



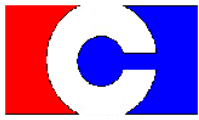
BLW004

Specification V1.2

**IEEE 802.11 a/b/g/n 2.4 / 5.8GHz 1T1R Wi-Fi
with Bluetooth V4.2(dual mode) combo module**

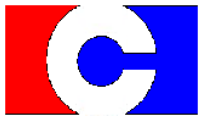
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Version	Date	Description	Drawn By	Approved By
V1.0	2016-09-16	Initial Release	Ken	
V1.1	2017-02-05	Add IO ports definition	Ken	
V1.2	2017-02-07	Modify bootstrap description	Ken	



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1 General Description

The module BLW004 is small form factor IEEE 802.11a/b/g/n/ MAC / baseband /radio and Bluetooth V4.2(dual mode) that are designed to meet both the low power and high throughput application. It also contains a 32-bit RISC CPU N9 that could fully offload the application processor. The application processor subsystem contains an ARM Cortex-M4F MCU. It also includes many peripherals, including UART, I2C, SPI, I2S, PWM, IrDA, and auxiliary ADC. It also includes embedded SRAM/ROM and a 4MB serial flash in module .

The BLW004 is a single stream 1x1 802.11 a/b/g/n implementation providing improved link robustness, extended range, increased throughput and better performance for an unparalleled user experience. BLW004 is a highly integrated module for IoT applications.

The BLW004 implements MTK' proprietary Internal Efficient Power AmplifierTM (EPA) technology with advanced linearization algorithms and an internal LNA, thereby reducing the BOM costs in the system design.

Table1:module information

Chipset	MT7697D
Core	ARM Cortex-M4F MCU
FPU Clock Speed	192MHz
SRAM	352KB
Flash	4MB
Operation Conditions	
Humidity	Operating:Operating: -20°C ~ +70°C (Non-Condensing) Storage:-40°C ~+85°C (Non-Condensing)
Dimension	18mmX18mmX2.2mm(Typ.)
Package	LGA44Pin



2 Characteristics

2.1 Technology and package

- 18mmX18mmX2.2mm(Typ.) 44pin SMT,
- Advanced Wi-Fi/Bluetooth coexistence scheme

2.2 Platform

- ARM Cortex-M4F MCU with FPU with up to 192MHz clock speed
- Embedded 352KB SRAM and 64KB boot ROM
- 32KB cache in XIP mode
- Hardware crypto engines including AES, DES/3DES, SHA2 for network security
- 28 General Purpose IOs multiplexed with other interfaces
- Two UART interfaces with hardware flow control and one UART for debug, all multiplexed with GPIO
- One SPI master interface multiplexed with GPIO ,One SPI slave interface multiplexed with GPIO
- Two I2C master interface multiplexed with GPIO
- One I2S interface multiplexed with GPIO
- Four channel 12-bit ADC multiplexed with GPIO
- 28 PWM multiplexed with GPIO
- 25 channels DMA
- Low power RTC mode with 32KHz crystal support

2.3 WLAN

- Dedicated high-performance 32-bit RISC CPU N9 up to 160MHz clock speed
- IEEE 802.11 a/b/g/n compliant
- Supports 20MHz, 40MHz bandwidth in 2.4GHz band 5GHz band
- Dual-band 1T1R mode with data rate up to 150Mbps
- Supports STBC, LDPC
- Greenfield, mixed mode, legacy modes support
- IEEE 802.11e support
- Security support for WFA WPA/WPA2 personal, WPS2.0
- Supports 802.11w protected managed frames
- QoS support of WFA WMM
- Integrated LNA, PA, and T/R switch
- RX diversity support with additional RX input
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2.4 Bluetooth

- Bluetooth 4.2 Low Energy (LE)
- Integrated BALUN and PA
- Support SCO and eSCO link with re-transmission
- Channel assessment for AFH



3 Block Diagram

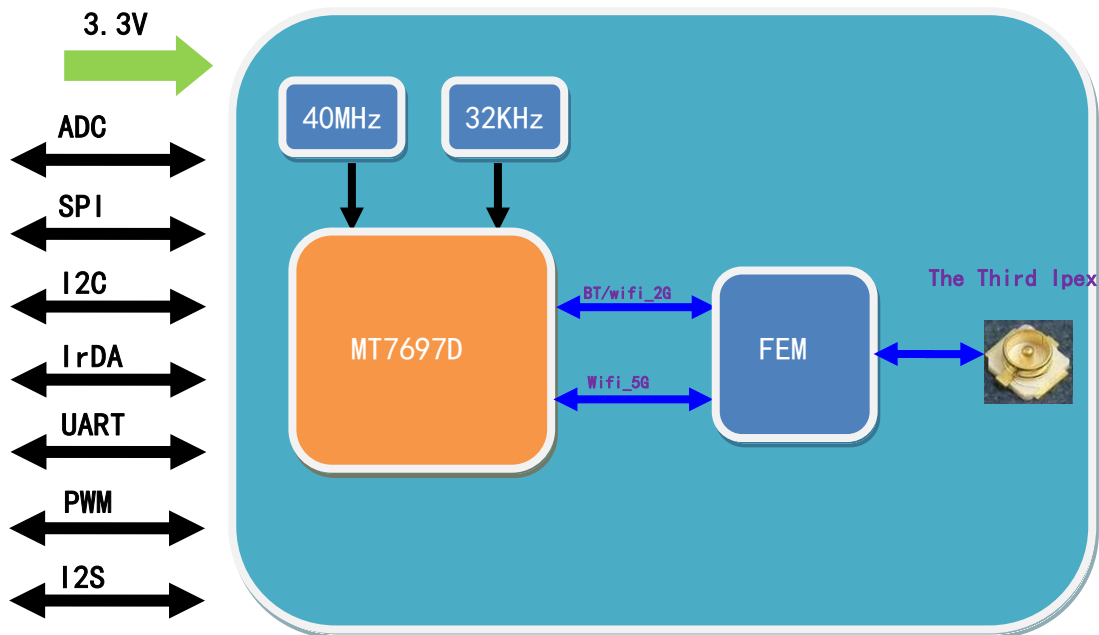


Figure1:module block diagram

4 Electrical Characteristics

Table2:Recommended operating conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDD	Supply Voltage	3	3.3	3.6	V
I/OVoltage	IO Power Supply	3	3.3	3.6	V

5 WLAN RF Characteristics

5.1 Wi-Fi 2.4GHz Band RF Receiver Characteristics

Table3: Wi-Fi 2.4GHz Band RF Receiver Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range	Center channel frequency	2412		2484	MHz
RX sensitivity	11 Mbps CCK PER<8%	-90	-88	-86	dBm
RX sensitivity	64QAM rate 3/4, 54 Mbps OFDM	-77	-75	-73	dBm
BW=20MHz	MCS 7, 64QAM rate 5/6	-75	-73	-71	dBm



BW=40MHz	MCS 7, 64QAM rate 5/6	-74	-70	-69	dBm
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5.2 Wi-Fi 2.4GHz Band RF Transmitter Characteristics

Table4: Wi-Fi 2.4GHz Band RF Transmitter Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range	Center channel frequency	2412		2484	MHz
TX Power	11 Mbps CCK	18	20	22	dBm
TX Power	64QAM rate 3/4, 54 Mbps OFDM	15	17	19	dBm
BW=20MHz	MCS 7, 64QAM rate 5/6	14	16.5	18.5	dBm
BW=40MHz	MCS 7, 64QAM rate 5/6	14	16	18	dBm

5.3 Wi-Fi 5GHz Band RF Receiver Characteristics

Table5: WiFi 5GHz Band RF Receiver Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range	Center channel frequency	5180		5825	MHz
RX sensitivity	BPSK rate 1/2, 6 Mbps OFDM		-92		dBm
RX sensitivity	64QAM rate 3/4, 54 Mbps OFDM		-75		dBm
BW=20MHz	MCS 7, 64QAM rate 5/6		-73		dBm
BW=40MHz	MCS 7, 64QAM rate 5/6		-70		dBm

5.4 Wi-Fi 5GHz Band RF Transmitter Characteristics

Table6: WiFi 5GHz Band RF Transmitter Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range	Center channel frequency	5180		5825	MHz
TX Power	6 Mbps OFDM		16		dBm
TX Power	64QAM rate 3/4, 54 Mbps OFDM		16		dBm
BW=20MHz	MCS 7, 64QAM rate 5/6		15		dBm



BW=40MHz	MCS 7, 64QAM rate 5/6		15		dBm
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6 Bluetooth RF Characteristics

6.1 BT 2.4GHz Band RF Receiver Characteristics

Table7: BT 2.4GHz Band RF Receiver Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range		2402		2480	MHz
Basic Rate Receiver	BER<0.1%		-91		dBm
Enhanced Data Rate Receiver	$\pi/4$ DQPSK, BER<0.01%		-90		dBm
	8PSK, BER<0.01%		-84		dBm
Bluetooth LE Receiver	PER < 30.8%		-95		dBm

6.2 BT 2.4GHz Band RF Transmitter Characteristics

Table8: BT 2.4GHz Band RF Transmitter Characteristics

Parameter	Description	Performance			
		MIN	TYP	MAX	Unit
Frequency range		2402		2480	MHz
Basic Rate Transmitter			9		dBm
Enhanced Data Rate Transmitter	$\pi/4$ DQPSK		6		dBm
	8PSK		6		dBm
Bluetooth LE Transmitter	At max power output level	-20	6	10	dBm

7 Module Package Information:Pin out Diagram

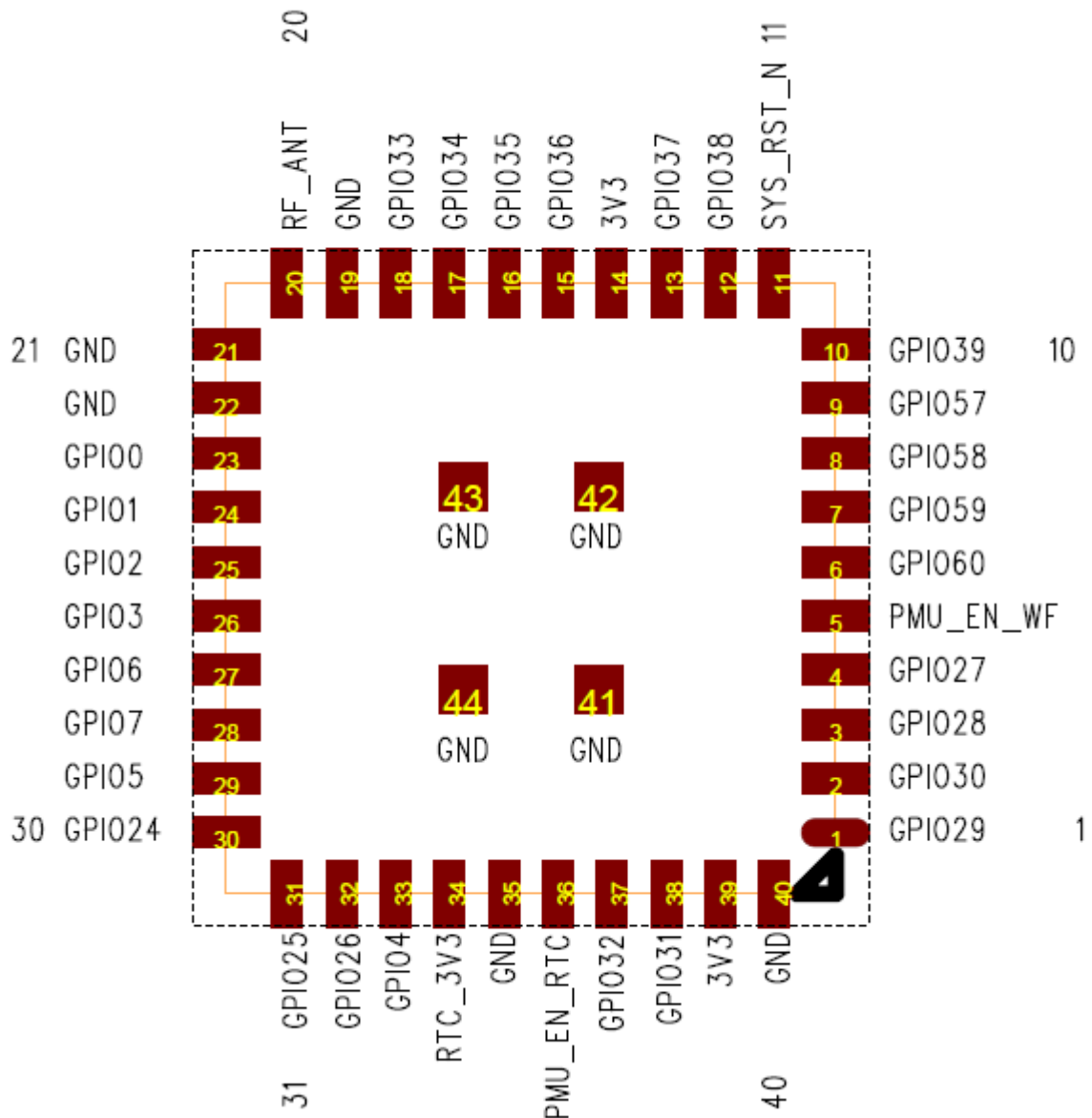


Figure2: Pin out Diagram

Table9:The Pin Definition

No.	Pin Name	TYPE	Description
1	GPI029	I/O	Programmable input/output
2	GPI030	I/O	Programmable input/output
3	GPI028	I/O	Programmable input/output
4	GPI027	I/O	Programmable input/output
5	PMU_EN_WF	Input	External PMU enable, active High
6	GPI060	I/O	Programmable input/output
7	GPI059	I/O	Programmable input/output
8	GPI058	I/O	Programmable input/output
9	GPI057	I/O	Programmable input/output



10	GPI039	I/O	Programmable input/output
11	SYS_RST_N	Input	External system reset active low
12	GPI038	I/O	Programmable input/output
13	GPI037	I/O	Programmable input/output
14	3V3	Power	3.3V power supply input
15	GPI036	I/O	Programmable input/output
16	GPI035	I/O	Programmable input/output
17	GPI034	I/O	Programmable input/output
18	GPI033	I/O	Programmable input/output
19	GND	Power	Ground
20	RF_ANT		Extend the antenna(Optional), Don't use by default.use
21	GND	Power	Ground
22	GND	Power	Ground
23	GPI00	I/O	Programmable input/output
24	GPI01	I/O	Programmable input/output
25	GPI02	I/O	Programmable input/output
26	GPI03	I/O	Programmable input/output
27	GPI06	I/O	Programmable input/output
28	GPI07	I/O	Programmable input/output
29	GPI05	I/O	Programmable input/output
30	GPI024	I/O	Programmable input/output
31	GPI025	I/O	Programmable input/output
32	GPI026	I/O	Programmable input/output
33	GPI04	I/O	Programmable input/output
34	RTC_3V3	Power	RTC domain power supply Input 3.3V
35	GND	Power	Ground
36	PMU_EN_RTC	Output	PMU enable
37	GPI032	I/O	Programmable input/output
38	GPI031	I/O	Programmable input/output
39	3V3	Power	3.3V power supply input
40	GND	Power	Ground
41	PAD_GND	Power	Ground
42	PAD_GND	Power	Ground
43	PAD_GND	Power	Ground
44	PAD_GND	Power	Ground



8 Peripherals

Several peripheral are multiplexed GPIOs. BLW003 has two dedicated UART interfaces with flow control, one dedicated I2C interface, and one dedicated IrDA interface. BLW003 also has the 2nd I2C interface, the SPI slave interface, the I2S interface, and the SPI master interface, but only 2 of the above interfaces can be effective at a time.

8.1 GPIO Interface

GPIOs Multiplex Function

BLW003 offers GPIO, each with the following configuration options:

- Input / Output mode
- Slew rate control
- Schmitt trigger hysteresis control
- Input mode: Floating (Hi-Z), pull-up, or pull-down
- Output mode: Active driving, or open drain
- Pull up/down control. The pull-up and pull-down resistance is 75K Ω with $\pm 20\%$ variation over PVT condition
- Driving strength: 4mA, 8mA, 12mA, 16mA
- Input and output duty cycle tuning



<u>GPIO60</u>	SWD_CLK	WIC11	PWM39	GPIO60	ADC3
<u>GPIO59</u>	SWD_DIO	WIC10	PWM38	GPIO59	ADC2
<u>GPIO58</u>		WIC9	PWM37	GPIO58	ADC1
<u>GPIO57</u>		WIC8	PWM36	GPIO57	ADC0
<u>GPIO28</u>			PWM29	GPIO28	SDA1
<u>GPIO27</u>		WIC2	PWM28	GPIO27	SCL1
<u>GPIO39</u>	EINT22		PWM22	GPIO39	UART2_CTS
<u>GPIO38</u>	EINT21		PWM21	GPIO38	UART2_RTS
<u>GPIO37</u>	EINT20		PWM20	GPIO37	UART2_TX
<u>GPIO36</u>	WIC7		PWM19	GPIO36	UART2_RX
<u>GPIO34</u>	WIC6		PWM35	GPIO34	IR_RX
<u>GPIO33</u>	WIC5		PWM34	GPIO33	IR_TX
<u>GPIO31</u>	SPI_SCK	I2S_RX/TX	PWM32	GPIO31	
<u>GPIO30</u>	MISO	I2S_FS	PWM31	GPIO30	
<u>GPIO29</u>	MOSI	I2S_MCLK	PWM30	GPIO29	WIC3
<u>GPIO32</u>	SPI_CS0	I2S_BCLK	PWM33	GPIO32	WIC4
<u>GPIO35</u>	UART_DBG	I2S_TX	PWM18	GPIO35	EINT19
<u>GPIO6</u>	SPI_CS1		PWM4	GPIO6	EINT5
<u>GPIO26</u>	RESERVE FOR 7697		PWM27	GPIO26	
<u>GPIO25</u>			PWM26	GPIO25	WIC1
<u>GPIO24</u>			PWM25	GPIO24	
<u>GPIO7</u>			PWM5	GPIO7	EINT6
<u>GPIO5</u>			PWM3	GPIO5	EINT4
<u>GPIO4</u>			PWM2	GPIO4	EINT3
<u>GPIO3</u>			PWM24	GPIO3	EINT2
<u>GPIO2</u>	UARR1_TX		PWM23	GPIO2	WIC0
<u>GPIO1</u>	UARR1_RX				
<u>GPIO0</u>	UART1_CTS		PWM1	GPIO1	EINT1
	UART1_RTS		PWM0	GPIO0	EINT0

Figure3: GPIOs Multiplex Function

8.2 UART Interface

BLW003 has two UART interfaces. The UART has M16C450 and M16550A modes of operation, which are compatible with a range of standard software drivers. And supports UART with configurable BAUD rates from 9.6Kbps, 19.2Kbps, 38.4Kbps, 115.2Kbps, and 921.6Kbps.

8.3 I2C Serial Interface

BLW003 features two I2C serial interface master controllers. The two signals of I2C channel 0 are I2C0_CLK and I2C0_DATA.

- I2C0_CLK is a clock signal that is driven by the master.



- I2C0_DATA is a bi-directional data signal that can be driven by either the master or the slave. It supports the clock rate of 50, 100, 200, and 400 KHz.
- I2C channel 1 supports the same feature as channel 0.

8.4 Auxiliary ADC function

BLW003 features one auxiliary ADC function. The ADC function contains a 4-channel analog switch, a single-end input asynchronous 12-bit SAR (Successive Approximation Register) ADC, and a digital averaging function. The digital averaging function can perform on-the-fly averaging function of 1/2/4/8/16/32/64 points. The ADC features the dithering function to enhance the DNL performance. The ADC uses an external VREF20 as a reference voltage.

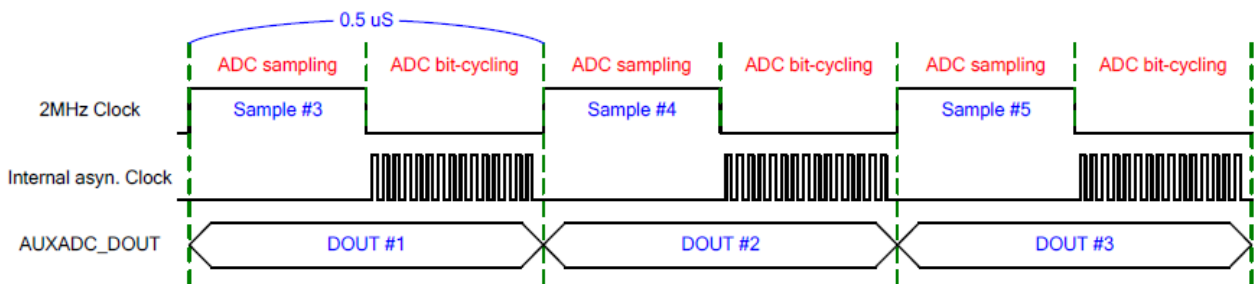


Figure4:Auxiliary ADC Clock Timing Diagram

Auxiliary ADC Features:

- ❑ Input channel number: 4 channels
- ❑ Sampling and output data rate: 2MS/s
- ❑ DNL without dithering and averaging: $<\pm 2\text{LSB}$
- ❑ DNL with dithering and averaging: $<\pm 1\text{LSB}$
- ❑ Dithering function: 16 levels with step size of 4LSB.

8.5 SPI Master Interface

BLW003 features one SPI master controller. It is used as an extension interface to control the peripheral device on expansion port. The SPI master controller supports the clock rates of 0.25, 0.5, 1, 2, 4, 6, 8, 10, and 12MHz. It supports two options of clock polarity (CPOL) and two options of initial clock phase (CPHA). SPI pins are multiplexed with I2S pins.

8.6 I2S Interface

BLW003 features one I2S interface, which is used to connect to an external audio codec. The I2S interface can support the I2S slave mode only. The five I2S signals are shown below. The I2S_MLK clock frequency is 16MHz. The external CODEC generates BCLK and LRCLK from MCLK. When configured as the I2S slave mode, the I2S interface can support two modes.



Table10: I2S Pin Description

Signal Name	Signal Description	Direction (Slave Mode)
I2S_MCLK	The base clock of the function.	Output
I2S_BCLK	The bit clock of the interface	Input
I2S_FS (LRCLK)	The left/right word select line of the interface	Input
I2S_TX	Digital audio output	Output
I2S_RX	Digital audio input	Input

Table11: I2S Slave Mode

Slave Mode	Bit Width	Input Sample (Uplink)	Output Sample (Downlink)	BCLK (Input)	FS (Input)
Mode 1	16b	16KHz, mono	16KHz, mono	512KHz	16KHz
Mode 2	16b	24KHz, mono	24KHz, mono	768KHz	24KHz

The I2S pins are multiplexed with SPI pins. The signal waveform of I2S is shown below.

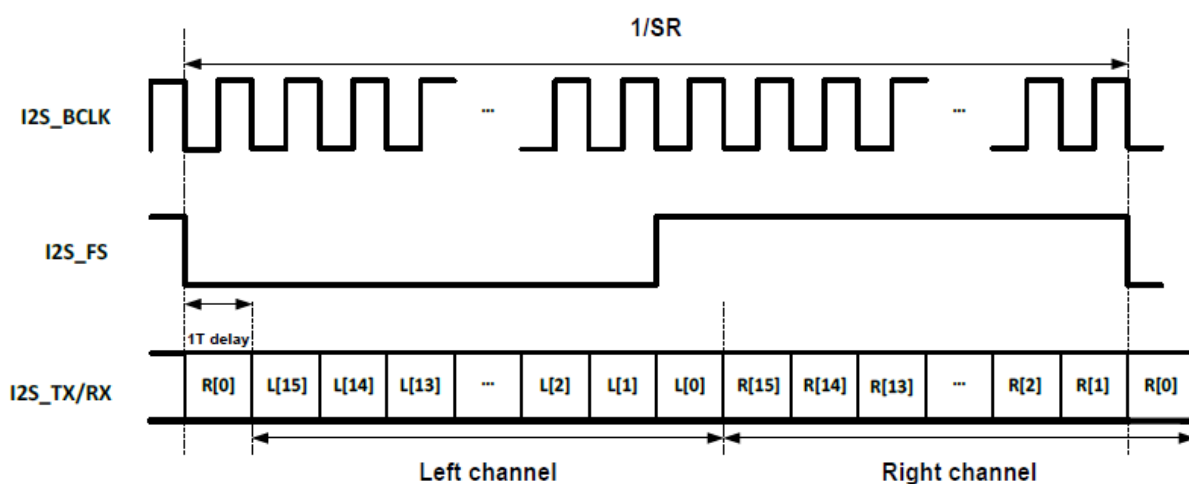


Figure5: I2S Signal Waveform

8.7 RTC

BLW003 features one RTC (Real Time Clock) module. The clock source is the 32.768 KHz Crystal .RTC has built in an accurate timer to wake up the system when it expires.



RTC uses a different power rail from PMU. In the hibernate mode, the PMU is turned off while the RTC module is remained powered on. The RTC module only consumes 3uA in hibernate mode.

RTC has a dedicated PMU control pin PMU_EN_RTC (pin 36 of module) used to turn on the power to the chip when the RTC timer expires and turn off the power to the chip when it intends to enter the deep sleep mode.

9 Bootstrap

The chip modes are sensed from the device pin during power up. After chip reset, the pull configuration are stored in a register and determine the device operation mode.the module use normal mode/40MHz/external 32.768KHz clock(not from 40MHz clock)

The module's Pin29"GPIO5",Pin27 " GPIO6", Pin 28" GPIO7", Pin16" GPIO35", Pin13" GPIO37", and Pin12" GPIO38" are is used for bootstrap. The system design should follow the following guide line:

- Those pins shall not be used as input functions because the signals from another device might affect the values sensed.
- Those pins shall not be used as an open-drain function because the pull-up resistor would affect the values sensed.

Table12: Bootstrap

Sub-Function	Pin	Value	Description
Flash mode (when SIP_MODE=1)	GPIO37	0	Flash normal mode
		1	Flash recovery mode
rtc_mode/external 32KHz	GPIO6	0	ext 32KHz clock disable
		1	ext 32KHz clock enable

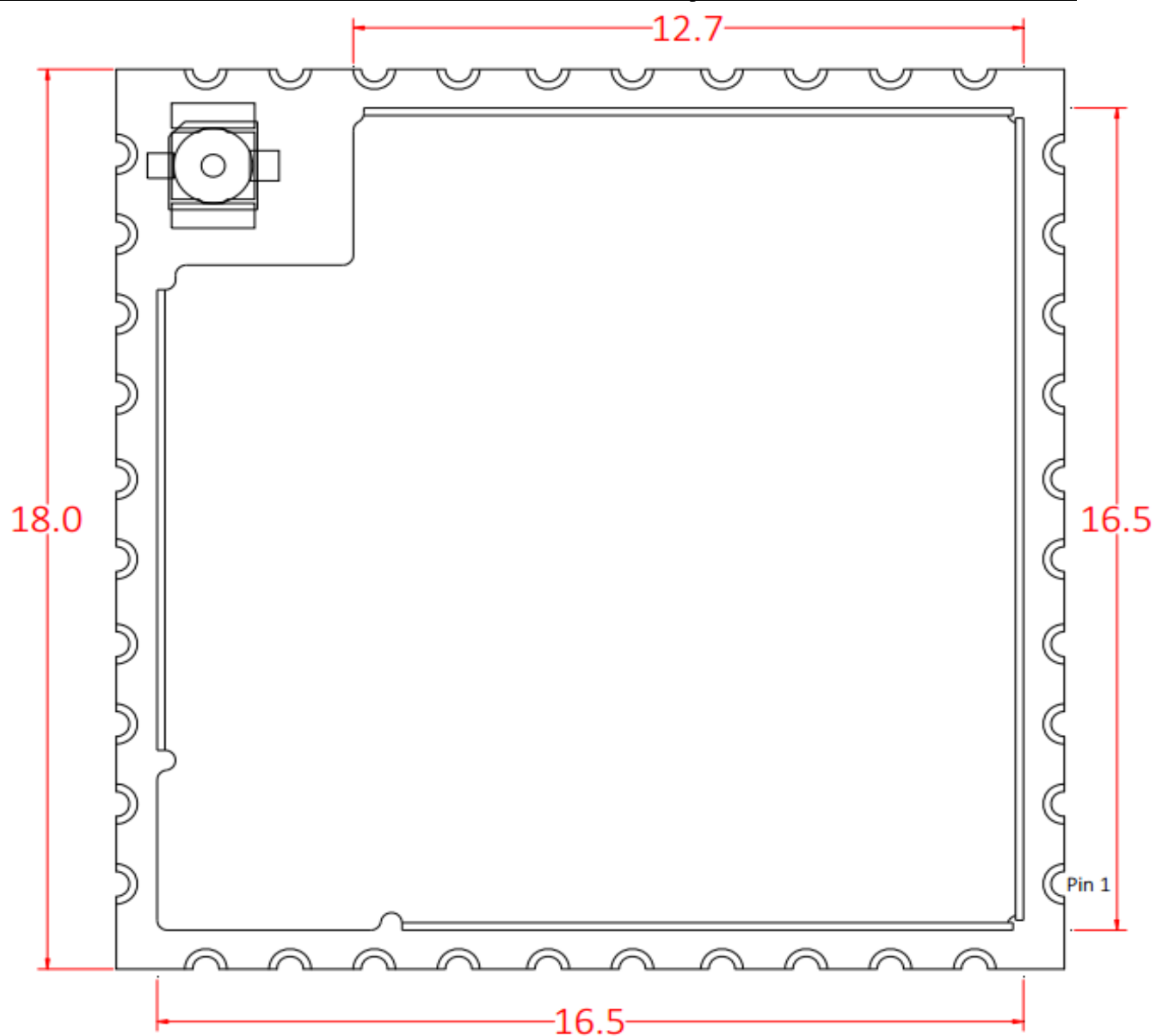
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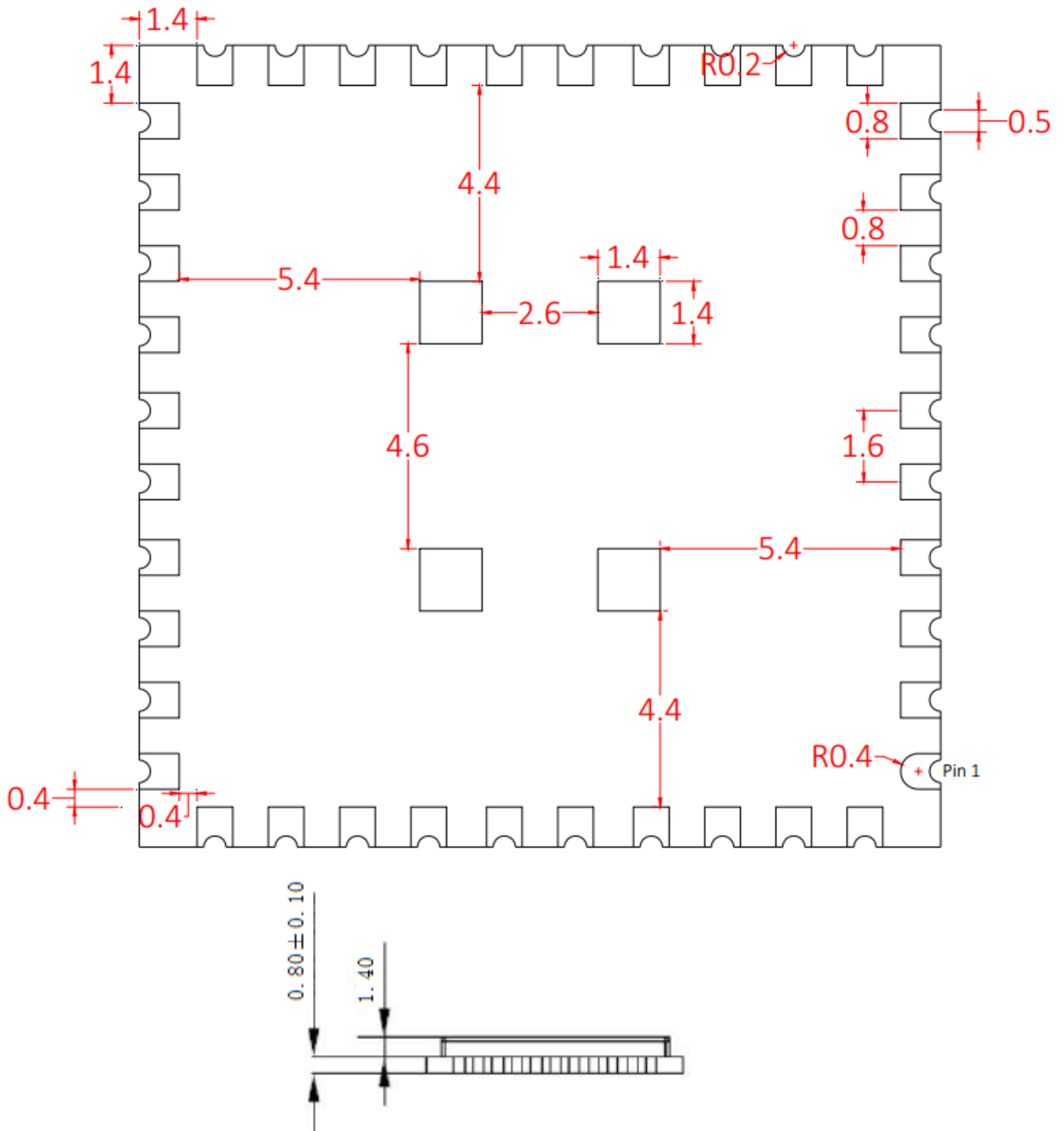
GPIO4、GPIO5、GPIO7、GPIO24、GPIO25、GPIO26,these gpios should not be connected with external other interfaces,keep float.

10 Package Dimensions

Dimension:18mmX18mm (WXL)

The Max height is 2.20mm .





11 Environmental Requirements

11.1 Operating Environment

Working temperature: -20°C to +70°C;

Storage temperature: -40°C to +80°C (no condensation);



Operating Humidity: 10% to 90%RH no condensation;

Storage humidity: 5% to 95%RH no condensation.

11.2 Recommended Reflow Profile

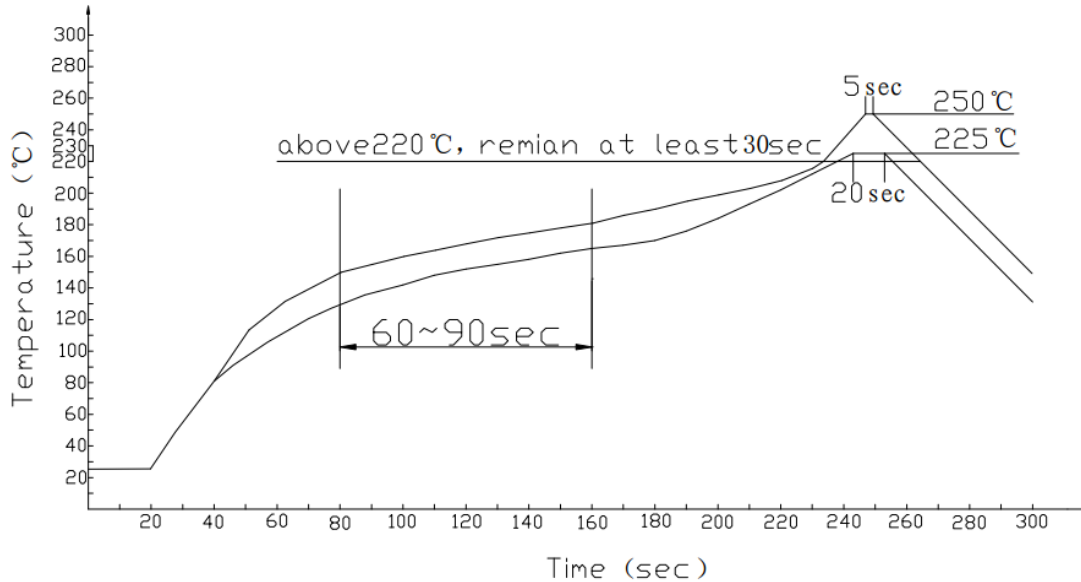


Figure7:Reflow Profile

注意:

Referred to IPC/JEDEC standard.

Peak Temperature : <250° C

Number of Times : ≤2 times

- Rising rate = 1~4°C /sec, 25°C to 150°C AVG
- Preheating temperature = 140°C to 150°C, 60sec~90sec
- temperature fluctuation = 225°C to 250°C, about 30sec
- Cooling rate = 2~6°C/sec, to 183°C, about 15sec
- Total time = about 300sec

11.3 Patch WIFI modules installed before the notice:

1. Please press 1 : 1 and then expand outward proportion to 0.7 mm, 0.12 mm thickness
When open a stencil
2. please insure the electrostatic protective measures for taking the WIFI module,
3. Reflow soldering temperature should be according to the customer the main size of the products, such as the temperature set at 250 + 5 °C.

About the module packaging, storage and use of matters needing attention are as follows:



1. The module of the reel and storage life of vacuum packing:

storage environment conditions: temperature in: $< 40^{\circ}\text{C}$, relative humidity: $< 90\%$ r.h.

2. The module vacuum packing once opened:

1) check the humidity Card: display value should be less than 30% (in blue), such as: 30% ~ 40% (pink) or greater than 40% (red) the module have been moisture absorption.

2.) factory environmental temperature humidity control: $\leq 30^{\circ}\text{C}$, $\leq 60\%$ r.h..

3). Once opened, the workshop the preservation of life for 168 hours.

3. Once opened, if when not used up within 168 hours:

1). The module must be again to remove the module moisture absorption.

2). The baking temperature: 125°C , 8 hours.

3.) After baking, put the right amount of desiccant to seal packages.