

PRODUCT SPECIFICATION

8223A-SR

Wi-Fi Dual-band 1x1 11ac+ Bluetooth 5.0

Combo Module

Version:v1.9

Customer: _____

Customer P/N: _____

Signature: _____

Date: _____

Office: 14th floor, Block B, phoenix zhigu, Xixiang Street, Baoan District, Shenzhen

Factory: NO.8, Litong RD., Liuyang Economic & Technical Development Zone, Changsha, CHINA

TEL:+86-755-2955-8186

Website:www.fn-link.com

8223A-SR Module Datasheet

Ordering Information	Part NO.	Description
	FG1023SM13-W2	QCA1023-0/QCA9377-3, a/b/g/n/ac Wi-Fi+BLE5.0, 1T1R, 12X12mm SDIO+Uart, V1.0
	FG1023SM13-K2	QCA1023-0/QCA9377-3, a/b/g/n/ac Wi-Fi+BLE5.0, 1T1R, 12X12mm SDIO+Uart, V1.0(Customer supply IC)
	FG1023SM13-W3	QCA1023-0/QCA9377-3, a/b/g/n/ac Wi-Fi+BLE5.0, 1T1R, 12X12mm SDIO+Uart, V1.0(GXX 版)
	FG1023SM13-RC	QCA1023-0,11a/b/g/n/ac+BT5.0,1T1R,12*12,SDIO3.0/Uart, PCB V1.0,睿创客供 MAC

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Revision History

[illegible]

1. General Description

1.1 Introduction

Fn-Link Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi, Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP, Bluetooth headsets applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n/ac Access Points in the wireless LAN.

The wireless module complies with IEEE 802.11 a/b/g/n/ac standard and it can achieve up to a speed of 433.3Mbps with single stream in 802.11ac draft to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi, UART / PCM interface for Bluetooth.

This compact module is a total solution for a combination of Wi-Fi + BT technologies. The module is specifically developed for Smart phones and Portable devices.

1.2 Description

Model Name	8223A-SR
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 12 x 12 x 1.7mm (typical)
Wi-Fi Interface	Support SDIO V3.0
BT Interface	UART / PCM
OS supported	Android /Linux/ Win CE /iOS /XP/WIN7/WIN10
Operating temperature	-40°C to 85°C
Storage temperature	-40°C to 125°C

1. -40 to 70°C range, the module is IEEE compliant. -40 to 85°C range, The module retains the ability to transmit data. Some parameters might decrease or exceed the specifications. When the temperature remains to normal levels, the module will meet IEEE specifications again.

2. Features

General

- Highly integrated wireless local area network(WLAN) system-on-chip (SOC) for 5 GHZ 802.11ac, or 2.4G/5G 802.11n WLAN applications.
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz

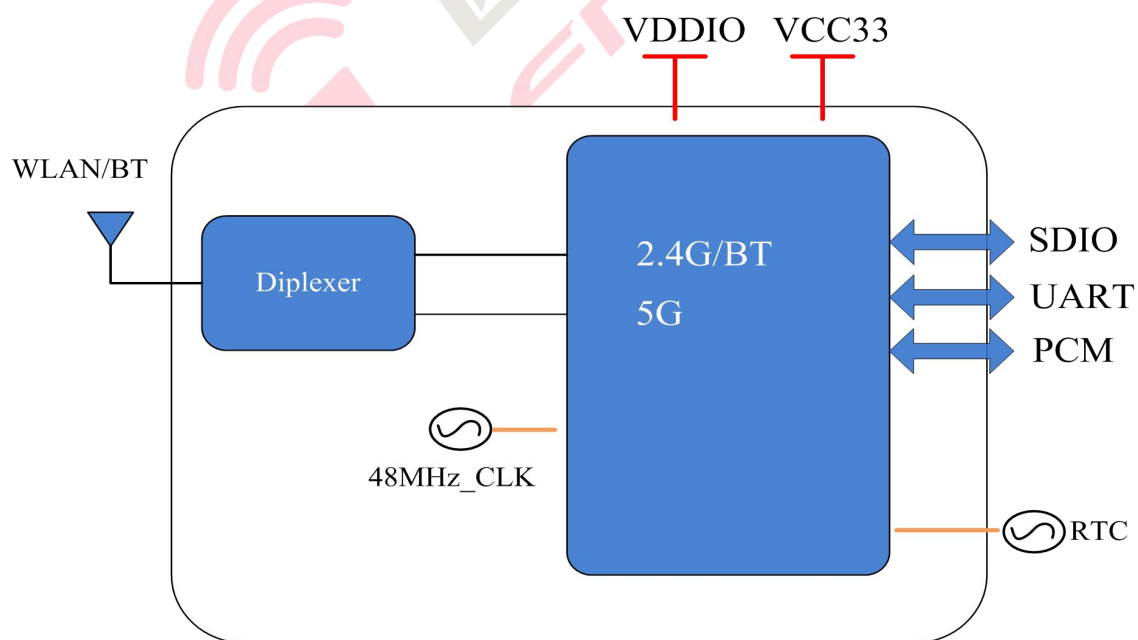
Host Interface

- Supports low power SDIO3.0 interface for WLAN and UART/PCM interface for Bluetooth

Bluetooth Features

- Supports Bluetooth V5.0, BLE and be backwards compatible with Bluetooth 1.2, 2.X+ enhance data rate
- Supports WLAN-Bluetooth coexistence
- Supports Bluetooth for class1 and class2 power level transmissions without requiring an external PA
- BT host digital interface:
 - HCI UART (up to 4 Mbps)
 - PCM for audio data

3. Block Diagram



4. General Specification

4.1 2.4GHz WI-FI Specification

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	
Test Items	Typical Value	EVM
Output Power	802.11b /11Mbps : 16dBm $\pm$ 2 dB	EVM $\leq$ -9dB
	802.11g /54Mbps : 15dBm $\pm$ 2dB	EVM $\leq$ -25dB
	802.11n /MCS7 : 14dBm $\pm$ 2 dB	EVM $\leq$ -28dB
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	$\pm$ 20ppm	
Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps PER @ -96 dBm	$\leq$ -83
	- 2Mbps PER @ -90 dBm	$\leq$ -80
	- 5.5Mbps PER @ -88 dBm	$\leq$ -79
	- 11Mbps PER @ -87 dBm	$\leq$ -76
Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -90 dBm	$\leq$ -85
	- 9Mbps PER @ -88 dBm	$\leq$ -84
	- 12Mbps PER @ -87 dBm	$\leq$ -82
	- 18Mbps PER @ -85 dBm	$\leq$ -80
	- 24Mbps PER @ -83 dBm	$\leq$ -77
	- 36Mbps PER @ -80 dBm	$\leq$ -73
	- 48Mbps PER @ -76 dBm	$\leq$ -69
	- 54Mbps PER @ -74 dBm	$\leq$ -68
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm	$\leq$ -85
	- MCS=1 PER @ -85 dBm	$\leq$ -82
	- MCS=2 PER @ -84 dBm	$\leq$ -80
	- MCS=3 PER @ -80 dBm	$\leq$ -77
	- MCS=4 PER @ -77 dBm	$\leq$ -73
	- MCS=5 PER @ -75 dBm	$\leq$ -69
	- MCS=6 PER @ -72 dBm	$\leq$ -68
	- MCS=7 PER @ -71 dBm	$\leq$ -67
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -89 dBm	$\leq$ -82
	- MCS=1 PER @ -85 dBm	$\leq$ -79
	- MCS=2 PER @ -84 dBm	$\leq$ -77
	- MCS=3 PER @ -80 dBm	$\leq$ -74

	- MCS=4	PER @ -76 dBm	≤ -70
	- MCS=5	PER @ -72 dBm	≤ -66
	- MCS=6	PER @ -70 dBm	≤ -65
	- MCS=7	PER @ -69 dBm	≤ -64

4.2 5GHz WI-FI Specification

Feature	Description	
WLAN Standard	IEEE 802.11a/n/ac, Wi-Fi compliant	
Frequency Range	5.150 GHz ~ 5.850 GHz (5.0 GHz ISM Band)	
Number of Channels	5.0GHz: Please see the table1	
Modulation	802.11a/n : 64-QAM,16-QAM, QPSK, BPSK 802.11ac : 256-QAM, 64-QAM,16-QAM, QPSK, BPSK	
Output Power	802.11a /54M: 12 dBm $\pm$ 2 dB	EVM $\leq$ -25dB
	802.11n /MCS7: 11 dBm $\pm$ 2 dB	EVM $\leq$ -28dB
	802.11ac/MCS8: 10 dBm $\pm$ 2 dB	EVM $\leq$ -30dB
	802.11ac/MCS9: 10 dBm $\pm$ 2 dB	EVM $\leq$ -32dB
Test Items	Test Value	Standard Value
Receive Sensitivity (11a, 20MHz)@10% PER	- 6Mbps PER @ -91 dBm	≤ -85
	- 9Mbps PER @ -89 dBm	≤ -84
	- 12Mbps PER @ -88 dBm	≤ -82
	- 18Mbps PER @ -86 dBm	≤ -80
	- 24Mbps PER @ -82 dBm	≤ -77
	- 36Mbps PER @ -79 dBm	≤ -73
	- 48Mbps PER @ -74 dBm	≤ -69
	- 54Mbps PER @ -73 dBm	≤ -68
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm	≤ -85
	- MCS=1 PER @ -88 dBm	≤ -82
	- MCS=2 PER @ -85 dBm	≤ -80
	- MCS=3 PER @ -82 dBm	≤ -77
	- MCS=4 PER @ -78 dBm	≤ -73
	- MCS=5 PER @ -74 dBm	≤ -69
	- MCS=6 PER @ -72 dBm	≤ -68

	- MCS=7	PER @ -71 dBm	≤-67
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0	PER @ -88 dBm	≤-85
	- MCS=1	PER @ -85 dBm	≤-82
	- MCS=2	PER @ -83 dBm	≤-80
	- MCS=3	PER @ -79 dBm	≤-76
	- MCS=4	PER @ -76 dBm	≤-73
	- MCS=5	PER @ -71 dBm	≤-68
	- MCS=6	PER @ -70 dBm	≤-67
	- MCS=7	PER @ -68 dBm	≤-65
Receive Sensitivity (11ac,20MHz)@10% PER	- MCS=0	PER @ -89 dBm	≤-83
	- MCS=1	PER @ -87 dBm	≤-82
	- MCS=2	PER @ -84 dBm	≤-80
	- MCS=3	PER @ -81 dBm	≤-75
	- MCS=4	PER @ -77 dBm	≤-72
	- MCS=5	PER @ -73 dBm	≤-68
	- MCS=6	PER @ -71 dBm	≤-67
	- MCS=7	PER @ -70 dBm	≤-62
Receive Sensitivity (11ac,40MHz)@10% PER	- MCS=8	PER @ -66 dBm	≤-60
	- MCS=0	PER @ -87 dBm	≤-80
	- MCS=1	PER @ -83 dBm	≤-77
	- MCS=2	PER @ -81 dBm	≤-74
	- MCS=3	PER @ -78 dBm	≤-70
	- MCS=4	PER @ -75 dBm	≤-69
	- MCS=5	PER @ -70 dBm	≤-65
	- MCS=6	PER @ -68 dBm	≤-64
Receive Sensitivity (11ac,80MHz)@10% PER	- MCS=7	PER @ -66 dBm	≤-59
	- MCS=8	PER @ -64 dBm	≤-57
	- MCS=9	PER @ -63 dBm	≤-55
	- MCS=0	PER @ -83 dBm	≤-79
	- MCS=1	PER @ -80 dBm	≤-76
	- MCS=2	PER @ -78 dBm	≤-74
	- MCS=3	PER @ -74 dBm	≤-71
	- MCS=4	PER @ -71 dBm	≤-67
Receive Sensitivity (11ac,80MHz)@10% PER	- MCS=5	PER @ -69 dBm	≤-63
	- MCS=6	PER @ -65 dBm	≤-62
	- MCS=7	PER @ -63 dBm	≤-61

	- MCS=8 PER @ -60 dBm	≤-56
	- MCS=9 PER @ -59 dBm	≤-54

15GHz Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5150MHz~5250MHz	36	5180
	40	5200
	44	5220
	48	5240
5250MHz~5350MHz	52	5260
	56	5280
	60	5300
	64	5320
5470MHz~5725MHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
5725MHz~5850MHz	140	5700
	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

4.3 Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V5.0 ,BLE		
Host Interface	UART		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2400 MHz ~ 2483.5 MHz		
Number of Channels	79 channels,40channels for BLE		
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK		
RF Specification			
	Min(dBm)	Typical(dBm)	Max(dBm)
Output Power (Class 1)	2	5	15
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-92	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-92	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-85	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

5. ID setting information

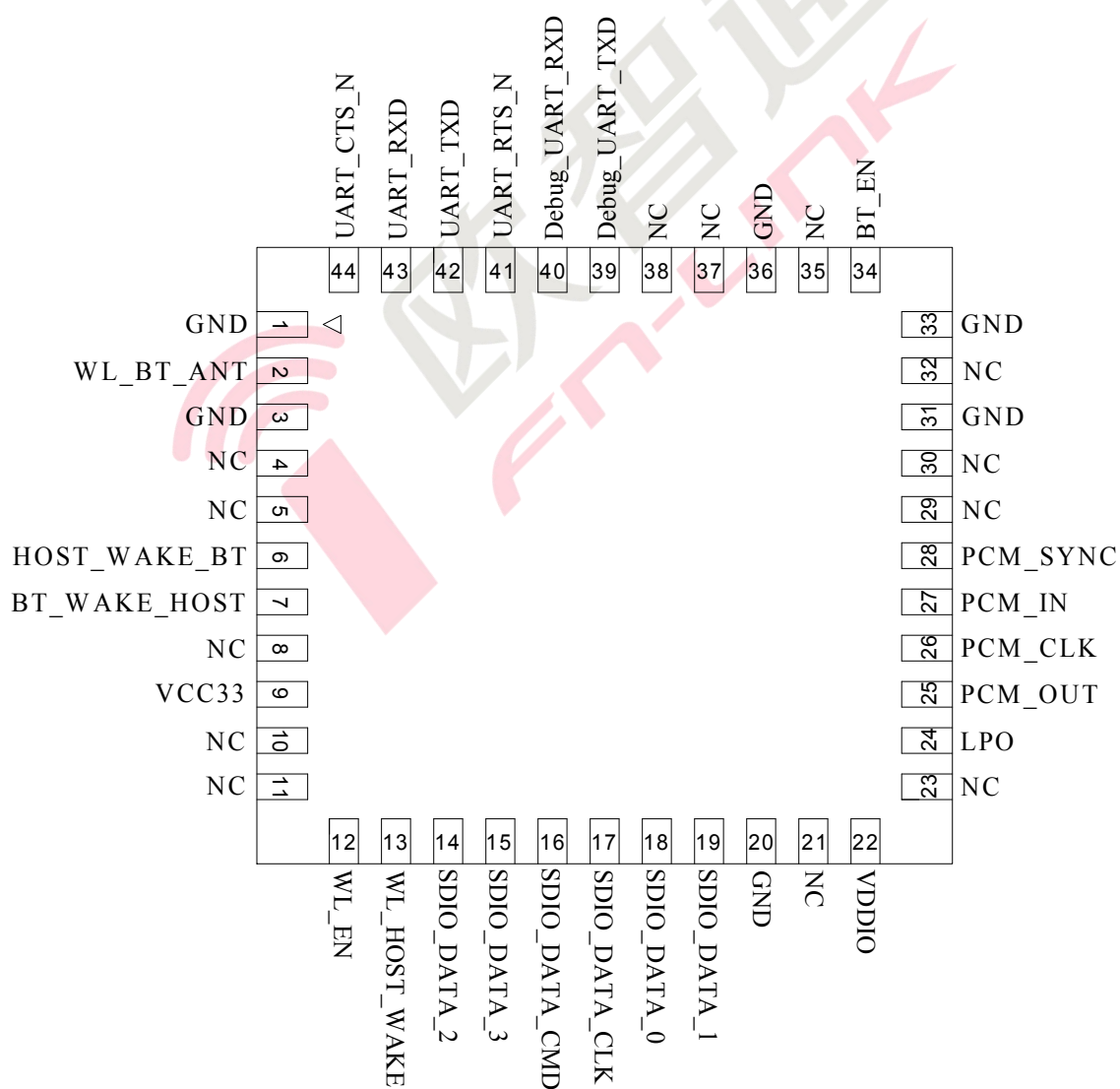
WI-FI

Vendor ID	0271
Product ID	0701

6. Pin Definition

6.1 Pin Outline

< TOP VIEW >



6.2 Pin Definition details

NO.	Name	Type	Description	Voltage
1	GND	—	Ground connections	
2	WL_BT_ANT	I/O	RF I/O port	
3	GND	—	Ground connections	
4	NC	—	Floating (Don't connected to ground)	
5	NC	—	Floating (Don't connected to ground)	
6	HOST_WAKE_BT	I	HOST to wake-up Bluetooth device (IC pin55 :3D_FRAME_SYNC)	1.8V or 3.3V
7	BT_WAKE_HOST	O	Bluetooth device to wake-up HOST, Active high (IC pin93 :HCI_UART_WAKEHOST)	1.8V or 3.3V
8	NC	—	Floating (Don't connected to ground)	
9	VCC33	P	Main power voltage source input 3.3V	3.3V
10	NC	—	Floating (module pin is GND)	
11	NC	—	Floating (Don't connected to ground)	
12	WL_EN	I	Enable pin for WLAN device ON: pull high ; OFF: pull low	1.8V or 3.3V
13	WL_HOST_WAKE	O	WLAN to wake-up HOST (IC pin92:QOW)	1.8V or 3.3V
14	SDIO_DATA_2	I/O	SDIO data line 2, this pin must pull high 10K Ω resistor to VDDIO in main board.	1.8V or 3.3V
15	SDIO_DATA_3	I/O	SDIO data line 3	1.8V or 3.3V
16	SDIO_DATA_CMD	I/O	SDIO command line	1.8V or 3.3V
17	SDIO_DATA_CLK	I/O	SDIO clock line	1.8V or 3.3V
18	SDIO_DATA_0	I/O	SDIO data line 0	1.8V or 3.3V
19	SDIO_DATA_1	I/O	SDIO data line 1	1.8V or 3.3V
20	GND	—	Ground connections	1.8V or 3.3V
21	NC	—	Floating (Don't connected to ground) (IC pin48 :CLK_REQ)	
22	VDDIO	P	I/O Voltage supply input 1.8V or 3.3V	3.3V or 1.8V
23	NC	—	Floating (Don't connected to ground)	
24	LPO	I	External Low Power Clock input (32.768KHz)	1.8V or 3.3V
25	PCM_OUT	O	PCM Data output	1.8V or 3.3V
26	PCM_CLK	I/O	PCM clock	1.8V or 3.3V
27	PCM_IN	I	PCM data input	1.8V or 3.3V
28	PCM_SYNC	I/O	PCM sync signal	1.8V or 3.3V
29	NC	—	Floating (Don't connected to ground)	

30	NC	—	Floating (Don't connected to ground)	
31	GND	—	Ground connections	
32	NC	—	Floating (Don't connected to ground)	
33	GND	—	Ground connections	
34	BT_EN	I	Enable pin for Bluetooth device ON: pull high ; OFF: pull low	1.8V or 3.3V
35	NC	—	Floating (Don't connected to ground)	
36	GND	—	Ground connections	
37	NC	—	Floating (Don't connected to ground)	
38	NC	—	Floating (Don't connected to ground)	
39	Debug_UART_TXD	O	Floating (Don't connected to ground) (IC pin61 :GPIO[19])	
40	Debug_UART_RXD	I	Floating (Don't connected to ground) (IC pin101 :GPIO[18])	
41	UART_RTS_N	O	Bluetooth UART interface	1.8V or 3.3V
42	UART_TXD	O	Bluetooth UART interface	1.8V or 3.3V
43	UART_RXD	I	Bluetooth UART interface	1.8V or 3.3V
44	UART_CTS_N	I	Bluetooth UART interface	1.8V or 3.3V

P:POWER I:INPUT O:OUTPUT

7. Electrical Specifications

7.1 Power Supply DC Characteristics

The digital IO supports VDD33 or VDD18 application.

	MIN	TYP	MAX	Unit
Operating Temperature	-40	25	85	deg.C
VCC33	3.15	3.3	3.45	V
VDDIO	1.7	1.8 or 3.3	3.45	V

Symbol	Min	Typ	Max	Unit
V _{IH}	0.7xVDDIO	-	VDDIO+0.3	V
V _L	-0.3	-	0.3xVDDIO	V

VOH	0.9xVDDIO	-	VDDIO	V
VOL	0	-	0.1xVDDIO	V
IOH	3	-	-	mA
IOL	-	-	-11	mA
RPULL	-	1.8V IO: 120 3.3 IQ:70	-	k Ω
IIL	-5.0	-	5.0	μ A

7.2 Power Consumption

Power Consumption		VCC33 = 3.3V(Unit:mA)
	Wi-Fi on Mode	72
	TX (2.4G HT20)	220
	RX (2.4G HT20)	78
	TX (5G HT80)	220
	RX (5G HT80)	112
	BT on	20

7.3 Power sequencing

7.3.1 Case 1: 3.3 V power down after 1.8 V

If the battery source can be removed from the end user device (battery removed, AC/DC plugged in), this is the recommended power sequence. It will avoid violating the power off sequence by allowing the 3.3 V rail to shut down after the 1.8 V rail.

Notes:

1. VDDIO_GPIO voltage should match VIO voltage from the host. In some applications, VDDIO_GPIO may be connected to 3.3 V upon Host VIO voltage.
2. In this case, both WLAN_EN and BT_EN on the QCA9377 are at 3.3 V due to using the VDD_AO power rail. If the host VIO voltage is 1.8 V, it must have level shifters to interface with host.
3. All host interface signals must stay floating or low before valid power on sequence (WLAN_EN and BT-EN goes high).

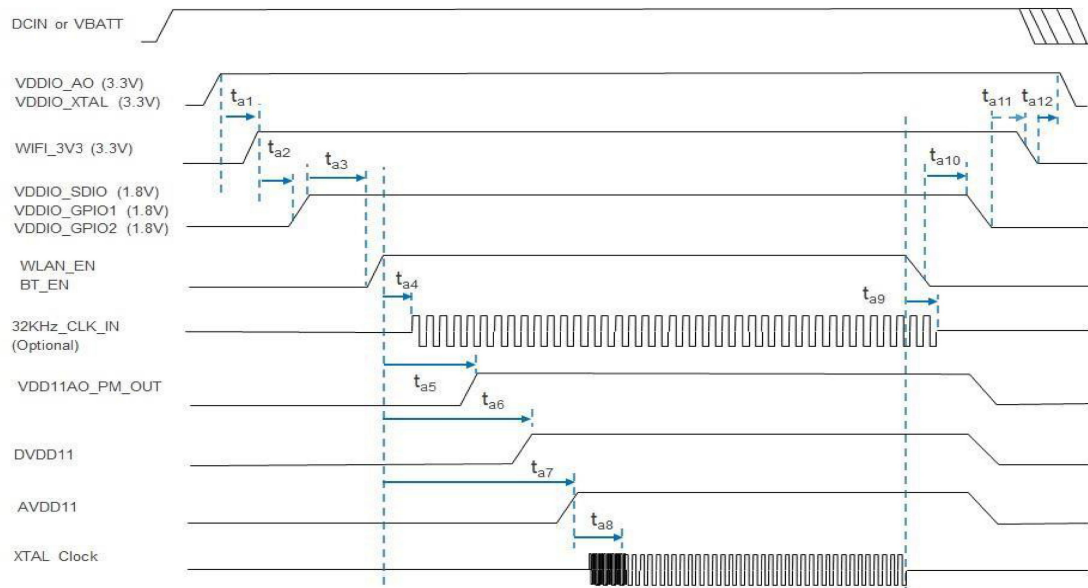


Figure 7-3-1 power sequence timing diagram (case 1)

power sequence timing table (case 1)

Symb	Parameter	Min	Max	Units
t _{a1}	No requirement if VDDIO_AO connected to 3.3 V	0	—	μs
t _{a2}	90% of 3.3 V to 10% of 1.8 V	0	0	μs
t _{a3}	90% of VDDIO_GPIO to 0.7 V of both WLAN_EN and BT_EN	10	—	μs
t _{a4}	WLAN_EN valid to LF_CLK_IN input	0	—	μs
t _{a5}	WLAN_EN valid to VDD11AO_PM_OUT established	—	50	μs
t _{a6}	WLAN_EN to DVDD11	—	3.5	ms
t _{a7}	WLAN_EN to AVDD11	—	4	ms
t _{a8}	AVDD11 to XTAL clock stable	1	—	ms
t _{a9}	WLAN_EN de-assert ("low") to LF_CLK_IN de-assert (tristate or	0	—	μs
t _{a10}	Both WLAN_EN = low and BT_EN = low to 90% of 1.8 V	10	—	μs
t _{a11}	3.3 V always higher than 1.8 V during operation, with power off by removing battery or unplugging AC/DC	0	—	μs
t _{a12}	VDDIO_AO and VDDIO_XTAL should be connected to 3.3 V power rail	0	—	μs

7.3.2 Case 2: 1.8 V power down after 3.3 V

If the battery source cannot be removed from the end user device, this is the recommended power sequence for this application. This sequence allows the software to control the power on/off sequence.

Notes:

1. VDDIO_GPIO voltage should match VIO voltage from the host. In some applications, VDDIO_GPIO may be connected to 3.3 V upon host VIO voltage.
2. Both WLAN_EN and BT_EN of QCA9377 are 1.8 V. If host VIO voltage is 1.8 V, it does not need level shifter to interface with host.
3. All host interface signals must stay floating or low before WLAN_EN/BT_EN = "high", and after WLAN_EN/BT_EN = Low.

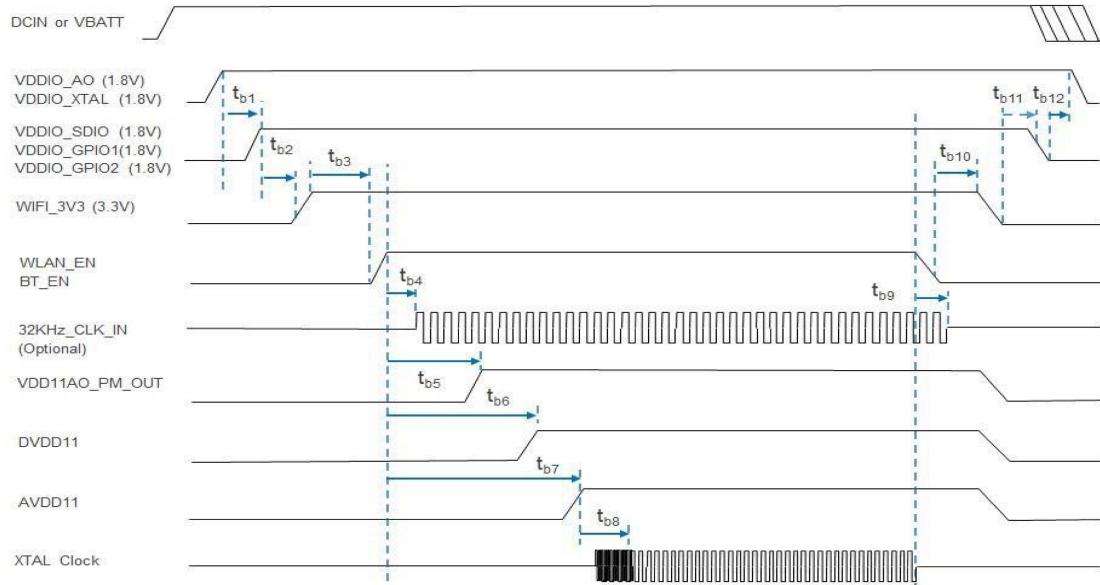


Figure 3-2 power sequence timing diagram (case 2)

Power sequence timing table (case 2)

Symbol	Parameter	Min	Max	Units
t _{b1}	No requirement if VDDIO_AO connected to 1.8 V	0	—	μs
t _{b2}	90% of 1.8 V to 10% of 3.3 V	0	—	μs
t _{b3}	90% of 3.3 V to 0.7 V of both WLAN_EN and BT_EN	10	—	μs
t _{b4}	WLAN_EN valid to LF_CLK_IN input	0	—	μs
t _{b5}	WLAN_EN valid to VDD11AO_PM_OUT established	—	50	μs
t _{b6}	WLAN_EN to DVDD11	—	3.	ms
t _{b7}	WLAN_EN to AVDD11		4	ms
t _{b8}	AVDD11 to XTAL clock stable	1	—	ms
t _{b9}	WLAN_EN de-assert ("low") to LF_CLK_IN de-assert (tristate or low)	0	—	μs
t _{b10}	Both WLAN_EN = low and BT_EN = low to 90% of 3.3 V	10	—	μs
Symb	Parameter	Min	Max	Units
t _{b11}	10% of 3.3 V to 90% of 1.8 V	0	—	μs
t _{b12}	VDDIO_AO and VDDIO_XTAL should be connected to 1.8 V power	0	—	μs

7.3.3 Case 3: All power rails supplied with 3.3 V

All power pins are connected to 3.3 V only include VDDIO_AO, VDDIO_XTAL, VDDIO_GPIOx.

Note: All host signals are either GND or floating before WLAN_EN/BT_EN = "high", and after WLAN_EN/BT_EN = Low.

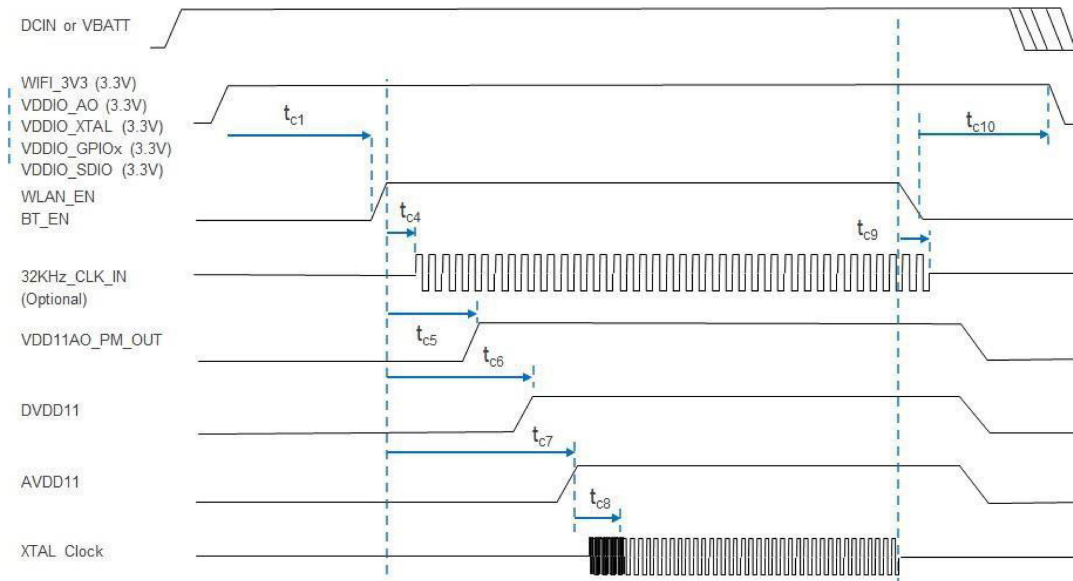


Figure 3-3 power sequence timing diagram (case 3)

Power sequence timing table (case 3)

Symbol	Parameter	Min	Max	Unit
tc1	90% of 3.3 V to 0.7 V of both WLAN_EN and BT_EN	0	—	μs
tc4	WLAN_EN valid to LF_CLK_IN input	0	—	μs
tc5	WLAN_EN valid to VDD11AO_PM_OUT established	—	50	μs
tc6	WLAN_EN to DVDD11	—	3	ms
tc7	WLAN_EN to AVDD11	—	4	ms
tc8	AVDD11 to XTAL clock stable	1	—	ms
tc9	WLAN_EN de-assert (“low”) to LF_CLK_IN de-assert(tristate or low)	0	—	μs
tc10	Both WLAN_EN = low and BT_EN = low to 90% of 3.3 V	10	—	μs

7.4 Host Interface Timing Diagram

7.4.1 SDIO Pin Description

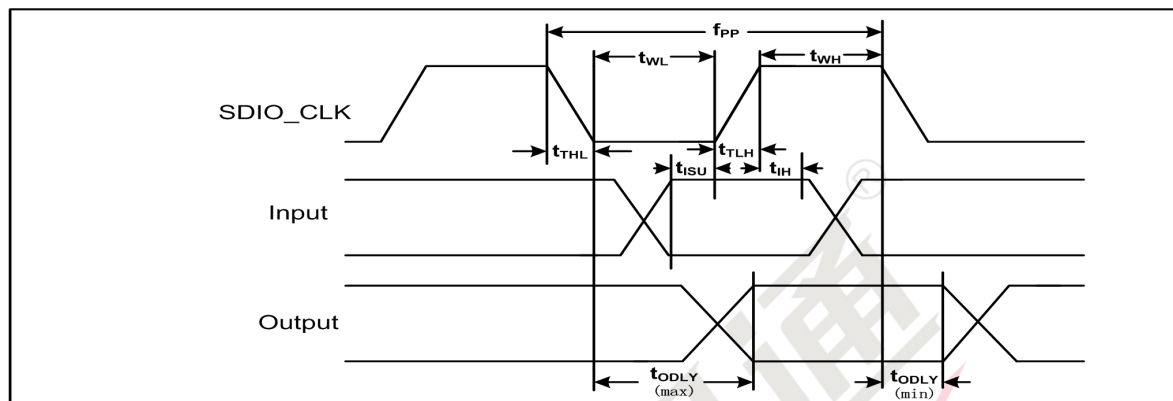
The module supports SDIO version 3.0 for all 1.8V 4-bit UHSI speeds: SDR50(100 Mbps), SDR104(208MHz) and DDR50(50MHz, dual rates) in addition to the 3.3V default speed(25MHz) and high speed (50 MHz). It has the ability to stop the SDIO clock and map the interrupt signal into a GPIO pin. This ‘out-of-band’ interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force the control of the gated clocks from within the WLAN chip is also provided.

SDIO Pin Description

SD 4-Bit Mode	
DATA0	Data Line 0
DATA1	Data Line 1 or Interrupt
DATA2	Data Line 2 or Read Wait

DATA3	Data Line 3
CLK	Clock
CMD	Command Line

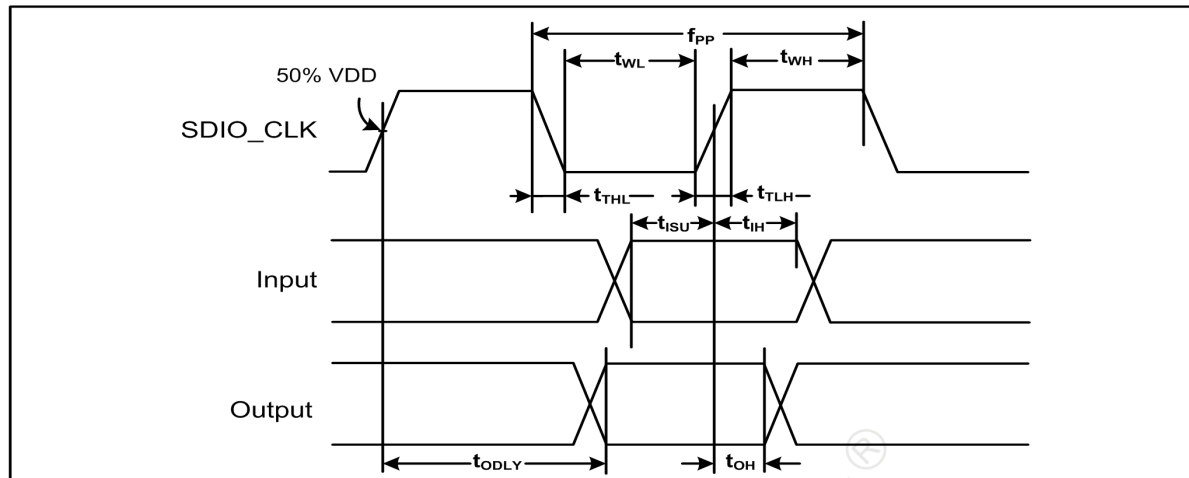
7.4.2 SDIO Default Mode Timing Diagram



Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK(All values are referred to minimum VIH and maximum VIL^b)					
Frequency - Data Transfer mode	fPP	0	-	25	MHz
Frequency - Identification mode	fOD	0	-	400	kHz
Clock low time	tWL	10	-	-	ns
Clock high time	tWH	10	-	-	ns
Clock rise time	tTLH	-	-	10	ns
Clock low time	tTHL	-	-	10	ns
Inputs:CMD, DAT(referenced to CLK)					
Input setup time	tISU	5	-	-	ns
Input hold time	tIH	5	-	-	ns
Outputs:CMD, DAT(referenced to CLK)					
Output delay time - Data Transfer mode	tODLY	0	-	14	ns
Output delay time - Identification mode	tODLY	0	-	50	ns

- a. Timing is based on $CL \leq 40$ pF load on CMD and Data.
- b. $\text{Min}(V_{ih}) = 0.7 \times V_{DDIO}$ and $\text{max}(V_{il}) = 0.2 \times V_{DDIO}$.

7.4.3 SDIO High Speed Mode Timing Diagram



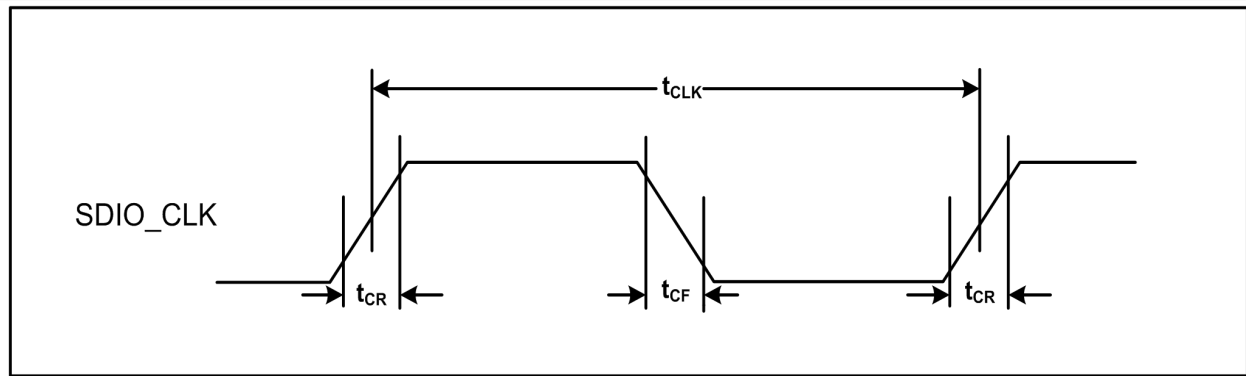
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK(all values are referred to minimum VIH and maximum VIL^b)					
Frequency - Data Transfer mode	f_{PP}	0	-	50	MHz
Frequency - Identification mode	f_{OD}	0	-	400	kHz
Clock low time	t_{WL}	7	-	-	ns
Clock high time	t_{WH}	7	-	-	ns
Clock rise time	t_{TLH}	-	-	3	ns
Clock low time	t_{THL}	-	-	3	ns
Inputs:CMD, DAT(referenced to CLK)					
Input setup time	t_{ISU}	6	-	-	ns
Input hold time	t_{IH}	2	-	-	ns
Outputs:CMD, DAT(referenced to CLK)					
Output delay time - Data Transfer mode	t_{ODLY}	-	-	14	ns
Output delay time - Identification mode	t_{ODLY}	2.5	-	-	ns
Total system capacitance(each line)	CL	-	-	40	pF

a. Timing is based on $CL \leq 40$ pF load on CMD and Data.

b. $\text{Min}(V_{ih}) = 0.7 \times V_{DDIO}$ and $\text{max}(V_{il}) = 0.2 \times V_{DDIO}$.

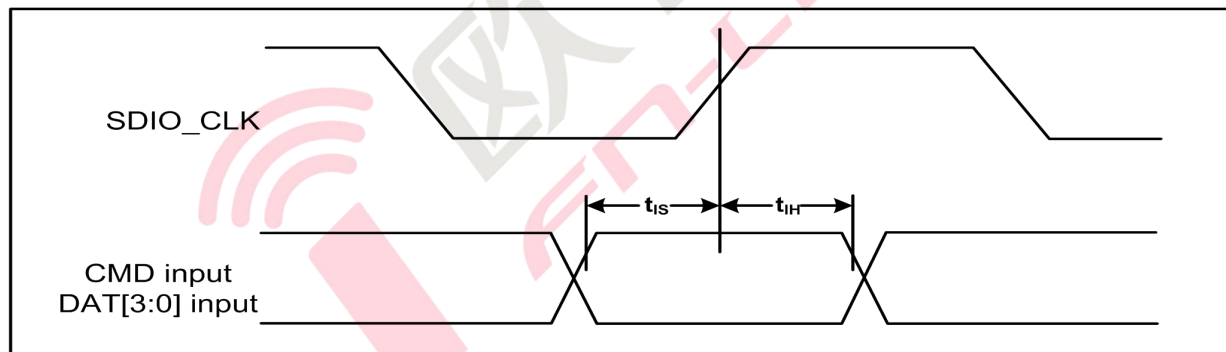
7.4.4 SDIO Bus Timing Specifications in SDR Modes

Clock timing(SDR Modes)



Parametwer	Symbol	Minimum	Maximum	Unit	Comments
-	t_{CLK}	40	-	ns	SDR12 mode
		20	-	ns	SDR25 mode
		10	-	ns	SDR50 mode
		4.8	-	ns	SDR104 mode
-	t_{CR}, t_{CF}	-	$0.2 \times t_{CLK}$	ns	$t_{CR}, t_{CF} < 2.00$ ns (max)@100 MHz, $C_{CARD} = 10$ pF $t_{CR}, t_{CF} < 0.96$ ns (max)@208 MHz, $C_{CARD} = 10$ pF
Clock duty	-	30	70	%	-

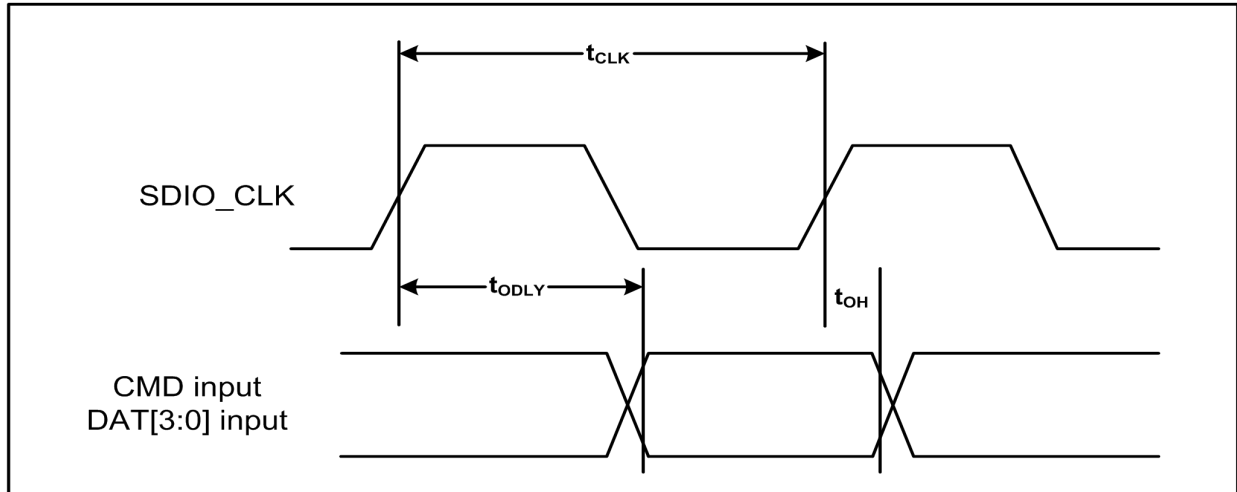
Card Input timing (SDR Modes)



Symbol	Minimum	Maximum	Unit	Comments
SDR104 Mode				
t_{IS}	1.70 ^a	-	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	-	ns	$C_{CARD} = 5$ pF, VCT = 0.975V
SDR50 Mode				
t_{IS}	3.00	-	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	-	ns	$C_{CARD} = 5$ pF, VCT = 0.975V

a. SDIO 3.0 specification value is 1.40 ns.

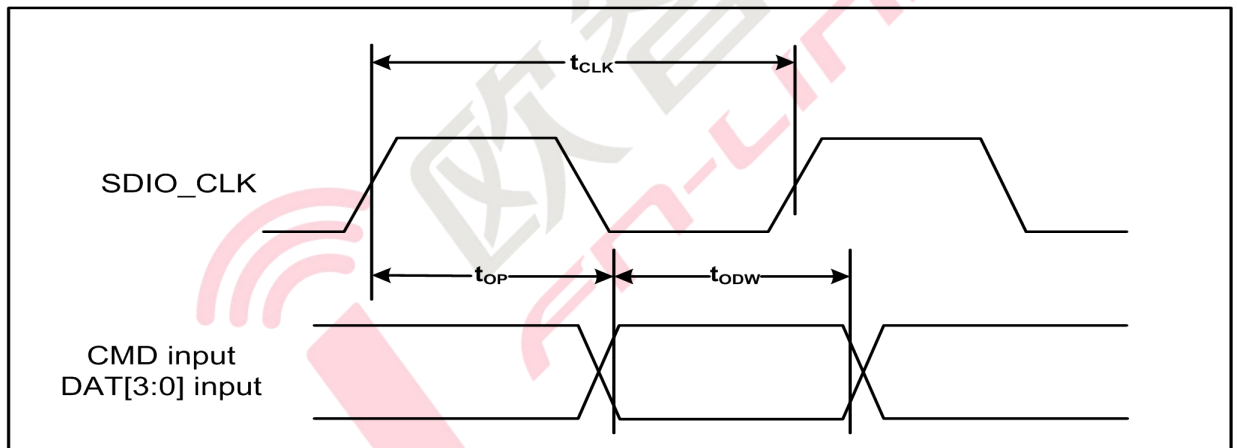
Card output timing (SDR Modes up to 100MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	-	7.85 ^a	ns	$t_{CLK} \geq 10$ ns $C_L = 30$ pF using driver type B for SDR50
t_{ODLY}	-	14.0	ns	$t_{CLK} \geq 20$ ns $C_L = 40$ pF using for SDR12, SDR25
t_{OH}	1.5	-	ns	Hold time at the $t_{ODLY}(\min)$ $C_L = 15$ pF

a. SDIO 3.0 specification value is 7.5 ns.

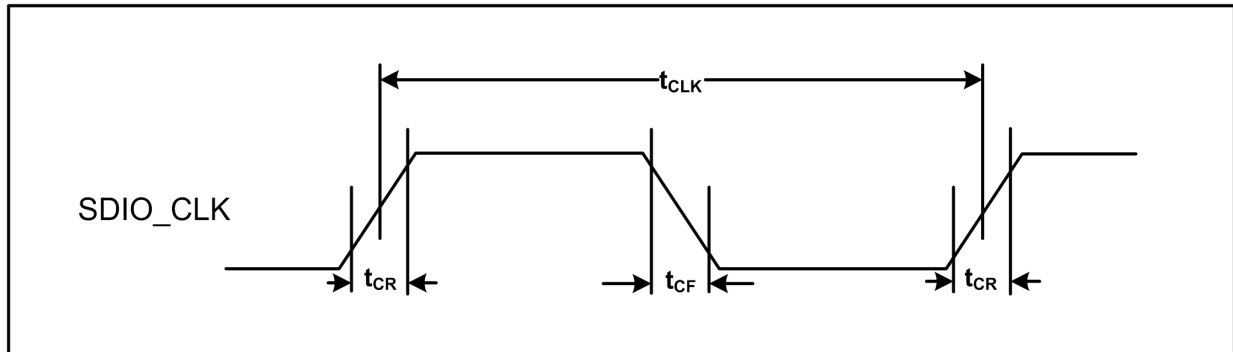
Card output timing (SDR Modes 100MHz to 208MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{OP}	0	2	UI	Card output phase
Δt_{OP}	-350	+1550	ps	Delay variation due to temp change after tuning
t_{ODW}	0.6	-	UI	$t_{ODW} = 2.88$ ns @ 208 MHz

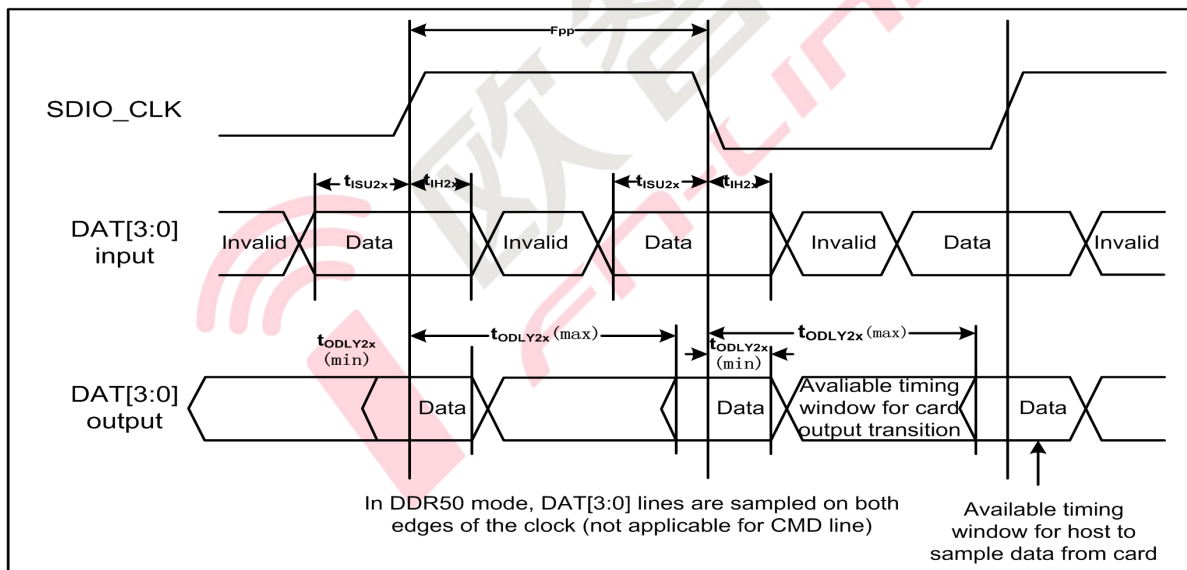
- $\Delta t_{OP} = +1550$ ps for junction temperature of $\Delta t_{OP} = 90$ degrees during operation
- $\Delta t_{OP} = -350$ ps for junction temperature of $\Delta t_{OP} = -20$ degrees during operation
- $\Delta t_{OP} = +2600$ ps for junction temperature of $\Delta t_{OP} = -20$ to $+125$ degrees during operation

7.4.5 SDIO Bus Timing Specifications in DDR50 Mode



parameter	Symbol	Minimum	Maximum	Unit	Comments
-	t_{CLK}	20	-	ns	DDR50 mode
-	t_{CR}, t_{CF}	-	$0.2 \times t_{CLK}$	ns	$t_{CR}, t_{CF} < 4.00$ ns (max)@50 MHz, $C_{CARD} = 10$ pF
Clock duty	-	45	55	%	-

Data Timing



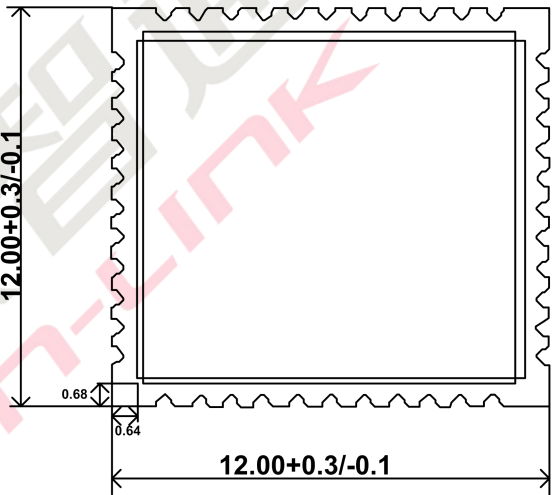
parameter	Symbol	Minimum	Maximum	Unit	Comments
Input CMD					
Input setup time	t_{ISU}	6	-	ns	$C_{CARD} < 10$ pF (1 Card)
Input hold time	t_{IH}	0.8	-	ns	$C_{CARD} < 10$ pF (1 Card)
Output CMD					
Output delay time	t_{ODLY}	-	13.7	ns	$C_{CARD} < 30$ pF (1 Card)
Output hold time	t_{OH}	1.5	-	ns	$C_{CARD} < 15$ pF (1 Card)
Input DAT					

Input setup time	t_{ISU2x}	3	-	ns	$C_{CARD} < 10 \text{ pF}$ (1 Card)
Input hold time	t_{IH2x}	0.8	-	ns	$C_{CARD} < 10 \text{ pF}$ (1 Card)
Output CMD					
Output delay time	t_{ODLY2x}	-	7.85 ^a	ns	$C_{CARD} < 25 \text{ pF}$ (1 Card)
Output hold time	t_{ODLY2x}	1.5	-	ns	$C_{CARD} < 15 \text{ pF}$ (1 Card)

a. SDIO 3.0 specification value is 7.0 ns

8. Size reference

8.1 Module Picture

L x W : 12 x 12 (+0.3/-0.1) mm -RC 	
H: 1.7 (±0.2) mm	
Weight	0.53g

8.2 Marking Description

< TOP VIEW >



备注:

二维码内容: 112233445566;FG1023SM13-W2

1. Fn-Link 商标 LOGO
2. 机型:8223A-SR
3. 二维码: 编码规则为“wifi mac 地址;成品料号”

例如: 112233445566;FG1023SM13-W2 (MAC 地址以实际为准)

----BT MAC 在 WIEI MAC 基础上+1(WIFI 地址需跳 1, 不能与 BT 地址重复), 二维码中不显示此内容。

4. V/N W2(V/N 到 W2 之间为两个空格, W2 为成品料号尾缀, 与二维码右对齐.)

Datecode:

W2: -w2 model

K2: -K2 model

W3: -W3 model

-RC model

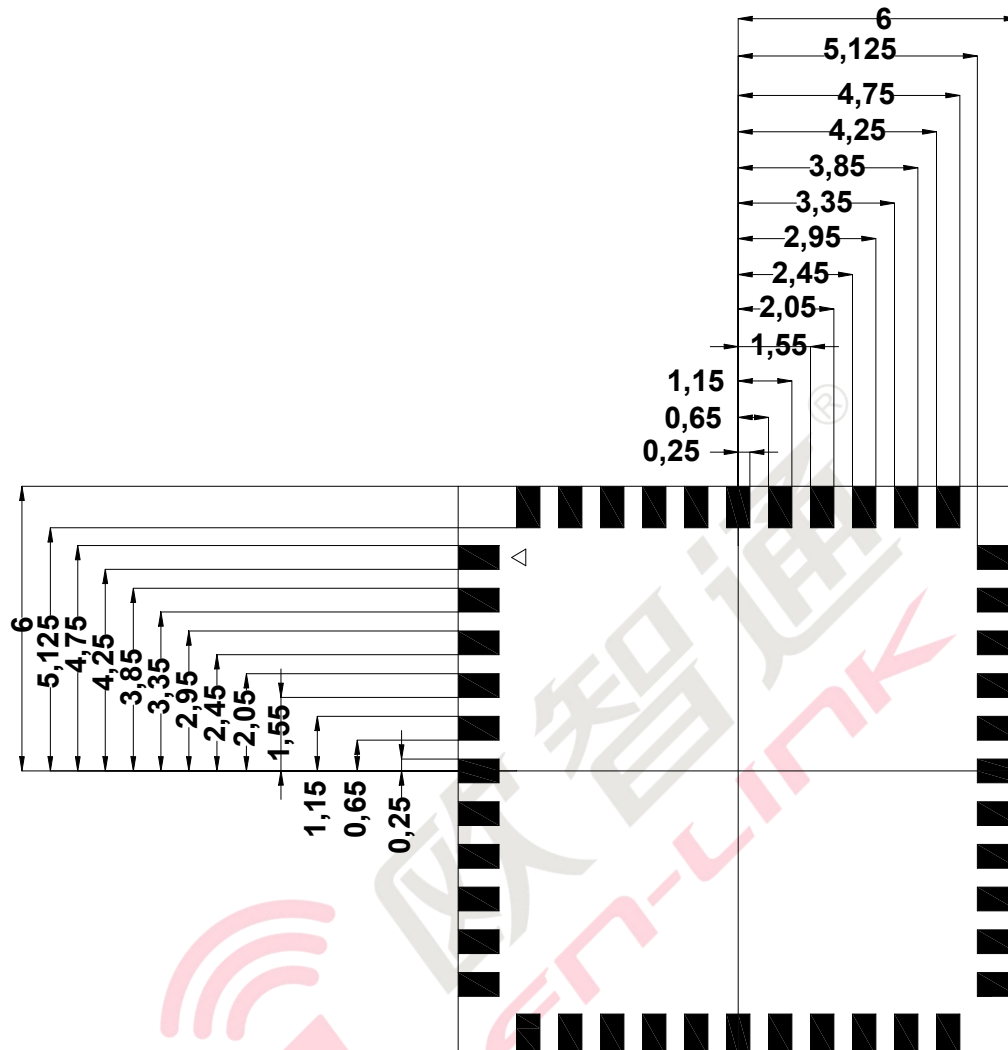


8.3 List of certified information

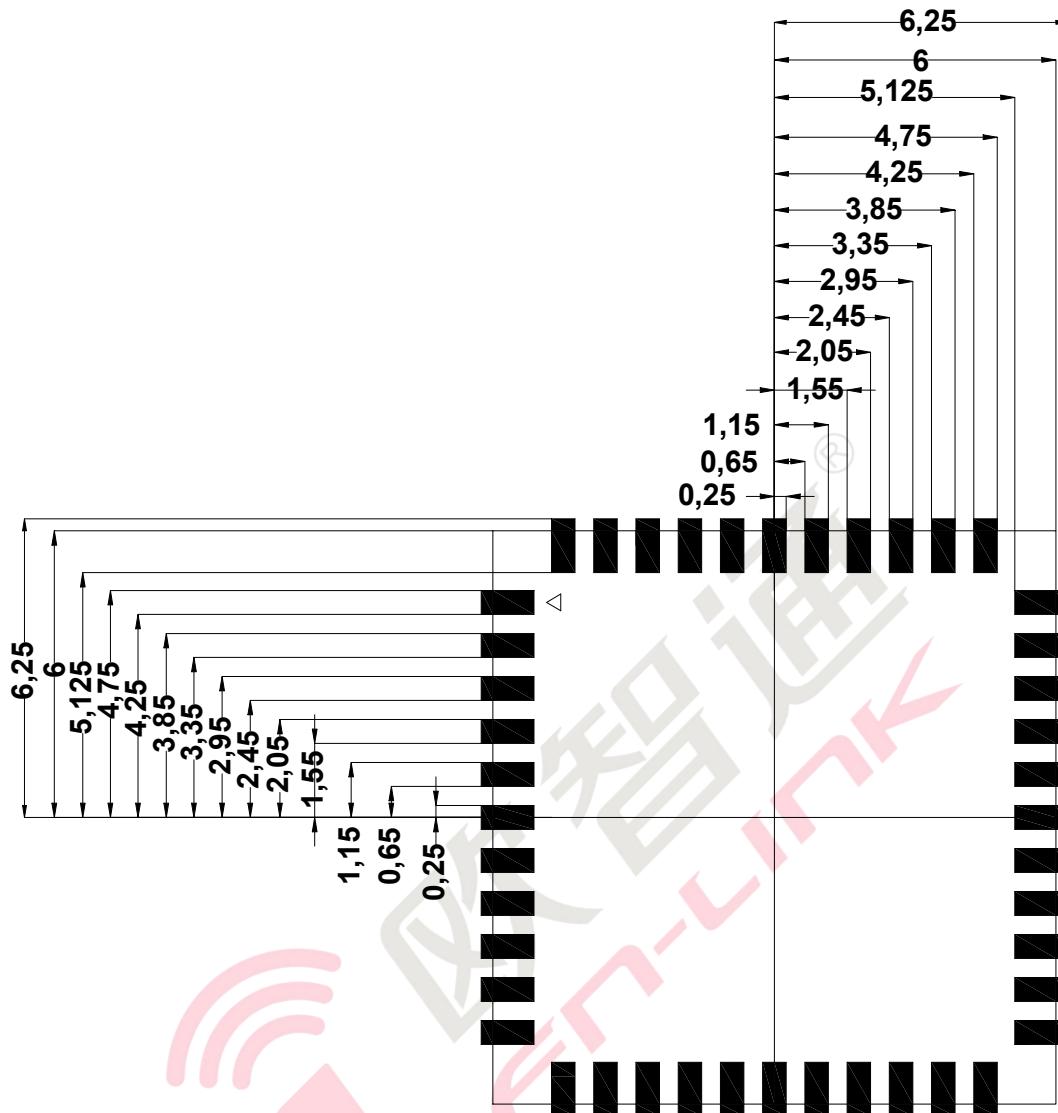
Certification project	Certificate number
SRRC	CMIIT ID:2019AP11087(M)
FCC	2AATL-8223A-SR
CE	RE-18010505
IC	24844-8223ASR
NCC	TBD
KCC	R-R-FNL-8223A-SR
TELEC	R210-130718
Brazil	TBD
Argentina	TBD
Japan	TBD
RCM	RCMA019080210

8.4 Physical Dimensions

<TOP View>



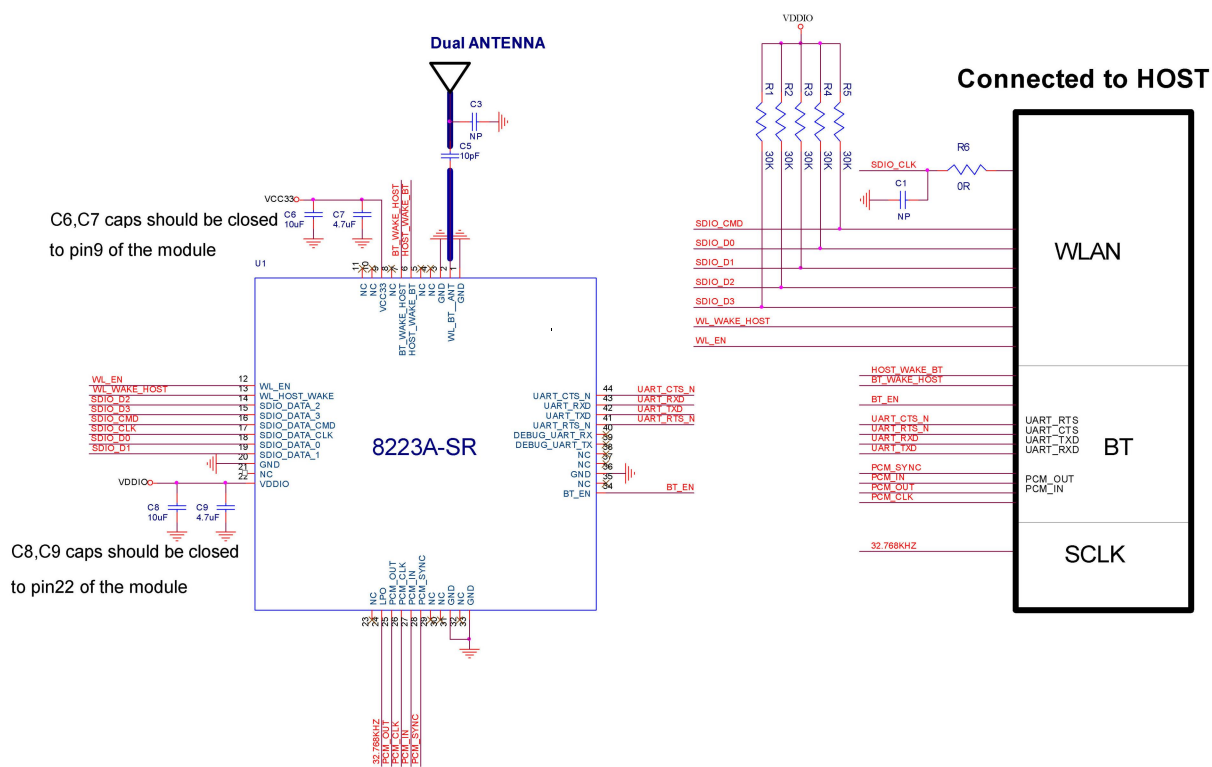
8.5 Layout Recommendation



9. The Key Material List

Item	Part Name	Description	Manufacturer
1	Inductor	2016 1.5uH, $\pm 20\%$, $>800\text{mA}$	Microgate,Cenke,Ceaiya,sunlord
2	Crystal	2016 48MHZ 10ppm, 8.8pF	Hosonic,ECEC,TKD,JWT,TST,SIW ARD
3	Diplexer	Diplexer,1608,2.4G+5G	ACX,Walsin,Glead,maglayers,FTR
4	Chipset	QCA1023-0/QCA9377-3	Qualcomm
5	Shielding	F1023XM13-W1 Shielding cover	精力通, 信太
6	PCB	8223A-SR Green,6L,12X12X0.498mm	Sunlord,Brainpower PCB,KX-PCB,ZL-PCB,XY-PCB

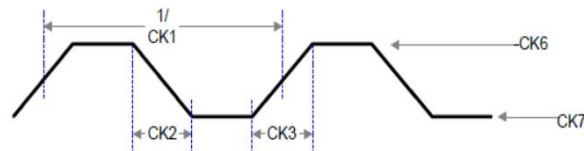
10. Reference Design



10.1 External 32KHz clock SPEC

- 1.The module does not require an external 32 kHz clock. By default, the WiFi chip set utilizes its internal 200 kHz clock shared with the WLAN and BT subsystem.
- 2.If the end application has a more accurate 32 kHz clock,the requirements are:

Symbol	Description	Min	Typ	Max	Unit
CK1	Clock rate	–	32.768	–	kHz
CK2	Fall time	1	–	100	ns
CK3	Rise time	1	–	100	ns
CK4	Duty cycle (high-to-low ratio)	15	–	85	%
CK5	Frequency stability	-200	–	200	ppm
CK6	Input high voltage	$0.8 \times VDDIO_GPIO2$	–	$VDDIO_GPIO2 + 0.2$	V
CK7	Input low voltage	-0.3	–	$0.2 \times VDDIO_GPIO2$	V

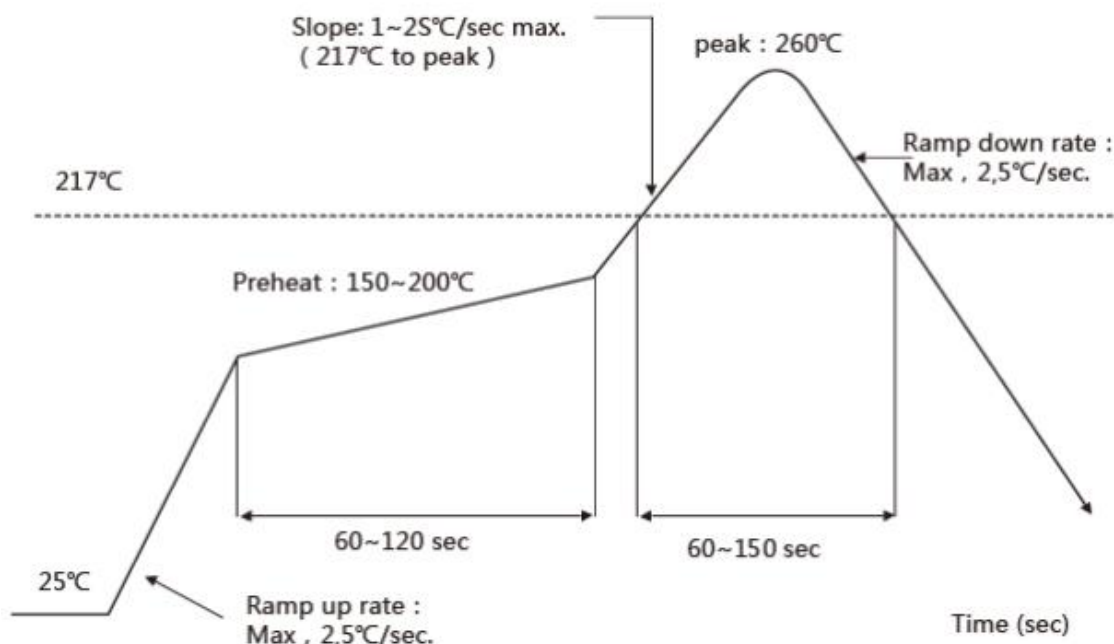


11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <260°C

Number of Times : ≤2 times



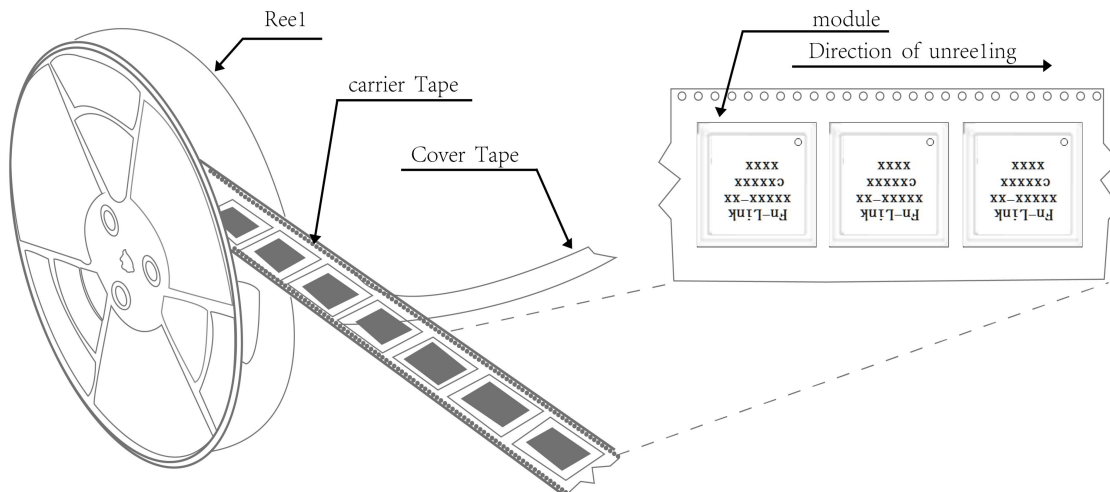
12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

13. Package

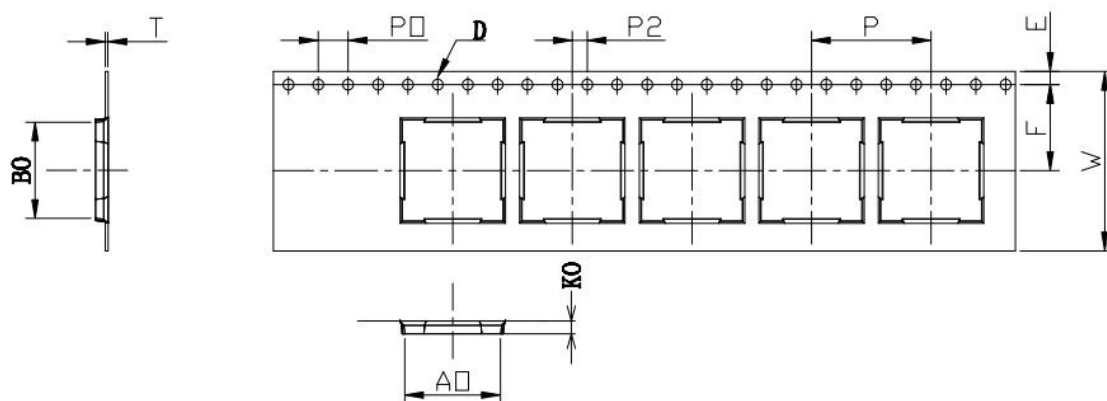
13.1 Reel

A roll of 1500pcs



13.2 Carrier Tape Detail

ITEM	W	A0	B0	D	F	E	K0	P0	P2	P	T
DIM	24	12.45	12.45	1.50	11.5	1.75	2.60	4.0	2.0	16.0	0.30
TOLE	+0.3 -0.3	±0.10	±0.10	+0.1 -0.0	+0.1 -0.1	±0.1	±0.10	±0.1	±0.1	±0.1	±0.05



13.3 Packaging Detail

the take-up package



Using self-adhesive tape

Size of black tape: 24mm*32.6m the cover tape :21.3mm*32.6m

Color of plastic disc: blue



NY bag size:450mm*415mm



size : 350*350*35mm



The packing case size:360*210*370mm

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

Appendix 1

Certification information

TELEC



CE

RE-18010505



FCC

FCC ID: 2AATL-8223A-SR

IC

24844-8223ASR

SRRC

CMIIT ID:2019AP11087(M)