 1M)	PER ≤ 30.8%	-97			dBm
P_{RX_MAX}	Maximum received power	PER ≤ 30.8%		-1		dBm
CI_{RX_1M}	C/I co-channel		21			dB
	C/I + 1MHz offset		15			dB
	C/I - 1MHz offset		15			dB
	C/I + 2MHz offset		-17			dB
	C/I - 2MHz offset		-15			dB
	C/I + 3MHz offset		-27			dB
	C/I image		-9			dB
	C/I image + 1MHz offset		-15			dB
	C/I image - 1MHz offset		-15			dB
CI_{RX_2M}	C/I co-channel		21			dB
	C/I + 2MHz offset		15			dB
	C/I - 2MHz offset		15			dB
	C/I + 4MHz offset		-17			dB
	C/I - 4MHz offset		-15			dB
	C/I + 6MHz offset		-27			dB
	C/I image		-9			dB
	C/I image + 2MHz offset		-15			dB
	C/I image - 2MHz offset		-15			dB
P_{RX_OOB}	Blocker Power Wanted signal level= -67dBm	30MHz ~ 2000MHz	-30			dBm
		2003MHz ~ 2399MHz	-30			dBm
		2484MHz ~ 2997MHz	-30			dBm
		3000MHz ~ 12.75GHz	-30			dBm

PER_{MAX}	Max PER report integrity	Wanted signal= -30dBm		50%		-
P_{RX_IMD}	Max Intermodulation level	Wanted signal f(0) = -64dBm Worst intermodulation level @2f1-f2=f0, |f1-f2|=n MHz, n=3,4,5…	-50			dBm

TX Performance

Condition: VBAT=3V, ambient temperature=25°C

Parameter	Description	Note	Min.	Typ.	Max.	Unit
P_{TX_MAX}	Maximum output power				8	dBm
P_{TX_ADJ}	Adjacent channel power ratio (LE 1M)	+2MHz			-20	dBm
		-2MHz			-20	dBm
		≥ +3MHz			-30	dBm
		≤ -3MHz			-30	dBm
	Adjacent channel power ratio (LE 2M)	+4MHz			-20	dBm
		-4MHz			-20	dBm
		≥ +6MHz			-30	dBm
		≤ -6MHz			-30	dBm
F_{MOD}	Modulation Characteristics (LE 1M)	Δf1avg		250		kHz
		Δf2max	185			kHz
		Δf2max pass rate		100%		-
		Δf2avg / Δf1avg		0.88		-
	Modulation Characteristics (LE 2M)	Δf1avg		500		kHz
		Δf2max	370			kHz
		Δf2max pass rate		100%		-
		Δf2avg / Δf1avg		0.88		-
F_{CAR_OFFSET}	Carrier frequency offset and drift (LE 1M)	Average Fn		12.5		kHz
		Drift rate		10		kHz/50μs
		Average drift		10		kHz/50μs
		Maximum drift		10		kHz/50μs
	Carrier frequency offset and drift (LE 2M)	Average Fn		12.5		kHz
		Drift rate		10		kHz/50μs
		Average drift		10		kHz/50μs
		Maximum drift		10		kHz/50μs
P_{TX_HD2}	2^{nd} harmonic power			-50		dBm
P_{TX_HD3}	3^{rd} harmonic power			-50		dBm

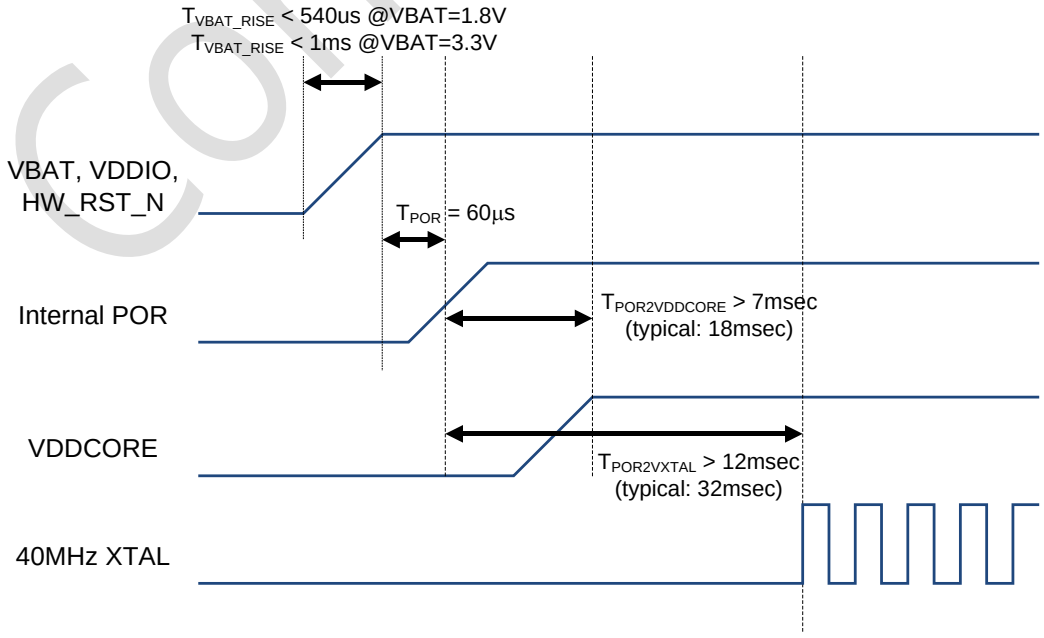
Digital I/O Pin DC Characteristics

Condition: ambient temperature=25°C

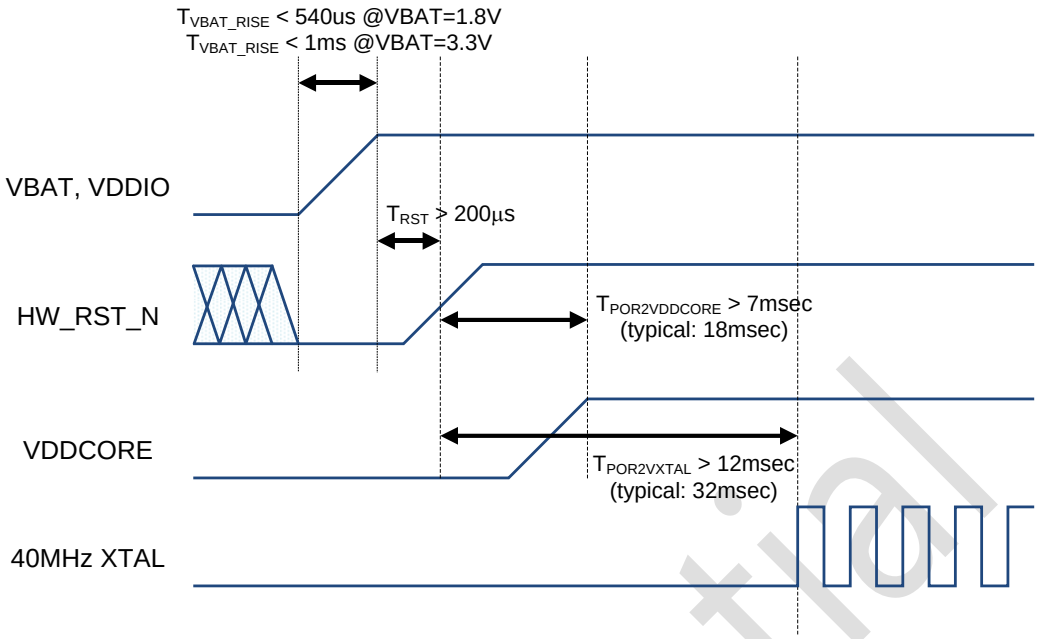
Parameter	Description	Note	Min.	Typ.	Max.	Unit
V_{IH33}	Input high voltage	VDDIO=3.3V	2	3.3	3.6	V
V_{IL33}	Input low voltage			0	0.9	V
V_{OH33}	Output high voltage		2.97		3.3	V
V_{OL33}	Output low voltage		0		0.33	V
V_{IH28}	Input high voltage	VDDIO=2.8V	1.8	2.8	3.1	V
V_{IL28}	Input low voltage			0	0.8	V
V_{OH28}	Output high voltage		2.5			V
V_{OL28}	Output low voltage		0		0.28	V
R_{pull}	Strong Pull	VDDIO=3.3V		10		kOhm
		VDDIO=1.8V		20		kOhm
	Weak Pull	VDDIO=3.3V		100		kOhm
		VDDIO=1.8V		200		kOhm
	Strong Pull (P2_2~P2_7)	VDDIO=3.3V		5		kOhm
		VDDIO=1.8V		2.5		kOhm
	Weak Pull (P2_2~P2_7)	VDDIO=3.3V		50		kOhm
		VDDIO=1.8V		25		kOhm
I_{IH}	Input high current	PAD configured as input mode			0.1	μA
I_{IL}	Input low current				0.1	μA

Boot Sequence

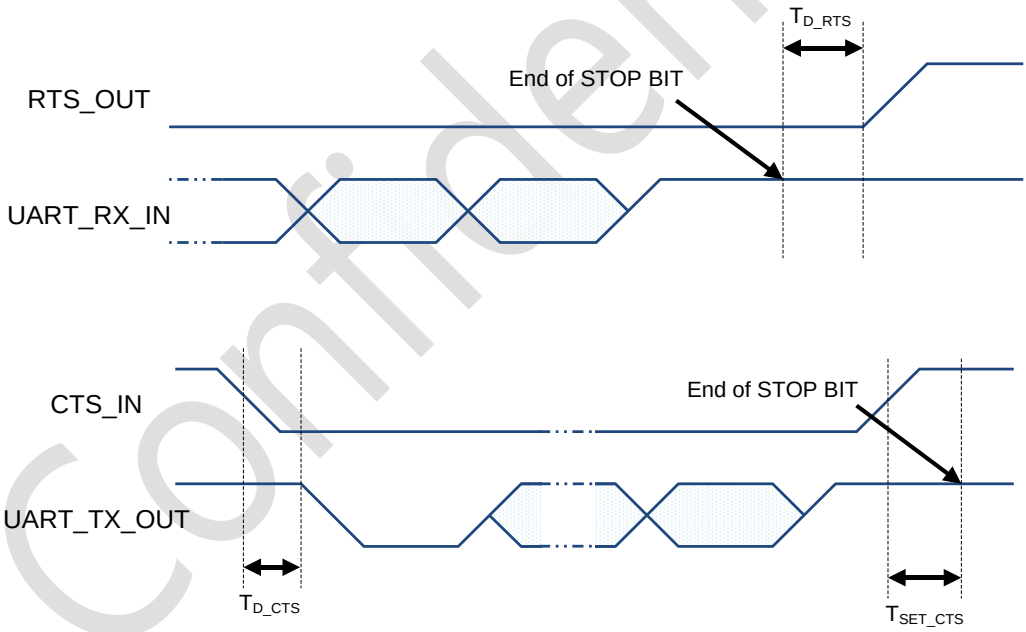
Boot up by internal power on reset circuit, power on timing is shown in below figure.



Boot up by HW_RST_N pin, power on timing is shown in below figure.

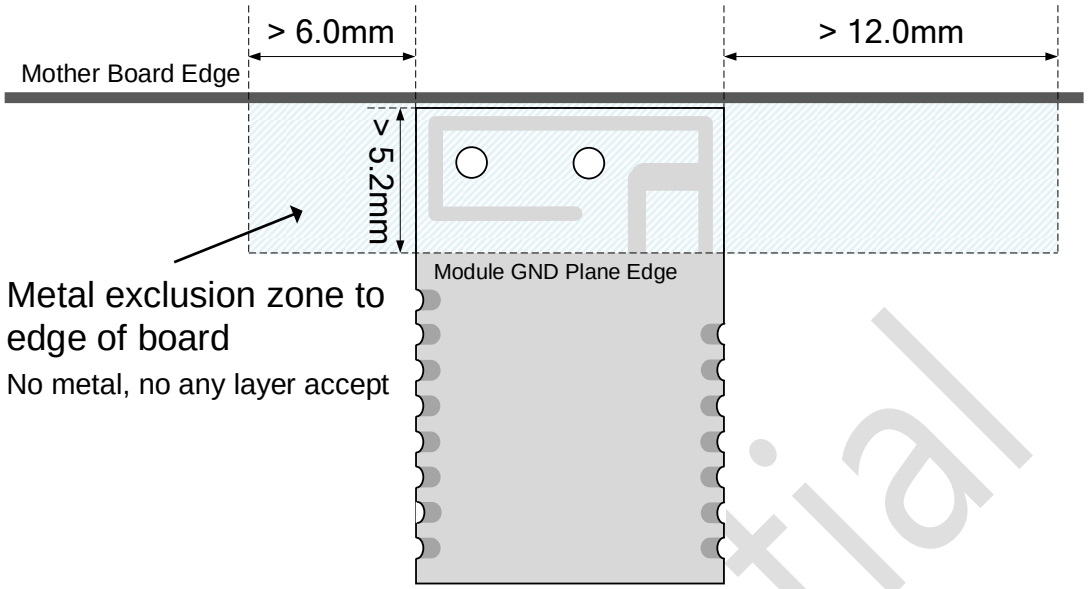


● UART Characteristics

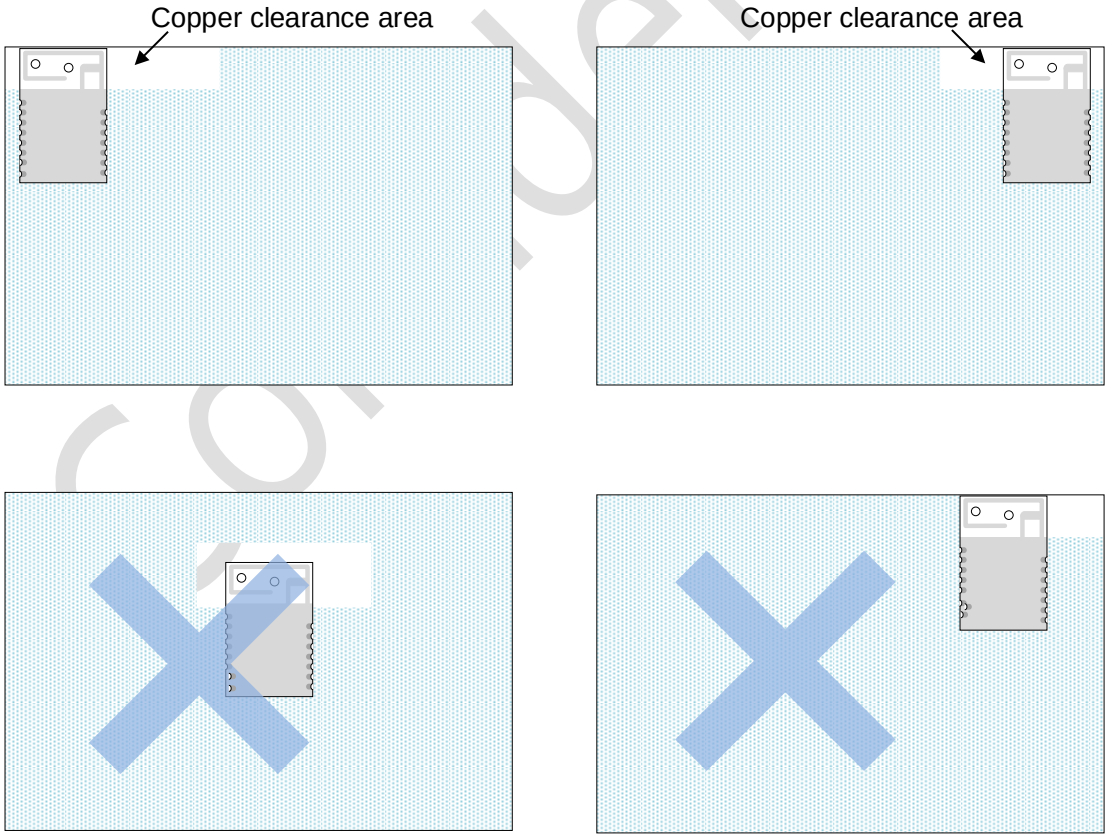


Parameter	Description	Note	Min.	Typ.	Max.	Unit
T_{D_RTS}	Timing between UART_RX_IN stop bit and RTS rising edge when RX FIFO is full				0.5	ns
T_{D_CTS}	Timing between CTS falling edge and UART_TX_OUT first bit				25	ns
T_{SET_CTS}	Timing between CTS rising edge and UART_TX_OUT stop bit		75			ns

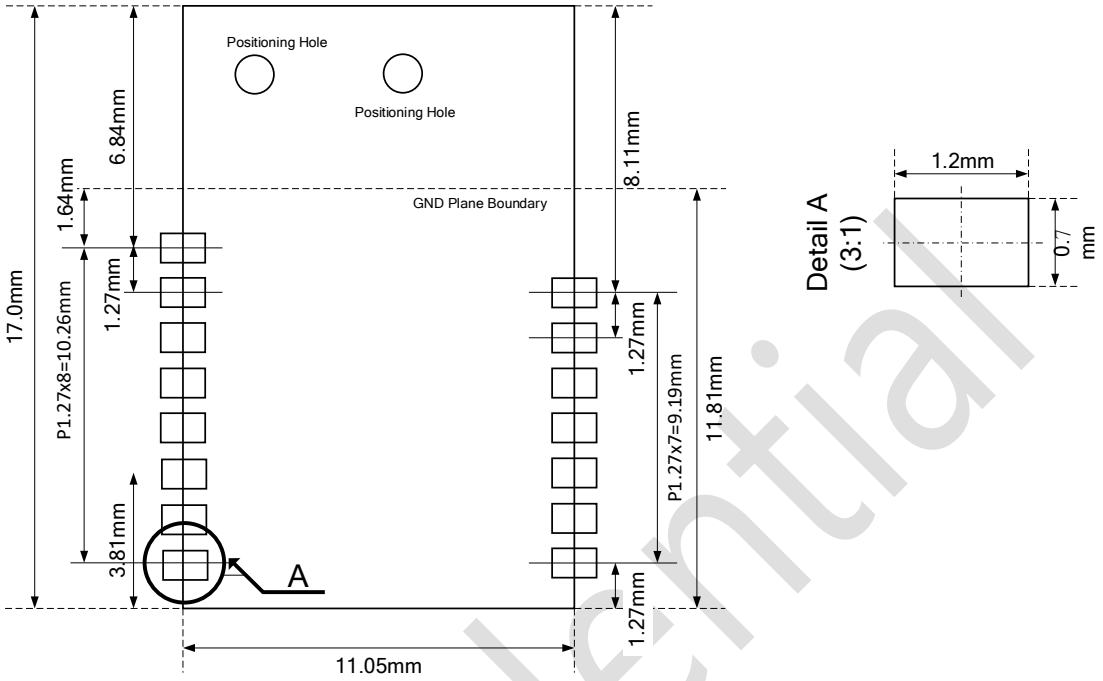
■ PCB LAYOUT GUIDE



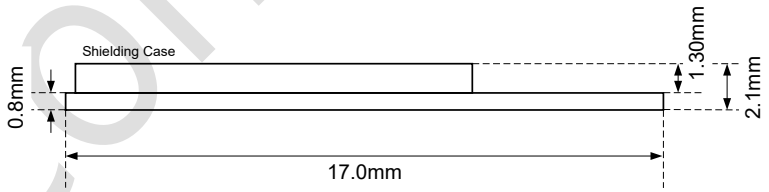
Module Placement Example:



■ MODULE DIMENTIONS



Top View



Side View

Federal Communication Commission Interference Statement

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 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 Caution: To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer or peripheral devices).

End Product Labeling

This transmitter module is authorized only for use in devices where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in visible area with the following: “Contains FCC ID: 2AXIJ-RL62M_ ”
”

End Product Manual Information

The user manual for end users must include the following information in a prominent location “IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be colocated or operating in conjunction with any other antenna or transmitter.” 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 and
(2) This device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or colocation with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization. This device is intended only for OEM integrators under the following conditions: The antenna must be installed such that 20 cm is maintained between the antenna and users. As long as a condition above is 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 (for example, digital device emissions, PC peripheral requirements, etc.).