

# Product SPEC Of WM-BAN-MT-41 Module

## Introduction

The WM-BAN-MT-41 is a small size module and consists of a MTK MT7697HD and an on-board of 2.4G/5G dual band antenna. The WM-BAN-MT-41 provides the highest level integration for electronic accessories and handheld devices.

The small size and low profile physical design make it easier for system board to enable high performance wireless connectivity without space constraint.

**Device Package**  
16x23x2.2 mm



## Features

### WM-BAN-MT-41 Wireless Module

- Featuring integrated IEEE 802.11 a/b/g/n + BT4.2
- ARM 32-bit Cortex-M4 CPU
- 28 General Purpose IOs multiplexed with other interfaces
- Low power consumption and excellent power management performance which extends battery life
- Small size suitable for low volume system integration
- Lead Free design which supporting Green design requirement, RoHS Compliance

## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

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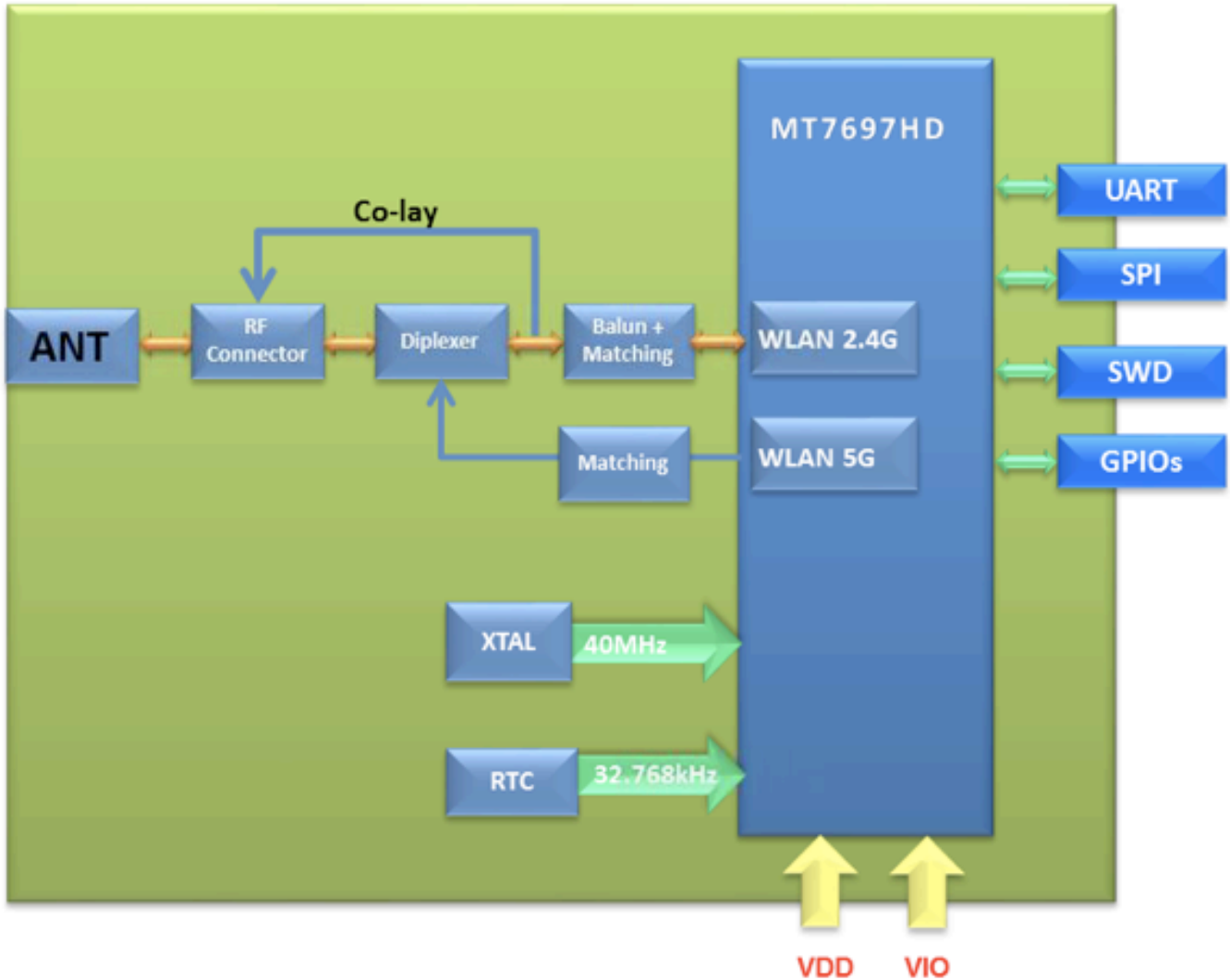
Change Lists					
Rev.	Date	Description of document change			Changed by
		Page	Par	Change(s)	
1.0	12/17/18	All	All	Initial Release	Chintang Lin
1.1	1/3/19	All	All	Remove watermark and optimize document	Chintang Lin

## TABLE OF CONTENTS

<b>Introduction</b> .....	2
<b>Features</b> .....	2
<b>1. BLOCK DIAGRAM</b> .....	5
<b>2. REFERENCE DOCUMENTS</b> .....	6
<b>3. TECHNICAL SPECIFICATIONS</b> .....	7
3.1. ABSOLUTE MAXIMUM RATING .....	7
3.2. RECOMMEND OPERATION CONDITION .....	7
TEMPERATURE, HUMIDITY .....	7
VOLTAGE .....	7
CURRENT CONSUMPTION .....	7
3.3. WIRELESS STANDARD .....	8
3.3.1 WLAN .....	8
3.3.2 BLUETOOTH .....	9
3.4. RADIO SPECIFICATIONS .....	9
3.4.1 WIFI'S OUTPUT POWER、EVM、SENSITIVITY .....	9
3.4.2 BLUETOOTH RADIO CHARACTERISTICS .....	11
<b>4. I/O PORT CHARACTERISTICS</b> .....	12
<b>5. INTERFACES</b> .....	13
5.1. UART .....	13
5.2. I2C .....	13
5.3. GPIO .....	13
<b>6. POWER ON SEQUENCE</b> .....	14
<b>7. MODULE DIMENSIONS</b> .....	15
<b>8. PIN DESCRIPTION</b> .....	16
<b>9. MODULE DIMENSION &amp; RECOMMEND LAYOUT DIMENSION</b> .....	18
<b>10. RECOMMENDED REFLOW PROFILE</b> .....	19
<b>11. PACKAGE AND STORAGE CONDITION</b> .....	20
11.1. PACKAGE .....	20
11.2. EMC/ESD LEVEL .....	20
11.3. MSL LEVEL/STORAGE CONDITION (REFERENCE ONLY) .....	21
11.4. ORDERING INFORMATION .....	21

## 1. BLOCK DIAGRAM

The WM-BAN-MT-41 module is designed based on MT7697HD chipset. It supports UART interface to connect the chipset to the host processor. A simplified block diagram of the WM-BAN-MT-41 module is depicted in below Figure.



Module Block Diagram

### 2. 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, 2 <sup>nd</sup> 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: <a href="http://www.access.gpo.gov/nara/cfr/waisidx_98/47cfr15_98.html">http://www.access.gpo.gov/nara/cfr/waisidx_98/47cfr15_98.html</a>
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.

### 3. TECHNICAL SPECIFICATIONS

#### 3.1. ABSOLUTE MAXIMUM RATING

Supply Power	Max +3.5 Volt	
Non Operating Temperature	- 40° to 85° Celsius	
Voltage ripple	+/- 2%	Max. Values not exceeding Operating voltage

#### 3.2. RECOMMAND OPERATION CONDITION

##### TEMPERATURE, HUMIDITY

The WM-BAN-MT-41 module has to withstand the operational requirements as listed in the table below

Operating Temperature	-30° to 85° Celsius	
Specification Temperature	-20° to 70° Celsius	
Humidity range	Max 85%	Non condensing, relative humidity

All RF characteristics defined in the spec sheet are compliant in Specification Temperature Range. Functionality is guaranteed but performance may derate at extreme temperatures.

##### VOLTAGE

The host via the power pins will provide power supply for the WM-BAN-MT-41 module

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD_3V3	Power Supply for MCU	3.1	3.3	3.5	V

##### CURRENT CONSUMPTION

(Typical spec is defined @3.3V 25DegC; MAX. spec is defined @3.1V 70DegC)

Current Consumption*	TYP.	MAX.
Tx output power @18dBm on 11b 1M	265mA	335mA
Tx output power @ 18dBm on 11b 11M	260mA	335mA
Tx output power @ 16dBm on 11g 6M	245mA	315mA
Tx output power @ 15dBm on 11g 54M	185mA	305mA
Tx output power @ 16dBm on 11n MCS0 (2.4G)	245mA	315mA
Tx output power @ 15dBm on 11n MCS7 (2.4G)	180mA	305mA
Tx output power @ 15dBm on 11a 6M	325mA	390mA
Tx output power @ 13dBm on 11a 54M	255mA	385mA
Tx output power @ 15dBm on 11n MCS0 (5G)	325mA	390mA
Tx output power @ 13dBm on 11n MCS7 (5G)	255mA	385mA
Tx output power @ 5dBm on BLE	65mA	125mA

## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

\* Measured in Tx normal mode (packet Tx), the current is averaged over on-duty period

(Typical spec is defined @3.3V 25DegC; MAX. spec is defined @3.1V 70DegC)

<b>Current Consumption</b>	<b>TYP.</b>	<b>MAX.</b>
Rx @ 11b 1M	80mA	115mA
Rx @ 11b 11M	80mA	115mA
Rx @ 11g 6M	80mA	115mA
Rx @ 11g 54M	80mA	115mA
Rx @ 11n MCS0 (2.4G)	80mA	115mA
Rx @ 11n MCS7 (2.4G)	80mA	115mA
Rx @ 11a 6M	90mA	130mA
Rx @ 11a 54M	90mA	130mA
Rx @ 11n MCS0 (5G)	90mA	130mA
Rx @ 11n MCS7 (5G)	90mA	130mA
Rx @ BLE	45mA	110mA

### 3.3. WIRELESS STANDARD

#### 3.3.1 WLAN

The WM-BAN-MT-41 module complies with the following features and standards;

<b>Features</b>	<b>Description</b>
WLAN Standards	IEEE 802 11 a/b/g/n
Antenna Port	Single Antenna
Frequency Band	2.400 GHz – 2.484 GHz 5.180 GHz – 5.825 GHz
Number of Sub Channels	1~ 14 Channels 36~165 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)



## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

### 3.3.2 BLUETOOTH

The Radio specification is compliant with the Bluetooth 4.2 specification

Features	Description
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	Ch0~Ch39
Modulation	GFSK
Antenna Port	Single Antenna for Wi-Fi and BT

### 3.4. RADIO SPECIFICATIONS

#### 3.4.1 WIFI'S OUTPUT POWER 、 EVM 、 SENSITIVITY

The WM-BAN-MT-41 module WiFi output power is listed in the table below:

Characteristics		TYP.	Criteria	Unit
RF Average Output Power, 802.11b CCK Mode	1M	18	+/- 2	dBm
	11M	18	+/- 2	dBm
RF Average Output Power, 802.11g OFDM Mode	6M	16	+/- 2	dBm
	54M	15	+/- 2	dBm
RF Average Output Power, 802.11n 2.4G OFDM	MCS0	16	+/- 2	dBm
	MCS7	15	+/- 2	dBm
RF Average Output Power, 802.11a OFDM Mode	MCS0	15	+/- 2	dBm
	MCS7	14	+/- 2	dBm
RF Average Output Power, 802.11n 5G OFDM	MCS0	15	+/- 2	dBm
	MCS7	14	+/- 2	dBm

## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

WiFi TX EVM follows the IEEE spec that is listed 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 (11a/g)	@6 Mbps	-5	dB
	@54 Mbps	-25	dB
RF Average Output EVM (11n)	@ MCS0	-5	dB
	@ MCS7	-27	dB

The WM-BAN-MT-41 module WiFi Sensitivity is listed in the table below:

Receiver Characteristics	TYP.	MAX.	Unit
PER <8%, Rx Sensitivity @ 1 Mbps	-95	-91	dBm
PER <8%, Rx Sensitivity @ 11 Mbps	-87	-83	dBm
PER <10%, Rx Sensitivity @ 6 Mbps 2.4G	-92	-88	dBm
PER <10%, Rx Sensitivity @ 54 Mbps 2.4G	-74	-70	dBm
PER <10%, Rx Sensitivity @ MCS0 2.4G	-91	-87	dBm
PER <10%, Rx Sensitivity @ MCS7 2.4G	-72	-68	dBm
PER <10%, Rx Sensitivity @ 6 Mbps 5G	-92	-88	dBm
PER <10%, Rx Sensitivity @ 54 Mbps 5G	-74	-70	dBm
PER <10%, Rx Sensitivity @ MCS0 5G	-91	-87	dBm
PER <10%, Rx Sensitivity @ MCS7 5G	-72	-68	dBm

## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

### 3.4.2 BLUETOOTH RADIO CHARACTERISTICS

Parameter	Conditions	Min.	Typ. <sup>*b</sup>	Max. <sup>*c</sup>	Unit
<b>BLE</b>					
BLE Output Power	Average Power	-20	5*	10	dBm
BLE Sensitivity (PER)	PER $\leq$ 30.8%	-	-95*	-70 <sup>*a</sup>	dBm
BLE Maximum Input Level	PER $\leq$ 30.8%	-	-	-10 <sup>*a</sup>	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 WiFi/BT Performance will be updated after RF and reliability verifications

## 4. I/O PORT CHARACTERISTICS

Unless otherwise specified, the parameters are given as below *Table*.

Table4-1 I/O Static Characteristics on 3.3V VDD\_IO

Symbol	Parameter	Conditions	MIN	MAX	Unit
V <sub>IL</sub>	Input low Voltage	LVTTL	-0.28	0.8	V
V <sub>IH</sub>	Input High Voltage		2	3.63	V
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub>   = 4~16 mA	-0.28	0.4	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub>   = 4~16 mA	2.4	VDD33+0.33	V
R <sub>PU</sub>	Input Pull-Up Resistance	PU=high,PD=low	40	190	KΩ
R <sub>PD</sub>	Input Pull-Down Resistance	PU=low,PD=high	40	190	KΩ

### 5. INTERFACES

Several peripheral are multiplexed GPIOs. MT7697HD has two dedicated UART interfaces with flow control, one dedicated I2C interface, and one dedicated IrDA interface. The section describes the function of all the peripherals.

#### 5.1. UART

WM-BAN-MT-41 Module UART interfaces. The UART has M16C450 and M16550A modes of operation, which are compatible with a range of standard software drivers. MT7697H supports UART with configurable BAUD rates from 9.6Kbps, 19.2Kbps, 38.4Kbps, 115.2Kbps, and 921.6Kbps.

#### 5.2. I2C

WM-BAN-MT-41 Module 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.

#### 5.3. GPIO

There are two types of GPIO (General purpose IO) designs in WM-BAN-MT-41 : GPIO and AGPIO.

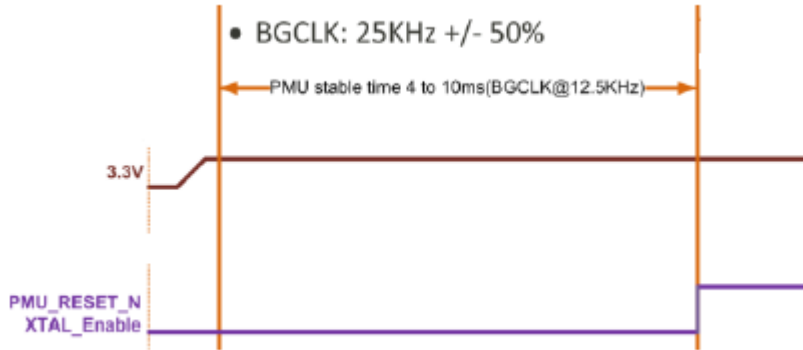
Floating-well design is used in GPIO and AGPIO. It prevents potential leakage problem when the DVDD33 power supply is not enabled but the pin input is pulled up to 3.3V source.

WM-BAN-MT-41 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 $\Omega$  with  $\pm 20\%$  variation over PVT condition
- Driving strength: 4mA, 8mA, 12mA, 16mA
- Input and output duty cycle tuning

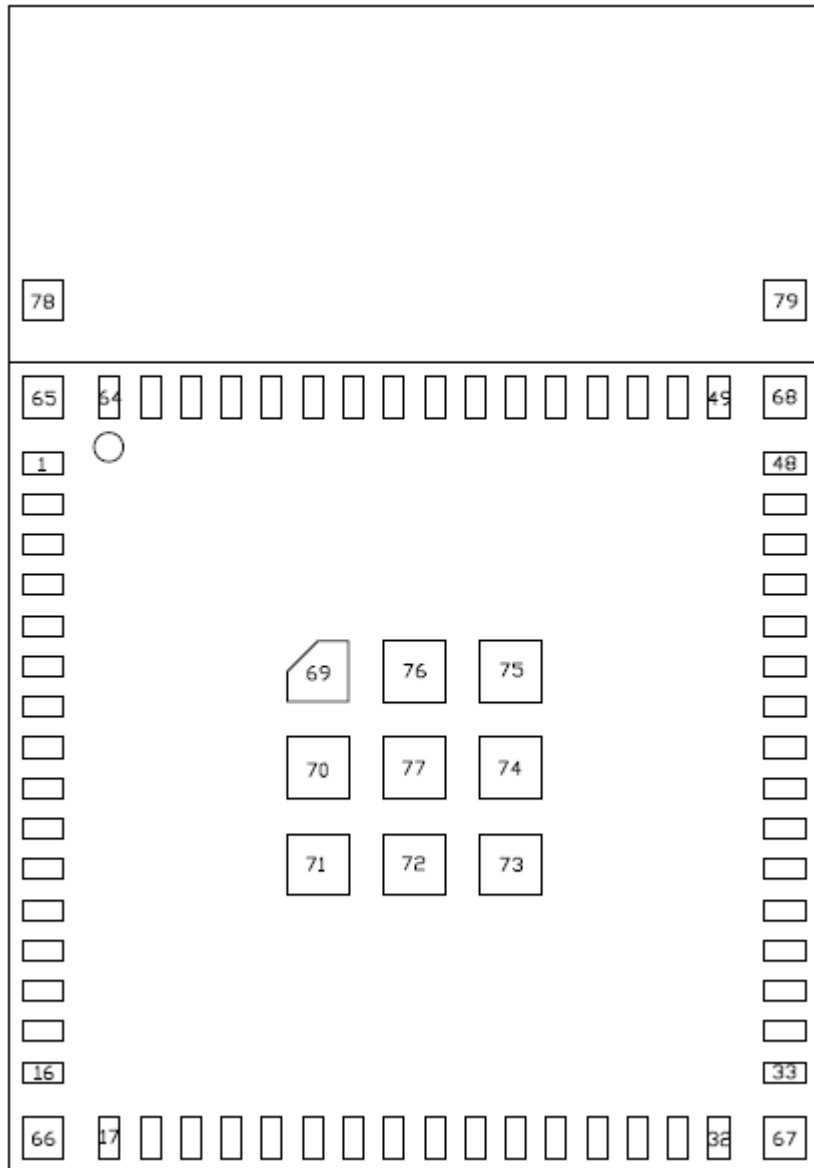
## 6. POWER ON SEQUENCE

The power-on control sequence diagram shows how the PMU\_RESET\_N is generated on the chip.



## 7. MODULE DIMENSIONS

The WM-BAN-MT-41 module size and thickness is “16 +/-0.1mm(W) x 23 +/-0.1mm (L) x 1.92 +/-0.28/-0.13mm (H) “(Including metal shield)



(Top View)

## 8. PIN DESCRIPTION

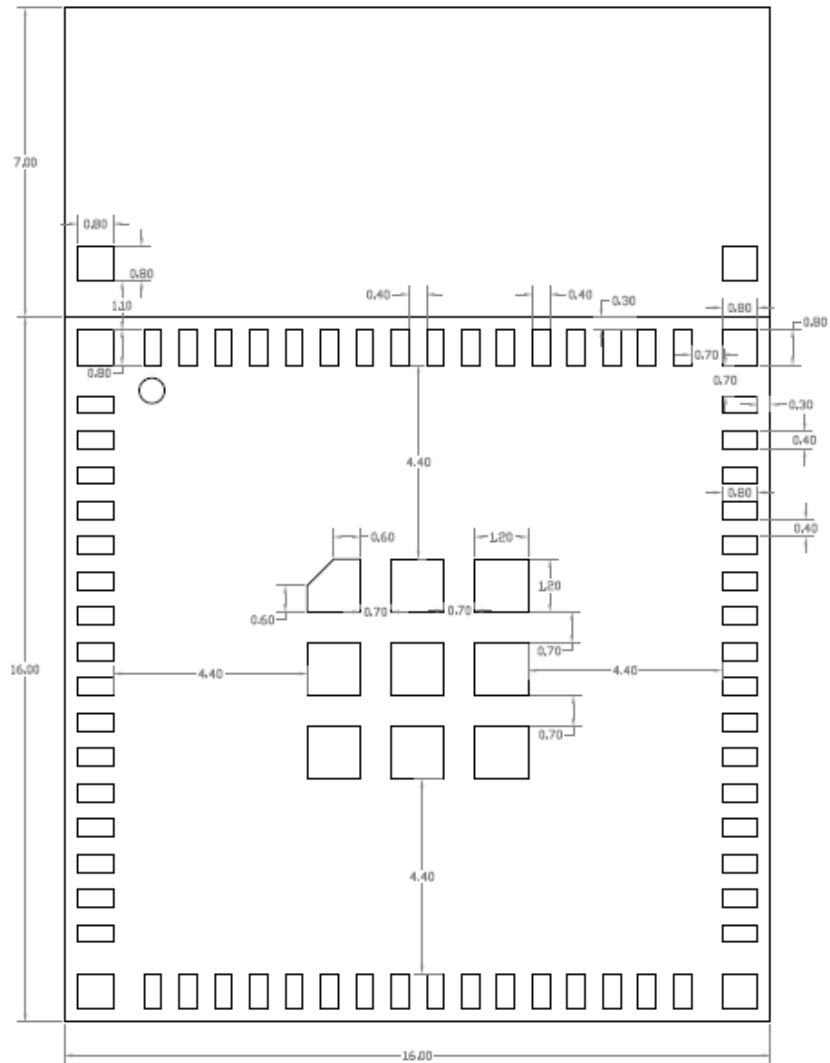
Pin-Number	Pin-Define	Type	Description
1	GPIO0	I/O	General Purpose I/O
2	GPIO1	I/O	General Purpose I/O
3	GPIO2	I/O	General Purpose I/O
4	GPIO3	I/O	General Purpose I/O
5	GPIO4	I/O	General Purpose I/O
6	GPIO5	I/O	General Purpose I/O
7	GPIO6	I/O	General Purpose I/O
8	GPIO7	I/O	General Purpose I/O
9	GPIO24	I/O	General Purpose I/O
10	GPIO25	I/O	General Purpose I/O
11	GPIO26	I/O	General Purpose I/O
12	GND	--	Ground
13	GPIO32	I/O	General Purpose I/O
14	GPIO31	I/O	General Purpose I/O
15	GPIO27	I/O	General Purpose I/O
16	GPIO30	I/O	General Purpose I/O
17	GPIO28	I/O	General Purpose I/O
18	GPIO29	I/O	General Purpose I/O
19	PMU_EN_WF	I	External PMU Enable
20	GND	--	Ground
21	GND	--	Ground
22	VDD_3V3	P	3V3 power supply
23	GND	--	Ground
24	GND	--	Ground
25	GND	--	Ground
26	GND	--	Ground
27	GND	--	Ground
28	GND	--	Ground



## 802.11 a/b/g/n + BT4.2 Wireless LAN SIP Module REV 1.1

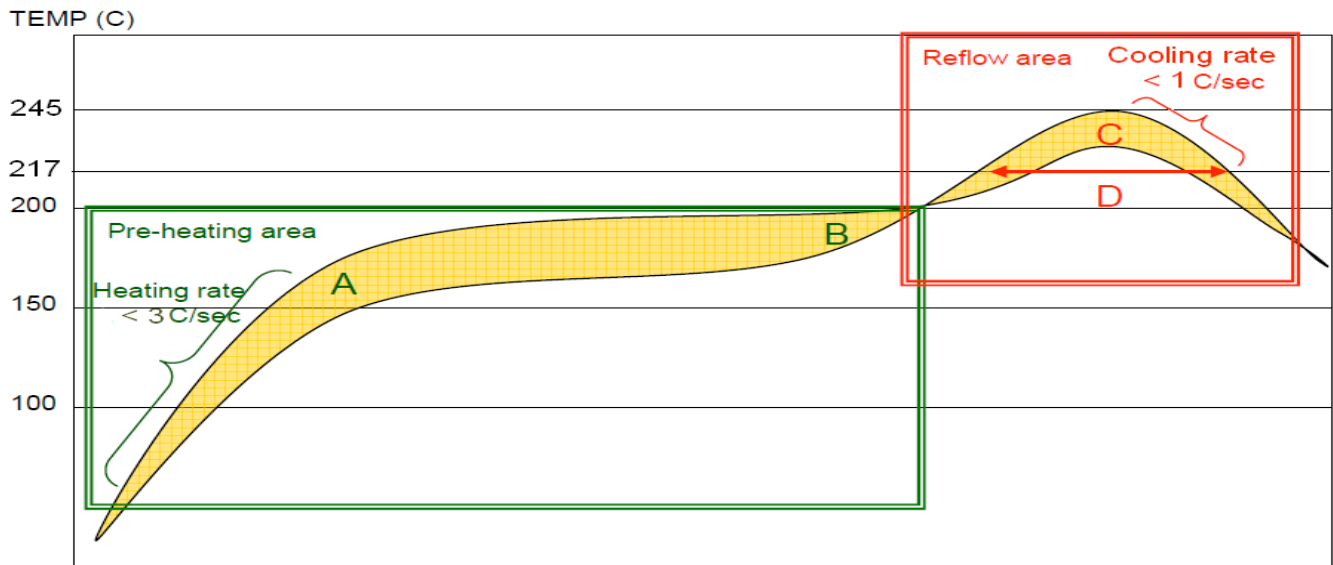
29	GND	--	Ground
30	GND	--	Ground
31	GND	--	Ground
32	GND	--	Ground
33	GPIO60	I/O	General Purpose I/O
34	GPIO59	I/O	General Purpose I/O
35	GPIO58	I/O	General Purpose I/O
36	GPIO57	I/O	General Purpose I/O
37	GND	--	Ground
38	GPIO39	I/O	General Purpose I/O
39	SYS_RST_N	I	System Reset
40	GPIO38	I/O	General Purpose I/O
41	GPIO37	I/O	General Purpose I/O
42	GND	--	Ground
43	VDD_3V3	P	3V3 power supply
44	GND	--	Ground
45	GPIO36	I/O	General Purpose I/O
46	GPIO35	I/O	General Purpose I/O
47	GPIO34	I/O	General Purpose I/O
48	GPIO33	I/O	General Purpose I/O
49	GND	--	Ground
50	GND	--	Ground
51	GND	--	Ground
52~77	GND	--	Ground
78~79	GND	--	Ground

9. MODULE DIMENSION & RECOMMEND LAYOUT DIMENSION



Top view / Unit:mm

## 10. RECOMMENDED REFLOW PROFILE



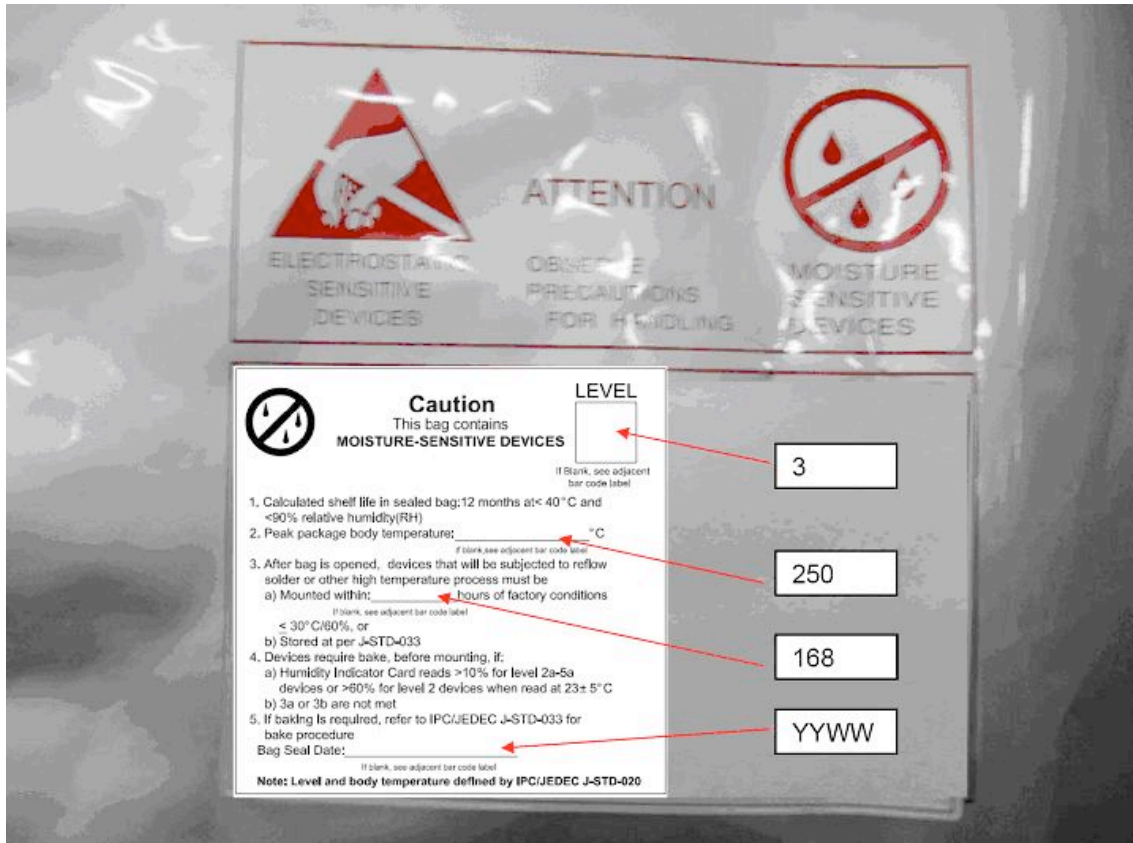
- (1) Solder paste alloy : SAC305 (Sn96.5/Ag3.0/Cu0.5) ( Lead Free solder paste.)
- (2) A-B. Temp.: 150~200°C; soak time:60~120sec.(Base on Flux type, reference only)
- (3) C. Peak temp: <245°C
- (4) D. Time above 217 °C: 40~90sec.(Base on SAC305)
- (5) Suggestion: Optimal cooling rate is <1°C/sec. from peak to 217 °C .
- (6) Nine heater zones at least for Reflow equipment.
- (7) Nitrogen usage is recommended and be controlled the value less than 1500 ppm.

**Note:**

Need to inspect solder joint by X-ray post reflow.

## 11. PACKAGE AND STORAGE CONDITION

### 11.1. PACKAGE




### 11.2. EMC/ESD LEVEL

According to FCC and CE standard

- Surface Resistivity:  
Interior:  $10^9 \sim 10^{11} \Omega/\text{SQUARE}$   
EXTERIOR:  $10^8 \sim 10^{12} \Omega/\text{SQUARE}$
- Dimension: 475\*420mm
- Tolerance: +5,0mm
- Color:  
Background : Gray  
Text : Red

**11.3. MSL LEVEL/STORAGE CONDITION (REFERENCE ONLY)**

	<p><b>Caution</b> This bag contains <b>MOISTURE-SENSITIVE DEVICES</b></p>	<p><b>LEVEL</b></p> <div style="border: 1px solid black; padding: 5px; width: 40px; margin: 0 auto;">3</div> <p><small>If Blank, see adjacent bar code label</small></p>
<p>1. Calculated shelf life in sealed bag: 12 months at &lt; 40°C and &lt; 90% relative humidity (RH)</p> <p>2. Peak package body temperature: <u>250</u> °C <small>If blank, see adjacent bar code label</small></p> <p>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be</p> <p>a) Mounted within: <u>168</u> hours of factory conditions <small>If blank, see adjacent bar code label</small></p> <p style="margin-left: 20px;">≤ 30°C/60%, or</p> <p>b) Stored at per J-STD-033</p> <p>4. Devices require bake, before mounting, if:</p> <p>a) Humidity Indicator Card reads &gt;10% for level 2a-5a devices or &gt;60% for level 2 devices when read at 23± 5°C</p> <p>b) 3a or 3b are not met</p> <p>5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure</p> <p>Bag Seal Date: _____ <small>If blank, see adjacent bar code label</small></p> <p><b>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</b></p>		

Half-Sine Shock  
Sustained for Mechanical Shock under 2000G

**11.4. ORDERING INFORMATION**

USI Project Code	USI P/N	Description
WM-BAN-MT-41	8501-601650-01	MT7697HD 11a/b/g/n+BT IoT Module
	8885-019468-13	USI ® MT7697HD Development Kit

Product Warranty: 1 year

USI reserves the right to make changes, without further notice, to any products or data to improve reliability, function, marking, and/or design. Any products, data or information furnished by USI is that USI believed to be accurate and reliable. However, USI shall not assume any liability arising from the application or use of such products, data and/or information.

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