Hardware SPEC
Of
WM-BN-BM-22 WICED Module

Introduction

The WM-BN-BM-22 wireless SiP module which refers as "SiP module" is a small size module and consists of a Broadcom BCM4343x single-chip, a ST STM32F4 MCU. The WM-BN-BM-22 provides for the highest-level integration for electronic accessories on WICED licensing, featuring integrated IEEE 802.11b/g/n and BT4.1.

It includes a 2.4 GHz WLAN CMOS power amplifier (PA) that meets the output power requirements of most handheld systems. Along with the integrated power amplifier, the WM-BN-BM-22 also includes integrated transmit and receive baluns, further reducing the overall solution cost.

The small size & low profile physical design make it easier for system design to enable high performance wireless connectivity without space constrain. This multi- functionality and board-to-board physical interface provides SPI/quad SPI/I2C/I2S/UART/USB/ADC interface options.

Hardware WAPI acceleration engine, AES, TKIP, WPA and WPA2 are supported to provide the latest security requirement on your network.

For the software and driver development, USI provides extensive technical document and reference software code for the system integration under the agreement of Broadcom International Ltd.

Hardware evaluation kit and development utilities will be released base on listed OS and processors to OEM customers.

Features

BCM43438 Wi-Fi

- Single band 2.4GHz IEEE 802.11b/g/n + BT4.1
- Supports wireless data rates up to 65Mbit/s
- Integrated RF power amplifier

STM32F4 Microprocessor

- ARM 32-bit Cortex-M4 CPU
- CPU frequency up to 100MHz
- 1 MB Flash memory
- 256 KB SRAM
- Low-power sleep, standby and stop modes

WM-BN-BM-22 Wireless Sip Module

- Featuring integrated IEEE 802.11 b/g/n + BT4.1.
- Support Rx Antenna diversity
- Low power consumption & excellent power management performance extend battery life.
- Small size suitable for low volume system integration.
- Easy for integration into mobile and handheld device with flexible system configuration.
- Lead Free design which supporting Green design requirement, RoHS Compliance.
- Up to 30 programmable GPIOs.
  -Up to 2x I2C interfaces
  -Support 1x 4-wire UART + 1x 2-wire UART
  -Up to 3x I2S interfaces, out of 1 supports full-duplex
  -Up to 4 full-duplex SPI interfaces
  -Support USB 2.0 OTG full-speed interface
  -Up to 11 ADC channels
  -Up to 5x 16-bit timers, 1x 32-bit timers

Device Package

- 12x11x1.5 mm

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Change Sheet					
Rev.	Date	Description of change			Changed by
		Page	Par	Change(s)	
1.0	15/11/11	All	All	Preliminary Release	Chintang Lin
1.1	15/11/16	All		Modify IC and MCU p/n	Chintang Lin
1.2	16/03/14	9,11		Update Tx power consumption, Rx sensitivity	Chintang Lin
1.3	16/06/24	2,15~20		Update Pin definitions, footprint, Module Height	Chintang Lin

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The WM-BN-BM-22 module - is one of the product families in UG's product offering, targeting for system integration requiring a smaller form factor. It also provides the standard migration to high data rate to UG's current SIP customers.

The purpose of this document is to define the product specification for 802.11b/g/n + BT4.1 module WM-BN-BM-22. All the data in this document is based on Broadcom 43438 data sheet , STM32F412xx data sheet and other documents provided from Broadcom and ST . The data will be updated after implementing the measurement of the module.

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2. BLOCK DIAGRAM

The WM-BN-BM-22 module is designed based on Broadcom 4343x chipset and ST MCU solution. It supports generic SPI, UART and USB interface to connect the WLAN to the host processor. A simplified block diagram of the WM-BN-BM-22 module is depicted in below Figure.
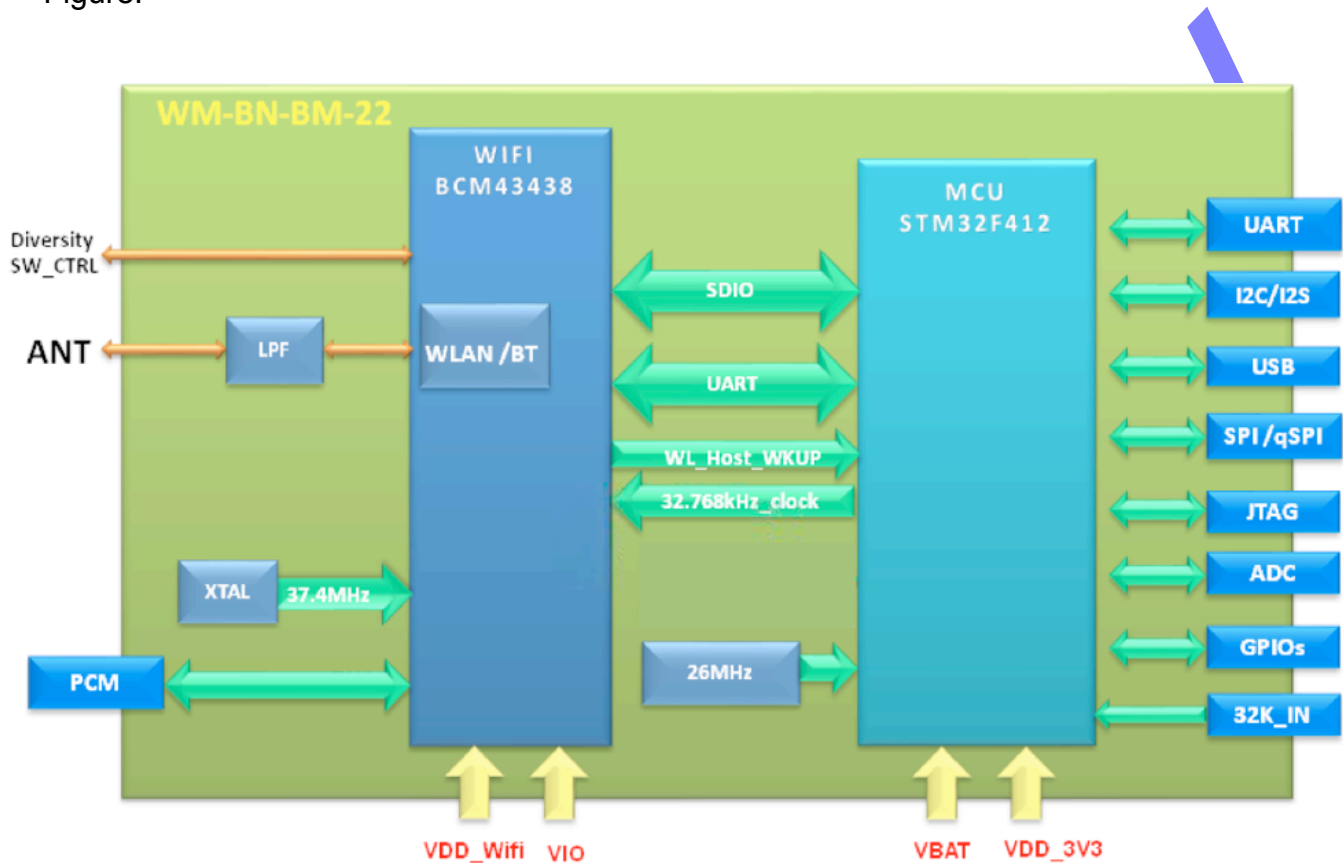
WM-BN-BM-22 Module Block Diagram

3. DELIVERABLES

The following products and software will be part of the product.

- WM-BN-BM-22 Module with packaging
- Evaluation kits (with SPI / UART / USB interface)
- Software utility which supporting customer for integration, performance test and homologation. Capable of testing, loading (firmware) and configuring (MAC, CIS) for the WM-BN-BM-22 module.
- Unit Test / Qualification report
- Product Specifications.
- Agency certification pre-test report base on adapter boards

4. REFERENCE DOCUMENTS

C.I.S.P.R. Pub. 22	"Limits and methods of measurement of radio interference characteristics of information technology equipment." International Special Committee on Radio Interference (C.I.S.P.R.), Third Edition, 1997.
CB Bulletin No. 96A	"Adherence to IEC Standards: "Requirements for IEC 950, 2nd Edition and Amendments 1 (1991), 2(1993), 3 (1995) and 4(1996). Product Categories: Meas, Med, Off, Tron." IEC System for Conformity Testing to Standards for Safety of Electrical Equipment (IECEE), April 2000.
CFR 47, Part 15-B	"Unintentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Radio Frequency Devices, Subpart B.
CFR 47, Part 15-C	"Intentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Subpart C. URL: http://www.access.gpo.gov/nara/cfr/waisidx_98/47cfr15_98.html
CSA C22.2 No. 950-95	"Safety of Information Technology Equipment including Electrical Business Equipment, Third Edition." Canadian Standards Association, 1995, including revised pages through July 1997.
EN 60 950	"Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization (CENELEC), 1996, (IEC 950, Second Edition, including Amendment 1, 2, 3 and 4).
IEC 950	"Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization, Intentional Electrotechnical Commission. 1991, Second Edition, including Amendments 1, 2, 3, and 4.
IEEE 802.11	"Wireless LAN Medium Access Control (MAC) And Physical Layer (PHY) Specifications." Institute of Electrical and Electronics Engineers. 1999.

5. TECHNICAL SPECIFICATIONS

5.1 ABSOLUTE MAXIMUM RATING

Supply Power	Max +3.6 Volt	
Non Operating Temperature	- 40° to 85° Celsius	
Voltage ripple	+/- 2%	Max. Values not exceeding Operating voltage

5.2 RECOMMEND OPERATION CONDITION

TEMPERATURE, HUMIDITY

The WM-BN-BM-22 module has to withstand the operational requirements as listed in the table below.

Operating Temperature	-20° to 70° Celsius	
Humidity range	Max 95%	Non condensing, relative humidity

The extreme operating ambient temperature can be -40degC and 85degC, but exposure to absolute-maximum-rated conditions may cause performance degradation and affect device reliability.

VOLTAGE

Power supply for the WM-BN-BM-22 module will be provided by the host via the power pins

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD_WIFI	Power Supply for BCM4343x*	3.0	3.3	3.6	V
VDDIO_WIFI	Host Interface Power Supply	3.0	3.3	3.6	V
VBAT	Backup operating voltage	3.0	3.3	3.6	V
VDD_3V3	Power Supply for MCU	3.0	3.3	3.6	V

Note: The BCM43438 is functional across this range of voltages. Optimal RF performance specified in this data sheet, however, is guaranteed only for 3.2V <VDD_WIFI<3.6V.

CURRENT CONSUMPTION

The WM-BN-BM-22 on TX mode Output current Consumption :
(Typical spec is defined @3.3V 25℃; MAX. spec is defined @3.0V 60℃)

Current Consumption	TYP.	MAX.
Tx output power @14 dBm on 11b 1M	320	380
Tx output power @ 14 dBm on 11b 11M	300	360
Tx output power @ 12 dBm on 11g 6M	285	340
Tx output power @ 12 dBm on 11g 54M	225	280
Tx output power @ 12 dBm on 11n MCS0	280	335
Tx output power @ 12 dBm on 11n MCS7	220	275

The WM-BN-BM-22 on RX mode current Consumption:

(Typical spec is defined @3.3V 25℃; MAX. spec is defined @3.0V 55℃)

Current Consumption	TYP.	MAX.
Rx @ 11b 1M	54	85
Rx @ 11b 11M	54	85
Rx @ 11g 6M	53	85
Rx @ 11g 54M	53	85
Rx @ 11n MCS0	53	85
Rx @ 11n MCS7	53	85

Remark: Tested with SDK3.5.1, FW version 7.45.41

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5.3 WIRELESS SPECIFICATIONS

5.3.1 WLAN

The WM-BN-BM-22 module complies with the following features and standards;

Features	Description
WLAN Standards	IEEE 802 11b/g/n
Antenna Port	Single Antenna
Frequency Band	2.400 GHz – 2.484 GHz
Number of Sub Channels	1~ 14 Channels
Modulation	DSSS, CCK, OFDM, BPSK, QPSK,16QAM, 64QAM
Supported data rates	1, 2, 5.5, 11 (Mbps) 6, 9, 12, 18, 24, 36, 48, 54 (Mbps) HT20_MCS0(6.5Mbps) ~ HT20_MCS7(65Mbps)

5.3.2 BLUETOOTH

The Radio specification is compliant with the Bluetooth ^{TM} 2.1 + EDR specification

Features	Description
Frequency Band	2400 MHz ~ 2483.5 MHz
Number of Channels	79 channels
Modulation	FHSS (Frequency Hopping Spread Spectrum) , GFSK, DPSK
Antenna Port	Single Antenna for Wi-Fi and BT

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5.4 RADIO SPECIFICATIONS

5.4.1 WIFI'S OUTPUT POWER、EVM、SENSITIVITY

The WM-BN-BM-22 module WiFi output power* as list in the table below:

Characteristics		TYP.	Criteria	Unit
RF Average Output Power, 802.11b CCK Mode	1M	14	+/- 2	dBm
	11M	14	+/- 2	dBm
RF Average Output Power, 802.11g OFDM Mode	6M	12	+/- 2	dBm
	54M	12	+/- 2	dBm
RF Average Output Power, 802.11n OFDM Mode	MCS0	12	+/- 2	dBm
	MCS7	12	+/- 2	dBm

WiFi TX EVM* follow the IEEE spec that as list in the table below:

Characteristics		IEEE Spec	Unit
RF Average Output EVM (11b)	@1 Mbps	-10	dB
	@11 Mbps	-10	dB
RF Average Output EVM (11g)	@6 Mbps	-5	dB
	@54 Mbps	-25	dB
RF Average Output EVM (11n)	@ MCS0	-5	dB
	@ MCS7	-28	dB

The WM-BN-BM-22 module WiFi Sensitivity* as list in the table below:

Receiver Characteristics	TYP.	MAX.	Unit
PER <8%, Rx Sensitivity @ 1 Mbps	-95	-82	dBm
PER <8%, Rx Sensitivity @ 11 Mbps	-88	-76	dBm
PER <10%, Rx Sensitivity @ 6 Mbps	-90	-82	dBm
PER <10%, Rx Sensitivity @ 54 Mbps	-75	-65	dBm
PER <10%, Rx Sensitivity @ MCS0	-89	-82	dBm
PER <10%, Rx Sensitivity @ MCS7	-72	-64	dBm

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* Optimal RF performance, as specified in this data sheet, is guaranteed only for temperatures between -10℃ and 55℃

5.4.2 BLUETOOTH RADIO CHARACTERISTICS

Parameter	Conditions	Min.	Typ.[b]	Max.[c]	Unit
Basic Rate					
Output Power	Average Power	0	TBD	20	dBm
Frequency Range[a]		2400	-	2483.5	MHz
Sensitivity (BER)	BER ≦0.1%	-	-89	-70[a]	dBm
Maximum Input Level	BER ≦0.1%	-	-	-20[a]	dBm
EDR					
Relative Power[a]	π/4-DQPSK	-4.0	0	1.0	dBm
	8DPSK	-4.0	0	1.0	dBm
EDR Sensitivity(BER)	π/4-DQPSK BER ≦0.01%	-	-84	-70[a]	dBm
	8DPSK BER ≦0.01%	-	-84	-70[a]	dBm
EDR Maximum Input Level	π/4-DQPSK BER ≦0.1%	-	-	-20[a]	dBm
	8DPSK BER ≦0.1%	-	-	-20[a]	dBm
BLE					
BLE Output Power	Average Power	-20	TBD	10	dBm
BLE Sensitivity (PER)	PER ≦30.8%	-	-89	-70[a]	dBm
BLE Maximum Input Level	PER ≦30.8%	-	-	-10[a]	dBm

* Note: a. Refer to Bluetooth specification.
        b. Based on the test result at room temperature and typical voltage.
        c. Based on the test result at the corner temperature and voltage operating.
** Note: The BT Performance will be updated after samples reliability test

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6. FLASH MEMORY

6.1 MCU EMBEDDED FLASH MEMORY

The devices embed up to 1 Mbytes of Flash memory available for storing programs and

data. To optimize the power consumption the Flash memory can also be switched off in Run or in Sleep mode. Two modes are available: Flash in Stop mode or in Deep Sleep mode (trade off between power saving and startup time. Before disabling the Flash, the code must be executed from the internal RAM.

For information on programming, erasing and protection of the internal Flash memory, please refer to the STM32F412RG Flash programming manual. The reference and Flash programming manuals are both available from the STMicroelectronics website *www.st.com*.

6.2 EXTERNAL FLASH MEMORY

WM-BN-BM-22 provide the option that user can extend memory by external flash. The SPI and qSPI are both supported for STM32F412.

6.2.1 SPI

It allow user to run different memory densities and peripherals for a greater degree of freedom during the development cycle. The SPi can communicate at up to 25Mbit/s. It also can be configured to operate in TI mode for communications in master mode and slave mode.

6.2.2 qSPI

All devices embed a QuadSPI memory interface, which is a specialized communication interface targeting single, dual or quad SPI Flash memories. It can work in direct mode through registers, external Flash status register polling mode and memory mapped mode. They can be accessed in 8, 16 or 32-bit mode. Code execution is also supported. The opcode and the frame format are fully programmable. Communication can be performed either in single data rate or dual data rate.

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7. I/O PORT CHARACTERISTICS

Each of the GPIO pins can be configured by software as output (push-pull or open-drain, with or without pull-up or pull-down), as input (floating, with or without pull-up or pull-down) or as peripheral alternate function. Most of the GPIO pins are shared with digital or analog alternate functions. All GPIOs are high-current-capable and have speed selection to better manage internal noise, power consumption and electromagnetic emission.
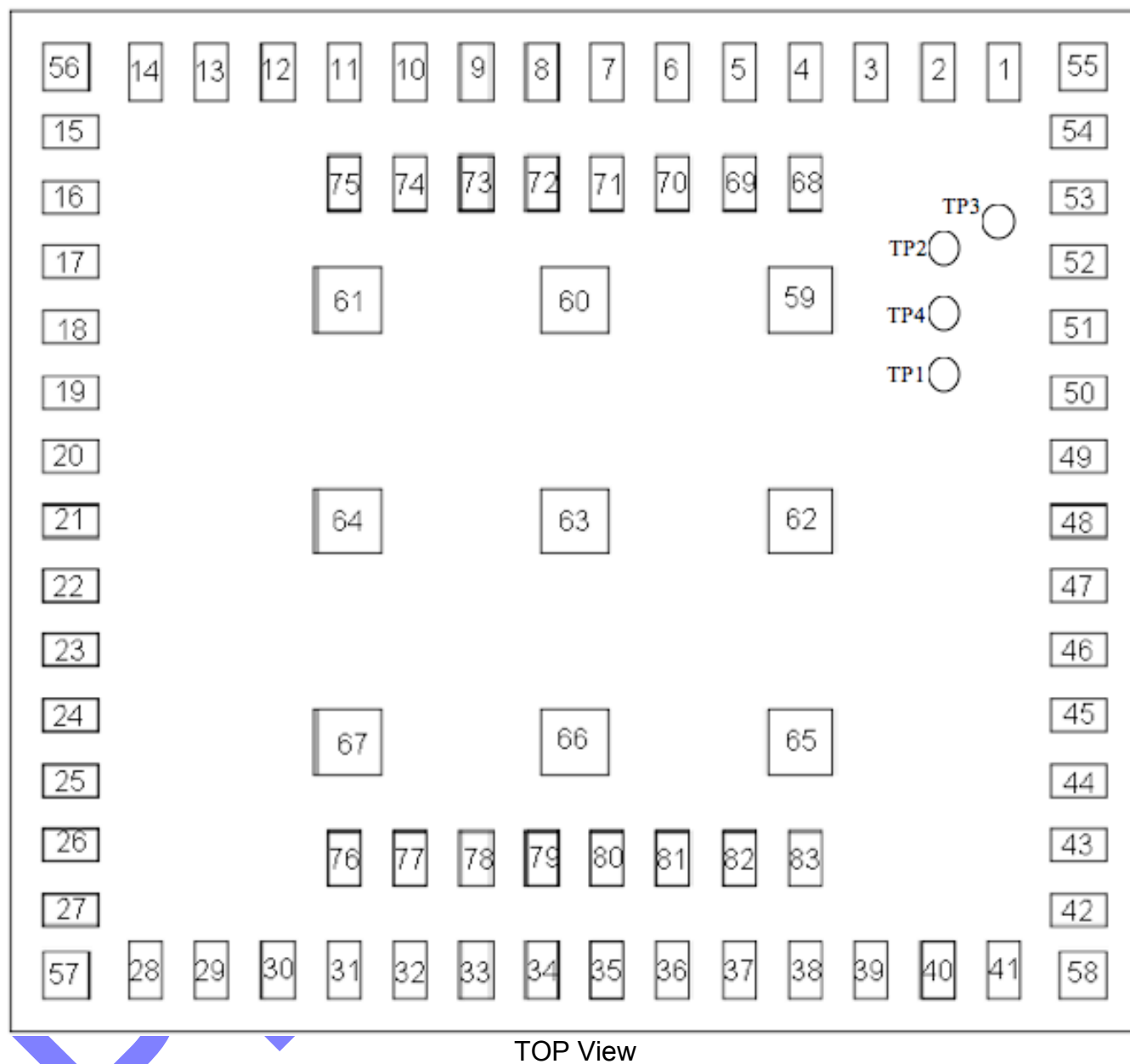
The I/O configuration can be locked if needed by following a specific sequence in order to avoid spurious writing to the I/Os registers.

8. MODULE DIMENSIONS

The WM-BN-BM-22 module size and thickness is "12 mm (W) x 11 mm (L) x 1.5 mm (H)

+/-0.1mm "(Including metal shielding)

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9. PIN DESCRIPTION

TOP View
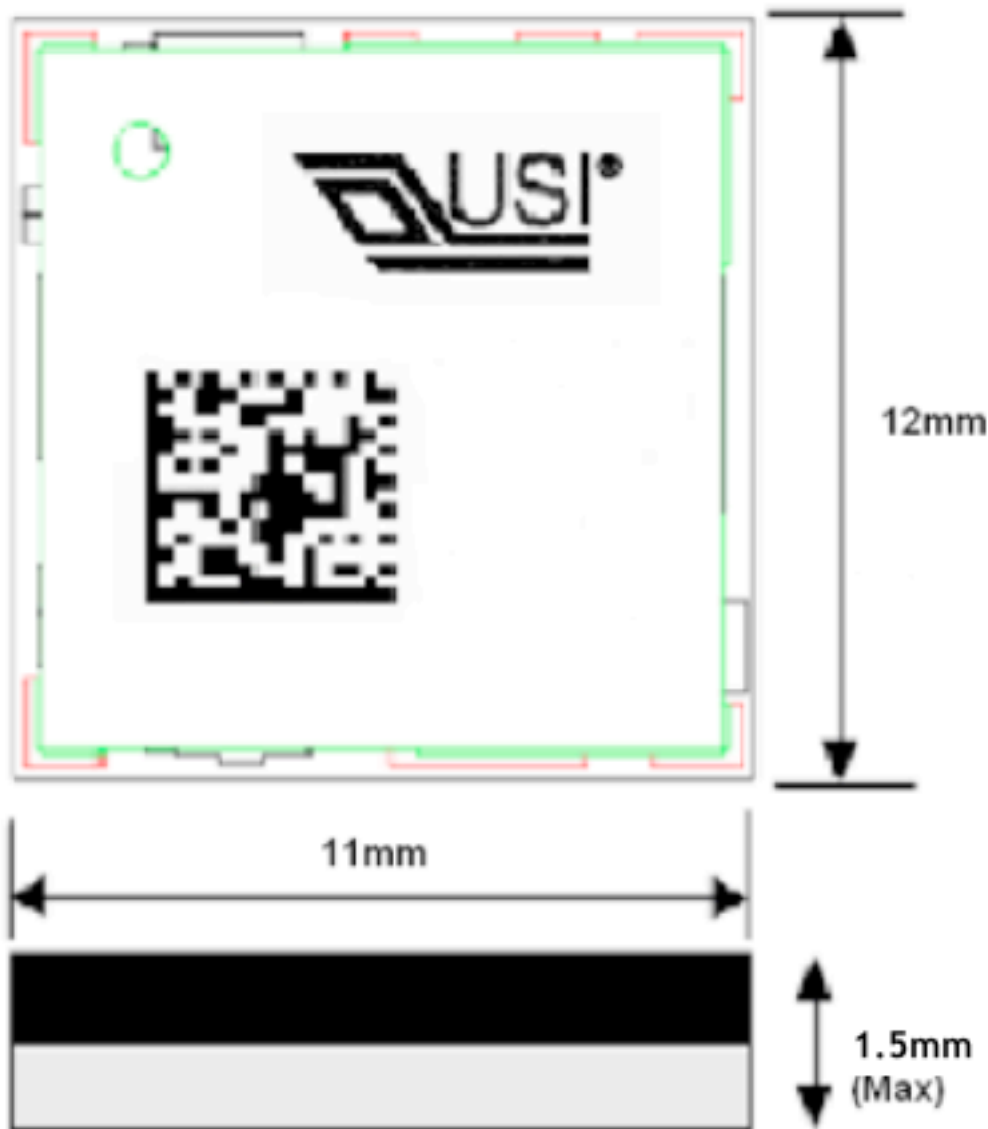
Pin Description

Pin-Number	Pin-Define	Type	Description
1	I2S_CK	I/O	I2S_CK/GPIO pin
2	I2S_WS	I/O	I2S_WS/GPIO pin
3	I2S_MCK	I/O	I2S_MCK/GPIO pin
4	I2S_SD	I/O	I2S_SD/GPIO pin
5	MICRO_GPIO_3	I/O	GPIO pin
6	MICRO_GPIO_2	I/O	GPIO pin
7	MICRO_GPIO_1	I/O	GPIO pin
8	MICRO_GPIO_0	I/O	GPIO pin
9	AUTH_RST	O	I2C_RST/GPIO pin
10	AUTH_SCL	O	I2C_SCL/GPIO pin
11	AUTH_SDA	I/O	I2C_SDA/GPIO pin
12	GND	--	Ground
13	WL_GPIO_2	O	RF div. switch control
14	GND	--	Ground
15	ANT	I/O	Antenna port for WLAN
16	GND	--	Ground
17	GND	--	Ground
18	GND	--	Ground
19	VDD_WIFI	I	VBAT for BCM43438
20	VDD_WIFI	I	VBAT for BCM43438
21	GND	--	Ground
22	MICRO_SPI_SSN	I/O	SPI_SS
23	MICRI_SPI_MOSI	I/O	SPI_MOSI
24	MICRO_SPI_SCK	I/O	SPI_SCK
25	MICRO_SPI_MISO	I/O	SPI_MISO
26	MICRO_RST_N	I/O	MCU Reset
27	MICRO_WKUP	I/O	MCU-Wake UP

Pin-Number	Pin-Define	Type	Description
28	VBAT	I	MCU operating voltage input (power supply for RTC, external clock, 32 kHz oscillator and backup registers (through power switch) when VDD is not present.)
29	GND	--	Ground
30	GND	--	Ground
31	qSPI_IO1	I/O	qSPI_IO1/GPIO pin
32	qSPI_IO2	I/O	qSPI_IO2/GPIO pin
33	qSPI_NCS	O	qSPI_NCS/GPIO pin
34	qSPI_IO3	I/O	qSPI_IO3/GPIO pin
35	qSPI_CLK	O	qSPI_CLK/GPIO pin
36	qSPI_IO0	I/O	qSPI_IO0/GPIO pin
37	GND	--	Ground
38	MICRO_UART_RX	I/O	UART_RX
39	MICRO_UART_TX	I/O	UART_TX
40	MICRO_JTAG_TCK	I/O	JTAG_TCK
41	MICRO_JTAG_TDO	I/O	JTAG_TDO
42	MICRO_JTAG_TRSTN	I/O	JTAG_TRSTN
43	MICRO_JTAG_TDI	I/O	JTAG_TDI
44	MICRO_JTAG_TMS	I/O	JTAG_TMS
45	GND	--	Ground
46	VDD_3V3	I	MCU operating voltage input
47	VDD_3V3	I	MCU operating voltage input
48	GND	--	Ground
49	VDDIO_WIFI	I	VDDIO for BCM43438
50	GND	--	Ground
51	MICRO_USB_HS_DP	I/O	USB_HS_DP
52	MICRO_USB_HS_DN	I/O	USB_HS_DN
53	MICRO_GPIO_7	I/O	GPIO pin
54	BOOT0	I	Pull high for programming ; Pull low for normal mode

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Pin-Number	Pin-Define	Type	Description
55	GND	--	Ground
56	GND	--	Ground
57	GND	--	Ground
58	GND	--	Ground
59 ~ 67	GND	--	Ground
68	GND	--	Ground
69	32K_IN	I	External 32.768K IN
70	GND	--	Ground
71	BT_I2S_DO	I/O	I2S_DO on BCM43438
72	BT_I2S_WS	I/O	I2S_WS on BCM43438
73	BT_I2S_CLK	I	2S_CLK on BCM43438
74	GND	--	Ground
75	BT_HOST_WKUP	O	BT Host Wake Up pin
76	NC	--	Not Connected
77	NC	--	Not Connected
78	WL_GPIO_1	I/O	WLAN GPIO
79	BT_PCM_CLK	I	PCM_CLK
80	BT_PCM_OUT	O	PCM_OUT
81	BT_PCM_SYNC	I	PCM_SYNC
82	BT_PCM_IN	O	PCM_IN
83	GND	--	Ground
TP1	BT_RTS	I	BT RTS, for testing only
TP2	BT_CTS	O	BT CTS, for testing only
TP3	BT_RXD	I	BT RXD, for testing only
TP4	BT_TXD	O	BT TXD, for testing only

10. MODULE DIMENSION & RECOMMEND LAYOUT DIMENSION
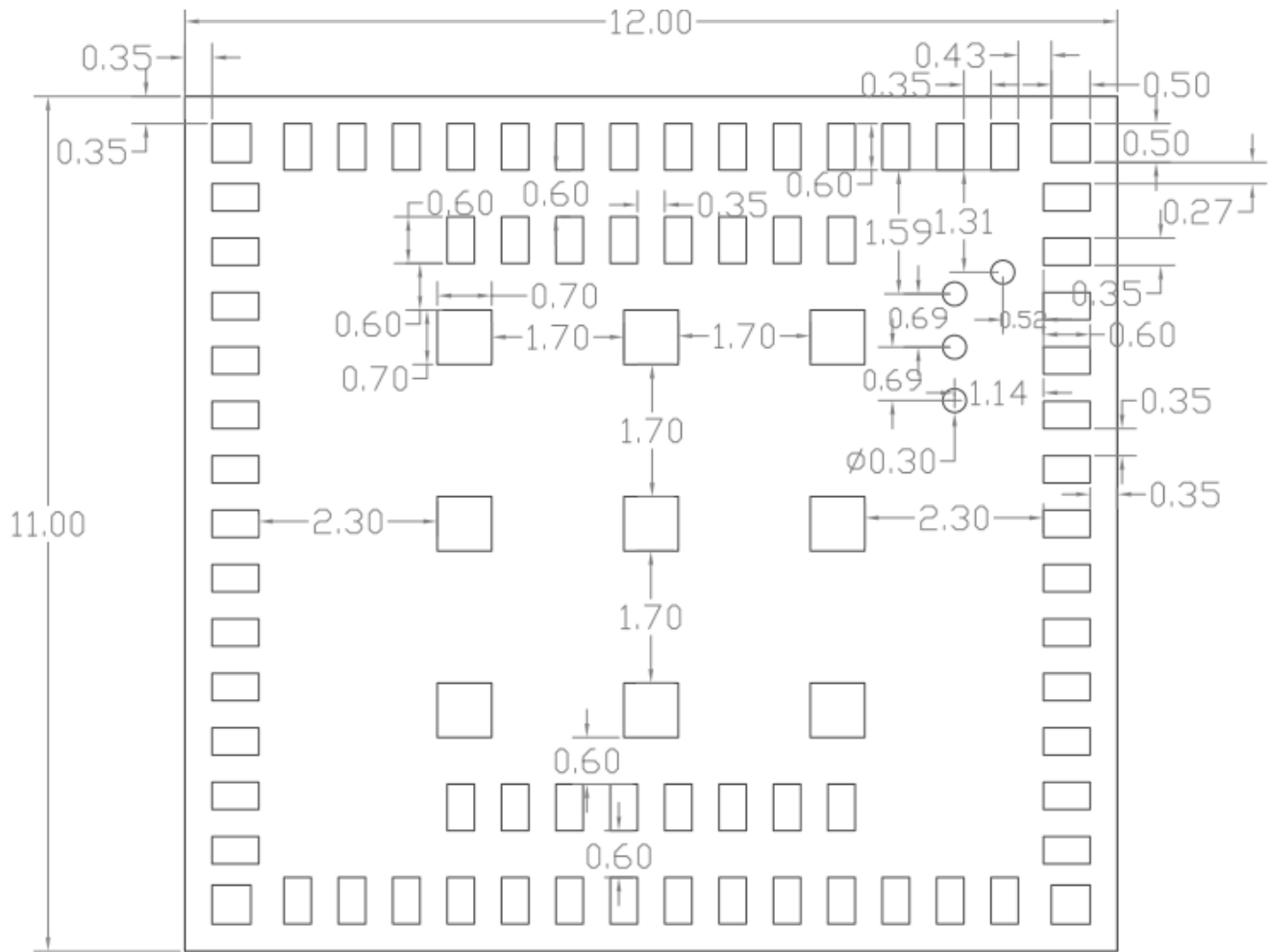
Top View Unit:mm

11. RECOMMEND REFLOW PROFILE
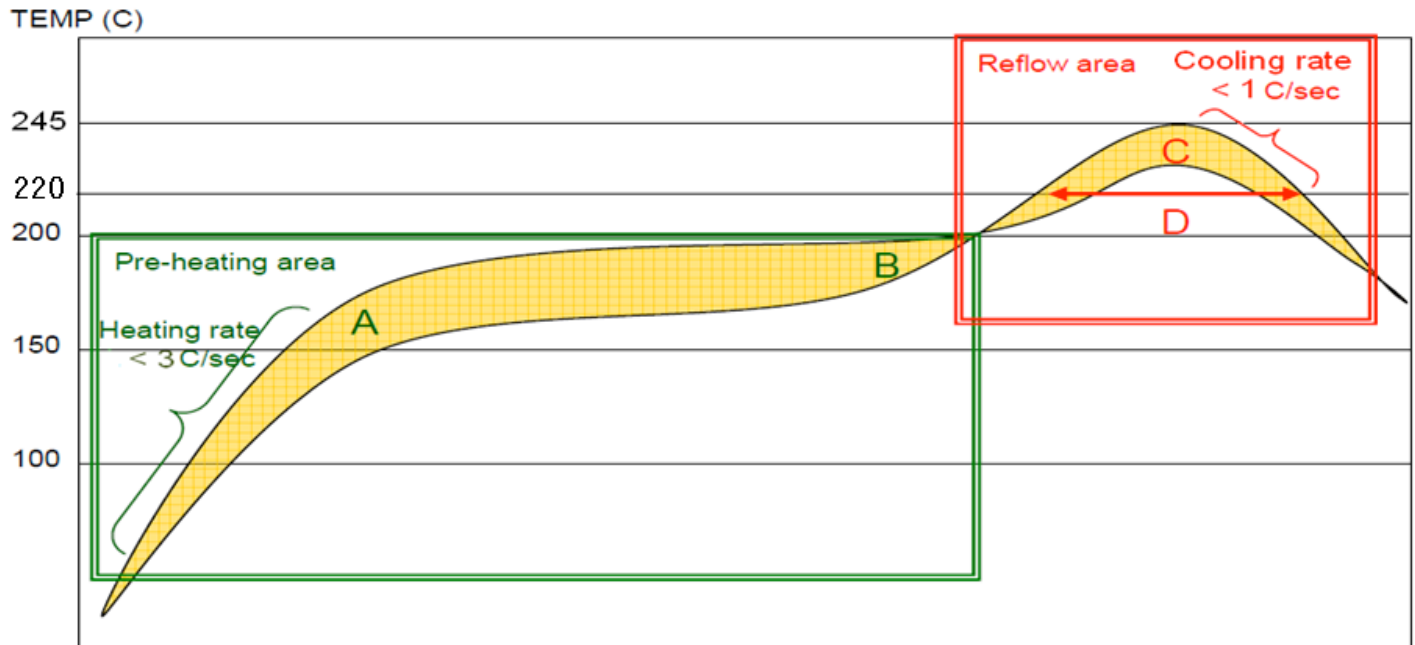
A-B. Temp.: 150~200℃; soak time:60~120sec.
C. Peak temp: 235~245℃
D. Time above 220℃: 40~90sec.
Suggestion: Optimal cooling rate is <1℃/sec. from peak to 220 ℃.

12. PACKAGE AND STORAGE CONDITION(FOR REFERENCE)

13. ESD LEVEL

Note:
1. Surface Resistivity:
   Interior:10^9~$10^{11}\Omega$/SQUARE
   EXTERIOR:10^8~$10^{12}\Omega$/SQUARE
2. Dimension:475*420mm
3. Tolerance:+5,0mm
4. Color:
   Background : Gray
   Text : Red

Length leader / trailer tape:
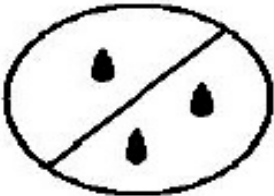
Leader tape: ≥550mm which includes ≥100mm of carrier tape with empty compartments and covered with tape; remaining part might be of cover tape only.

Trailer tape: ≥160mm with empty compartments and covered with tape.

NOTES:

1. Material: Conductive Polystyrene (Recycle)

2. Color: Black

3. Surface resIstance: 10^6Error! Reference source not found. **Ohms/square 以下.**

   Cumulative tolerance per 10 pictches(P_0) is ±0.2mm.

   A_0 & B_0 are measured on the plane by 0.3mm above the bottom of the pocket.

4. K_0 is measured from the Inside bottom of the pocket to the top surface of the carrier.

5. Pocket position relative to sprocket hold is measured as true position of pocket, not sprocket hold.

14. MSL LEVEL / STORAGE CONDITION

Life cycle: 2 years
Broadcom is Trademark of 3'rd Party.

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