

PRODUCT SPECIFICATION

6252M-PUC

Wi-Fi Tri-band 2x2 11ax + Bluetooth 5.3

PCIe Combo Module

Version:v1.3

Customer: _____

Customer P/N: _____

Signature: _____

Date: _____

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6252M-PUC Module Datasheet

Ordering Information	Part NO.	Description
	FG6252MPUC-00	RTL8852CE-CG/wifi6E/2T2R+BT5.3,802.11a/b/g/n/ac/ax,PC IE+USB,22*30,M.2 接口



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1. General Description

1.1 Introduction

6252M-PUC is a highly integrated module that support 2-stream 802.11ax solutions with Multi-user MIMO with WLAN PCI Express network interface controller with integrated Bluetooth 5 USB interface controller. It combines a WLAN MAC, a 2T2R capable WLAN base band and RF. The 6252M-PUC provides a complete solution for a high-performance integrated wireless and Bluetooth device.

1.2 Description

Model Name	6252M-PUC
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 22 x 30 mm x 2.2 mm
Host Interface	Support PCIE/USB
OS supported	Android /Linux/windows
Operating temperature	-10°C to 70°C
Storage temperature	-55°C to 125°C

2. Features

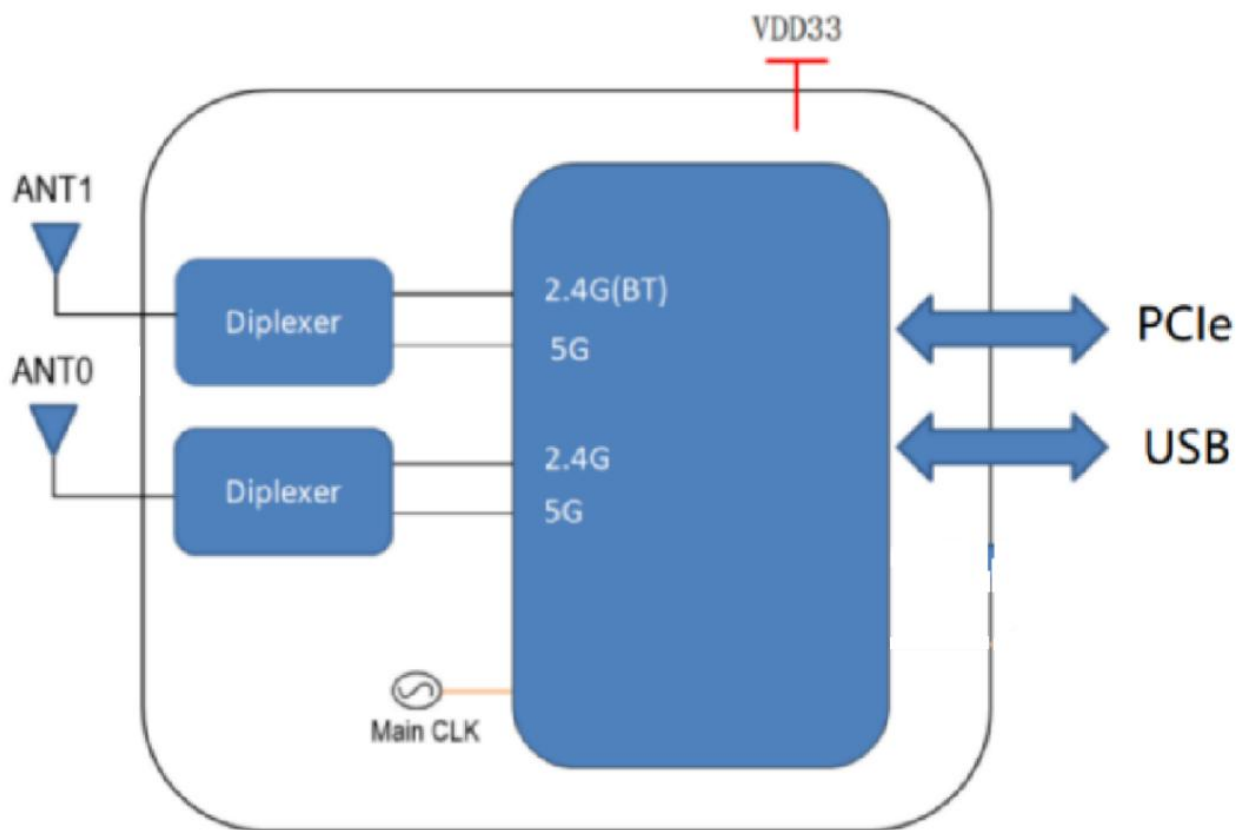
General

- IEEE 802.11a/b/g/n/ac/ax compatible WLAN
- Support 802.11ac 2x2, Wave-2 compatible with MU-MIMO
- Support 802.11ax 2x2, with OFDMA and MU-MIMO, by 4 types PPDU format, such as HE-SU-PPDU, HE-ER-SU-PPDU, HEMU-PPDU, and HE-TB-PPDU
- Complete 802.11n MIMO solution for 2.4GHz and 5Ghz band and 6Ghz band
- Compatible with PCI-e Base Specification Revision 2.1, PCIe LTR/L1.Off state supported
- IEEE 802.11e/i(WPA, WPA2, WPA3)/h DFS, TPC/k/WAPI
- Maximum PHY data rate up to 2402Mbps using 160MHz, 573.5Mbps using 40MHz bandwidth

Bluetooth Features

- Support Bluetooth 5 system (BT 5.3 Logo Compliant)
- Compatible with USB2.0 FS-mode Specification for Bluetooth. USB Selective Suspend supported
- Compatible with Bluetooth v2.1+EDR
- Dual Mode support: Simultaneous LE and BR/EDR

3. Block Diagram



4. General Specification

4.1 2.4GHz RF Specification

Feature	Description	
WLAN Standard	IEEE 802.11 b/g/n/ax Wi-Fi compliant	
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)	
Number of Channels	2.4GHz: Ch1 ~ Ch14	
Test Items	Typical Value	EVM
	802.11a 11Mbps: 17dBm $\pm$ 2 dB	
Output Power ¹	802.11b 11Mbps: 17dBm $\pm$ 2 dB	EVM $\leq$ -9dB
	802.11g 54Mbps: 17dBm $\pm$ 2 dB	EVM $\leq$ -25dB
	802.11n MCS7: 17dBm $\pm$ 2 dB	EVM $\leq$ -28dB
	802.11ax HE20 MCS11: 13dBm $\pm$ 2 dB	EVM $\leq$ -35dB
	802.11ax HE40 MCS11: 13dBm $\pm$ 2 dB	EVM $\leq$ -35dB
Spectrum Mask	Meet with IEEE standard	

Freq. Tolerance	$\pm 20\text{ppm}$	
Test Items	TYP Test Value	Standard Value
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps @ -94 dBm	$\leq -82\text{ dBm}$
	- 11Mbps @ -85 dBm	$\leq -76\text{ dBm}$
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps @ -90 dBm	$\leq -82\text{ dBm}$
	- 54Mbps @ -71 dBm	$\leq -65\text{ dBm}$
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 @ -90 dBm	$\leq -82\text{ dBm}$
	- MCS=7 @ -69 dBm	$\leq -64\text{ dBm}$
SISO Receive Sensitivity (11n ,40MHz) @10% PER	- MCS=0 @ -87 dBm	$\leq -79\text{ dBm}$
	- MCS=7 @ -66 dBm	$\leq -61\text{ dBm}$
SISO Receive Sensitivity (11ax,20MHz) @10% PER	- MCS=0 @ -90 dBm	$\leq -82\text{ dBm}$
	- MCS=11 @ -60 dBm	$\leq -52\text{ dBm}$
SISO Receive Sensitivity (11ax ,40MHz) @10% PER	- MCS=0 @ -87 dBm	$\leq -79\text{ dBm}$
	- MCS=11 @ -57 dBm	$\leq -49\text{ dBm}$
Maximum Input Level	802.11b : -10 dBm	
	802.11g/n : -20 dBm	

4.2 5GHz RF Specification

Feature	Description	
WLAN Standard	IEEE 802.11a/n/ac/ax 2x2, Wi-Fi compliant	
Frequency Range	5.15 GHz ~ 5.850 GHz(5.0 GHz ISM Band)	
Number of Channels	5.0GHz: Please see the table ¹	
Test Items	Typical Value	EVM
Output Power ¹	802.11a /54Mbps: 16 dBm $\pm$ 2 dB	EVM $\leq -25\text{dB}$
	802.11n /MCS7: 15 dBm $\pm$ 2 dB	EVM $\leq -28\text{dB}$
	802.11ac VHT20 MCS8: 14 dBm $\pm$ 2 dB	EVM $\leq -30\text{dB}$
	802.11ac VHT40 MCS9: 13 dBm $\pm$ 2 dB	EVM $\leq -32\text{dB}$
	802.11ac VHT80 MCS9: 13 dBm $\pm$ 2 dB	EVM $\leq -32\text{dB}$
	802.11ax HE20 MCS11: 11 dBm $\pm$ 2 dB	EVM $\leq -35\text{dB}$
	802.11ax HE40 MCS11: 11 dBm $\pm$ 2 dB	EVM $\leq -35\text{dB}$
	802.11ax HE80 MCS11: 11 dBm $\pm$ 2 dB	EVM $\leq -35\text{dB}$
	802.11ax HE160 MCS11: 11 dBm $\pm$ 2 dB	EVM $\leq -35\text{dB}$
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	$\pm 20\text{ppm}$	
Test Items	Test Value	Standard Value

SISO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps @ -90 dBm	≤-82
	- 54Mbps @ -71 dBm	≤-65
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-82
	- MCS=7 @ -69 dBm	≤-64
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-79
	- MCS=7 @ -66 dBm	≤-61
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 @ 90 dBm	≤-82
	- MCS=8, NSS1 @ -64 dBm	≤-57
SISO Receive Sensitivity (11ac ,40MHz) @10% PER	- MCS=0, NSS1 @ -87 dBm	≤-79
	- MCS=9, NSS1 @ -59 dBm	≤-54
SISO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 @ -84 dBm	≤-76
	- MCS=9, NSS1 @ -56 dBm	≤-51
SISO Receive Sensitivity (11ax,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-82
	- MCS=11 @ -60 dBm	≤-52
SISO Receive Sensitivity (11ax ,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-79
	- MCS=11 @ -57 dBm	≤-49
SISO Receive Sensitivity (11ax,80MHz) @10% PER	- MCS=0 @ -84 dBm	≤-76
	- MCS=11 @ -54 dBm	≤-46
SISO Receive Sensitivity (11ax,160MHz) @10% PER	- MCS=0 @ -83 dBm	≤-63
	- MCS=11 @ -53 dBm	≤-43
Maximum Input Level	802.11a/n: -30 dBm	

4.3 6GHz RF Specification

Feature	Description	
WLAN Standard	IEEE 802.11a/n/ac/ax 2x2, Wi-Fi compliant	
Frequency Range	5.925 GHz ~ 7.125 GHz	
Number of Channels	6.0GHz: full band supported	
Test Items	Typical Value	EVM
Output Power ¹	802.11ax HE20 MCS11: 9 dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE40 MCS11: 9 dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE80 MCS11: 9 dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE160 MCS11: 9 dBm ± 2 dB	EVM ≤ -35dB
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	± 20ppm	

Test Items	Test Value	Standard Value
SISO Receive Sensitivity (11ax,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-82
	- MCS=11 @ -60 dBm	≤-52
SISO Receive Sensitivity (11ax ,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-79
	- MCS=11 @ -57 dBm	≤-49
SISO Receive Sensitivity (11ax,80MHz) @10% PER	- MCS=0 @ -84 dBm	≤-76
	- MCS=11 @ -54 dBm	≤-46
SISO Receive Sensitivity (11ax,160MHz) @10% PER	- MCS=0 @ -80 dBm	≤-73
	- MCS=11 @ -51 dBm	≤-43
Maximum Input Level	802.11a/n: -30 dBm	

1. 2.4G,5G,6G output power control by firmware power by rate table, user can define module target power

4.3 Bluetooth Specification

Feature	Description
General Specification	
Bluetooth Standard	BDR(1Mbps),EDR(2Mbps & 3Mbps),LE(1Mbps),2LE(2Mbps)
Host Interface	USB
Frequency Band	2400 MHz ~ 2483.5 MHz
Number of Channels	79 channels for classic,40 channels for BLE
Modulation	GFSK, $\pi/4$ -DQPSK,8DPSK
RF Specification	
Output Power , tolerance ± 3 dB	
	CL1(dBm)
BDR Output Power	4
EDR Output Power	4
BLE Output Power	4
Sensitivity, tolerance : ± 2 dB	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-90
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-88

Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-83
Sensitivity @ BLE=30.8% for LE (1Mbps)	-94
Sensitivity @ BLE=30.8% for 2LE (2Mbps)	-91
Maximum Input Level	GFSK (1Mbps):-20dBm
	$\pi/4$ -DQPSK (2Mbps) :-20dBm
	8DPSK (3Mbps) :-20dBm

5. ID setting information

WI-FI

Vendor ID	-
Product ID	-

6. Pin Definition

6.1 Pin Outline

PIN	Signal	Signal	PIN
1	GND	VD33 NGFF2230	2
3	HSDP	VD33 NGFF2230	4
5	HSDM	LED WL	6
7	GND	PCM CLK	8
9	NC	PCM SYNC	10
11	NC	PCM OUT	12
13	NC	PCM IN	14
15	NC	LED BT	16
17	NC	GND	18
19	NC	BT WAKE HOST	20
21	NC	UART TX	22
23	NC	NC	24
25	NC	NC	26
27	NC	NC	28
29	NC	NC	30
31	NC	UART RX	32
33	GND	UART RTS	34
35	HSIP	USRT CTS	36
37	HSIN	HOST WAKE BT	38
39	GND	NC	40
41	HSOP	NC	42
43	HSOP	NC	44
45	GND	NC	46
47	REFCLK+	NC	48
49	REFCLK-	NC	50
51	GND	PERSTn	52
53	CLKREQn	BT DIS N	54
55	WAKEn	WL DIS N	56
57	GND	NC	58
59	NC	NC	60
61	NC	NC	62
63	GND	NC	64
65	NC	Ant[1]	66
67	NC	Ant[2]	68
69	GND	Ant[3]	70
71	NC	VD33 NGFF2230	72
73	NC	VD33 NGFF2230	74
75	GND	GND	76
		GND	77

6.2 Pin Definition details

NO	Name	Type	Description	Voltage
1	GND	-	Ground connections	
3	HSDP	I/O	USB line for BT	
5	HSDM	I/O	USB line for BT	
7	GND	-	Ground connections	
9	NC	-	Floating (NC)	

11	NC		Floating (NC)	
13	NC		Floating (NC)	
15	NC		Floating (NC)	
17	NC	-	Floating (NC)	
19	NC	-	Floating (NC)	
21	NC	-	Floating (NC)	
23	NC	-	Floating (NC)	
25	NC		Floating (NC)	
27	NC		Floating (NC)	
29	NC		Floating (NC)	
31	NC		Floating (NC)	
33	GND	-	Ground connections	
35	HSIP	I	PCIe RX differential signals	
37	HSIN	I	PCIe RX differential signals	
39	GND	-	Ground connections	
41	HSOP	O	PCIe TX differential signals	
43	HSIN	O	PCIe TX differential signals	
45	GND	-	Ground connections	
47	REFCLK+	I	PCIe clock differential input signal	
49	REFCLK-	I	PCIe clock differential input signal	
51	GND		Ground connections	
53	CLKREQn	O	Reference Clock Request Signal. Also used by L1 PM substates. This signal is used by the 6252M to request for the PCI Express reference clock.	1.8V/3.3V
55	WAKEn	O	Power Management Event: Open drain, active low. Used to reactivate the PCI Express slot's main power rails and reference clocks. The host pull-up voltage can support 3.3V or 1.8V	1.8V/3.3V
57	GND	-	Ground connections	
59	NC	-	Floating (NC)	
61	NC	-	Floating (NC)	
63	GND	-	Ground connections	
65	NC	-	Floating (NC)	
67	NC	-	Floating (NC)	

69	GND	-	Ground connections	
71	NC	-	Floating (NC)	
73	NC	-	Floating (NC)	
75	GND	-	Ground connections	

Bottom side

NO	Name	Type	Description	Voltage
2	VD33_NGFF2230	P	Power supply	3.3V
4	VD33_NGFF2230	P	Power supply	3.3V
6	LED_WL	O	WLAN LED signal,active low	3.3V
8	PCM_CLK	I/O	general perpose input	3.3V
10	PCM_SYNC	I/O	general perpose input	3.3V
12	PCM_OUT	I/O	general perpose input	3.3V
14	PCM_IN	I/O	general perpose input	3.3V
16	LED_BT	O	BT LED signal,active low	3.3V
18	GND	-	Ground connections	
20	BT_WAKE_HOST	O	Bluetooth device to wake-up HOST, internal 100K pull high	3.3V
22	UART_TX	-	NC (keep no connection)	
24	NC		Floating (NC)	
26	NC		Floating (NC)	
28	NC		Floating (NC)	
30	NC		Floating (NC)	
32	UART_RX	-	NC (keep no connection)	
34	UART_RTS	-	NC (keep no connection)	
36	UART_CTS	-	NC (keep no connection)	
38	HOST_WAKE_BT	-	HOST device to wake-up Bluetooth	3.3V
40	NC	-	Floating (NC)	
42	NC	-	Floating (NC)	
44	NC	-	Floating (NC)	
46	NC	-	Floating (NC)	
48	NC	-	Floating (NC)	
50	NC	-	Floating (NC)	
52	PERSTn	I	PCI Express Reset Signal: active low. When the PERST# is asserted at power-on state,	1.8V/3.3V

			the RTL8852CE-CG returns to a pre-defined reset state and is ready for initialization and configuration after the de-assertion of the PERST#. The host pull-up voltage can support 3.3V or 1.8V	
54	BT_DIS_N	I	Bluetooth enable signal, pull low to disable BT function, default high. When this function is not required, external pull high is not required.	3.3V
56	WL_DIS_N	I	WLAN enable signal, pull low to disable BT function, default high. suggest configuring the control pin in platform side as open-drain and using internal pull high.	3.3V
58	NC	-	Floating (NC)	
60	NC	-	Floating (NC)	
62	NC	-	Floating (NC)	
64	NC	-	Floating (NC)	
66	Ant[1]		NC (keep no connection)	
68	Ant[2]		NC (keep no connection)	
70	Ant[3]		NC (keep no connection)	
72	VD33_NGFF2230	P	Power supply	
74	VD33_NGFF2230	P	Power supply	
76	GND	-	Ground connections	
77	GND	-	Ground connections	

P:POWER I:INPUT O:OUTPUT VDDIO:3.3V

7. Electrical Specifications

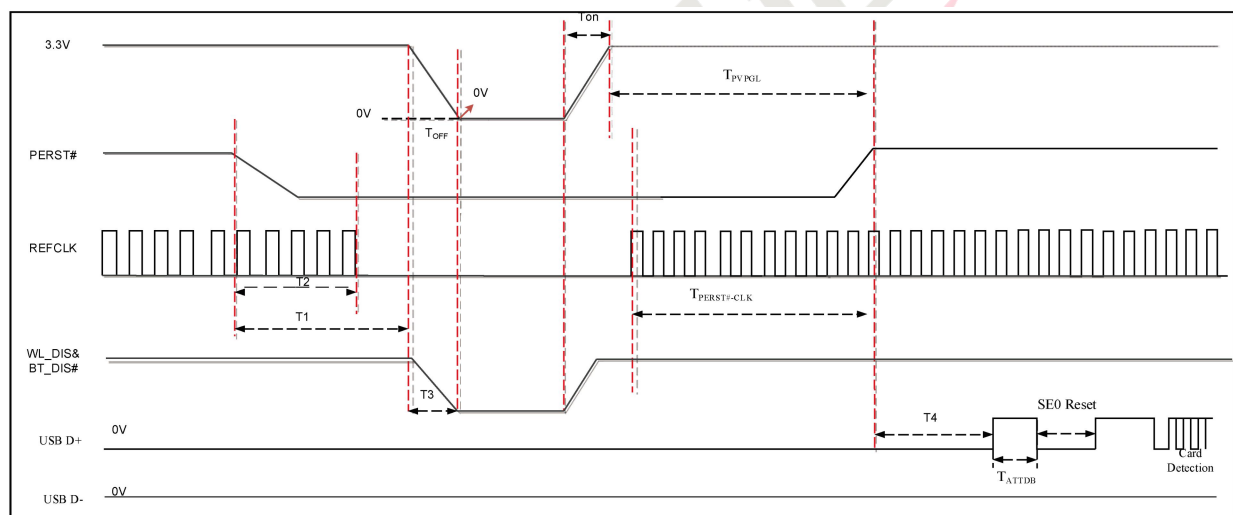
7.1 Power Supply DC Characteristics

	Min.	Typ.	Max.	Unit
Operating Temperature	-10	25	70	deg.C
VDD33	3.0	3.3	3.6	V
Current			1.5	A

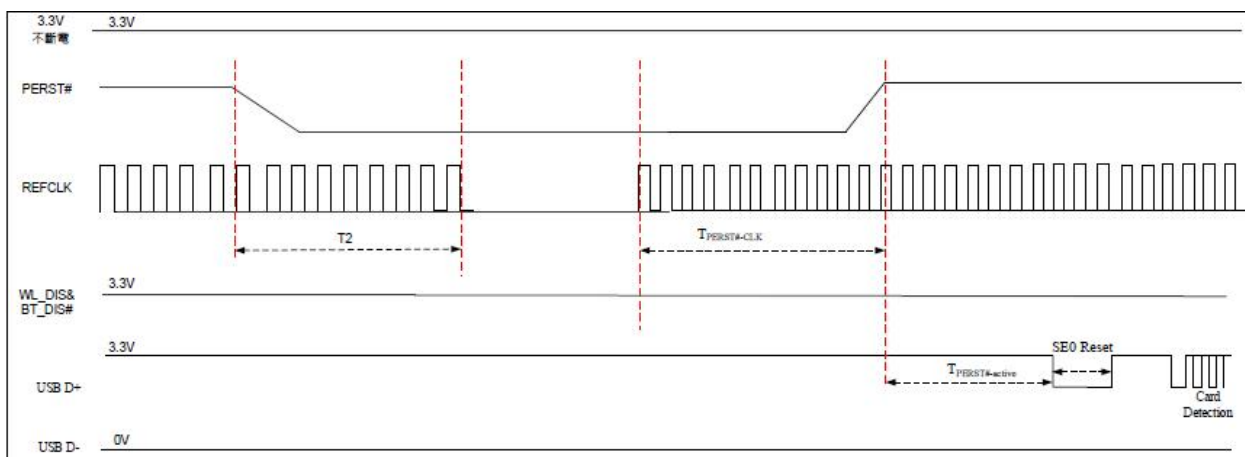
7.2 Interface Circuit time series

7.2.1 PCIe Bus during Power On Sequence

a. When WLAN is power off



b. When WLAN is NOT power off



T_{on}: The main power ramp up duration

T_{off}: The main power off duration

TPVPGL: Power valid to PERST# input inactive

T_{PERST#-CLK}: Reference clock stable before PERST# inactive

T_{ATTDB}: the debounce interval with a minimal duration of 100ms that provided by the USB system Software

T_{SE0 Reset}: USB host send SE0 Reset duration

T_{PERST#-active}: PCI-e initial duration after PERST# inactive

Note:

1. T1: PERST# goes active before the power on the connector is removed.
2. T2: Clock to inactive after PERST# goes active.
3. T3: WL_DIS# and BT_DIS# goes asserted when the power on the connector is removed.
4. T4: USB D+ go active after PERST# goes inactive.
5. T1/T2/T3/T4 timing value should large than 0.

Symbol	Unit	Min	Typical	Max
T_{on}	ms	0.5	1.5	5
T_{off}	ms	1.5		
T_{PVPGL}	ms	Implementation specific;recommended 50ms	--	--
T_{PERST#-CLK}	us	100	--	--
T_{ATTDB}	ms	100	--	--
T_{SE0 Reset}	ms	10	--	--
T_{PERST#-active}	ms	10	--	--

7.2.2 PCIe PERST# Timing sequence

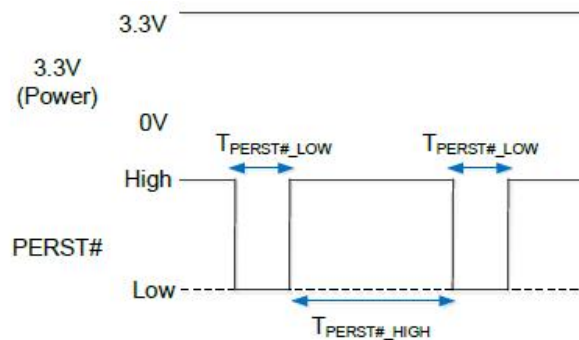
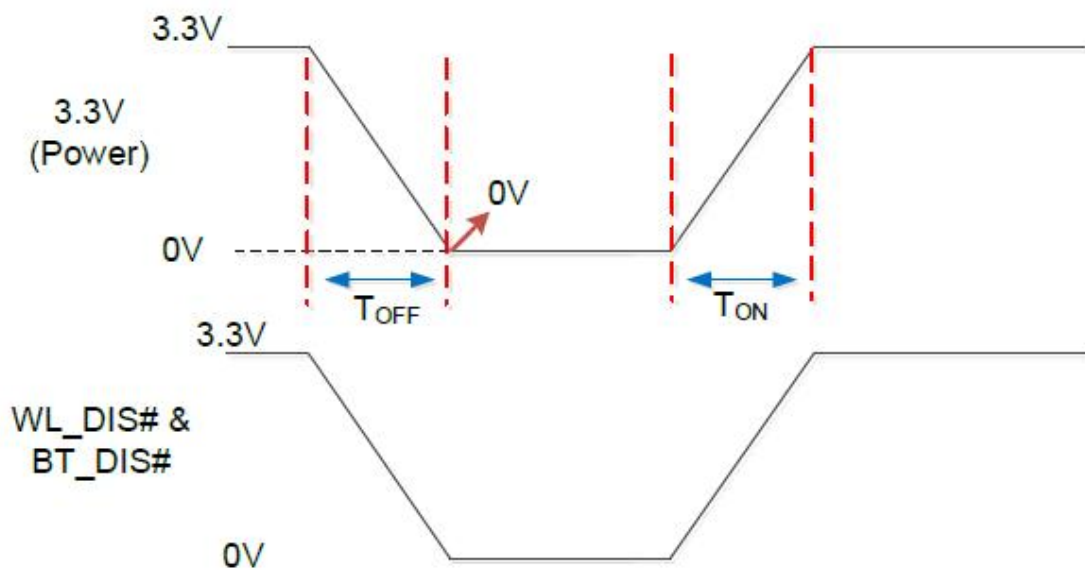


Table 18. RTL8852CE-CG PCIe PERST# Timing Parameters

	Min	Typical	Max	Unit	Description
T _{PERST#_LOW}	6	10	X	ms	PERST# low duration
T _{PERST#_HIGH}	400	500	X	ms	PERST# high duration

7.2.3 power off sequence



Symbol	Min	Typical	Max	Unit	Description
T _{OFF}	1.5	--	--	ms	Measure point start on 100% Measure point end on 0% (must be 0V)
T _{ON}	0.5	1.5	5	ms	Measure point start on 0% (must be 0V) Measure point end on 100%

Note: If BT_DIS# can't connect to the same power source with 3.3V, it need to be de-asserted before PERST# with 100ms in power on sequence.

7.2.4 BT_DIS Timing sequence



	Min	Typical	Max	Unit	Description
BT_DIS#_LOW	200	--	--	ms	BT_DIS# low duration
BT_DIS#_HIGH	500	--	--	ms	BT_DIS# high duration

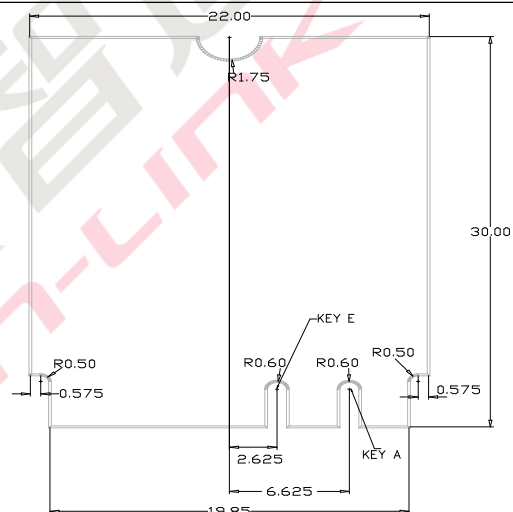
8. Size reference

8.1 Module Picture

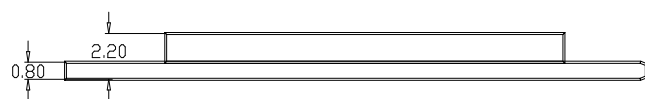
L x W : 22 x 30 (+0.3/-0.1) mm



Module shielding marking will update to QR code as section 8.2 shown.



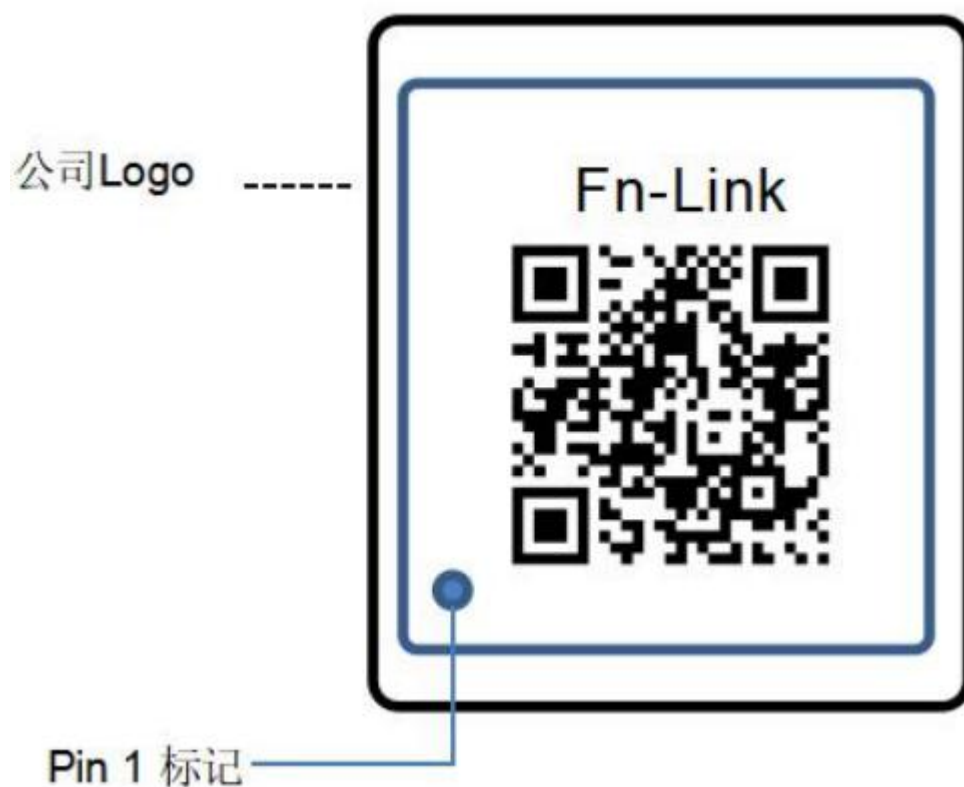
H: 2.2 (± 0.2) mm



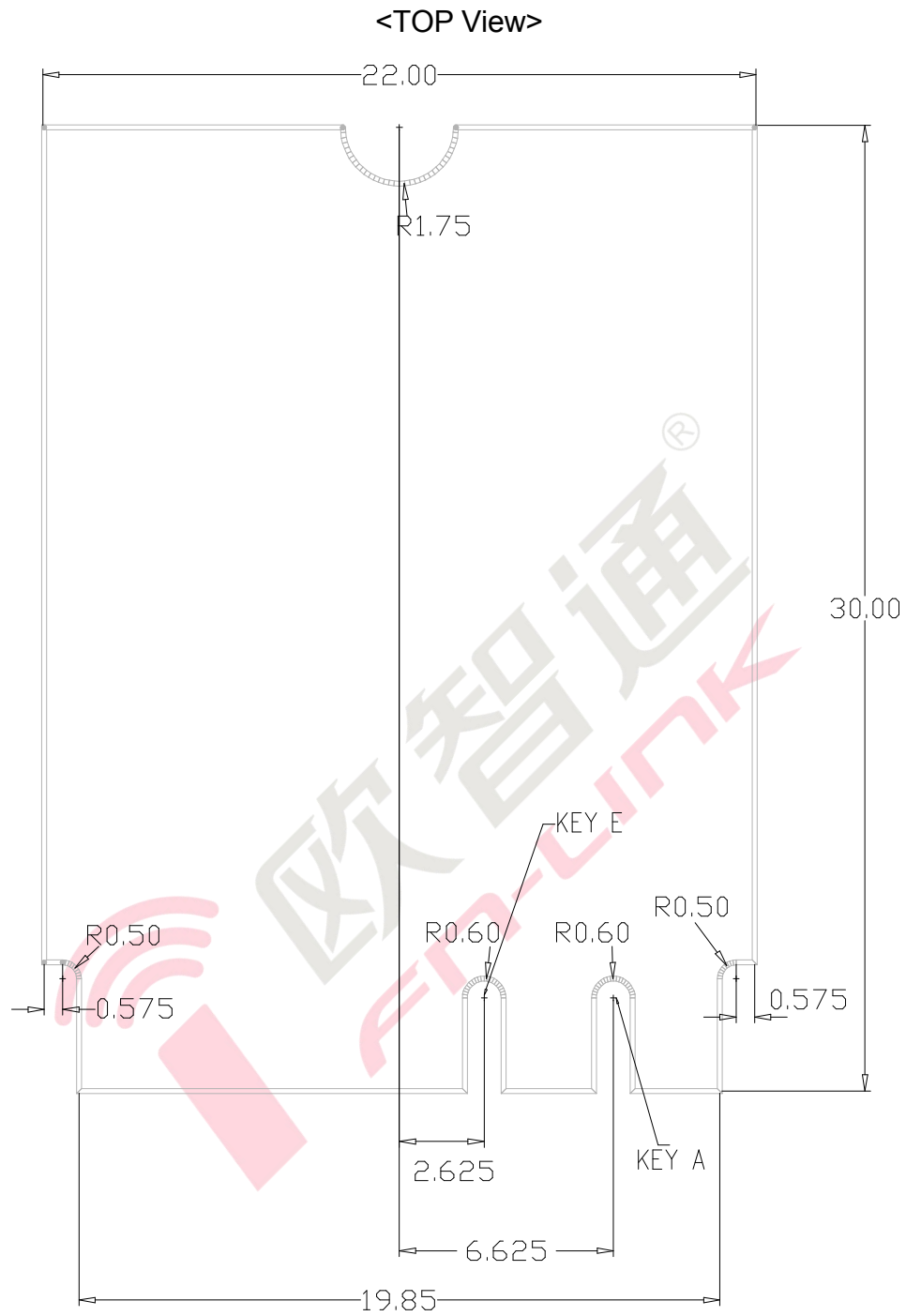
Weight

2.51 g

8.2 Marking Description



8.3 Physical Dimensions



9. The Key Material List

Item	Part Name	Description	Manufacturer
1	Chipset	RTL8852CE-CG,wifi6E/2T2R+BT5.3	Realtek
2	PCB	6252M-PUC 深绿色,4 层板,带金手指, FR4 TG150,化金,8 连片,22X30X0.8mm	XY-PCB, GDKX, Sunlord, SLPCB,TRULY
3	Crystal	2016 40MHz ± 10 ppm	ECEC, TKD, Hosonic, JWT, TXC
4	Inductor	2016 2.2uH, $\pm 20\%$	Sunlord, Ceaiya, Cenke,INPAQ,chilisin,Murata
5	Diplexer	DP1608,2.4G+5G/6G	Glead, Walsin, ACX, Murata, MAG.LAYERS,TDK,FTR
6	IPEX	4 代天线座	创迪尔
7	Shielding	6252M-PUB Shielding	Suntech, JLitong,卓益
8	Inductor	2016 1.0uH, $\pm 20\%$,	Sunlord, Ceaiya, Cenke,INPAQ,chilisin,Murata

10. Reference Design

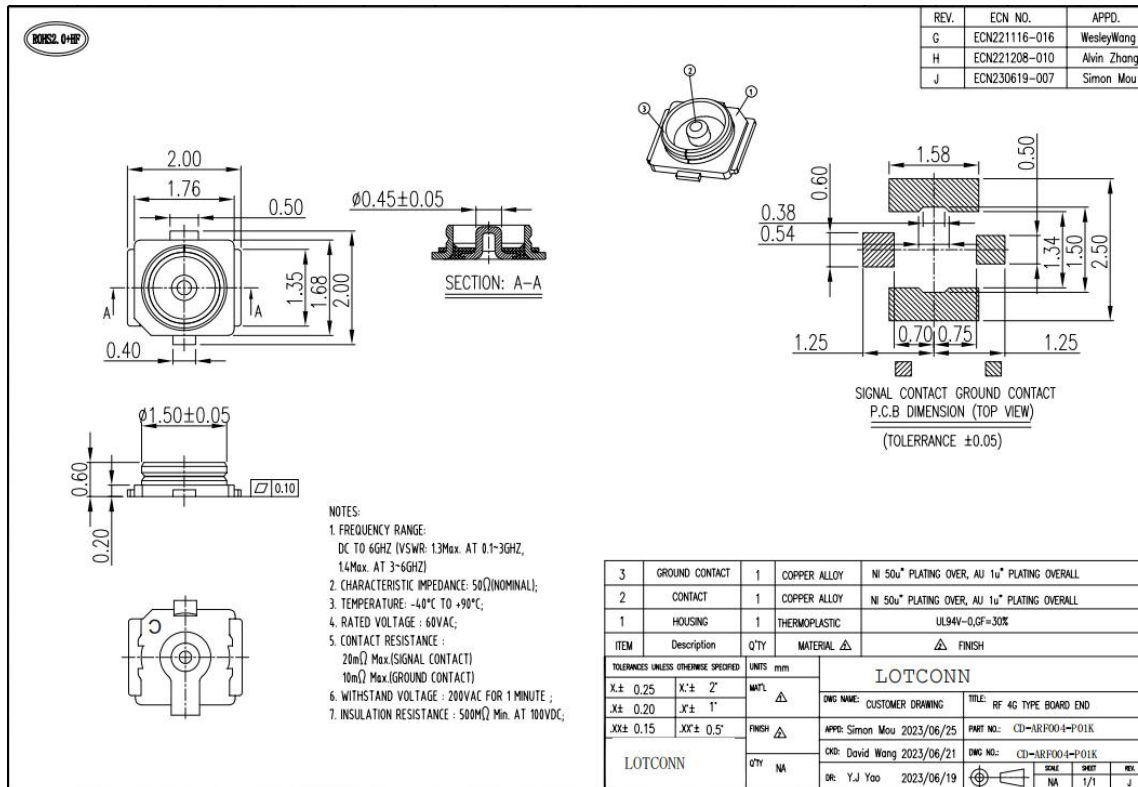
10.1 Reference design

The impedance of PCIe Gen2 trace is 85ohm.

The difference of P/N trace length must be less than 5mils.

The impedance of USB trace is 90ohm.

10.2 Connector Specification



11. Recommended Reflow Profile

No need to do SMT reflow process.

12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

13. Package

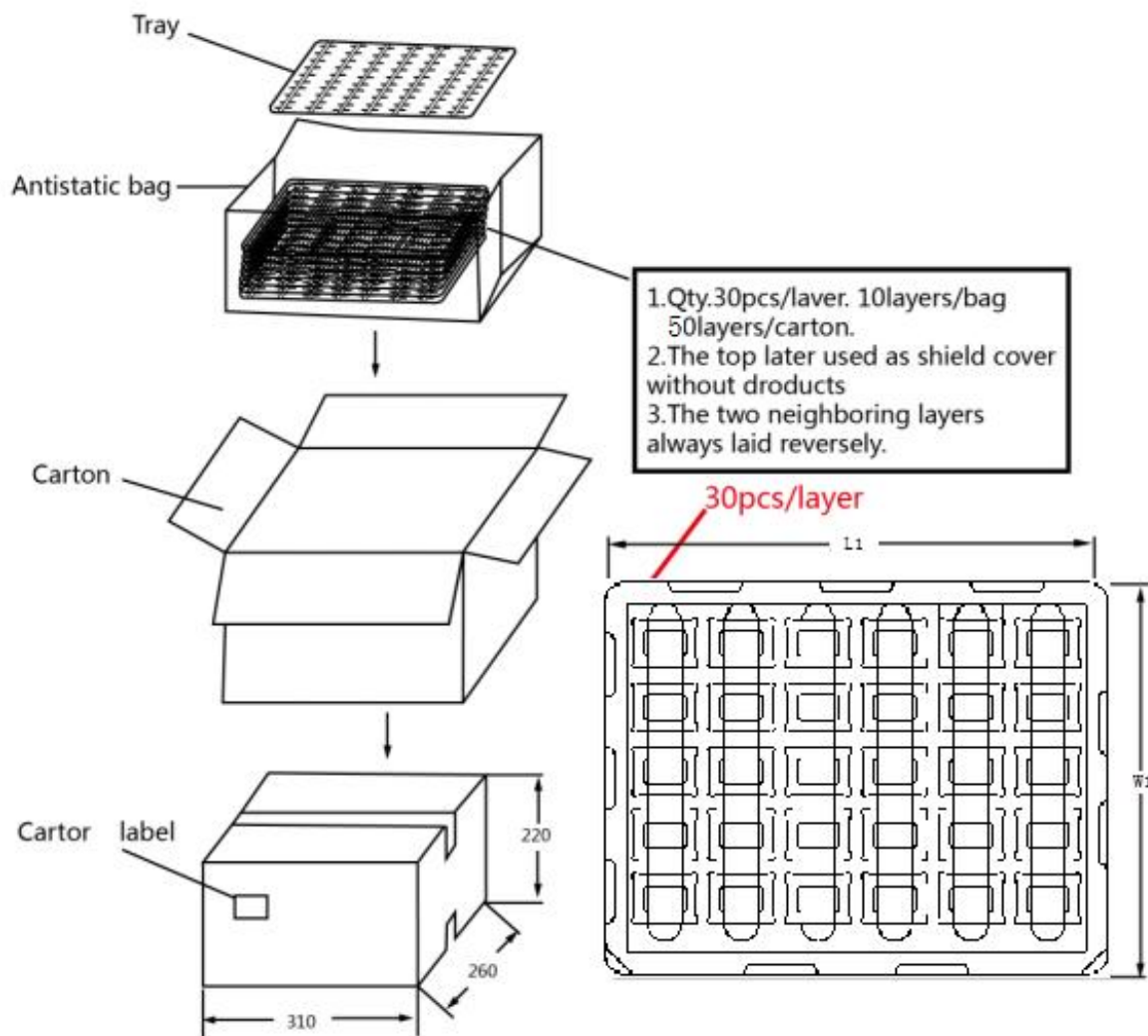
13.1 Tray

Layer size: L250.0*W190.0 mm

Layer material: PVC

Carton size: L310.0*W260.0*H220.0 mm

Carton material: A=A



14. Moisture sensitivity

The Modules 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°C and <90% relative humidity (RH)
- b) Environmental condition during the production: 30°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
- e) Baking is required if conditions b) or c) are not respected
- f) Baking is required if the humidity indicator inside the bag indicates 10% RH or more