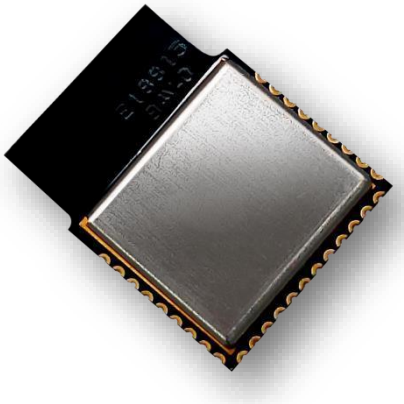
REYAX
TECHNOLOGY CORPORATION, LTD

22-AUG-2019 56312E37

RYWB116

2.4GHz Ultra Low Power Wi-Fi / Bluetooth 5.0 UART/SPI Interface Module with Integrated Antenna

Users manual



PRODUCT DESCRIPTION

REYAX's RYWB116 module provides a comprehensive multi-protocol wireless solution including 802.11 b/g/n, dual-mode Bluetooth 5.

FEATURES

- Compliant to single-spatial stream IEEE 802.11 b/g/n, Bluetooth 5.
- Co-existence of multiple wireless protocols managed by an internal protocol arbitration manager.
- Ultra-low power consumption with multiple power modes to reduce the system energy consumption.
- Leading edge RF performance providing long range and higher throughputs.
- Support for 20 channel bandwidths.
- Transmit power up to +21dBm with integrated PA.
- Wi-Fi receive sensitivity as low as -98.5 dBm.
- BT receive sensitivity as low as -95 dBm.
- Support for Client mode, Access point mode, Wi-Fi Direct and enterprisesecurity.
- Support for concurrent Wi-Fi, Bluetooth 5.
- 8.9 mA transmit current in BT 5 mode, 2 Mbps data rate
- Operating temperature: -40°C to +85°C

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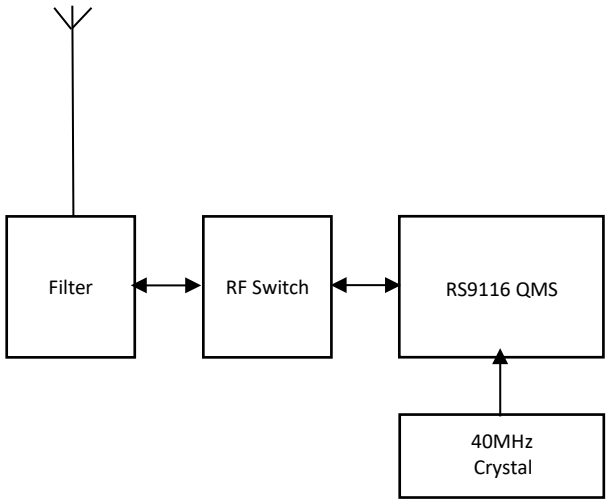
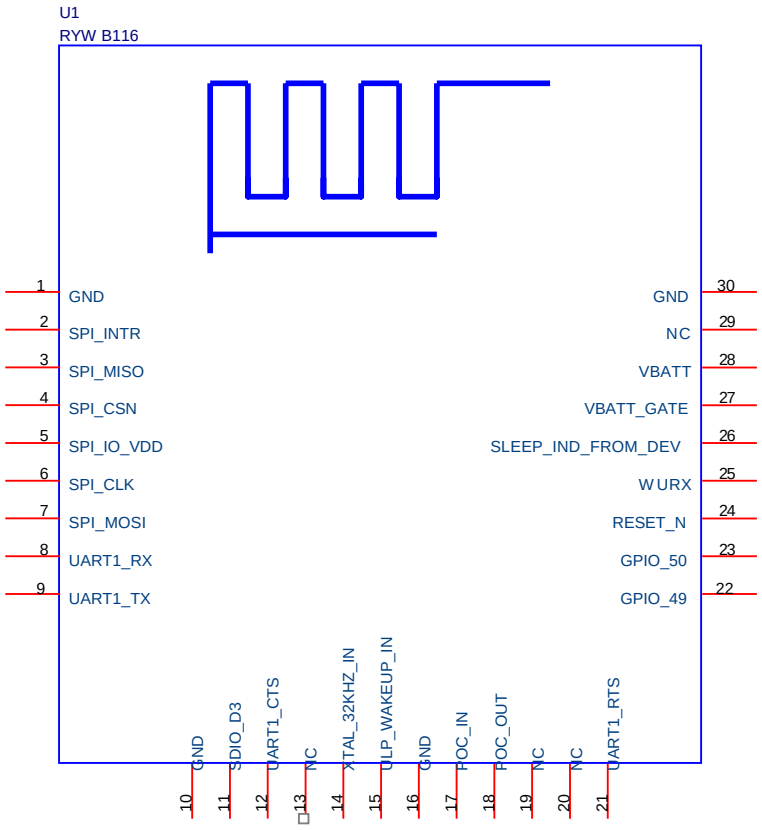
BLOCK DIAGRAM



PIN DESCRIPTION



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Pin	Name	I/O	Condition
1	GND	-	Ground
2	SPI_INTR	O	SPI_INTR: SPI Slave interface Interrupt Signal to the Host.
3	SPI_MISO	O	SPI_MISO: SPI Slave interface Master-In-Slave-Out signal.
4	SPI_CSN	I	SPI_CSN: Active-low Chip Select signal of SPI Slave interface.
5	SPI_IO_VDD	I	I/O Supply for GPIOs (1.9-3.6V).
6	SPI_CLK	I	SPI_CLK: SPI Slave interface clock.
7	SPI_MOSI	I	SPI Slave interface Master-Out-Slave-In signal.
8	UART1_RX	I	UART 1 interface serial input.
9	UART1_TX	O	UART 1 interface serial output.
10	GND	-	Ground
11	SDIO_D3	I/O	SDIO_D3: SDIO interface Data3 signal.
12	UART1_CTS	I	UART1_CTS: UART 1 interface Clear to Send.
13	NC	-	Leave Unconnected.
14	XTAL_32KHZ_IN	I	This pin can be used to feed external clock from a host processor or from external crystal oscillator.
15	ULP_WAKEUP_IN	I	This signal has two functionalities – one during the bootloading process and one after the bootloading. During bootloading, this signal is an active-high input to indicate that the bootloader should bypass any inputs from the Host processor and continue to load the default firmware from Flash. After bootloading, this signal is an active-high input to indicate that the chip/module should wakeup from its Ultra Low Power (ULP) sleep mode.
16	GND	-	Ground
17	POC_IN	I	Power On Control Input.
18	POC_OUT	O	Power On Control Output.
19	NC	-	Leave Unconnected.
20	NC	-	Leave Unconnected.
21	UART1_RTS	O	UART1_RTS: UART 1 interface Request to Send.
22	GPIO_49	I/O	General Purpose I/O.
23	GPIO_50	I/O	General Purpose I/O.
24	RESET_N	I	Active-low reset asynchronous reset signal.
25	WURX	I	2.4 GHz Wakeup receiver RF input. If unused, leave unconnected.
26	SLEEP_IND_FROM_DEV	O	This signal is used to send an indication to the Host processor. An indication is sent when the chip enters (logic low) and exits (logic high) the ULP Sleep mode.
27	VBATT_GATE	I	If not use the power gate, please connect to the VBATT pin.

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			The power gate reduces sleep mode current. Please refer to the EVB Schematic.
28	VBATT	I	Input supply voltage (1.75-3.6V).
29	NC	-	Leave Unconnected.
30	GND	-	Ground

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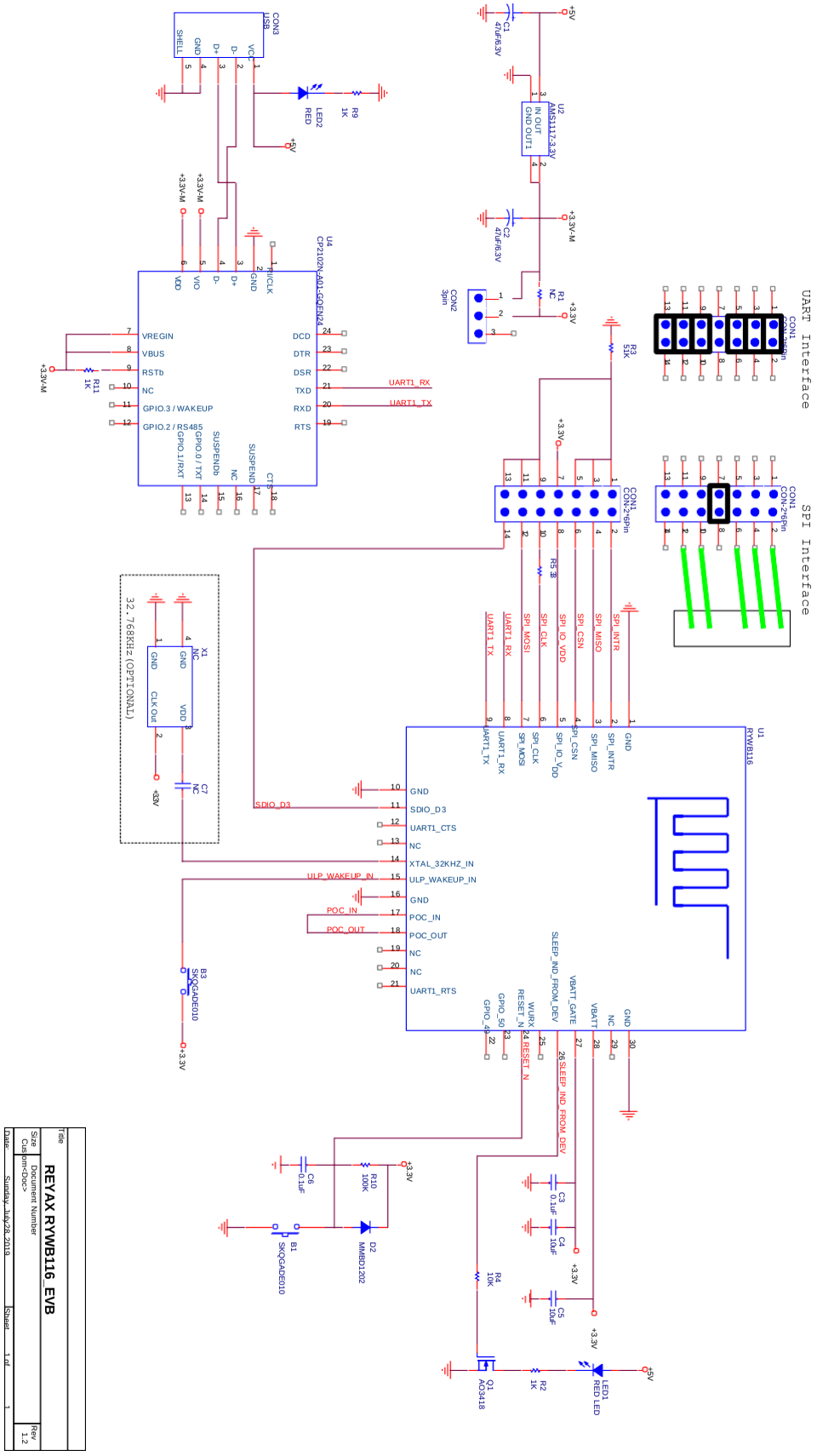
EVB APPLICATION SCHEMATIC



Title	REYAX RYWB116_EVB		
Size	Document Number		Rev
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Date: Sunday, July 28, 2019	Sheet 1 of 1		

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SPECIFICATION

Item	Min.	Typical	Max.	Unit	Description
Operation Voltage	1.75	3.3	3.6	V	VBATT
TX Mode Current			400	mA	
WLAN Data Transfer Average Current		270		mA	11Mbps Tx
WLAN Data Receive Average Current		48.2		mA	72 Mbps Rx
WLAN Standby Associated Mode Current		119		uA	DTIM=3 Cisco Aironet AP
WLAN Standby Associated Mode Current		51		uA	DTIM=10 Cisco Aironet AP
Quiescent current		3		nA	
Baud Rate	9600	115200	921600	bps	
Wireless Protocols					IEEE 802.11b, 802.11g, 802.11n Bluetooth 5 (2.1+EDR, LE, LE 2 Mbp)
Operational ModesSupported					Wi-Fi Access Point with support for up to 16 clients Wi-Fi Client Wi-Fi Direct Bluetooth Classic (EDR v 2.1) Wi-Fi Client + Bluetooth Low Energy
Receive Power			10	dBm	
WLAN Modulation					OFDM with BPSK, QPSK, 16-QAM, and 64-QAM 802.11b with CCK and DSSS
WLAN Operating Frequency	2.412		2.484	GHz	
WLAN Bandwidth		20		MHz	
WLAN Data Rates	1 6		11 54	Mbps	802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 to MCS7
Bluetooth Channel Spacing	1		2	MHz	BR, EDR, - 1 MHz LE - 2 MHz
Bluetooth Modulation		GFSK, DQPSK, D8PSK			
Bluetooth Operating Frequency	2.402		2.480	GHz	
Bluetooth Data Rates	125		3000	Kbps	
Communication Range			266	M	
Operating Temperature	-40	25	+85	˚C	

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DC CHARACTERISTICS

RESET_N PIN

Symbol	Min.	Typical	Max.	Unit	Parameter
VIH	0.8 VDD		3.63	V	High level input voltage
VIL	-0.5		0.3 VDD	V	Low-level input voltage
Vhys	0.05 VDD			V	Hysteresis voltage

DIGITAL INPUT OUTPUT SIGNALS

Symbol	Min.	Typical	Max.	Unit	Parameter
VIH	2.0		3.63	V	High level input voltage
VIL	-0.3		0.8	V	Low-level input voltage
Vhys	0.1 VDD			V	Hysteresis voltage
VOL			0.4	V	Low level output voltage
VOH	VDD-0.4			V	High level output voltage
IOL	2.0	4.0	12.0	mA	Low level output current
IOH	2.0	4.0	12.0	mA	High level output current

PIN CAPACITANCE

Symbol	Parameter	Min.	Typical	Max.	Unit
Cio	Input/output capacitance, digital pins only			2.0	pF

WIRELESS PERFORMANCE SPECIFICATIONS

WLAN 2.4 GHz TRANSMITTER CHARACTERISTICS

Parameter	Conditions	Min.	Typical	Max.	Unit
Transmit Power for 20MHz Bandwidth, compliant with IEEE mask and EVM	1 Mbps DSSS		20		dBm
	2 Mbps DSSS		20		dBm
	5.5 Mbps CCK		20		dBm
	11 Mbps CCK		20		dBm
	6 Mbps OFDM		20		dBm
	9 Mbps OFDM		20		dBm
	12 Mbps OFDM		20		dBm
	18 Mbps OFDM		20		dBm

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	24 Mbps OFDM		19		dBm
	36 Mbps OFDM		18		dBm
	48 Mbps OFDM		18		dBm
	54 Mbps OFDM		17		dBm
	MCS0 Mixed Mode		20		dBm
	MCS1 Mixed Mode		20		dBm
	MCS2 Mixed Mode		20		dBm
	MCS3 Mixed Mode		19		dBm
	MCS4 Mixed Mode		17.5		dBm
	MCS5 Mixed Mode		17.5		dBm
	MCS6 Mixed Mode		17		dBm
	MCS7 Mixed Mode		14		dBm

WLAN 2.4 GHz RECEIVER CHARACTERISTICS

Parameter	Conditions	Min.	Typical	Max.	Unit
Sensitivity for 20MHz Bandwidth	1 Mbps DSSS		-98.5		dBm
	2 Mbps DSSS		-93		dBm
	5.5 Mbps CCK		-90		dBm
	11 Mbps CCK		-88		dBm
	6 Mbps OFDM		-93		dBm
	9 Mbps OFDM		-92		dBm
	12 Mbps OFDM		-91		dBm
	18 Mbps OFDM		-89		dBm
	24 Mbps OFDM		-85.5		dBm
	36 Mbps OFDM		-82.5		dBm
	48 Mbps OFDM		-78		dBm
	54 Mbps OFDM		-76.5		dBm
	MCS0 Mixed Mode		-91.5		dBm
	MCS1 Mixed Mode		-90		dBm
	MCS2 Mixed Mode		-88		dBm
	MCS3 Mixed Mode		-85		dBm
	MCS4 Mixed Mode		-81		dBm
	MCS5 Mixed Mode		-77		dBm
	MCS6 Mixed Mode		-75		dBm
	MCS7 Mixed Mode		-73		dBm
Maximum Input Level for PER	1 Mbps DSSS		0		dBm

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below 10%	11 Mbps CCK		-10		dBm
	54 Mbps OFDM		-10		dBm
	MCS0 Mixed Mode		-10		dBm
Adjacent Channel Rejection	1 Mbps DSSS		36		dB
	11 Mbps CCK		37		dB
	6 Mbps OFDM		38		dB
	54 Mbps OFDM		22		dB
Return Loss		-10			dB
RSSI Accuracy		-3		+3	dB

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BLUETOOTH TRANSMITTER CHARACTERISTICS

Parameter	Conditions	Min.	Typical	Max.	Unit
Transmit Power	BR, EDR		20		dBm
	LE		-1		dBm
Power Control Step	BR, EDR		3		dB
Adjacent Channel Power |M-N| = 2	BR		-20		dB
	EDR		-20		dB
	LE		-20		dB
Adjacent Channel Power |M-N| > 2	BR		-40		dB
	EDR		-40		dB
	LE		-30		dB

BLUETOOTH RECEIVER CHARACTERISTICS

Parameter	Conditions	Min.	Typical	Max.	Unit
Sensitivity	BR (1 Mbps), 339 bytes, DH5 Packet		-93.5		dBm
	EDR2 (2 Mbps), 679 bytes, 2-DH5 Packet		-94		dBm
	EDR3 (3 Mbps), 1020 bytes, 3-DH5 Packet		-88		dBm
	LE (1 Mbps), 37 bytes, Advertising Channel		-95		dBm
Maximum Input Level	BR, EDR2, EDR3		-16		dBm
	LE		-8		dBm
BER Floor				1e-4	%
C/I Performance	BR, co-channel		9		dB
	BR, adjacent +1 MHz		-2		dB
	BR, adjacent -1 MHz		-2		dB
	BR, adjacent +2 MHz		-19		dB
	BR, adjacent >=|±3| MHz		-19		dB
	BR, adjacent to image channel		-22		dB
	EDR2, co-channel		11		dB
	EDR2, adjacent +1 MHz		-2		dB
	EDR2, adjacent -1 MHz		-2		dB
	EDR2, adjacent +2 MHz		-17		dB
	EDR2, adjacent -2 MHz		-17		dB
	EDR2, adjacent >=|±3| MHz		-17		dB
	EDR3, co-channel		19		dB
	EDR3, adjacent +1 MHz		3		dB
	EDR3, adjacent -1 MHz		3		dB
	EDR3, adjacent +2 MHz		-12		dB
	EDR3, adjacent -2 MHz		-12		dB
	EDR3, adjacent >=|±3| MHz		-12		dB
	LE, co-channel		19		dB
	LE, adjacent +1 MHz		13		dB
	LE, adjacent -1 MHz		13		dB

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	LE, adjacent +2 MHz		-19		dB
	LE, adjacent -2 MHz		-19		dB
	LE, adjacent >=|±3| MHz		-19		dB

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REFLOW SOLDERING

Consider the "IPC-7530 Guidelines for temperature profiling for mass soldering (reflow and wave) processes, published 2001.

Preheat phase

Initial heating of component leads and balls. Residual humidity will be dried out. Please note that this preheat phase will not replace prior baking procedures.

- Temperature rise rate: max. 3 °C/s If the temperature rise is too rapid in the preheat phase it may cause excessive slumping.
- Time: 60 - 120 s If the preheat is insufficient, rather large solder balls tend to be generated. Conversely, if performed excessively, fine balls and large balls will be generated in clusters.
- End Temperature: 150 - 200 °C If the temperature is too low, non-melting tends to be causedin areas containing large heat capacity.

Heating/ Reflow phase

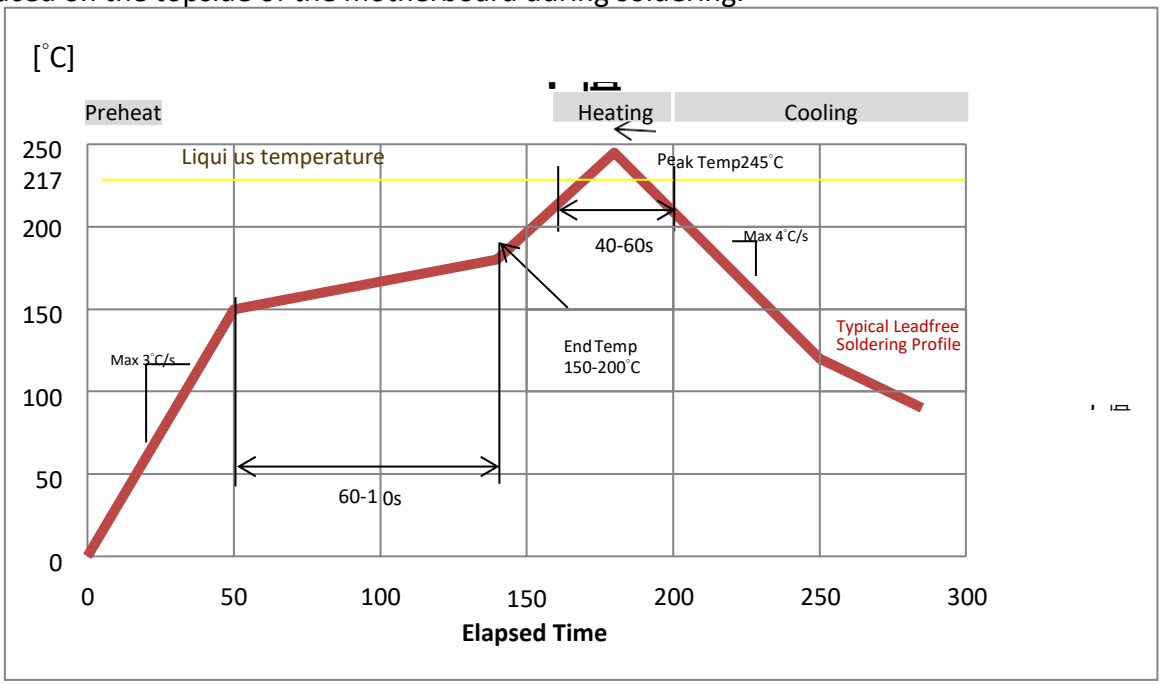
The temperature rises above the liquidus temperature of 217°C. Avoid a sudden rise in temperature as the slump of the paste could become worse.

- Limit time above 217 °C liquidus temperature: 40 - 60 s
- Peak reflow temperature: 245 °C

Cooling phase

A controlled cooling avoids negative metallurgical effects (solder becomes more brittle) of the solder and possible mechanical tensions in the products. Controlled cooling helps to achieve bright solder fillets with a good shape and low contact angle.

- Temperature fall rate: max 4 °C/s To avoid falling off, the REYAX RYWB116 module should be placed on the topside of the motherboard during soldering.



Recommended soldering profile

***Note: Does not support upside-down/bottom side reflow.**

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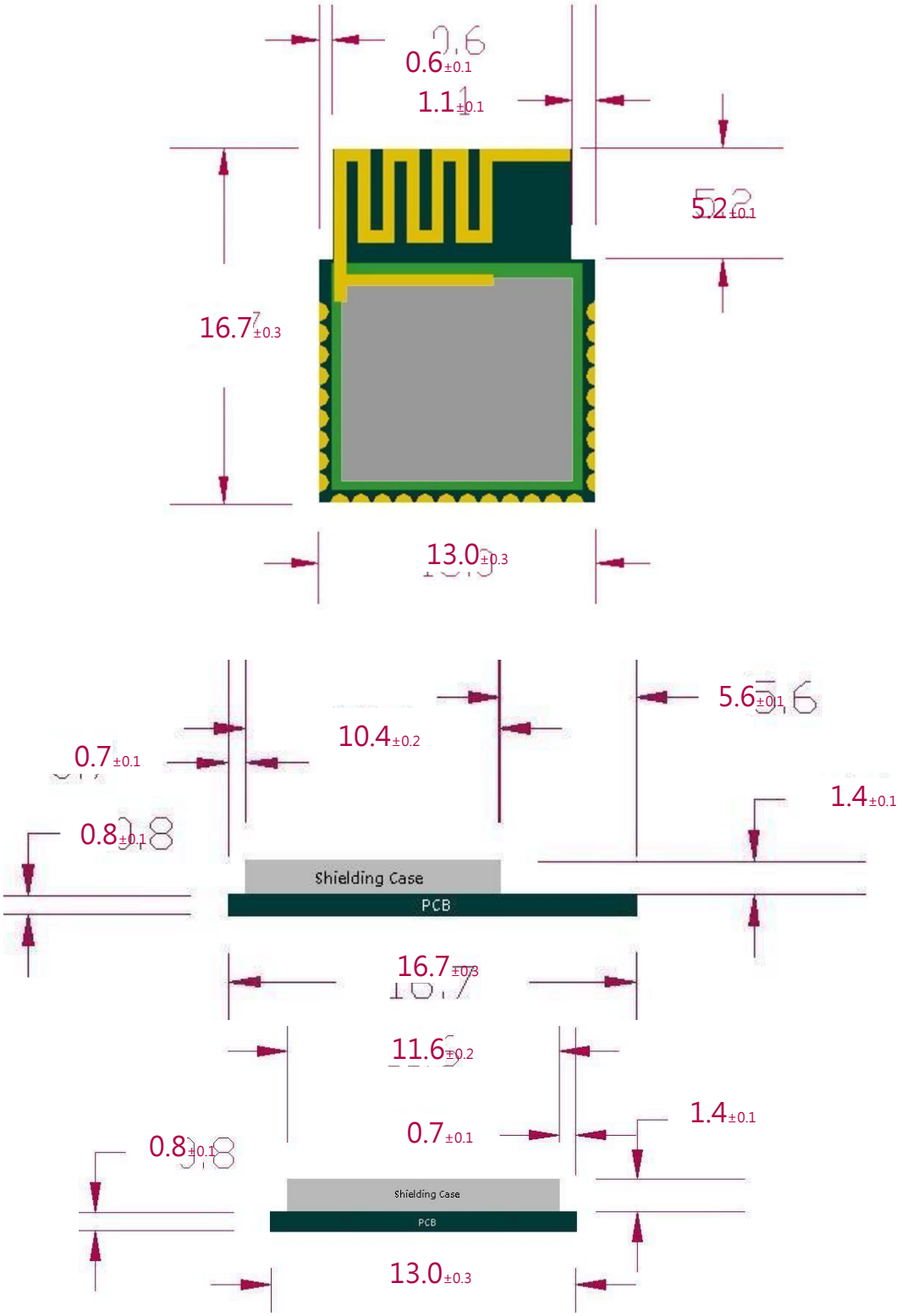
DIMENSIONS



Unit : mm

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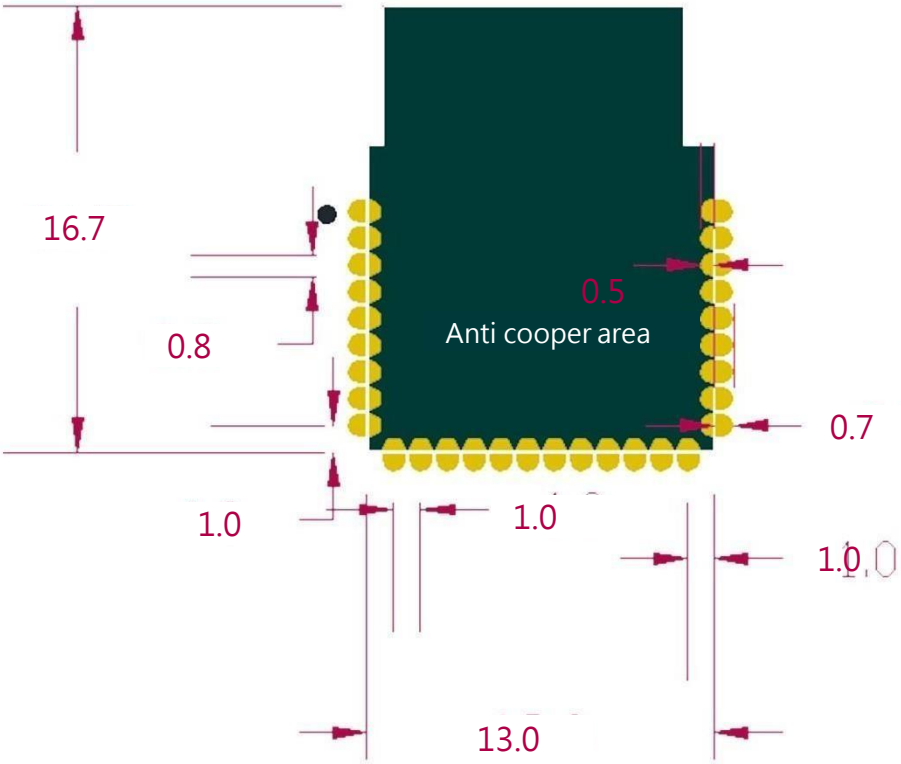
LAYOUT FOOTPRINT RECOMMENDATIONS



Unit : mm

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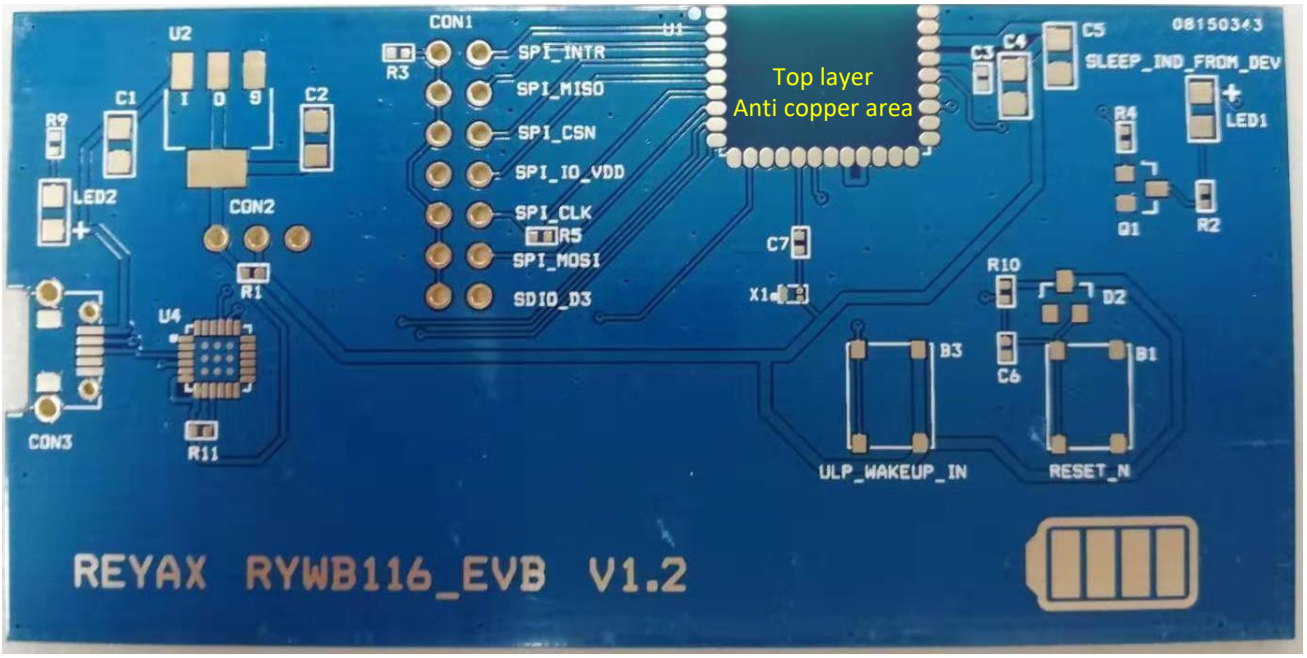

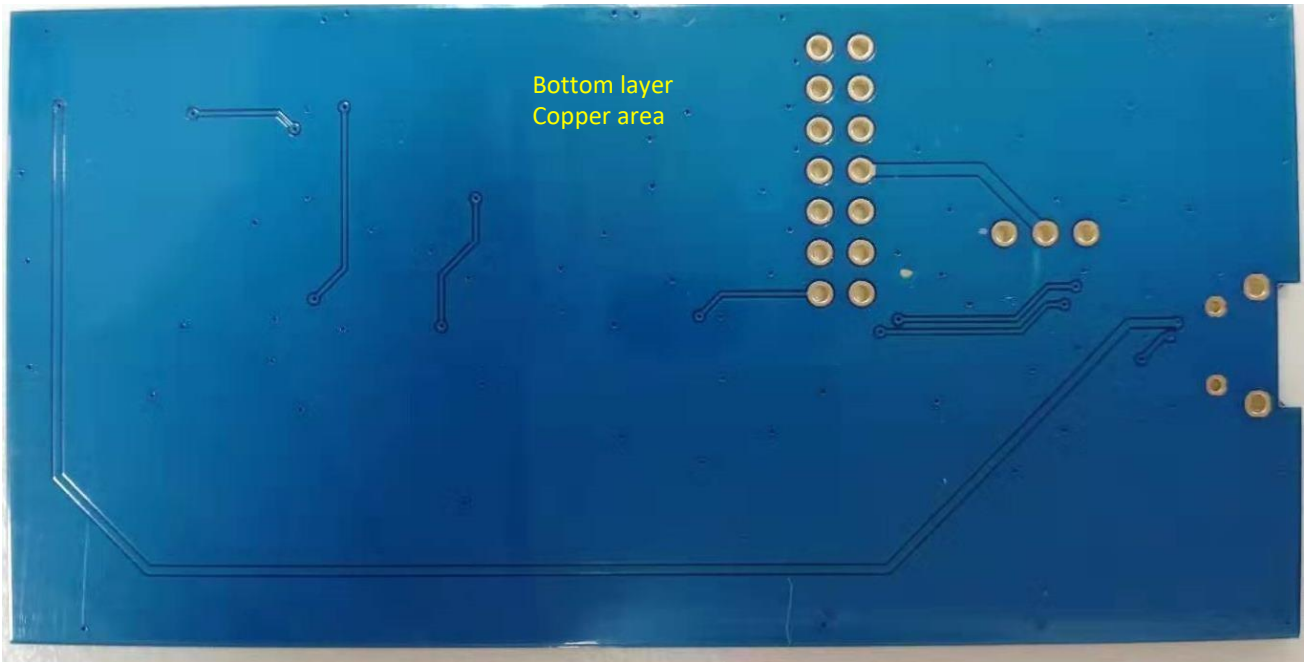

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FCC Statement:

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.

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

Important FCC notice:

In accordance with FCC Part 15C , this module is listed as a Modular Transmitter device.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

The antenna of this transmitter must not be co-located or operating in conjunction with any other antenna or transmitters within a host device, except in accordance with FCC multitransmitter product approval procedures.

FCC Label Instructions

The outside of final products that contains this module device must display a label

referring to the enclosed module. This exterior label can use wording such as the

following: "Contains Transmitter Module FCC ID: QLY-RYWB116" or "Contains FCC ID:

QLY-RYWB116." Any similar wording that expresses the same meaning may be used.

Additionally, there must be the following sentence on the device, unless it is too small to carry it:

"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."

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RF Exposure

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

From the FCC Grant: Output power listed is conducted. This transmitter is restricted for use with the specific antenna(s) tested in this application for Certification.

In the end product, the antenna(s) used with this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operation in conjunction with any other antenna or transmitter. User and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying the RF exposure compliance.

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