AzureWave Technologies, Inc.

AW-CU488

IEEE 802.11 a/b/g/n 1T1R WLAN and Bluetooth Low Energy Microcontroller Module

Datasheet

Rev. F

DF

(For Standard)
(Halogen Free)

Features

WiFi

802.11 a/b/g/n/ 1x1, 2.4GHz & 5GHz

Support 20MHz/40MHz up to MCS7

Low power architecture

Support low power TX/RX for short range application

Low power beacon listen mode

Low power Rx mode

Very low power suspends mode (DLPS)

Bluetooth

Support BLE

Support both central and peripheral modes

High power mode (10dbm, share the PA and WIFI) (optional)

Internal co-existence mechanism between and WIFI and BT to share the same antenna

Support BLE5.0

Peripheral Interface

USB host controller with HS/FS/LS capability

SDIO device with highest SDR25 supported

HS_UART/LP_UART supported

Standard and fast mode I2C supported

I2S with 8/12/16/24/32/48/…./176.4 KHz sampling rate

Maximum 2 SPI supported. One supports baud rate up to 50MHz;the other one supports baud rate up to 25MHz

Revision History

Document NO: RW-2488-DST-01

Version	Revision Date	DCN NO.	Description	Initials	Approved
A	2020/04/13	DCN017201	Initial	Jeff Kuo	Peter Chen
B	2020/06/01	DCN017406	Modify Pin table and Pin map	Jeff Kuo	Peter Chen
C	2020/06/23	DCN017655	Modify Pin table, Pin map and Block Diagram	Jeff Kuo	Peter Chen
D	2020/12/01	DCN019376	Modify 5G Calibration Output Power	Jeff Kuo	N.C Chen
E	2020/12/16	DCN019569	Modify Number of Channels Modify Mechanical Drawing Modify 1.31.General 1.3.2 WLAN table 1.3.3 BT table	Jeff Kuo	N.C Chen
F	2021/04/13	DCN021216	Modify Weight Modify 1.3.2 WLAN table 1.3.3 BT table Modify Packaging Information Modify Format Modify Operating Temperature Modify Form factor	Jeff Kuo	N.C Chen

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1. Introduction

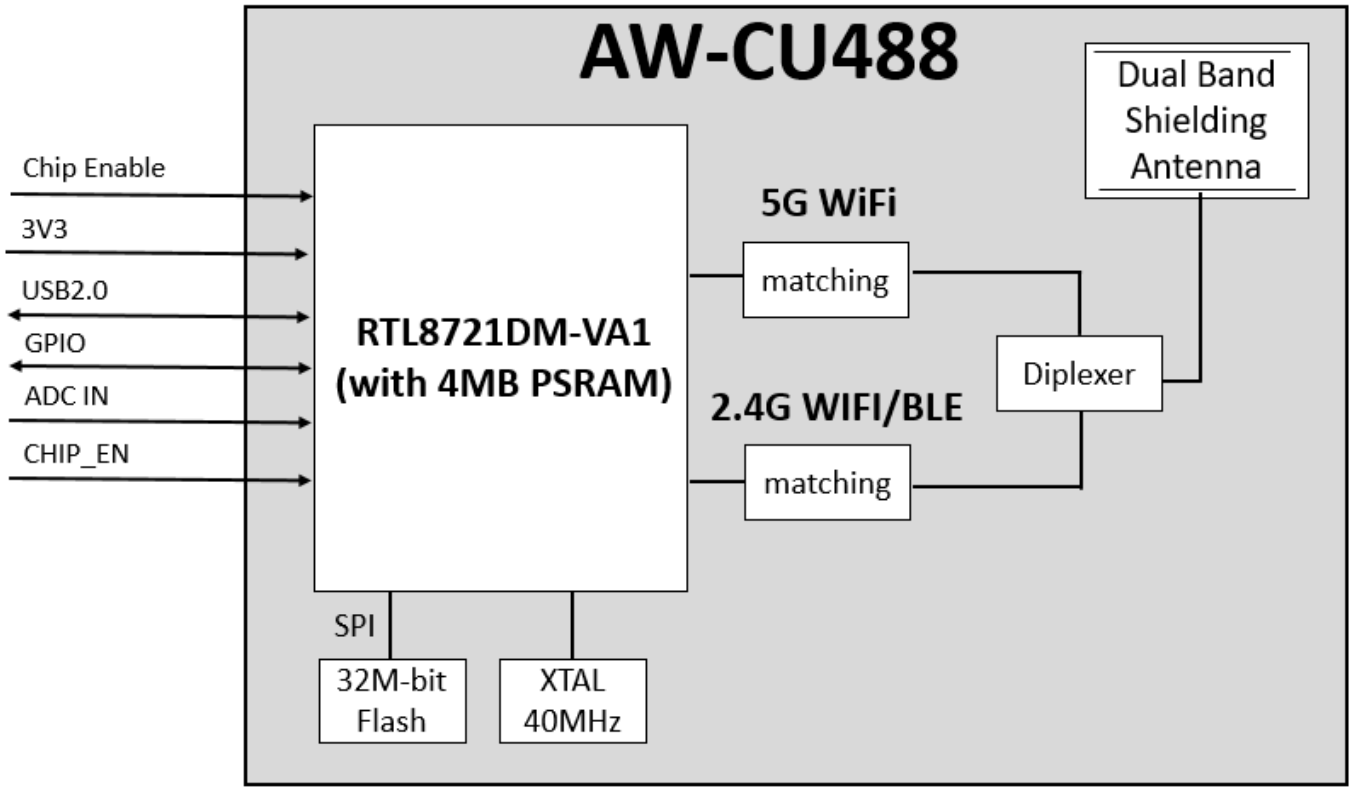
1.1 Product Overview

AzureWave presents AW-CU448 802.11a/b/g/n 1T1R WLAN and Bluetooth low energy (5.0) Microcontroller Solution provides a highly cost-effective, flexible and easy to-use hardware/software platform to build a new generation of connected, smart devices. These smart-connected devices enable device to deliver a broad-range of services to consumers including energy-management, demand-response, home automation and remote access. This allows a user to manage comfort and convenience, also run diagnostics and receive alerts and notifications, in addition to managing and controlling the device. Developers can leverage the rich connectivity features of these new smart devices to create a new generation of innovative new applications and services

The architecture features the Realtek RTL8721DM integrated single-chip low power dual band (2.4GHz and 5GHz) wireless LAN and Bluetooth Low Energy (V5.0) communication controller. It consists of high-performance MCU (latest architecture v8m, Cortex-M4F instruction compatible) named KM4, a low power MCU (v8m, Cortex-M0 instruction compatible) named KM0, WLAN (802.11a/b/g/n) MAC, a 1T1R capable WLAN baseband, RF, Bluetooth and peripherals.

The AW-CU448 is powered by production quality, field-tested Realtek Easy Connect software that includes a rich set of software components that work together to support the development of Smart Energy devices, and enable these devices to connect to mobile clients such as smart-phones, Internet-based Cloud and Smart-Grid services. The feature-rich software stack enables OEMs to focus on application-specific software functionality, thus enabling rapid development and reduced software development costs and risks.

1.2 Block Diagram



AW-CU488 Block Diagram

1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	802.11a/b/g/n 1T1R WLAN and Bluetooth low energy (5.0) Microcontroller Module
Major Chipset	Realtek RTL8721DM(with pSRAM 4MB)
Flash	Built-in SPI 32M-bit Serial Flash
Host Interface	UART
Dimension	36 mm x 18 mm x 3.15 mm
Form factor	LGA module, 150-pin
Antenna	Internal Shielding Antenna for WLAN/BT
Weight	2.78g

1.3.2 WLAN

<table>
<tr><th>Features</th><th>Description</th></tr>
<tr><td>WLAN Standard</td><td>IEEE 802.11a/b/g/n, Wi-Fi compliant</td></tr>
<tr><td>Frequency Rage</td><td>2.4 GHz：2.412 ~ 2.484 GHz, ISM radio band
5 GHz：4.915 ~5.925GHz</td></tr>
<tr><td>Modulation</td><td>DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM for WLAN</td></tr>
<tr><td>Number of Channels</td><td>2.4GHz
USA, North America, Canada and Taiwan – 1 ~ 11
China, Australia, Most European Countries – 1 ~ 13
Japan, 1 ~ 14(CH14 only for 802.11b)
5GHz
USA, EUROPE – 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144(*1),149, 153, 157, 161, 165
(*1) CH144 only for USA</td></tr>
<tr><td>Calibration Output Power</td><td>2.4G
<table>
<tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td>11b (11Mbps) @EVM<35%</td><td>15</td><td>18</td><td>20</td><td>dBm</td></tr>
<tr><td>11g (54Mbps) @EVM≦-27 dB</td><td>14</td><td>17</td><td>19</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7) @EVM≦-28 dB</td><td>13</td><td>16</td><td>18</td><td>dBm</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>11n (HT40 MCS7)
@EVM≦-28 dB</td><td>13</td><td>16</td><td>18</td><td>dBm</td></tr>
</table>
5G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11a (54Mbps)
@EVM≦-27 dB</td><td>12</td><td>14</td><td>16</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)
@EVM≦-28 dB</td><td>11</td><td>13</td><td>15</td><td>dBm</td></tr>
<tr><td>11n (HT40 MCS7)
@EVM≦-28 dB</td><td>11</td><td>13</td><td>15</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Limit Output Power</td><td>
2.4G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11b (11Mbps)
@EVM<35%</td><td>TBD</td><td>TBD</td><td>TBD</td><td>dBm</td></tr>
<tr><td>11g (54Mbps)
@EVM≦-27 dB</td><td>TBD</td><td>TBD</td><td>TBD</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)
@EVM≦-28 dB</td><td>TBD</td><td>TBD</td><td>TBD</td><td>dBm</td></tr>
</table>
5G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11a (54Mbps)
@EVM≦-27 dB</td><td>TBD</td><td>TBD</td><td>TBD</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)
@EVM≦-28 dB</td><td>TBD</td><td>TBD</td><td>TBD</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Receiver Sensitivity</td><td>
2.4G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11b (11Mbps)</td><td></td><td>-90</td><td>-82</td><td>dBm</td></tr>
<tr><td>11g (54Mbps)</td><td></td><td>-77</td><td>-71</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)</td><td></td><td>-75</td><td>-67</td><td>dBm</td></tr>
</table>
5G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11a (54Mbps)</td><td></td><td>-77</td><td>-71</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)</td><td></td><td>-75</td><td>-67</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Data Rate</td><td>WLAN:
802.11b: 1, 2, 5.5, 11Mbps
802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
802.11n: up to 150Mbps-single</td></tr>
<tr><td>Security</td><td>AES/DES/SHA hardware engine
TrustZone-M supported</td></tr>
</table>

	Secure boot supported Debug port access protection and prohibition modes Security e-Fuse Flash Decryption on-the-fly

* HT40 is not yet supported in normal mode
* If you have any certification questions about output power please contact FAE directly.

1.3.3 Bluetooth

<table>
<tr><th>Features</th><th>Description</th></tr>
<tr><td>Bluetooth Standard</td><td>Bluetooth V5.0 complaint</td></tr>
<tr><td>Frequency Rage</td><td>2402~2480MHz</td></tr>
<tr><td>Modulation</td><td>GFSK</td></tr>
<tr><td>Output Power</td><td>
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>LE 1M</td><td>2</td><td>4</td><td>6</td><td>dBm</td></tr>
<tr><td>LE 2M</td><td>2</td><td>4</td><td>6</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Receiver Sensitivity</td><td>
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>LE 1M</td><td></td><td>-90</td><td>-70</td><td>dBm</td></tr>
<tr><td>LE 2M</td><td></td><td>-90</td><td>-70</td><td>dBm</td></tr>
</table>
</td></tr>
</table>

1.3.4 Operating Conditions

Features	Description
Operating Conditions	
Voltage	3.3V +/- 9%
Operating Temperature	Operating: -20℃ ~ 85℃
Operating Humidity	less than 85% R.H.
Storage Temperature	-40℃ ~ 85℃
Storage Humidity	less than 60% R.H.
ESD Protection	
Human Body Model	+/- 3.5KV
Changed Device Model	+/- 500V

2. Pin Definition

2.1 Pin Map

AW-CU488 Top View Pin Map

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
	GND	GND	PA8	PA7	CHIP EN	PA2	PA4	PA0	PB31	PB29	PB26	GND	GND	PB23	PB22	K
	GND	GND	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	J
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	NC	NC	H
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	G
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	3V3	F
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	E
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	VBAT MEA	PB7	D
	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	PB6	PB5	C
	GND	GND	PA13	PA15	PA17	PA19	NC	NC	NC	NC	NC	NC	NC	PB4	PB3	B
	GND	GND	PA12	PA14	PA16	PA18	PA27	PA30	NC	PA26	PA25	PB2	PB1	GND	GND	A

2.2 Pin Table

Pin No	Definition	Basic Description	Voltage	Type
A1	GND	Ground.		GND
A2	GND	Ground.		GND
A3	PB1	The MUX function GPIO pin.		I/O
A4	PB2	The MUX function GPIO pin.		I/O
A5	PA25	The MUX function GPIO pin.		I/O
A6	PA26	The MUX function GPIO pin.		I/O
A7	NC	Floating Pin. (RREF Port, internal 12kΩ pulled down for USB interface)		I/O
A8	PA30	The MUX function GPIO pin.		I/O
A9	PA27	The MUX function GPIO pin.		I/O
A10	PA18	The MUX function GPIO pin.		I/O
A11	PA16	The MUX function GPIO pin.		I/O
A12	PA14	The MUX function GPIO pin.		I/O
A13	PA12	The MUX function GPIO pin.		I/O
A14	GND	Ground.		GND
A15	GND	Ground.		GND
B1	PB3	The MUX function GPIO pin.		I/O
B2	PB4	The MUX function GPIO pin.		I/O
B3	NC	Floating Pin		Floating
B4	NC	Floating Pin		Floating
B5	NC	Floating Pin		Floating
B6	NC	Floating Pin		Floating
B7	NC	Floating Pin		Floating
B8	NC	Floating Pin		Floating
B9	NC	Floating Pin		Floating
B10	PA19	The MUX function GPIO pin.		I/O
B11	PA17	The MUX function GPIO pin.		I/O
B12	PA15	The MUX function GPIO pin.		I/O
B13	PA13	The MUX function GPIO pin.		I/O
B14	GND	Ground.		GND
B15	GND	Ground.		GND
C1	PB5	The MUX function GPIO pin.		I/O
C2	PB6	The MUX function GPIO pin.		I/O
C3	GND	Ground.		GND
C4	GND	Ground.		GND
C5	GND	Ground.		GND
C6	GND	Ground.		GND
C7	GND	Ground.		GND
C8	GND	Ground.		GND
C9	GND	Ground.		GND
C10	GND	Ground.		GND
C11	GND	Ground.		GND
C12	GND	Ground.		GND
C13	GND	Ground.		GND
C14	GND	Ground.		GND
C15	GND	Ground.		GND
D1	PB7	The MUX function GPIO pin.		I/O
D2	VBAT_MEAS	ADC input pin, 5V tolerance		I

D3	GND	Ground.		GND
D4	GND	Ground.		GND
D5	GND	Ground.		GND
D6	GND	Ground.		GND
D7	GND	Ground.		GND
D8	GND	Ground.		GND
D9	GND	Ground.		GND
D10	GND	Ground.		GND
D11	GND	Ground.		GND
D12	GND	Ground.		GND
D13	GND	Ground.		GND
D14	GND	Ground.		GND
D15	GND	Ground.		GND
E1	GND	Ground.		GND
E2	GND	Ground.		GND
E3	GND	Ground.		GND
E4	GND	Ground.		GND
E5	GND	Ground.		GND
E6	GND	Ground.		GND
E7	GND	Ground.		GND
E8	GND	Ground.		GND
E9	GND	Ground.		GND
E10	GND	Ground.		GND
E11	GND	Ground.		GND
E12	GND	Ground.		GND
E13	GND	Ground.		GND
E14	GND	Ground.		GND
E15	GND	Ground.		GND
F1	3V3	3.3V power supply		VCC
F2	GND	Ground.		GND
F3	GND	Ground.		GND
F4	GND	Ground.		GND
F5	GND	Ground.		GND
F6	GND	Ground.		GND
F7	GND	Ground.		GND
F8	GND	Ground.		GND
F9	GND	Ground.		GND
F10	GND	Ground.		GND
F11	GND	Ground.		GND
F12	GND	Ground.		GND
F13	GND	Ground.		GND
F14	GND	Ground.		GND
F15	GND	Ground.		GND
G1	GND	Ground.		GND
G2	GND	Ground.		GND
G3	GND	Ground.		GND
G4	GND	Ground.		GND
G5	GND	Ground.		GND
G6	GND	Ground.		GND
G7	GND	Ground.		GND
G8	GND	Ground.		GND
G9	GND	Ground.		GND
G10	GND	Ground.		GND

G11	GND	Ground.		GND
G12	GND	Ground.		GND
G13	GND	Ground.		GND
G14	GND	Ground.		GND
G15	GND	Ground.		GND
H1	NC	Floating Pin		Floating
H2	NC	Floating Pin		Floating
H3	GND	Ground.		GND
H4	GND	Ground.		GND
H5	GND	Ground.		GND
H6	GND	Ground.		GND
H7	GND	Ground.		GND
H8	GND	Ground.		GND
H9	GND	Ground.		GND
H10	GND	Ground.		GND
H11	GND	Ground.		GND
H12	GND	Ground.		GND
H13	GND	Ground.		GND
H14	GND	Ground.		GND
H15	GND	Ground.		GND
J1	NC	Floating Pin		Floating
J2	NC	Floating Pin		Floating
J3	NC	Floating Pin		Floating
J4	NC	Floating Pin		Floating
J5	NC	Floating Pin		Floating
J6	NC	Floating Pin		Floating
J7	NC	Floating Pin		Floating
J8	NC	Floating Pin		Floating
J9	NC	Floating Pin		Floating
J10	NC	Floating Pin		Floating
J11	NC	Floating Pin		Floating
J12	NC	Floating Pin		Floating
J13	NC	Floating Pin		Floating
J14	GND	Ground.		GND
J15	GND	Ground.		GND
K1	PB22	The MUX function GPIO pin.		I/O
K2	PB23	The MUX function GPIO pin.		I/O
K3	GND	Ground.		GND
K4	GND	Ground.		GND
K5	PB26	The MUX function GPIO pin.		I/O
K6	PB29	The MUX function GPIO pin.		I/O
K7	PB31	The MUX function GPIO pin.		I/O
K8	PA0	The MUX function GPIO pin.		I/O
K9	PA4	The MUX function GPIO pin.		I/O
K10	PA2	The MUX function GPIO pin.		I/O
K11	CHIP_EN	Enable Chip:1 Enable Chip, 0 Shut Down Chip		I
K12	PA7	The MUX function GPIO pin.		I/O
K13	PA8	The MUX function GPIO pin.		I/O
K14	GND	Ground.		GND
K15	GND	Ground.		GND

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
3V3	3.3V Power supply	3.0	3.3	3.6	V

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
3V3	3.3V Power supply	3.0	3.3	3.6	V

3.3 Digital IO Pin DC Characteristics

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIH	Input high voltage	2	--		V
VIL	Input low voltage		--	0.8	V
VOH	Output high voltage	2.4	--		V
VOL	Output low voltage		--	0.4	V

3.4 Host Interface

3.4.1 UART Interface

TBD

3.5 Power up Timing Sequence

TBD

3.6 Power Consumption*

3.6.1 WLAN

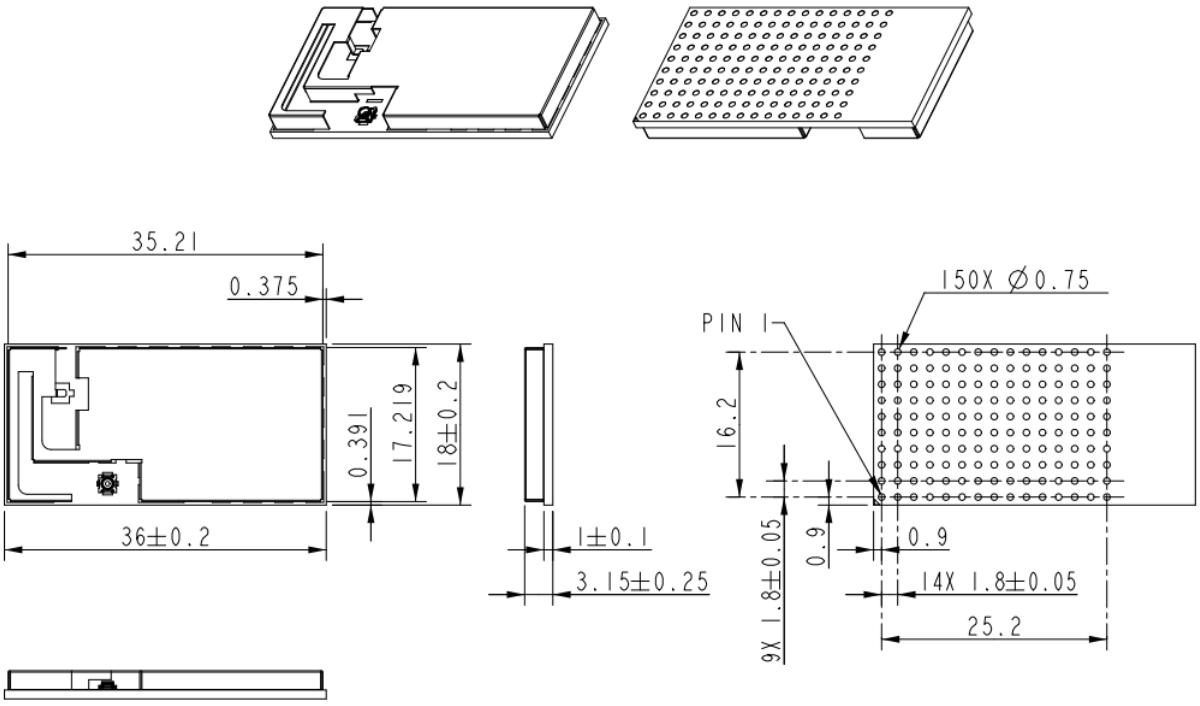
TBD

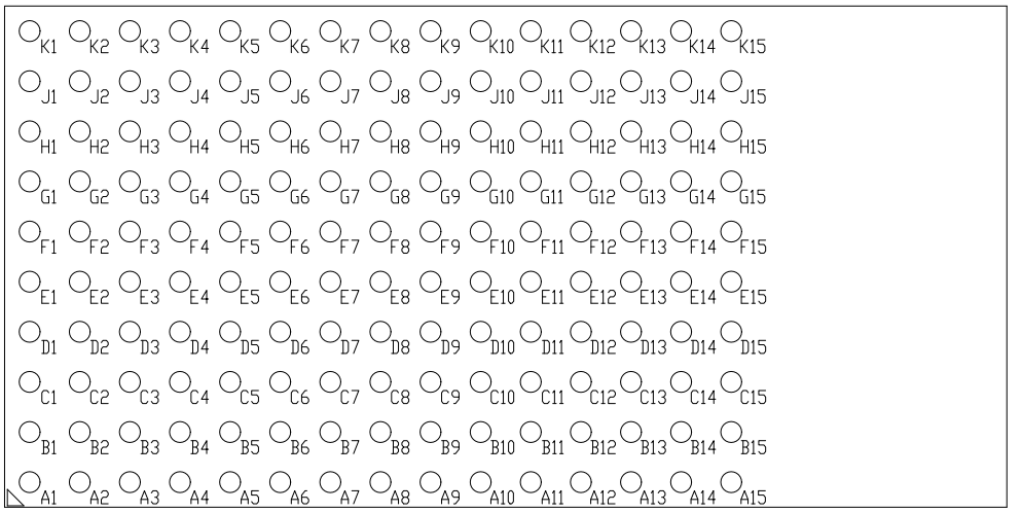
3.6.2 Bluetooth

TBD

4. Mechanical Information

4.1 Mechanical Drawing





PIN DEFINED (BOTTOM VIEW)

PIN Defined

5. Packaging Information

500pcs / reel, 1.5K / carton

1. Put desiccant in the middle of tape & reel.

2. Seal the tape & reel in an aluminum foil bag and put it in the inner box.

3. Put packed product into carton. One package label pasted in side of inner box, three inner boxes inside in one carton.

4. Seal the outside box by AzureWave tape.