



ITM-1720-DF

IEEE 802.11a/b/g/n Dual-band WLAN +
Bluetooth LE 5.0 IoT Module Datasheet

V1.0

Revision History

Date	Revision Content	Revised By	Version
2021/10/08	- Initial released (Preliminary)	Issac Chen	0.1
2022/05/16	- Correct typo in Reference Design	Issac Chen	0.11
2022/12/15	- Update PCB Outline/Layout/Packing	Issac Chen	0.2
2023/01/06	- Add P/N for different antenna type	Issac Chen	0.21
2023/04/25	- Official Release	Issac Chen	1.0

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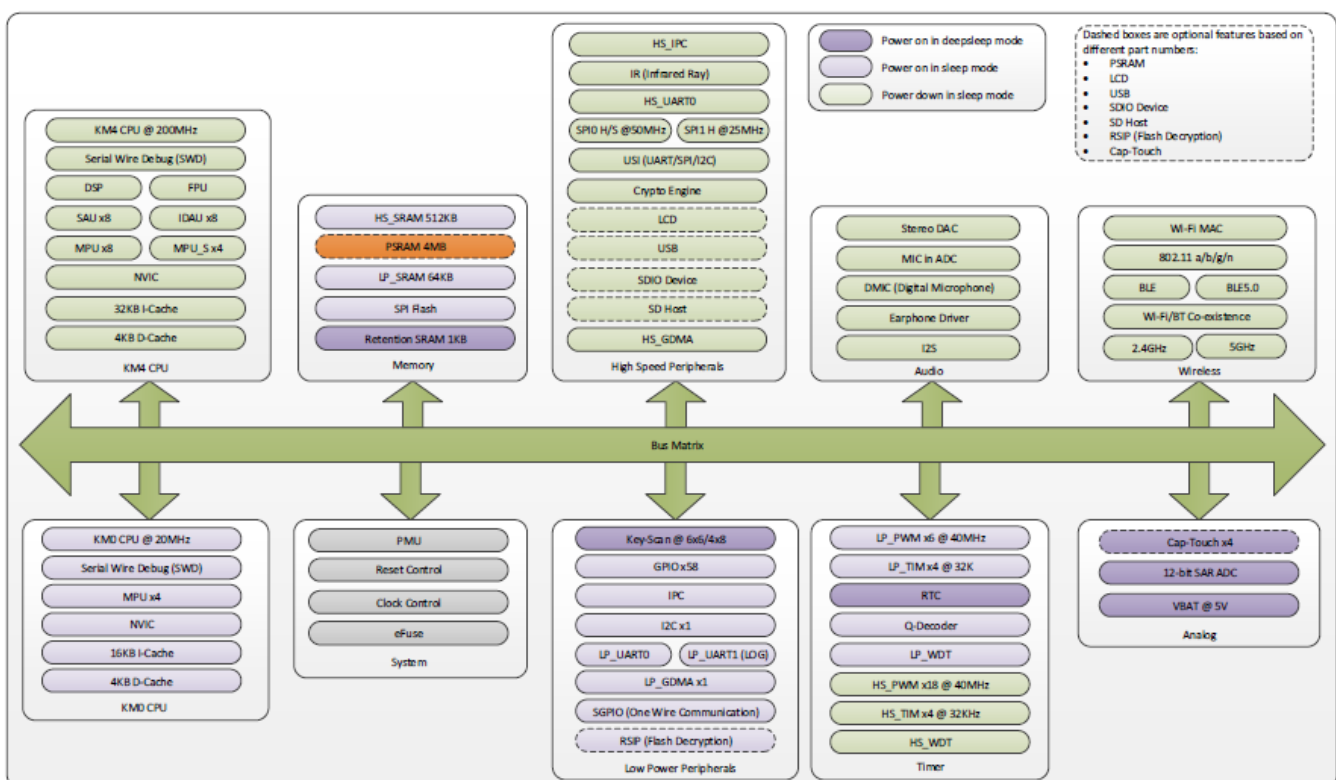
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1. General Description

iTM-1720-DF module is a highly integrated and low power consumption module supporting dual-band (2.4GHz/5GHz) Wireless LAN (WLAN 802.11 a/b/g/n) and Bluetooth Low Energy (BLE 5.0).

iTM-1720-DF module uses Realtek RTL8720DF chipset, which has two built-in 32-bit MCU: KM4 and KM0. KM4 is high performance and Cortex-M33 instruction-set compatible; KM0 is low power and Cortex-M23 instruction-set compatible. RTL8720DF provides high-speed connectivity interfaces, USB and SDIO. GPIO pins can be configured as different functions according to applications. RTL8720DF also integrates memories ROM/RAM/Flash for WLAN/BLE IoT functions and applications. The user-friendly development kits (SDK and HDK) are supported for customers to develop their IoT product.

The architecture of RTL8720DF is shown as below.



2. Features

- Dual Processor Core
 - KM4: ARMv8-M architecture with Cortex-M33 instruction-set compatible
 - ◆ FPU/DSP
 - ◆ 32KB I-cache and 4KB D-cache
 - ◆ 512KB SRAM
 - ◆ Clock rate up to 200MHz
 - KM0: ARMv8-M architecture with Cortex-M23 instruction-set compatible
 - ◆ 16KB I-cache and 4KB D-cache
 - ◆ 64KB SRAM + 1KB retention SRAM
 - ◆ Clock rate up to 20MHz
- Wi-Fi
 - 2.4GHz/5GH 1T1R IEEE 802.11a/b/g/n
 - Support 11n MCS7 HT20/HT40
 - Support antenna diversity
 - Low power architecture and Tx/Rx for short range application @1.8V
 - Low power beacon listen mode
 - Low power Rx mode
 - Very low power suspend mode (DLPS)
- Bluetooth LE
 - BLE 5.0
 - Support both central / peripheral modes
 - Support high power mode (8dBm, shares the same PA with Wi-Fi)
 - Internal co-existence mechanism between Wi-Fi and BLE to share the same antenna.
- System
 - (512KB+64KB) SRAM and 1KB retention SRAM
 - 4MB flash memory
 - AES/DES/SHA hardware crypto engine
 - Low-voltage and watchdog reset.

- Multiple power state: Normal/Sleep/Deep sleep/Shutdown
- I/O Interfaces (Total 19-pins GPIO can be configured for functions listed below)
 - USB 2.0 (Host/Device, Selectable)
 - HS/FS/LS mode
 - 1.5KB bulk-in and 1.5KB bulk-out buffers
 - SDIO Host
 - Clock rate up to 50MHz
 - SPI (Max. Master-only x 1 + Master/Slave x 2)
 - Clock rate up to 50MHz
 - UART (Max. 4 channels, LOG/Low-Power /High-Speed /USI)
 - Baud rate up to 6MHz
 - I2S Audio Interface
 - I2C (Max. 2 channels)
 - Clock rate up to 400kHz
 - PWM (Max. 12 channels)
 - 16-bit resolution
 - ADC (Max. 2 channels)
 - 12-bit resolution
- Please refer to the table below for different types of ITM-1720DF

P/N	Antenna Type
ITM-1720DF	Using on-board PCB antenna
ITM-1720DF-X	Using I-PEX connector for external antenna

3. General Specification

3.1 Voltages

3.1.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.3	3.6	V

Operating temperature	-20°C to 85°C
Storage temperature	-40°C to 85°C

3.1.2 Recommended Operating Ratings

Test conditions: At room temperature				
Symbol	Min.	Typ.	Max.	Unit
VBAT	3.0	3.3	3.6	V

3.2 Wi-Fi RF Specification (RX)

2.4G WLAN

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
RX Sensitivity 11b @ 8% PER	- 1Mbps		-95		dBm
	- 2Mbps		-93		dBm
	- 5.5Mbps		-91		dBm
	- 11Mbps		-88		dBm
RX Sensitivity 11g @ 10% PER	- 6Mbps		-92		dBm
	- 9Mbps		-91		dBm
	- 12Mbps		-90		dBm
	- 18Mbps		-87		dBm
	- 24Mbps		-84		dBm
	- 36Mbps		-81		dBm
	- 48Mbps		-76		dBm
	- 54Mbps		-74		dBm
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0		-92		dBm
	- MCS=1		-89		dBm
	- MCS=2		-86		dBm
	- MCS=3		-83		dBm
	- MCS=4		-80		dBm
	- MCS=5		-75		dBm
	- MCS=6		-74		dBm
	- MCS=7		-72		dBm
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0		-90		dBm
	- MCS=1		-86		dBm
	- MCS=2		-83		dBm
	- MCS=3		-80		dBm
	- MCS=4		-77		dBm
	- MCS=5		-72		dBm
	- MCS=6		-71		dBm
	- MCS=7		-69		dBm
Maximum Receive Level	802.11b		-10		dBm
	802.11g		-8		dBm
	802.11n		-8		dBm

5G WLAN

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		5180		5825	MHz
RX Sensitivity 11a @ 10% PER	- 6Mbps		-90		dBm
	- 9Mbps		-90		dBm
	- 12Mbps		-89		dBm
	- 18Mbps		-86		dBm
	- 24Mbps		-83		dBm
	- 36Mbps		-80		dBm
	- 48Mbps		-75		dBm
	- 54Mbps		-73		dBm
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0		-90		dBm
	- MCS=1		-88		dBm
	- MCS=2		-85		dBm
	- MCS=3		-82		dBm
	- MCS=4		-79		dBm
	- MCS=5		-74		dBm
	- MCS=6		-72		dBm
	- MCS=7		-71		dBm
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0		-88		dBm
	- MCS=1		-85		dBm
	- MCS=2		-82		dBm
	- MCS=3		-79		dBm
	- MCS=4		-76		dBm
	- MCS=5		-71		dBm
	- MCS=6		-70		dBm
	- MCS=7		-68		dBm

3.3 Wi-Fi RF Specification (TX)

2.4G WLAN

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
Output Power	802.11b @11Mbps		18.0		dBm
	802.11g @54Mbps		15.0		dBm
	802.11n @MCS7		14.0		dBm

@EVM	802.11b @11Mbps			-10	dB
	802.11g @54Mbps			-25	dB
	802.11n @MCS7			-28	dB

5G WLAN

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		5180		5825	MHz
Output Power	802.11a @54Mbps		14.0		dBm
	802.11n @MCS7		13.0		dBm
@EVM	802.11a @54Mbps			-25	dB
	802.11n @MCS7			-28	dB

3.4 BLE RF Specification (RX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
RX Sensitivity (LE1M)		-100			dBm
RX Sensitivity (LE2M)		-96			dBm

3.5 BLE RF Specification (TX)

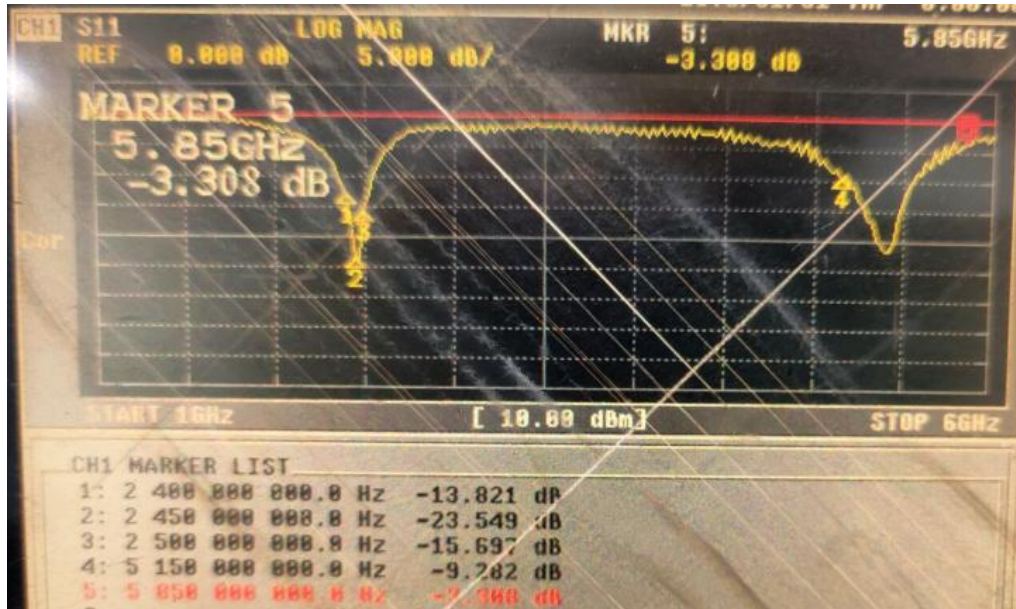
Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
Maximum Output Power		-10	4	10	dBm

3.6 Power Consumption

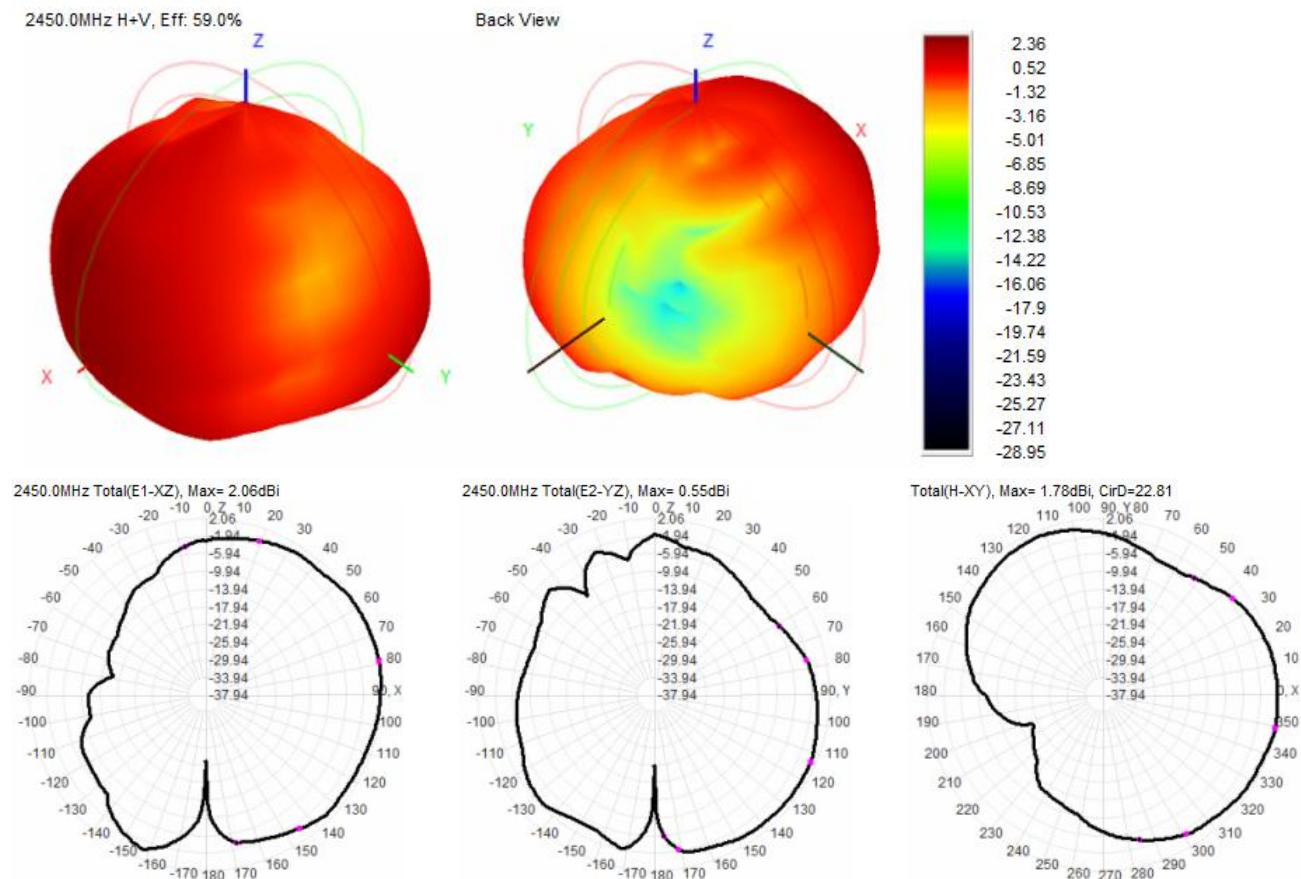
Parameters	Condition	Min.	Typ.	Max.	Unit
Current	In sleep mode		38	105	uA
	In deep-sleep mode		10	25	uA

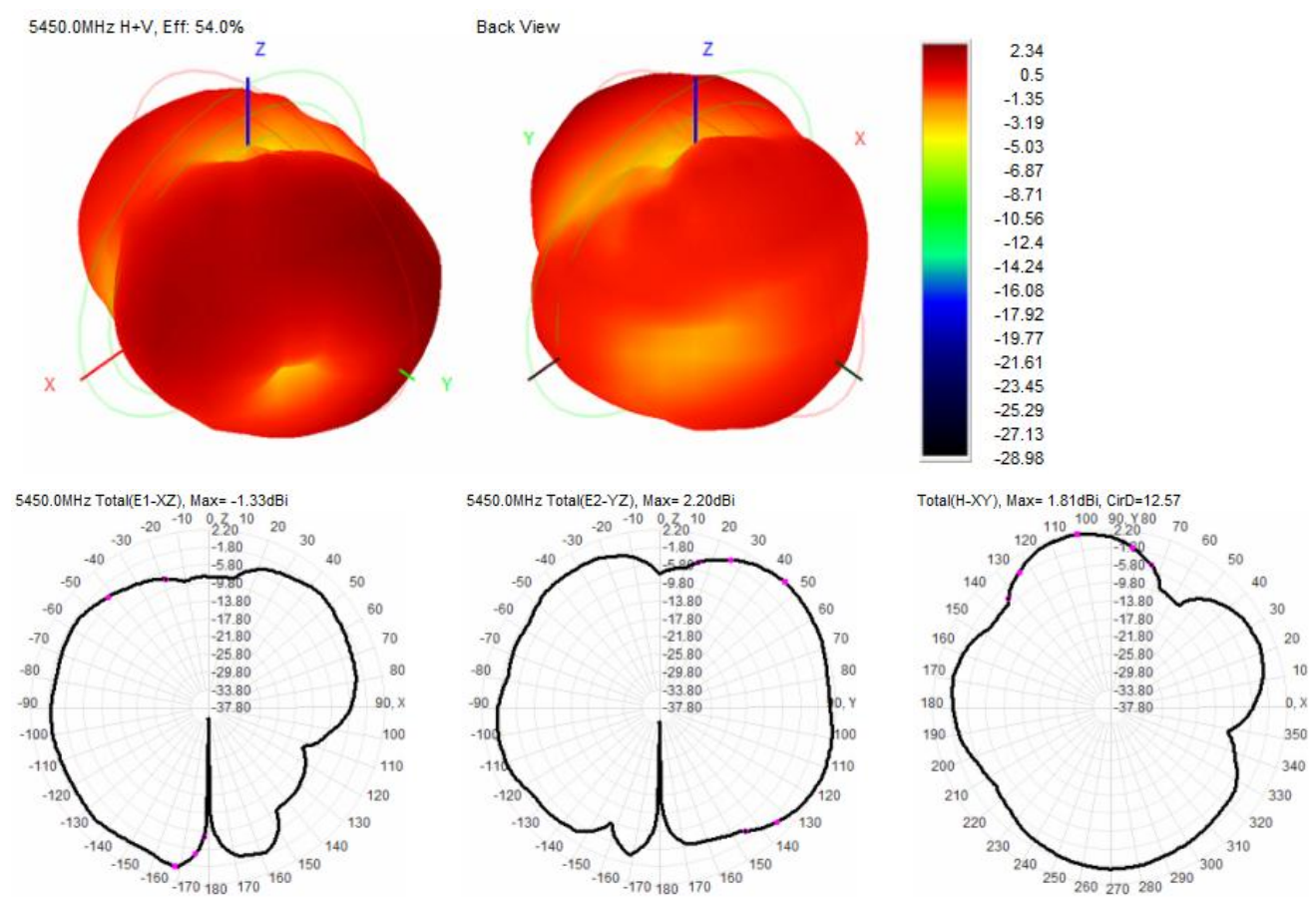
4. Embedded PCB Antenna

4.1 S11 Parameter



4.2 Gain Pattern





4.3 Efficiency

Frequency ID	11	12	13	14	15	16	17	18	19	20	21
Frequency (MHz)	2400.0	2410.0	2420.0	2430.0	2440.0	2450.0	2460.0	2470.0	2480.0	2490.0	2500.0
Efficiency (dBi)	-2.27	-2.11	-2.10	-2.23	-2.36	-2.29	-2.26	-2.27	-2.46	-2.63	-2.69
Gain (dBi)	2.64	2.79	2.71	2.45	2.37	2.36	2.34	2.47	2.36	2.02	1.95
Efficiency (%)	59.35	61.49	61.64	59.85	58.09	59.02	59.45	59.33	56.81	54.52	53.83
Directivity (dB)	4.90	4.90	4.82	4.68	4.73	4.65	4.60	4.74	4.82	4.65	4.64

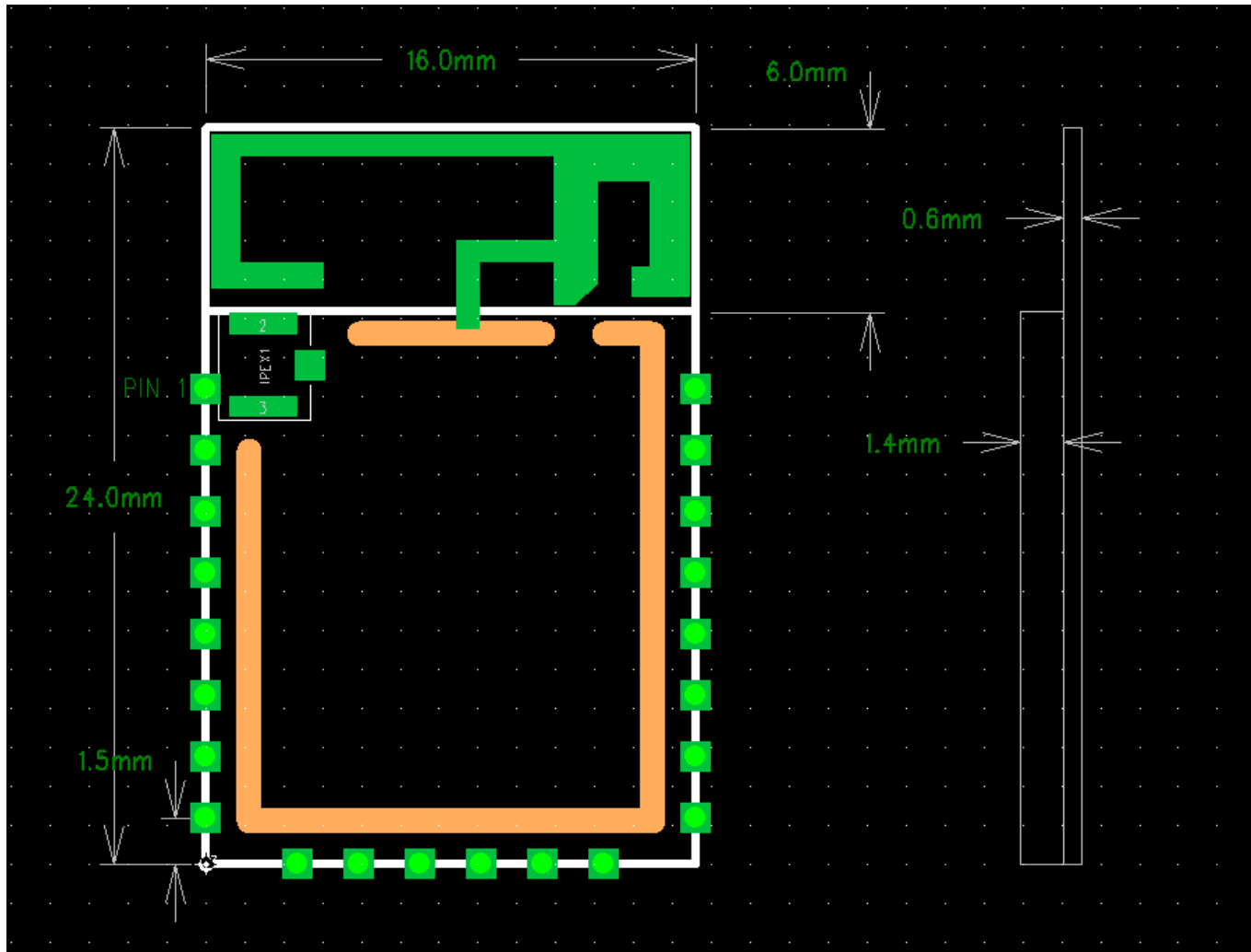
Frequency ID	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Frequency (MHz)	5150.0	5200.0	5250.0	5300.0	5350.0	5400.0	5450.0	5500.0	5550.0	5600.0	5650.0	5700.0	5750.0	5800.0	5850.0
Efficiency (dBi)	-3.96	-3.63	-3.20	-3.09	-3.14	-2.96	-2.67	-2.77	-3.14	-3.53	-3.82	-4.11	-4.77	-5.27	-5.86
Gain (dBi)	0.85	1.34	1.78	2.04	1.71	2.04	2.34	2.41	2.25	1.82	1.56	1.22	0.71	0.20	-0.49
Efficiency (%)	40.23	43.35	47.84	49.05	48.53	50.61	54.02	52.80	48.56	44.41	41.47	38.84	33.35	29.70	25.91
Directivity (dB)	4.80	4.97	4.98	5.14	4.85	4.99	5.01	5.19	5.39	5.35	5.38	5.33	5.48	5.48	5.37

5. Pin Assignments

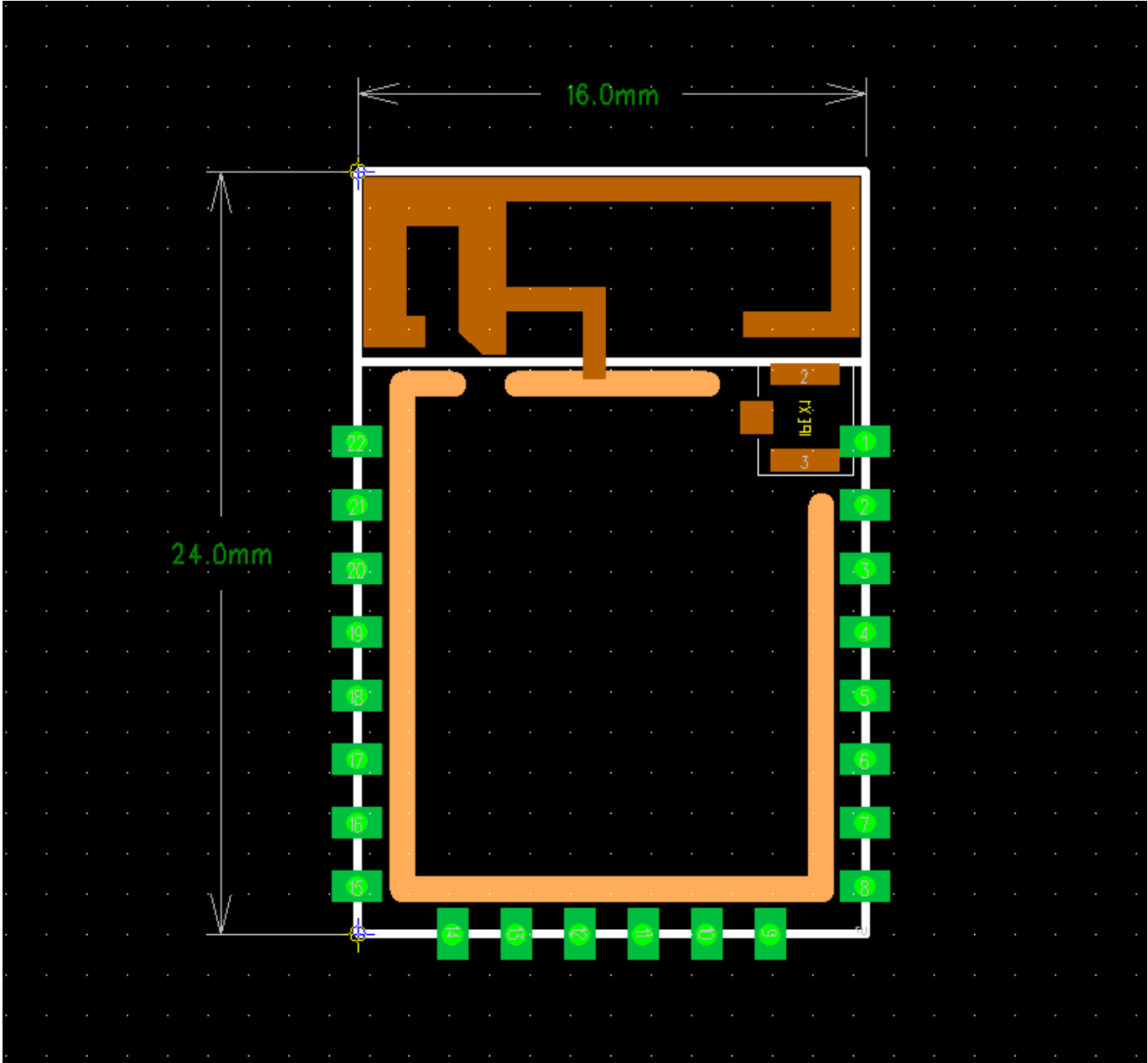
5.1 PCB Pin Outline

< TOP VIEW >

< SIDE VIEW >



< BOTTOM VIEW >



5.2 Pin Definition

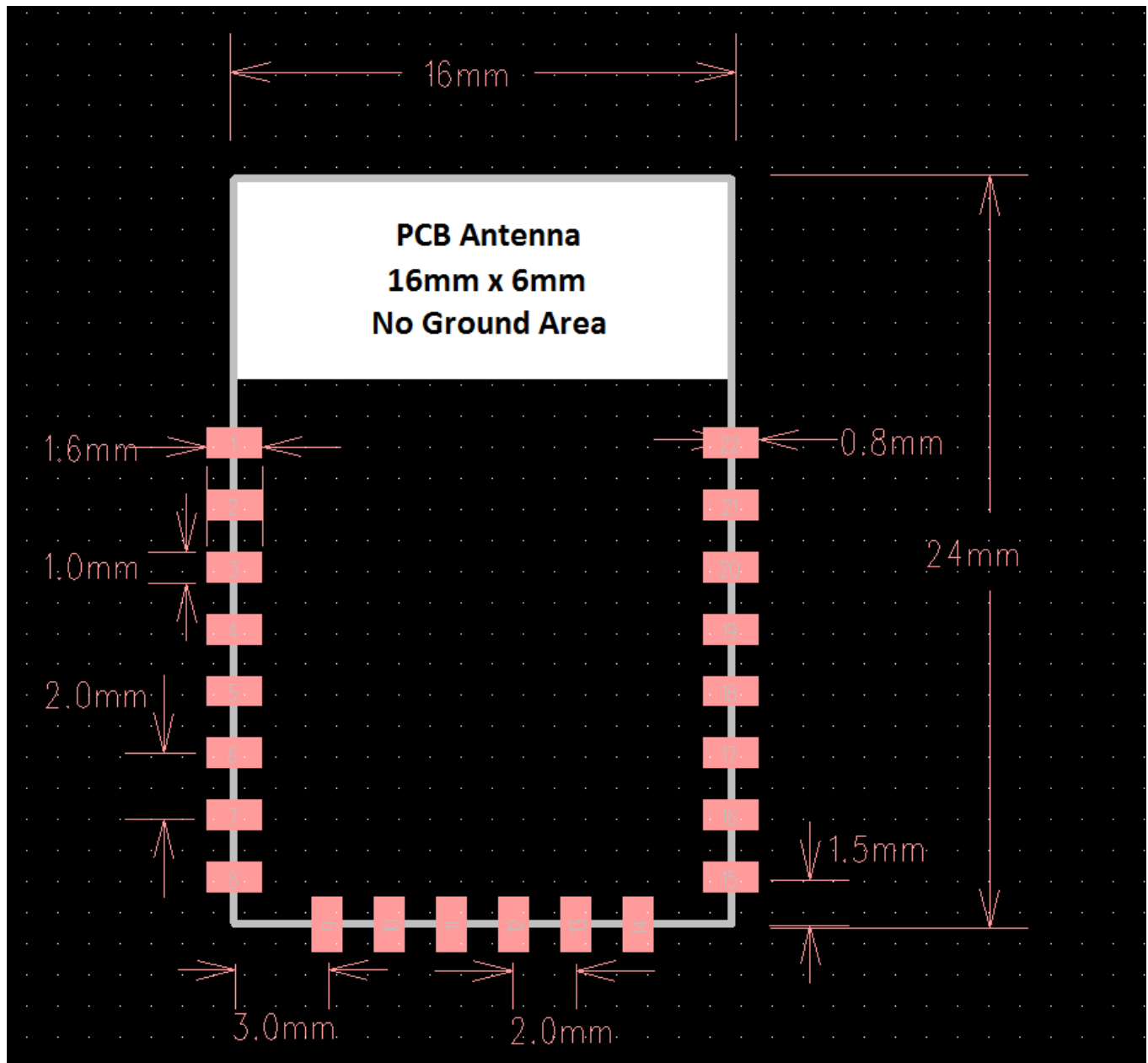
Pin	Pin-Define	Type	Description
1	PA[12] / LP_PWM0 / SPI1_MOSI	I/O	GPIOA_12 / LP_UART_TXD / SPI1_MOSI / LP_PWM0 / HS_PWM0 / I2S_MCLK
2	PA[13] / LP_PWM1 / SPI1_MISO	I/O	GPIOA_13 / LP_UART_RXD / SPI1_MISO / LP_PWM1 / HS_PWM1 / I2S_SD_TX1
3	CEN	I	Chip Enable (High Active)
4	PA[14] / SPI1_CLK	I/O	GPIOA_14 / LP_UART_RTS / SPI1_CLK / I2S_SD_TX2
5	PA[15] / PA[16] / SPI1_CS	I/O	GPIOA_15 / LP_UART_CTS / SPI1_CS / GPIOA_16 / HS_UART0_RTS / SPI0_MOSI
6	PA[27]	I/O	GPIOA_27 / LP_UART_RTS / SWD_DATA Boot Trap (L=Test mode; H=Normal mode)
7	PA[30] / HS_PWM7	I/O	GPIOA_30 / HS_USI_SPI_CLK / HS_PWM7 / LP_PWM1 Boot Trap (L=1.1V by LDO mode; H=1.1V by SPS mode)
8	VBAT	P	Main Power Supply Input
9	PA[28] / USB_RREF	I/O	GPIOA_28 / LP_UART_CTS / HS_USI_SPI_CS / HS_PWM6 / LP_PWM0 / RREF
10	PA[26] / USB_HSDP	I/O	GPIOA_26 / LP_UART_TXD / HS_USI_SPI_MISO / LP_I2C_SDA / HS_PWM5 / LP_PWM5 / HSDP
11	PA[25] / USB_HSDM	I/O	GPIOA_25 / LP_UART_RXD / HS_USI_SPI_MOSI / LP_I2C_SCL / HS_PWM4 / LP_PWM4 / HSDM
12	PB[2] / ADC_5	I/O	GPIOB_2 / LP_UART_RXD / ADC_5
13	PB[1] / ADC_4	I/O	GPIOB_1 / LP_UART_TXD / ADC_4
14	PB[20] / SD_CMD	I/O	GPIOB_20 / HS_USI_UART_TXD / HS_UART0_CTS / SPI0_CLK / HS_USI_I2C_SCL / SD_CMD / HS_PWM12 / LP_PWM0 / I2S_CLK
15	GND	P	Ground
16	PB[21] / SD_CLK	I/O	GPIOB_21 / HS_USI_UART_RXD / HS_UART0_RTS / SPI0_CS / HS_USI_I2C_SDA / SD_CLK / HS_PWM13 / LP_PWM1 / I2S_WS
17	PB[19] / SD_D3 / HS_UART0_TXD	I/O	GPIOB_19 / HS_USI_UART_CTS / HS_UART0_TXD / SPI0_MISO / SD_D3 / HS_PWM11 / LP_PWM5 / SWD_DATA / I2S_SD_TX0
18	PB[18] / SD_D2 / HS_UART0_RXD	I/O	GPIOB_18 / HS_USI_UART_RTS / HS_UART0_RXD / SPI0_MOSI / SD_D2 / HS_PWM10 / LP_PWM4 / SWD_CLK
19	PB[22] / SD_D0	I/O	GPIOB_22 / IR_RX / SD_D0 / HS_PWM14 / LP_PWM2 / I2S_SD_RX
20	PB[23] / PB[24] / SD_D1	I/O	GPIOB_23 / IR_TX / SD_D1 / HS_PWM15 / LP_PWM3 / I2S_MCLK / GPIOB_24 / HS_USI_I2C_SCL / SD_WP / HS_PWM16 / LP_PWM4
21	PA[8] / UART_LOG_RXD	I/O	GPIOA_8 / UART_LOG_RXD
22	PA[7] / UART_LOG_TXD	I/O	GPIOA_7 / UART_LOG_TXD Boot Trap (L= Flash download; H=Normal run)

6. Dimensions

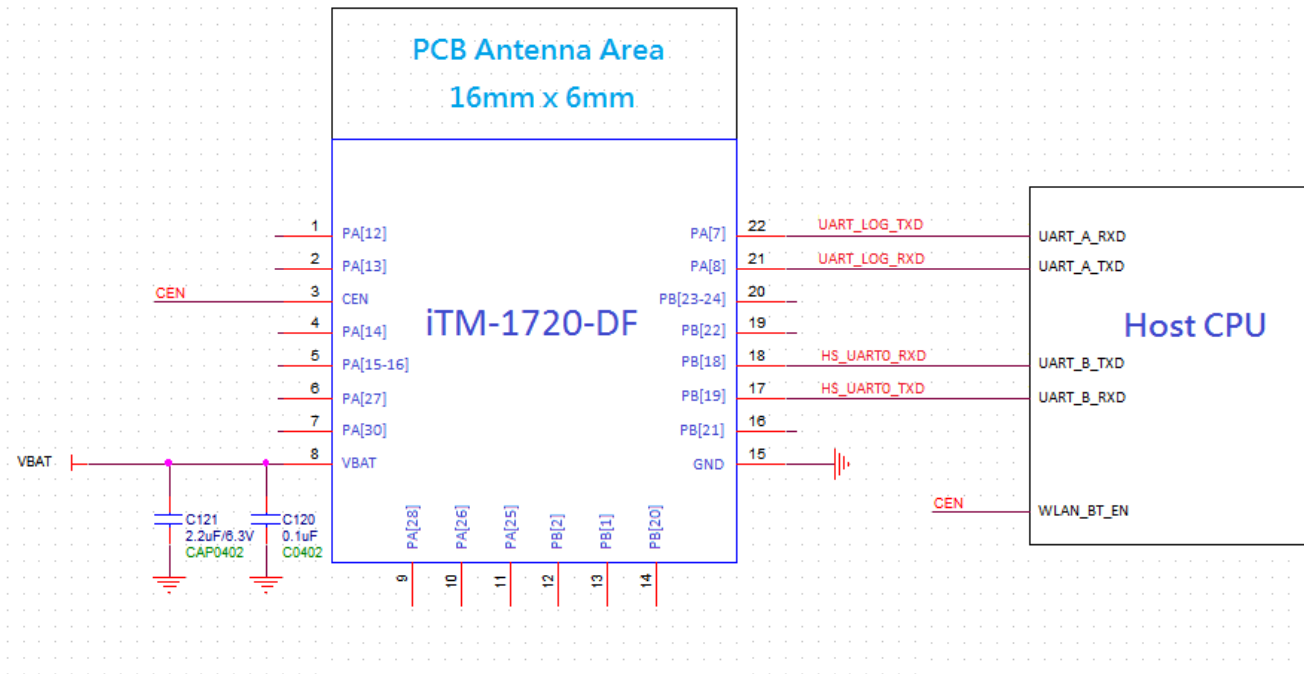
6.1 Layout Recommendation

(Unit: mm)

< TOP VIEW >



7. Reference Design



PA[12] / PA[13] / PA[14] / PA[15-16]

- Can be configured as SPI(1)

PA[26] / PA[25]

- Can be configured as USB

PB[2] / PB[1]

- Can be configured as SAR ADC

PB[20] / PB[21] / PB[19] / PB[18] / PB[22] / PB[23-24]

- Can be configured as SDIO / SPI(0)

PA[7]

- Pull-high when boot-up for normal operation
- Pull-low when boot-up for firmware download

PA[27] / PA[30]

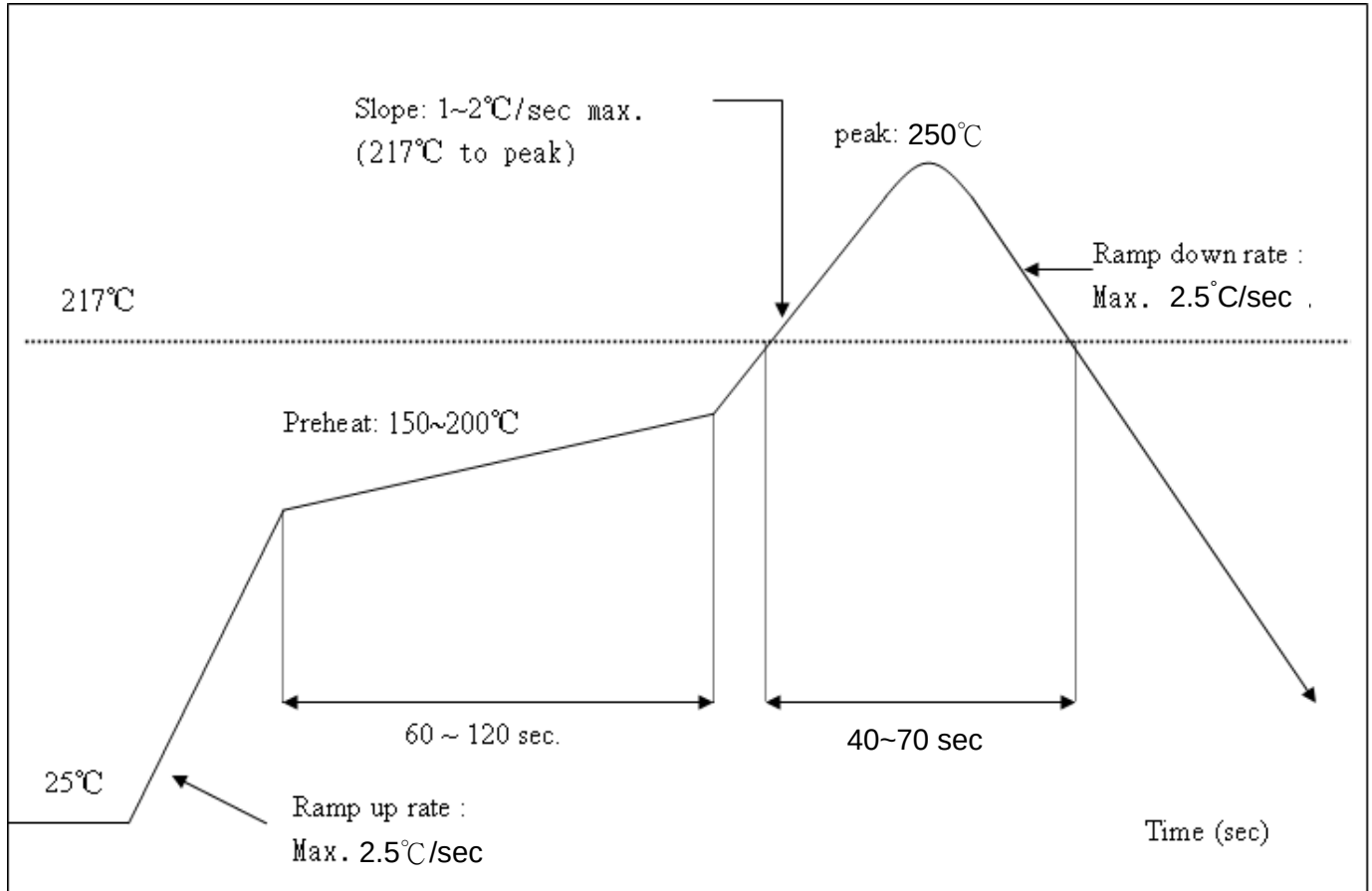
- Pull-high when boot-up for normal operation

8. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : $<250^{\circ}\text{C}$

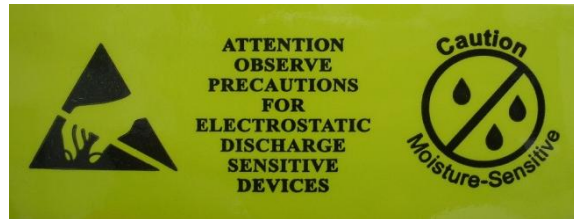
Number of Times : ≤ 2 times



9. Packing Information

9.1 Label

Label A → Anti-static and humidity notice



Label B → MSL caution / Storage Condition

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

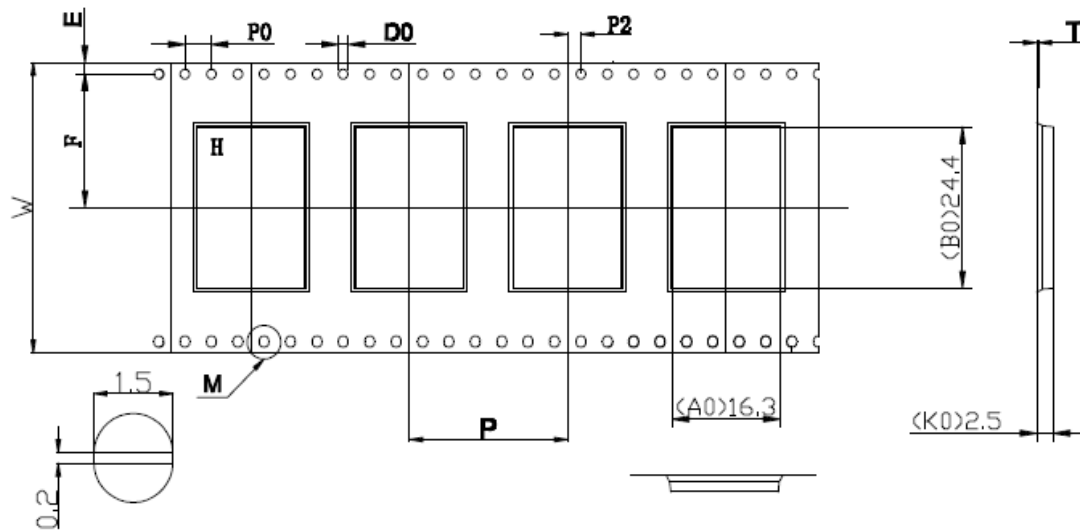
Label C → Inner box label .

PKG S/N :	
Model:	
P/N :	
Qty :	
Date Code	
Lot Code :	

Label D → Carton box label .

iotTech Corporation	
Model Name :	
Part No :	
Quantity :	
Lot D/C :	
Manufacture :	

9.2 Dimension



Symbol	AO	BO	KO	PO	P	P2
Spec	16.3±0.10	24.4±0.10	2.50±0.10	4.00±0.10	32.0±0.10	2.00±0.10
Symbol	W	T	E	F	DO	
Spec	44.0±0.30	0.30±0.05	1.75±0.10	20.2±0.10	1.50±0.10	

1. 10 sprocket hole pitch cumulative tolerance ± 0.20 .
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481-D requirements.
5. Thickness : 0.30 ± 0.05 mm.
6. Packing length per 22" reel : 98.5 Meters.(1:3)
7. Component load per 13" reel : 1000 pcs.

