



iTM1852-BS

**IEEE 802.11 a/b/g/n/ac/ax 2T2R WLAN
+ Bluetooth 5.2 Combo Module**

2024-02-01

Revision History

Date	Revision Content	Revised By	Version
2021/12/15	- Initial released	Issac Chen	0.0
2022/03/11	- Dimension info. revised	Issac Chen	1.0
2024/02/01	- RF and pin description revised	Issac Chen	1.1
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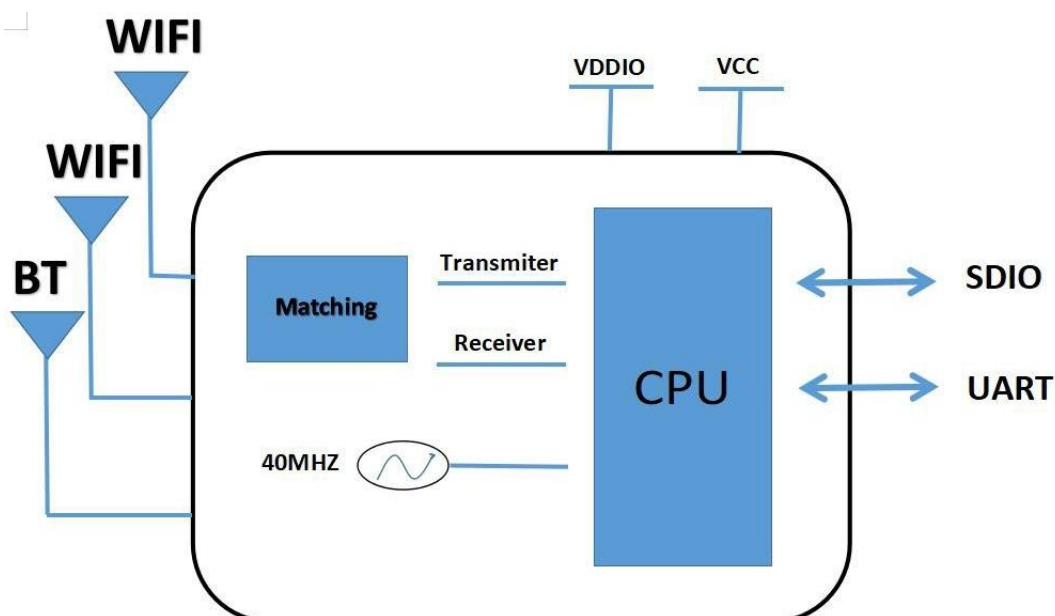
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1. General Description

The iTM1852-BS is a highly integrated module that support 2-stream 802.11ax solutions with Multi-user MIMO (Multiple-Input, Multiple-Output) with Wireless LAN (WLAN) SDIO(SDIO 1.1/2.0/3.0) interface controller with integrated Bluetooth 5 HS-UART interface controller. It combines a WLAN MAC, a 2T2R capable WLAN baseband, and RF in a single chip. The iTM1852-BS provides a complete solution for a high-performance integrated wireless and Bluetooth device. The iTM1852-BS baseband implements Multi-user Multiple Input,

Multiple Output (MU-MIMO) Orthogonal Frequency Division Multiplexing (OFDM) with two transmit and two receive paths(2T2R). Features include two spatial stream transmissions, short Guard Interval (GI), spatial spreading, and support for variant channel bandwidth. Moreover, iTM1852-BS provides one spatial stream space-time block code (STBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range of transmission. At the receiver, extended range and good minimum sensitivity is achieved by having receiver diversity up to 2 antennas. As the recipient, the iTM1852-BS also supports explicit sounding packet feedback that helps senders with beam-forming capability.

The general hardware for the module is shown as below.



2. Features

- IEEE 802.11a/b/g/n/ac/ax compatible WLAN.
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz.
- Supports 802.11ac 2x2, Wave-2 compliant with RX MU-MIMO.
- Complete 802.11n MIMO solution for 2.4GHz and 5GHz band.
- Supports Bluetooth 5.0 system.
- Support Bluetooth 5 system (BT 5.2 Logo Compliant).
- Supports WLAN-Bluetooth coexistence and low power Bluetooth.
- Compatible with Bluetooth v2.1+EDR.
- Maximum PHY data rate up to 286.8 Mbps using 20MHz bandwidth, 573.5Mbps using 40MHz bandwidth, and 1201Mbps using 80MHz bandwidth.
- Backward compatible with 802.11a/b/g devices while operating at 802.11n data rates.
- Backward compatible with 802.11a/n/ac devices while operating at 802.11ax data rates.

3. General Specification

3.1 Voltages

3.1.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VCC33	Input Power Supply Voltage	-0.3	3.6	V
VDDIO	IO Power Supply Voltage	-0.3	3.6	V

3.1.2 Recommended Operating Ratings

Test conditions: At room temperature				
Symbol	Min.	Typ.	Max.	Unit
VCC33	3.15	3.3	3.45	V
VDDIO	1.68	1.8/3.3	3.6	V

Test conditions: At operating temperature -10°C ~70°C				
Symbol	Min.	Typ.	Max.	Unit
VCC33	3.15	3.3	3.45	V
VDDIO	1.68	1.8/3.3	3.6	V

3.2 Wi-Fi RF Specification

2.4G WLAN

Feature	Description		
WLAN Standard	IEEE 802.11 b/g/n Wi-Fi compliant		
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)		
Number of Channels	2.4GHz: Ch1 ~ Ch14		
Spectrum Mask	Complies with IEEE standard		
Freq. Tolerance	±12 ppm		
Test Items	Typical Value		EVM
Output Power	802.11b 11Mbps	17dBm ± 2 dB	EVM ≤ -13dB
	802.11g 54Mbps	14dBm ± 2 dB	EVM ≤ -25dB
	802.11n MCS7 HT20	13dBm ± 2 dB	EVM ≤ -28dB
	802.11n MCS7 HT40	13dBm ± 2 dB	EVM ≤ -28dB
	802.11ax HE20 MCS11	10dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE40 MCS11	10dBm ± 2 dB	EVM ≤ -35dB
Test Items	Typical Value		
SISO Receive Sensitivity (11b,20MHz) @8% PER	1Mbps	-94 dBm	≤-83 dBm
	11Mbps	-85 dBm	≤-76 dBm
SISO Receive Sensitivity (11g,20MHz) @10% PER	6Mbps	-90 dBm	≤-85 dBm
	54Mbps	-71 dBm	≤-68 dBm
SISO Receive Sensitivity (11n,20MHz) @10% PER	MCS=0	-90 dBm	≤-85 dBm
	MCS=7	-69 dBm	≤-67 dBm
SISO Receive Sensitivity (11n ,40MHz) @10% PER	MCS=0	-87 dBm	≤-82 dBm
	MCS=7	-66 dBm	≤-64 dBm
SISO Receive Sensitivity (11ax ,20MHz) @10% PER	MCS=0	-90 dBm	≤ -74 dBm
	MCS=11	-60 dBm	≤ -52 dBm
SISO Receive Sensitivity (11ax ,40MHz) @10% PER	MCS=0	-87 dBm	≤ -71 dBm
	MCS=11	-57 dBm	≤ -49 dBm
Maximum Input Level	802.11b: -10 dBm		
	802.11g/n : -20 dBm		
Antenna Reference	Small antennas with 0~3 dBi peak gain		

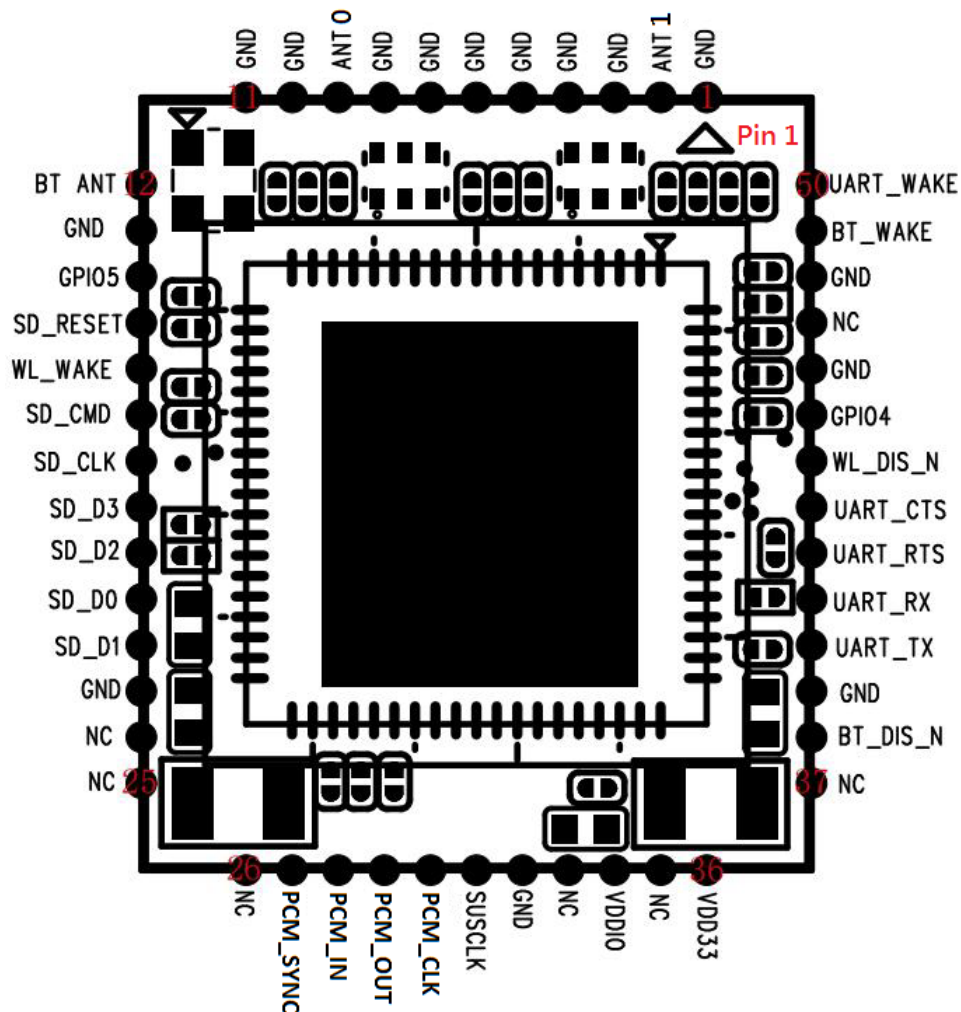
5G WLAN

Feature	Description		
WLAN Standard	IEEE 802.11a/n/ac/ax 2x2, Wi-Fi compliant		
Frequency Range	4.900 GHz ~ 5.845 GHz (5.0 GHz ISM Band)		
Test Items	Typical Value		EVM
Output Power	802.11a 54Mbps:	13 dBm $\pm$ 2 dB	EVM $\leq$ -25dB
	802.11n MCS7:	12 dBm $\pm$ 2 dB	EVM $\leq$ -28dB
	802.11ac VHT80 MCS9:	10 dBm $\pm$ 2 dB	EVM $\leq$ -32dB
	802.11ax HE80 MCS11:	10 dBm $\pm$ 2 dB	EVM $\leq$ -35Db
Test Items	Test Value		
SISO Receive Sensitivity (11a,20MHz) @10% PER	6Mbps	-90 dBm	$\leq$ -85
	54Mbps	-71 dBm	$\leq$ -68
SISO Receive Sensitivity (11n,20MHz) @10% PER	MCS=0	-90 dBm	$\leq$ -85
	MCS=7	-69 dBm	$\leq$ -67
SISO Receive Sensitivity (11n,40MHz) @10% PER	MCS=0	-87 dBm	$\leq$ -82
	MCS=7	-66 dBm	$\leq$ -64
SISO Receive Sensitivity (11ac,20MHz)@10% PER	MCS=0, NSS1	-90 dBm	$\leq$ -82
	MCS=8, NSS1	-64 dBm	$\leq$ -60
SISO Receive Sensitivity (11ac,40MHz) @10% PER	MCS=0, NSS1	-87 dBm	$\leq$ -79
	MCS=9, NSS1	-59 dBm	$\leq$ -55
SISO Receive Sensitivity (11ac,80MHz) @10% PER	MCS=0, NSS1	-84 dBm	$\leq$ -79
	MCS=9, NSS1	-56 dBm	$\leq$ -54
SISO Receive Sensitivity (11ax,20MHz) @10% PER	MCS=0	-90 dBm	$\leq$ -74
	MCS=11	-60 dBm	$\leq$ -52
SISO Receive Sensitivity (11ax,40MHz) @10% PER	MCS=0	-87 dBm	$\leq$ -71
	MCS=11	-57 dBm	$\leq$ -49
SISO Receive Sensitivity (11ax,80MHz) @10% PER	MCS=0	-84 dBm	$\leq$ -68
	MCS=11	-53 dBm	$\leq$ -46
Maximum Input Level	802.11a/n: -30 dBm		
Antenna Reference	Small antennas with 0~3 dBi peak gain		

3.3 Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V5.2		
Host Interface	HS-UART		
Antenna Reference	Small antennas with 0~3 dBi peak gain		
Frequency Band	2402 MHz ~ 2480 MHz.		
Number of Channels	79 channels		
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK		
RF Specification			
	Min.	Typical.	Max.
Output Power (Class 1)	2dBm	5dBm	8dBm
Output Power (Class 2)		2dBm	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-92dBm	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-86dBm	
Sensitivity @ BER=0.01% for 8-DPSK (3Mbps)		-85dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

4. Pin Assignments



4.1 Pin Definition

NO	Name	Type	Description
1	GND	G	Ground connections
2	ANT1	I/O	RF I/O Port 1 for WIFI/BT
3	GND	G	Ground connections
4	GND	G	Ground connections
5	GND	G	Ground connections
6	GND	G	Ground connections
7	GND	G	Ground connections
8	GND	G	Ground connections

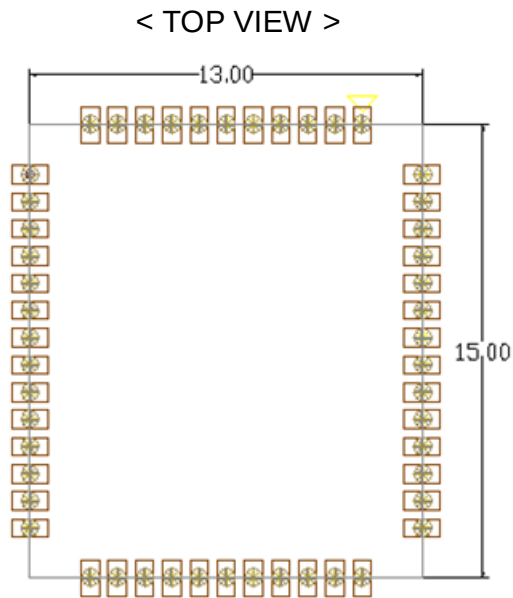
9	ANT0	I/O	RF I/O Port 0 for WIFI
10	GND	G	Ground connections
11	GND	G	Ground connections
12	BT_ANT	--	No connect (Optional BT RF I/O Port)
13	GND	G	Ground connections
14	GPIO5	I/O	GPIO5 / G_BT NC if not used Do not connect to GND
15	SD_RESET	I	Reset Pin for SDIO interface ON: pull high OFF: pull low to disable SDIO interface
16	WL_WAKE	O	WLAN to wake-up HOST
17	SD_CMD	I/O	SDIO command line
18	SD_CLK	I/O	SDIO CLK
19	SD_D3	I/O	SDIO Data Line 3
20	SD_D2	I/O	SDIO Data Line 2
21	SD_D0	I/O	SDIO Data Line 0
22	SD_D1	I/O	SDIO Data Line 1
23	GND	G	Ground connections
24	NC	—	No connect
25	NC	—	No connect
26	NC	—	No connect
27	PCM_SYNC	—	No connect
28	PCM_IN	—	No connect
29	PCM_OUT	—	No connect
30	PCM_CLK	—	No connect
31	SUSCLK	—	No connect
32	GND	G	Ground Connections
33	NC	—	No connect
34	VDDIO	P	I/O voltage supply 1.8V or 3.3V
35	NC	--	No connect
36	VDD33	—	Main voltage supply 3.3V
37	NC	--	No connect
38	BT_DIS_N	I	Enable pin for Bluetooth device ON: pull high ; OFF: pull low
39	GND	G	Ground connections

40	UART_TX	O	High-Speed UART Data Out
41	UART_RX	I	High-Speed UART Data In
42	UART_RTS	O	High-Speed UART RTS
43	UART_CTS	I	High-Speed UART CTS
44	WL_DIS_N	I	Enable pin for WLAN Radio ON: pull high; OFF: pull low External pull low to disable WLAN Radio
45	GPIO4	—	GPIO4, G_WL NC if not used. Do not pull high
46	GND	G	Ground connections
47	NC	—	No connect
48	GND	G	Ground connections
49	BT_WAKE	I	Host wake-up Bluetooth device
50	UART_WAKE	O	Bluetooth device to wake-Host

5. Dimensions

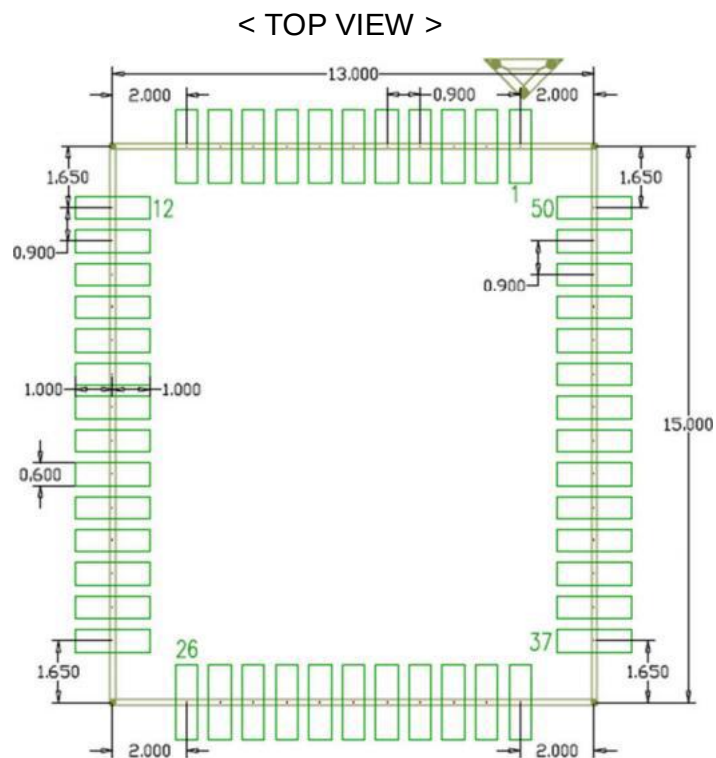
5.1 Physical Dimension

(Unit: mm)

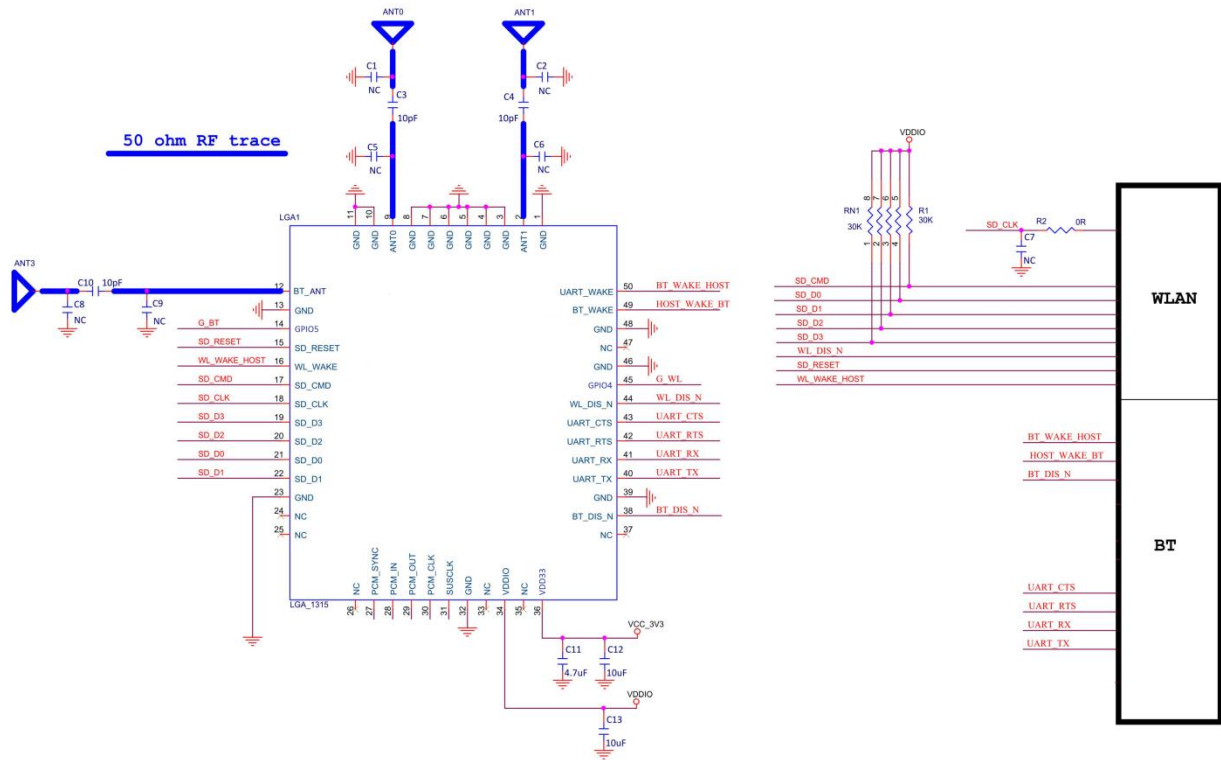


5.2 Layout Recommendation

(Unit: mm)



6. Reference Design



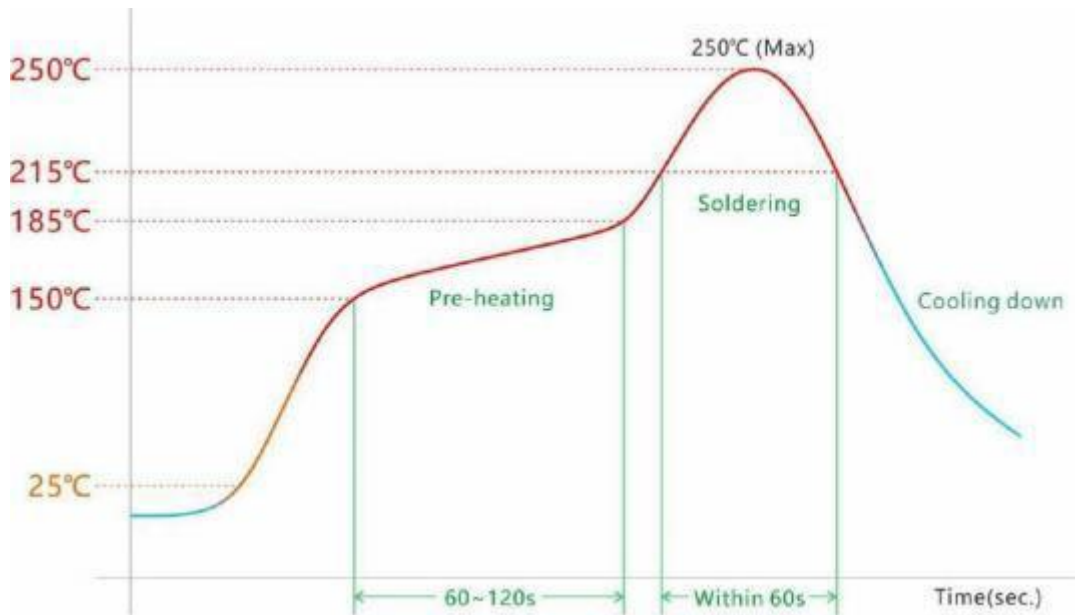
C11, C12 should be placed close to pin 36 of the module
C13 should be placed close to pin 34 of the module

7. Recommended Reflow Profile

Referred to IPC/JEDEC standard. Peak

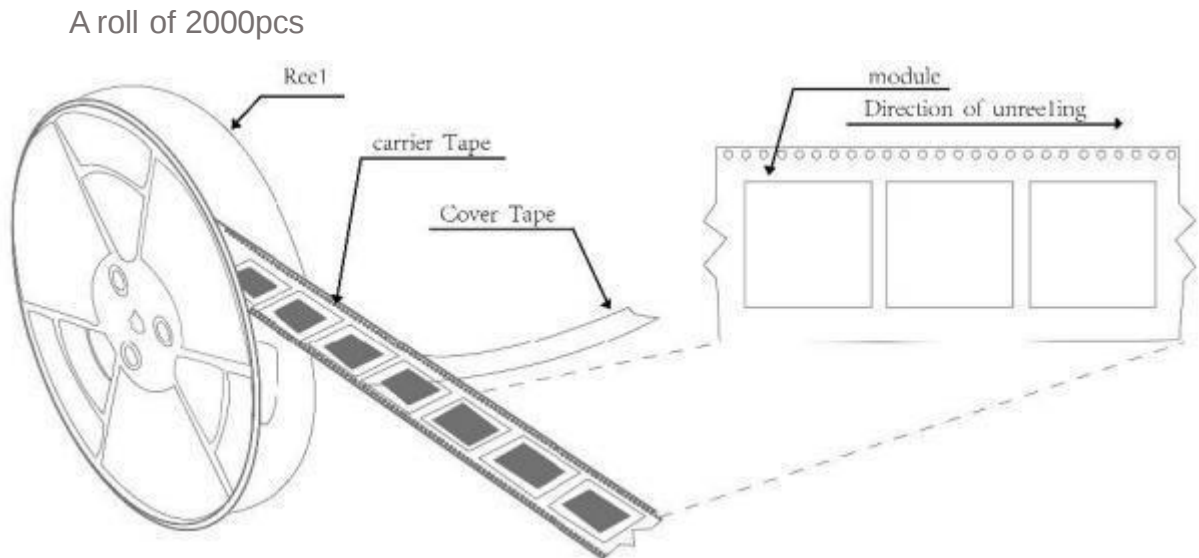
Temperature : <250° C Number of Times :

≤2 times

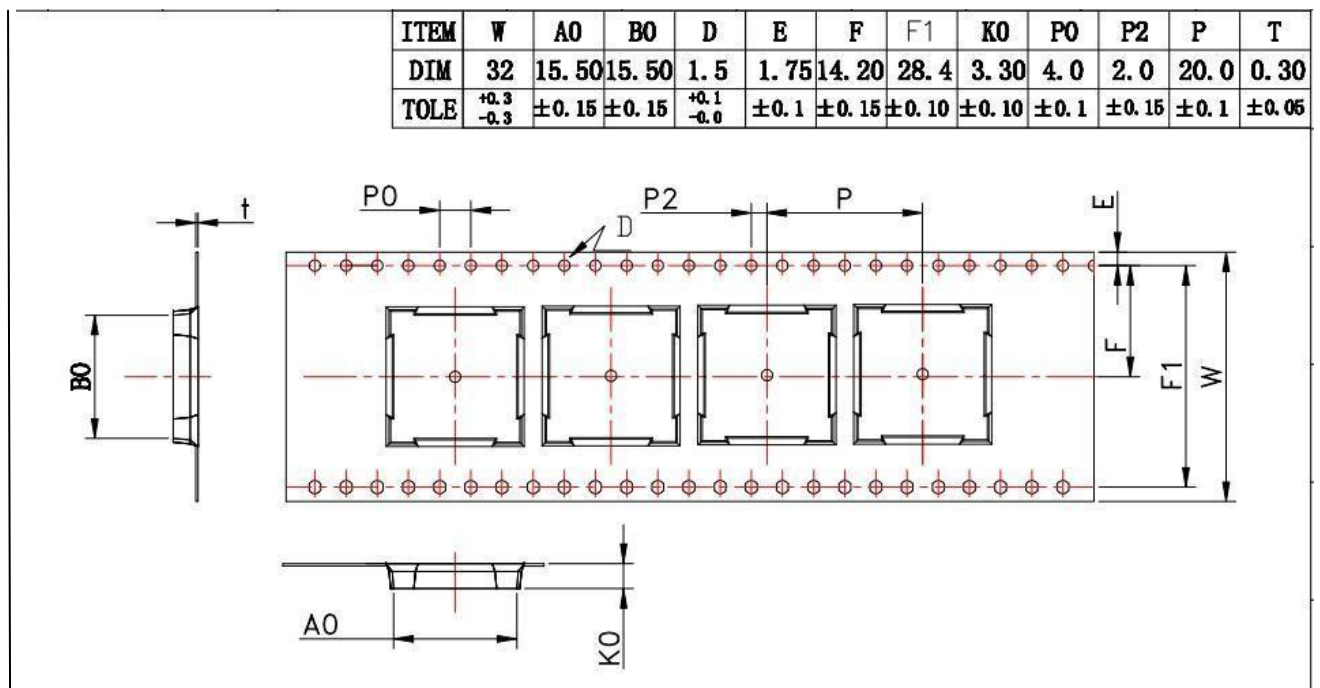


8. Package Information

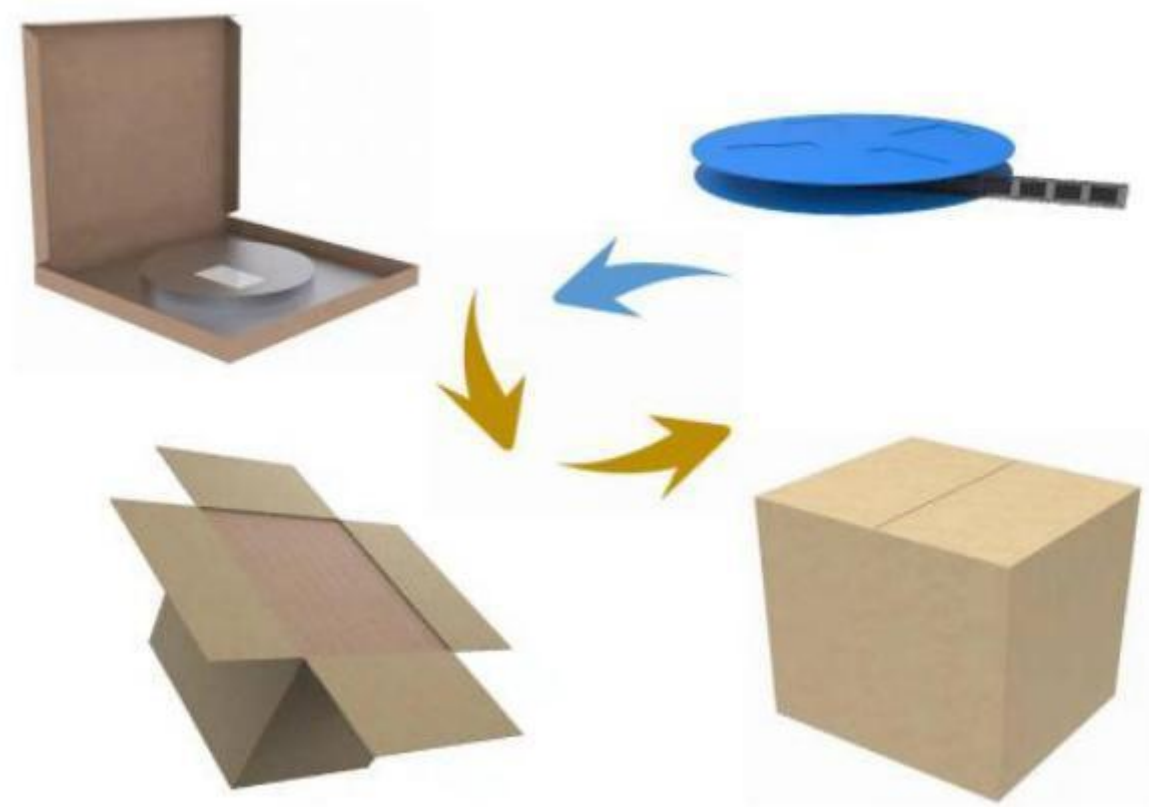
8.1 Reel



8.2 Carrier Tape Detail



8.3 Packaging Detail



8.4 Moisture sensitivity

The module is a Moisture Sensitive Device Level 3, in according with standard IPC/JEDEC J-STD-020, take care all the relatives requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

- (a) Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH).
- (b) Environmental condition during the production: $30^{\circ}\text{C}/60\%$ RH according to IPC/JEDEC J-STD-033A paragraph 5.
- (c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition
- (d) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected

Baking is required if conditions (b) or (c) are not respected

Baking is required if the humidity indicator inside the bag indicates 10% RH or more