



正基科技股份有限公司

SPECIFICATION

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PRODUCT NAME : _____ AP6255

	APPROVED	CHECKED	PREPARED	DCC ISSUE
NAME				

AMPAK

AP6255

WiFi 11ac + Bluetooth 4.1
Module Spec Sheet

Revision History

Date	Revision Content	Revised By	Version
2015/04/09	- Preliminary	Gary	1.0
2015/04/26	- Add GPIO pin definiion	Gary	1.1

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1. Introduction

AMPAK 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.

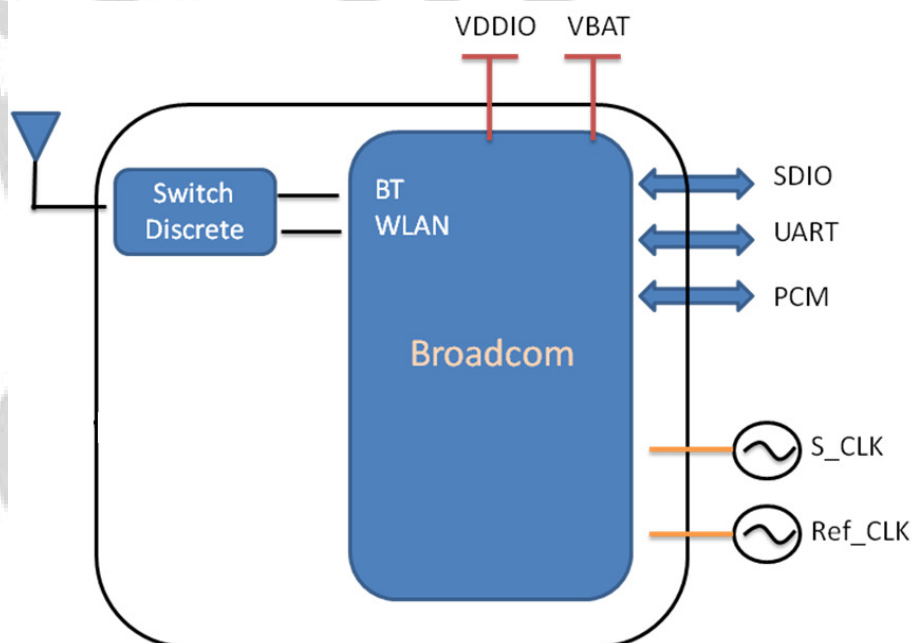
The wireless module complies with IEEE 802.11 a/b/g/n/ac standard and it can achieve up to a speed of 433.3Mbps with single stream in 802.11ac draft to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi, UART / PCM interface for Bluetooth.

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.

2. Features

- IEEE 802.11a/b/g/n/ac dual-band radio with virtual-simultaneous dual-band operation
- Single-stream spatial multiplexing up to 433.3 Mbps data rate.
- Supports 20, 40, 80 MHz channels with optional SGI(256 QAM modulation)
- Bluetooth V4.0+EDR with integrated Class 1 PA and Low Energy (BLE) support
- Concurrent Bluetooth, and WLAN operation
- Simultaneous BT/WLAN receive with single antenna
- Supports standard SDIO v3.0 and backward compatible with SDIO v2.0 host interfaces.
 - SDIO v3.0(4-bit) — up to 208 MHz clock rate in SDR104 mode
- BT host digital interface:
 - UART (up to 4 Mbps)
- IEEE Co-existence technologies are integrated die solution
- ECI — enhanced coexistence support, ability to coordinate BT SCO transmissions around WLAN receives

A simplified block diagram of the module is depicted in the figure below.



3. Deliverables

3.1 Deliverables

The following products and software will be part of the product.

- Module with packaging
- Evaluation Kits
- Software utility for integration, performance test.
- Product Datasheet.
- Agency certified pre-tested report with the adapter board.

3.2 Regulatory certifications

The product delivery is a pre-tested module, without the module level certification. For module approval, the platform's antennas are required for the certification.

4. General Specification

4.1 General Specification

Model Name	AP6255
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 12 x 12 x 1.5 (typical) mm
WiFi Interface	SDIO v2.0/v3.0
BT Interface	UART / PCM
Operating temperature	-30°C to 85°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 95% Non-Condensing

4.2 Voltages

4.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	6	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	3.9	V

4.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

	Min.	Typ.	Max.	Unit
Operating Temperature	-30	25	85	deg.C
VBAT	3.13	3.6	4.8	V
VDDIO	1.71	1.8	3.63	V

5. Wi-Fi RF Specification

5.1 2.4GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25 °C

Feature	Description
WLAN Standard	IEEE 802.11b/g/n/ac, WiFi compliant
Frequency Range	2.400 GHz ~ 2.497 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz : Ch1 ~ Ch14
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11g/n : 64-QAM,16-QAM, QPSK, BPSK 802.11ac : 256-QAM, 64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11b /CCK : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -9dB
	802.11g /64-QAM(R=3/4) : 15 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /64-QAM(R=5/6) : 14 dBm $\pm$ 1.5 dB @ EVM $\leq$ -28dB
Receive Sensitivity (11b) @8% PER	- 1Mbps PER @ -96 dBm, typical
	- 2Mbps PER @ -90 dBm, typical
	- 5.5Mbps PER @ -88 dBm, typical
	- 11Mbps PER @ -87 dBm, typical
Receive Sensitivity (11g) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -88 dBm, typical
	- 12Mbps PER @ -87 dBm, typical
	- 18Mbps PER @ -85 dBm, typical
	- 24Mbps PER @ -83 dBm, typical
	- 36Mbps PER @ -80 dBm, typical
	- 48Mbps PER @ -76 dBm, typical
	- 54Mbps PER @ -74 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -85 dBm, typical
	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -80 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -75 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -71 dBm, typical
Receive Sensitivity (11n,40MHz)	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -85 dBm, typical

@10% PER	- MCS=2	PER @ -84 dBm, typical
	- MCS=3	PER @ -80 dBm, typical
	- MCS=4	PER @ -76 dBm, typical
	- MCS=5	PER @ -72 dBm, typical
	- MCS=6	PER @ -70 dBm, typical
	- MCS=7	PER @ -69 dBm, typical
Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0	PER @ -90 dBm, typical
	- MCS=1	PER @ -87 dBm, typical
	- MCS=2	PER @ -86 dBm, typical
	- MCS=3	PER @ -82 dBm, typical
	- MCS=4	PER @ -79 dBm, typical
	- MCS=5	PER @ -75 dBm, typical
	- MCS=6	PER @ -73 dBm, typical
	- MCS=7	PER @ -72 dBm, typical
	- MCS=8	PER @ -67 dBm, typical
Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0	PER @ -88 dBm, typical
	- MCS=1	PER @ -85 dBm, typical
	- MCS=2	PER @ -83 dBm, typical
	- MCS=3	PER @ -80 dBm, typical
	- MCS=4	PER @ -77 dBm, typical
	- MCS=5	PER @ -72 dBm, typical
	- MCS=6	PER @ -71 dBm, typical
	- MCS=7	PER @ -69 dBm, typical
	- MCS=8	PER @ -65 dBm, typical
	- MCS=9	PER @ -64 dBm, typical
Maximum Input Level	802.11b : -10dBm	
	802.11g/n : -20dBm	
	802.11ac : -30dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

5.1 5GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25 °C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n/ac, Wi-Fi compliant
Frequency Range	4.900 GHz ~ 5.845 GHz (5.0 GHz ISM Band)
Number of Channels	5.0GHz : Please see the table ¹
Modulation	802.11a/n : 64-QAM,16-QAM, QPSK, BPSK 802.11ac : 256-QAM, 64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11a /64-QAM(R=3/4) : 14 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /64-QAM(R=5/6) : 13 dBm ± 1.5 dB @ EVM ≤ -28dB
	802.11ac/256-QAM(R=3/4) : 12 dBm ± 1.5 dB @ EVM ≤ -30dB
	802.11ac/256-QAM(R=5/6) : 10 dBm ± 1.5 dB @ EVM ≤ -32dB
Receive Sensitivity (11a, 20MHz) @10% PER	- 6Mbps PER @ -91 dBm, typical
	- 9Mbps PER @ -89 dBm, typical
	- 12Mbps PER @ -88 dBm, typical
	- 18Mbps PER @ -86 dBm, typical
	- 24Mbps PER @ -82 dBm, typical
	- 36Mbps PER @ -79 dBm, typical
	- 48Mbps PER @ -74 dBm, typical
	- 54Mbps PER @ -73 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -88 dBm, typical
	- MCS=2 PER @ -85 dBm, typical
	- MCS=3 PER @ -82 dBm, typical
	- MCS=4 PER @ -78 dBm, typical
	- MCS=5 PER @ -74 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -71 dBm, typical
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -88 dBm, typical
	- MCS=1 PER @ -85 dBm, typical
	- MCS=2 PER @ -83 dBm, typical
	- MCS=3 PER @ -79 dBm, typical
	- MCS=4 PER @ -76 dBm, typical
	- MCS=5 PER @ -71 dBm, typical
	- MCS=6 PER @ -70 dBm, typical
	- MCS=7 PER @ -68 dBm, typical

Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0	PER @ -89 dBm, typical
	- MCS=1	PER @ -87 dBm, typical
	- MCS=2	PER @ -84 dBm, typical
	- MCS=3	PER @ -81 dBm, typical
	- MCS=4	PER @ -77 dBm, typical
	- MCS=5	PER @ -73 dBm, typical
	- MCS=6	PER @ -71 dBm, typical
	- MCS=7	PER @ -70 dBm, typical
	- MCS=8	PER @ -66 dBm, typical
Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0	PER @ -87 dBm, typical
	- MCS=1	PER @ -83 dBm, typical
	- MCS=2	PER @ -81 dBm, typical
	- MCS=3	PER @ -78 dBm, typical
	- MCS=4	PER @ -75 dBm, typical
	- MCS=5	PER @ -70 dBm, typical
	- MCS=6	PER @ -68 dBm, typical
	- MCS=7	PER @ -66 dBm, typical
	- MCS=8	PER @ -64 dBm, typical
Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0	PER @ -83 dBm, typical
	- MCS=1	PER @ -80 dBm, typical
	- MCS=2	PER @ -78 dBm, typical
	- MCS=3	PER @ -74 dBm, typical
	- MCS=4	PER @ -71 dBm, typical
	- MCS=5	PER @ -69 dBm, typical
	- MCS=6	PER @ -65 dBm, typical
	- MCS=7	PER @ -63 dBm, typical
	- MCS=8	PER @ -60 dBm, typical
	- MCS=9	PER @ -59 dBm, typical
Maximum Input Level	802.11a/n : -20dBm	
	802.11ac : -30dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

¹5GHz Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5.15GHz~5.25GHz	36	5180
	40	5200
	44	5220
	48	5240
5.25GHz~5.35GHz	52	5260
	56	5280
	60	5300
	64	5320
5.5GHz~5.7GHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
5.725GHz~5.825GHz	140	5700
	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

6. Bluetooth Specification

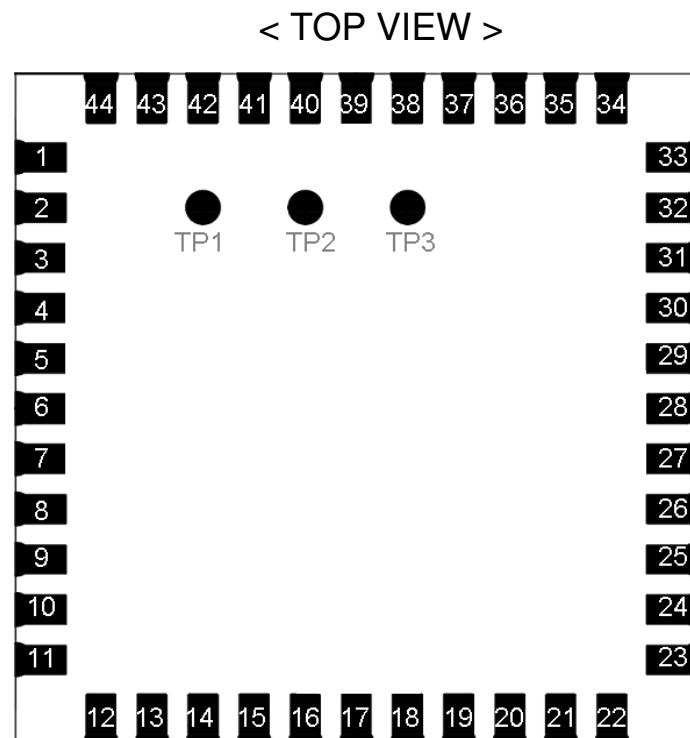
6.1 Bluetooth Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25 °C

Feature	Description																									
General Specification																										
Bluetooth Standard	Bluetooth V4.0 of 1, 2 and 3 Mbps.																									
Host Interface	UART																									
Antenna Reference	Small antennas with 0~2 dBi peak gain																									
Frequency Band	2402 MHz ~ 2480 MHz																									
Number of Channels	79 channels																									
Modulation	FHSS, GFSK, DPSK, DQPSK																									
RF Specification																										
	<table><tr><th>Min.</th><th>Typical.</th><th>Max.</th></tr><tr><td>Output Power (Class 1.5)</td><td>9 dBm</td><td></td></tr><tr><td>Output Power (Class 2)</td><td>2 dBm</td><td></td></tr><tr><td>Sensitivity @ BER=0.1% for GFSK (1Mbps)</td><td>-86 dBm</td><td></td></tr><tr><td>Sensitivity @ BER=0.01% for $\pi/4$-DQPSK (2Mbps)</td><td>-86 dBm</td><td></td></tr><tr><td>Sensitivity @ BER=0.01% for 8DPSK (3Mbps)</td><td>-80 dBm</td><td></td></tr><tr><td rowspan="3">Maximum Input Level</td><td colspan="2">GFSK (1Mbps) :-20dBm</td></tr><tr><td colspan="2">$\pi/4$-DQPSK (2Mbps) :-20dBm</td></tr><tr><td colspan="2">8DPSK (3Mbps) :-20dBm</td></tr></table>	Min.	Typical.	Max.	Output Power (Class 1.5)	9 dBm		Output Power (Class 2)	2 dBm		Sensitivity @ BER=0.1% for GFSK (1Mbps)	-86 dBm		Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-86 dBm		Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-80 dBm		Maximum Input Level	GFSK (1Mbps) :-20dBm		$\pi/4$ -DQPSK (2Mbps) :-20dBm		8DPSK (3Mbps) :-20dBm	
Min.	Typical.	Max.																								
Output Power (Class 1.5)	9 dBm																									
Output Power (Class 2)	2 dBm																									
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-86 dBm																									
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Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-80 dBm																									
Maximum Input Level	GFSK (1Mbps) :-20dBm																									
	$\pi/4$ -DQPSK (2Mbps) :-20dBm																									
	8DPSK (3Mbps) :-20dBm																									

7. Pin Assignments

7.1 Pin Outline



7.2 Pin Definition

NO	Name	Type	Description
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	BT_WAKE	I	HOST wake-up Bluetooth device
7	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST
8	NC	—	Floating (Don't connected to ground)
9	VBAT	P	Main power voltage source input
10	XTAL_IN	I	Crystal input
11	XTAL_OUT	O	Crystal output
12	WL_REG_ON	I	Power up/down internal regulators used by WiFi section
13	WL_HOST_WAKE	O	WLAN to wake-up HOST

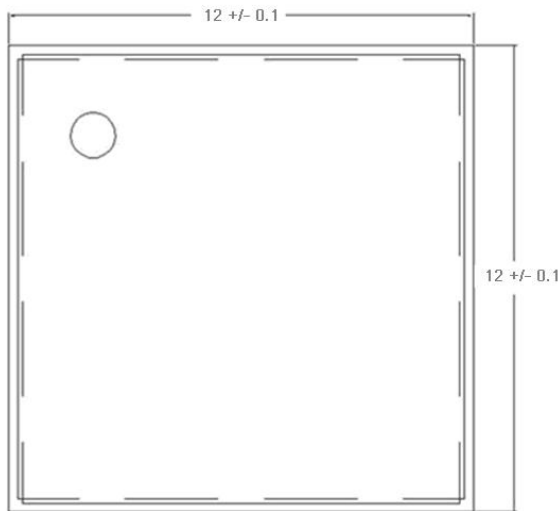
14	SDIO_DATA_2	I/O	SDIO data line 2
15	SDIO_DATA_3	I/O	SDIO data line 3
16	SDIO_DATA_CMD	I/O	SDIO command line
17	SDIO_DATA_CLK	I/O	SDIO clock line
18	SDIO_DATA_0	I/O	SDIO data line 0
19	SDIO_DATA_1	I/O	SDIO data line 1
20	GND	—	Ground connections
21	VIN_LDO_OUT	P	Internal Buck voltage generation pin
22	VDDIO	P	I/O Voltage supply input
23	VIN_LDO	P	Internal Buck voltage generation pin
24	LPO	I	External Low Power Clock input (32.768KHz)
25	PCM_OUT	O	PCM Data output
26	PCM_CLK	I/O	PCM clock
27	PCM_IN	I	PCM data input
28	PCM_SYNC	I/O	PCM sync signal
29	SDIO_VSEL	I/O	SDIO mode selection pin
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_REG_ON	I	Power up/down internal regulators used by BT section
35	NC	—	Floating (Don't connected to ground)
36	GND	—	Ground connections
37	GPIO_6	I/O	GPIO configuration pin
38	GPIO_3	I/O	GPIO configuration pin
39	GPIO_5	I/O	GPIO configuration pin
40	GPIO_2	I/O	GPIO configuration pin
41	UART_RTS_N	O	Bluetooth UART interface
42	UART_TXD	O	Bluetooth UART interface
43	UART_RXD	I	Bluetooth UART interface
44	UART_CTS_N	I	Bluetooth UART interface
45	TP1(NC)	—	Floating (Don't connected to ground)
46	TP2(NC)	—	Floating (Don't connected to ground)
47	TP3(NC)	—	Floating (Don't connected to ground)

8. Dimensions

8.1 Physical Dimensions

(Unit: mm)

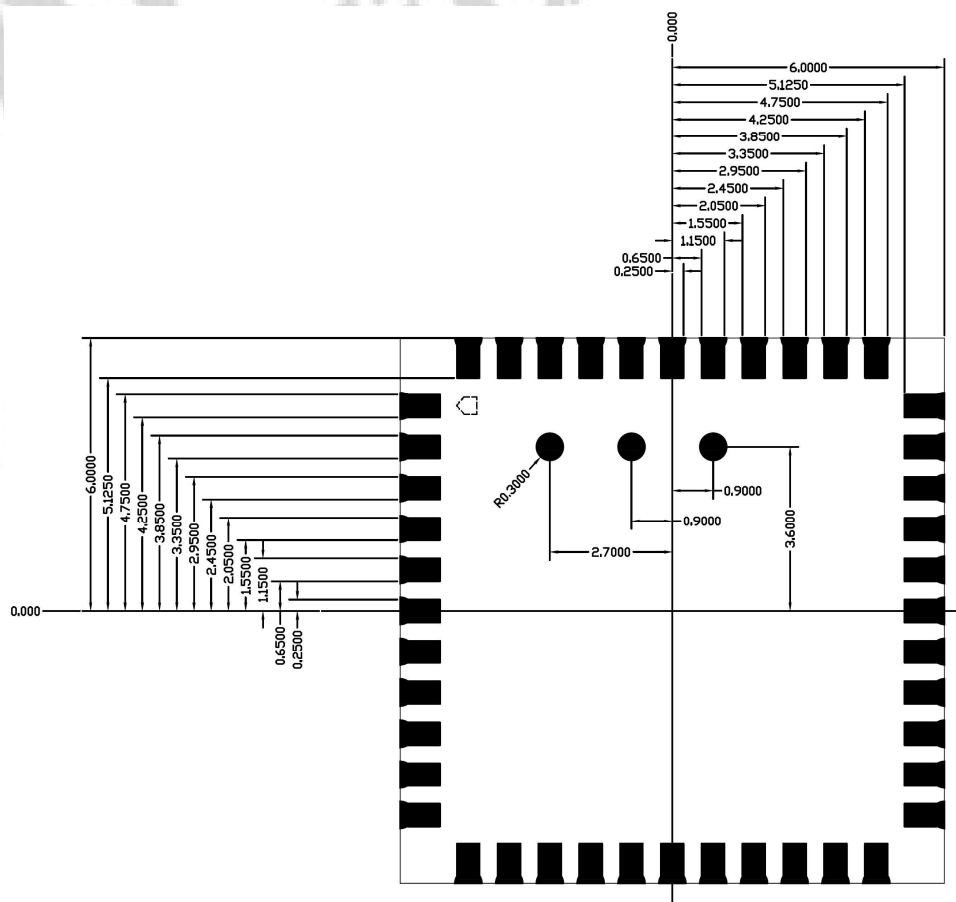
< TOP VIEW >



< Side View >



< TOP VIEW >



(Unit: mm)

Technical drawing of a rectangular building footprint. The drawing shows the overall dimensions and internal layout. The overall width is 6.2500 and the overall height is 6.0000. The drawing includes a central area with three circular features, each with a radius of R0.3000. The distance between the centers of the circles is 2.7000. The distance from the center of the leftmost circle to the left wall is 0.9000. The distance from the center of the middle circle to the left wall is 0.9000. The distance from the center of the rightmost circle to the left wall is 0.9000. The distance from the center of the rightmost circle to the right wall is 0.9000. The distance from the center of the rightmost circle to the bottom wall is 3.6000. The drawing also shows a series of vertical lines on the right side, with dimensions ranging from 0.2500 to 6.2500. The drawing is oriented with the top wall at the top and the bottom wall at the bottom. The left wall is on the left and the right wall is on the right. The drawing is a technical drawing and should be used as such.

9. External clock reference

External LPO signal characteristics

Parameter	Specification	Units
Nominal input frequency	32.768	kHz
Frequency accuracy	± 30	ppm
Duty cycle	30 - 70	%
Input signal amplitude	400 to 1800	mV, p-p
Signal type	Square-wave	-
Input impedance	>100k	Ω
	<5	pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7V _{io} - V _{io}	V

10.1 SDIO Pin Description

All three package options of the WLAN section provide support for SDIO version 3.0 including the new UHS-I modes:

- DS: Default speed up to 25MHz (3.3V signaling).
- HS: High speed up to 50MHz (3.3V signaling).
- SDR12: SDR up to 25MHz (1.8V signaling).
- SDR25: SDR up to 50MHz (1.8V signaling).
- SDR50: SDR up to 100MHz (1.8V signaling).
- SDR104: SDR up to 208MHz (1.8V signaling).
- DDR50: DDR up to 50MHz (1.8V signaling).

The SDIO interface also has the ability to map the interrupt signal on to a GPIO pin for applications requiring an interrupt different from the one provided by SDIO interface. The ability to force control of gated clocks from within the device is also provided.

The following three functions are supported:

- ❖ Function 0 Standard SDIO function (Max BlockSize / ByteCount = 32B)
- ❖ Function 1 Backplane Function to access the internal System On Chip (SOC) address space (Max BlockSize / ByteCount = 64B)
- ❖ Function 2 WLAN Function for efficient WLAN packet transfer through DMA (Max BlockSize/ByteCount=512B)

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

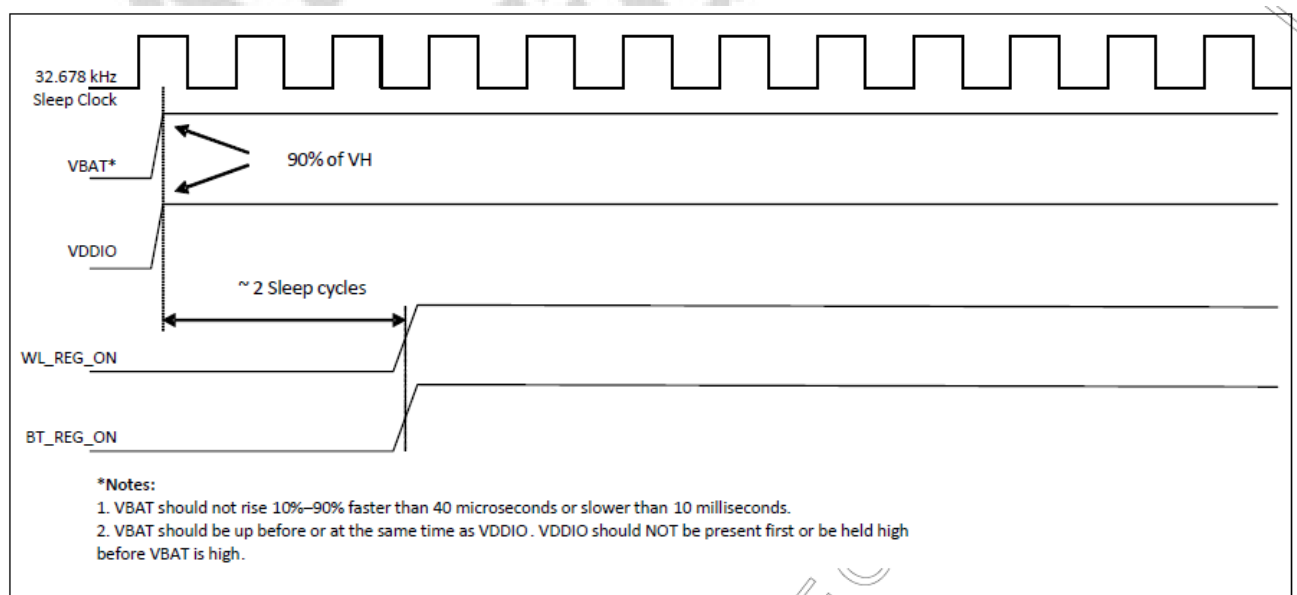
10. Host Interface Timing Diagram

10.1 Power-up Sequence Timing Diagram

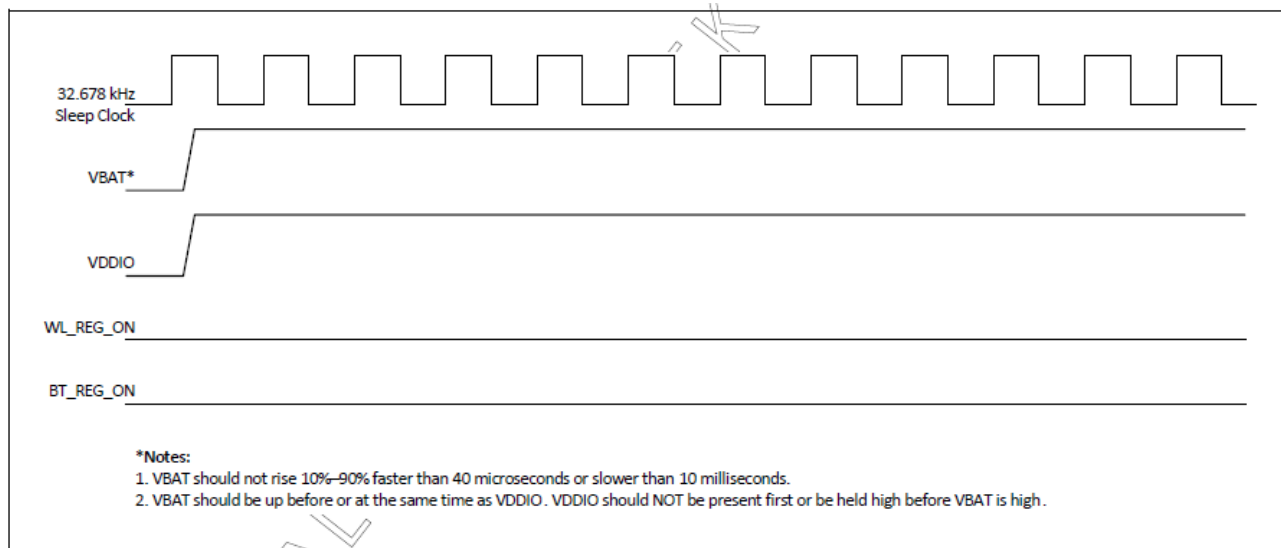
The module has signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN and internal regulator blocks. These signals are described below.

Additionally, diagrams are provided to indicate proper sequencing of the signals for various operating states. The timing value indicated are minimum required values: longer delays are also acceptable.

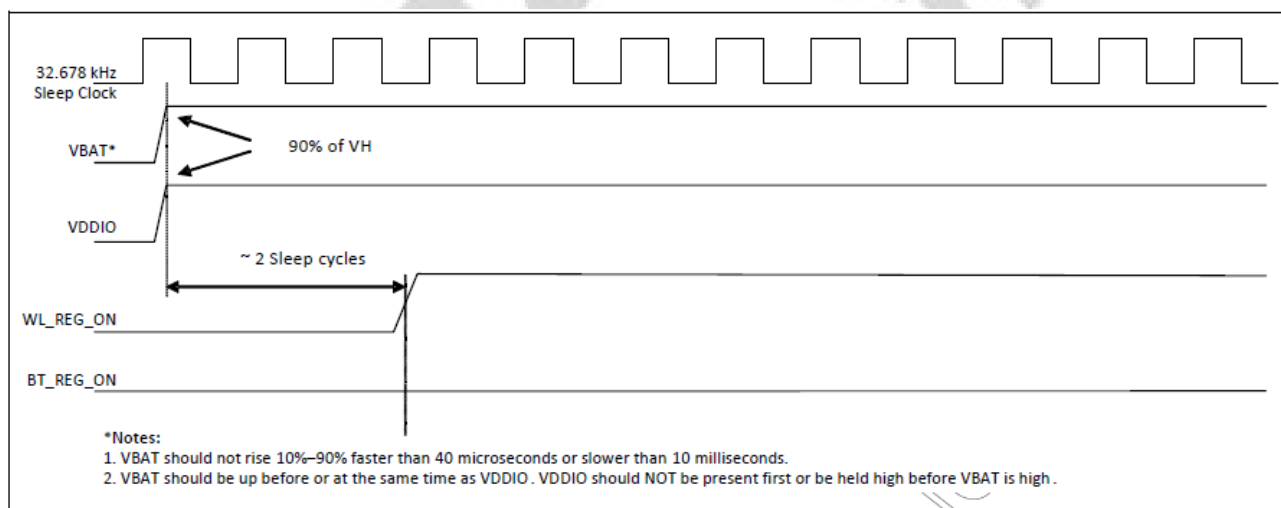
- ※ WL_REG_ON: Used by the PMU to power up or power down the internal regulators used by the WLAN section. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset.
- ※ BT_REG_ON: Used by the PMU to power up or power down the internal regulators used by the BT section. Low asserting reset for Bluetooth. This pin has no effect on WLAN and does not control any PMU functions. This pin must be driven high or low (not left floating).



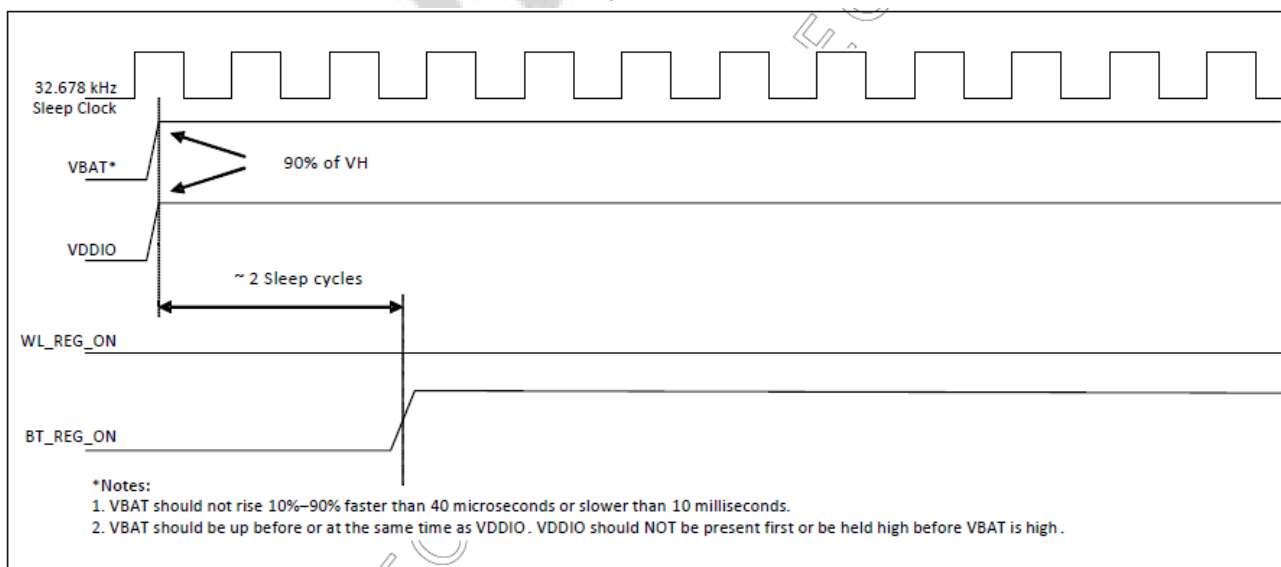
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF

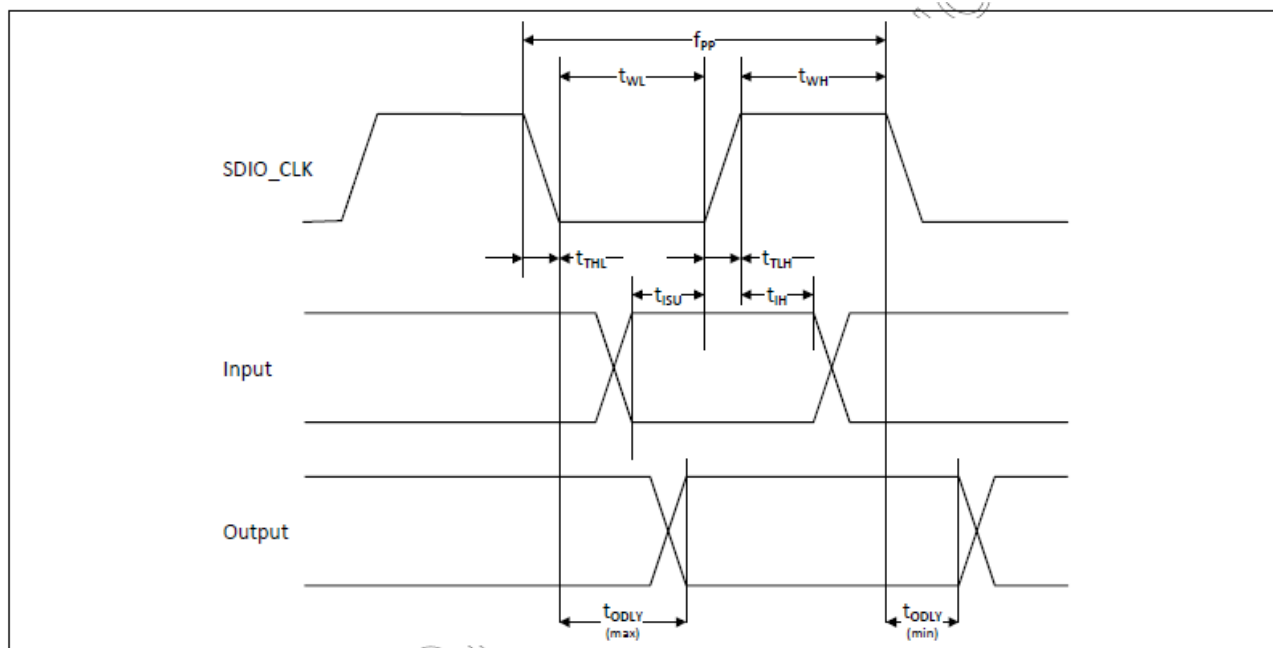


WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

10.2 SDIO Default Mode Timing Diagram

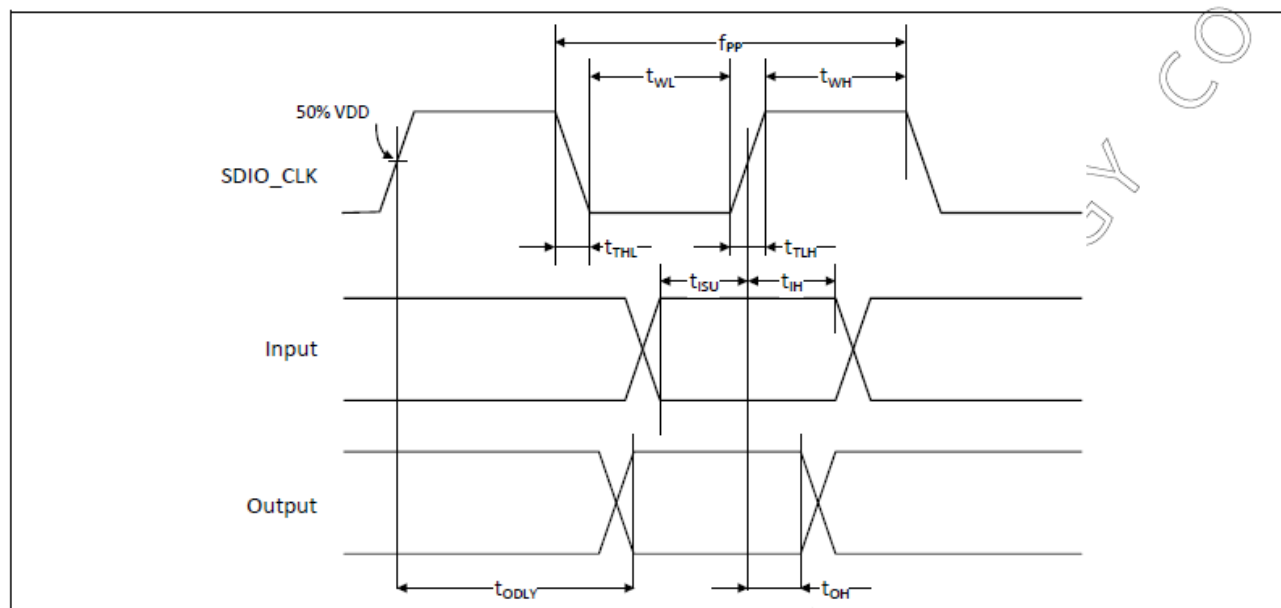


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer mode	f_{pp}	0	–	25	MHz
Frequency – Identification mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	10	–	–	ns
Clock high time	t_{WH}	10	–	–	ns
Clock rise time	t_{TLH}	–	–	10	ns
Clock low time	t_{THL}	–	–	10	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup time	t_{ISU}	5	–	–	ns
Input hold time	t_{IH}	5	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer mode	t_{ODLY}	0	–	14	ns
Output delay time – Identification mode	t_{ODLY}	0	–	50	ns

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

b. $\min(V_{IH}) = 0.7 \times V_{DDIO}$ and $\max(V_{IL}) = 0.2 \times V_{DDIO}$.

10.3 SDIO High Speed Mode Timing Diagram



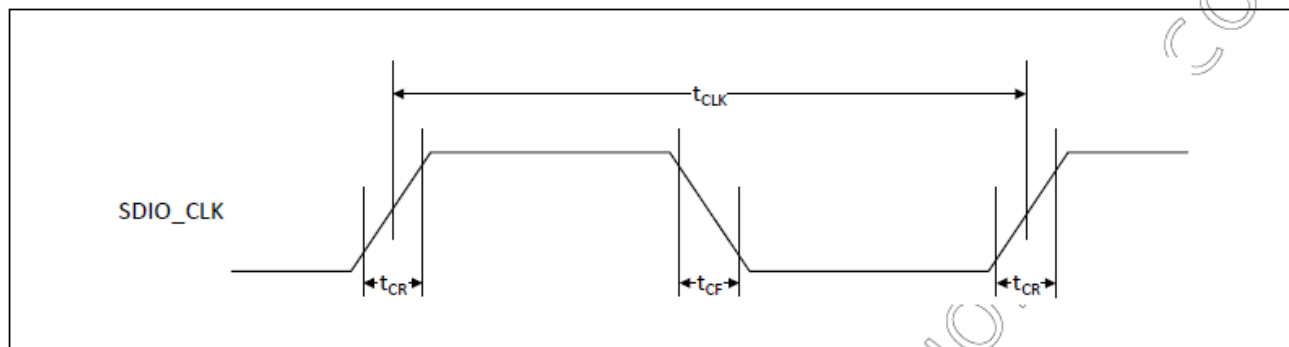
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (all values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer Mode	f_{PP}	0	–	50	MHz
Frequency – Identification Mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	7	–	–	ns
Clock high time	t_{WH}	7	–	–	ns
Clock rise time	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 hold time	t_{OH}	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. $\min(V_{IH}) = 0.7 \times V_{DDIO}$ and $\max(V_{IL}) = 0.2 \times V_{DDIO}$.

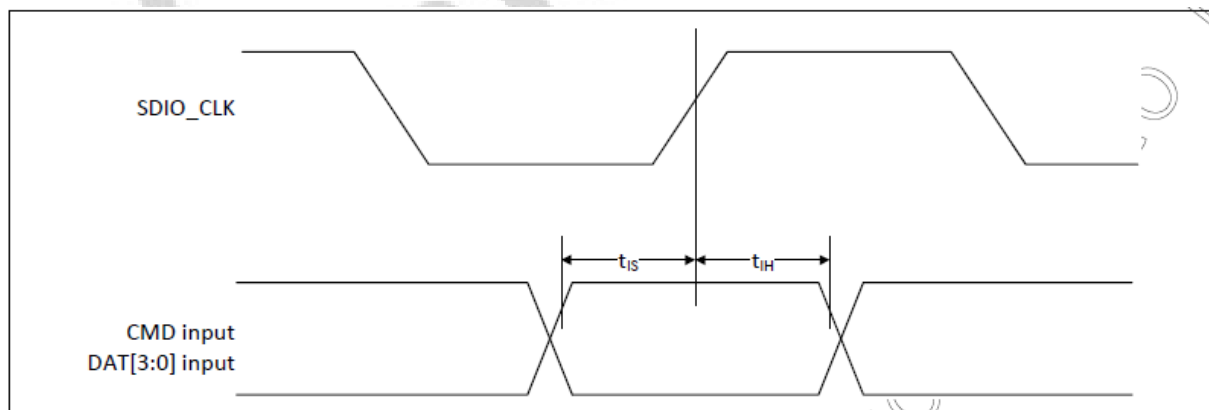
10.4 SDIO Bus Timing Specifications in SDR Modes

Clock timing (SDR Modes)



Parameter	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	%	–

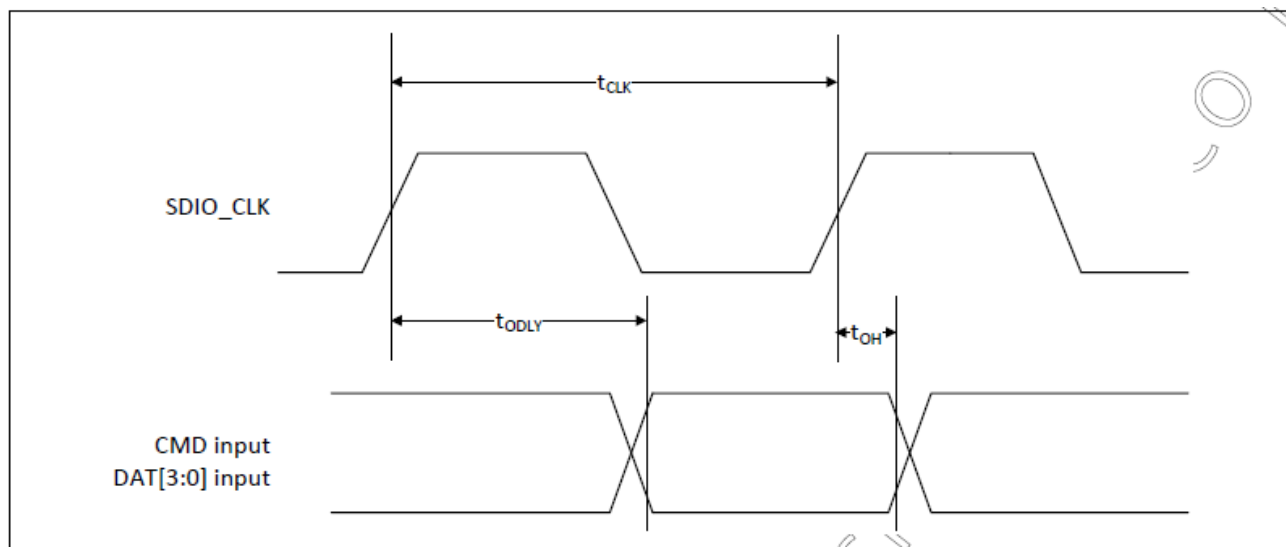
Card Input timing (SDR Modes)



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.

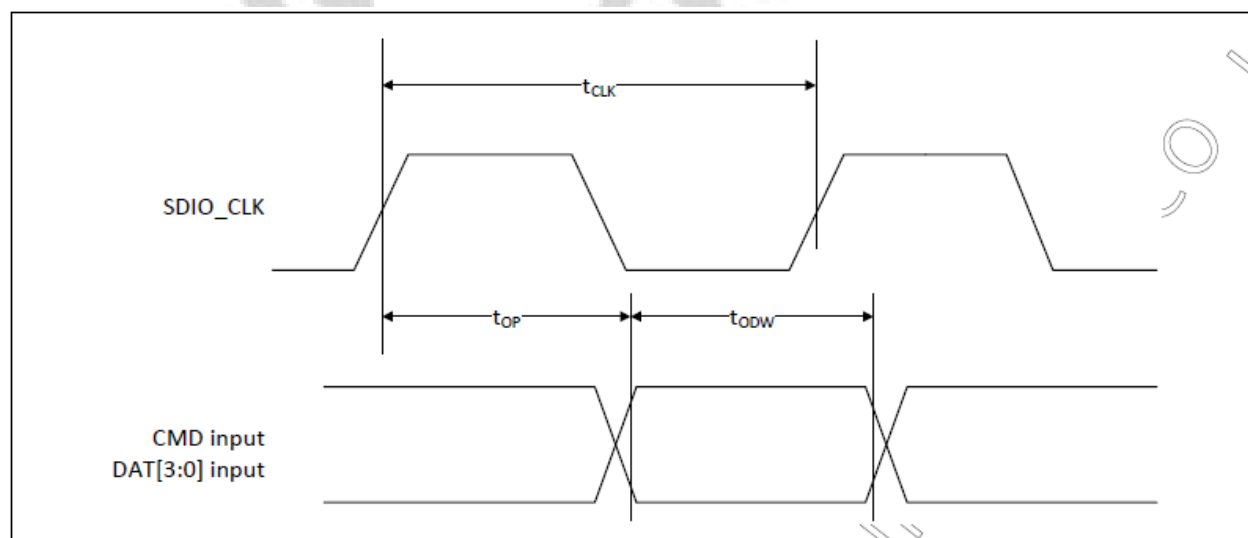
Card output timing (SDR Modes up to 100MHz)



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.

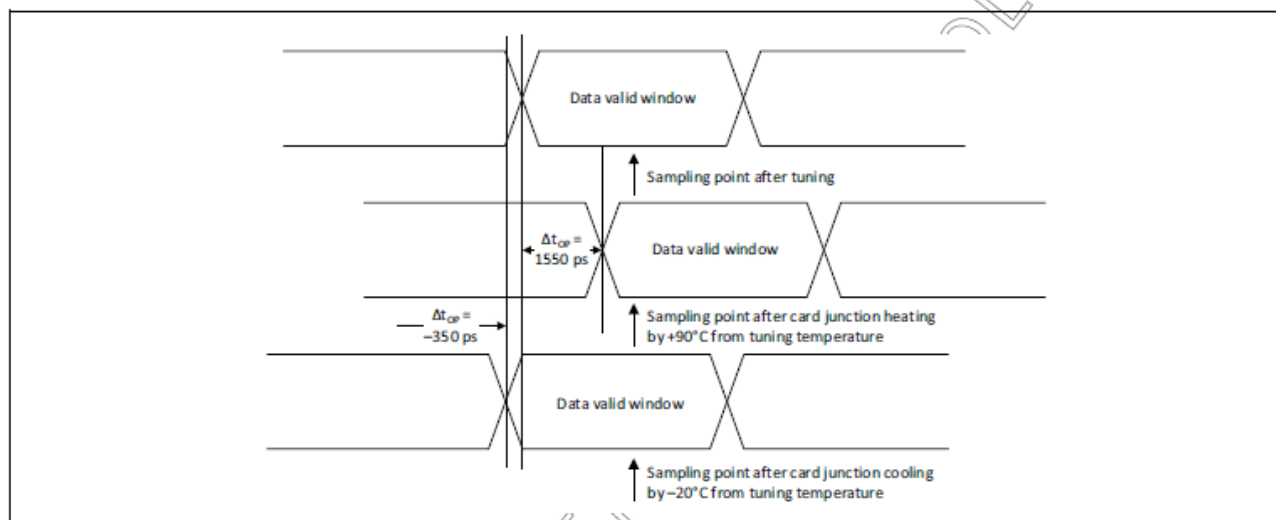
Card output timing (SDR Modes 100MHz to 208MHz)



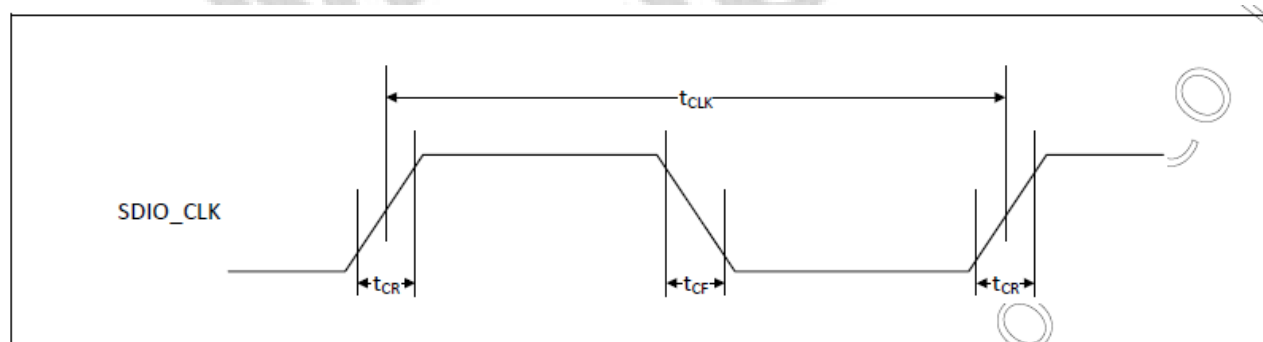
Symbol	Minimum	Maximum	Unit	Comments
t_{OP}	0	2	UI	Card output phase
Δt_{OP}	–350	+1550	ps	Delay variation due to temp change after tuning
t_{ODW}	0.60	–	UI	$t_{ODW} = 2.88$ ns @ 208 MHz

- $\Delta t_{OP} = +1550$ 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

Δt_{OP} Consideration for Variable Data Window (SDR 104 Mode)

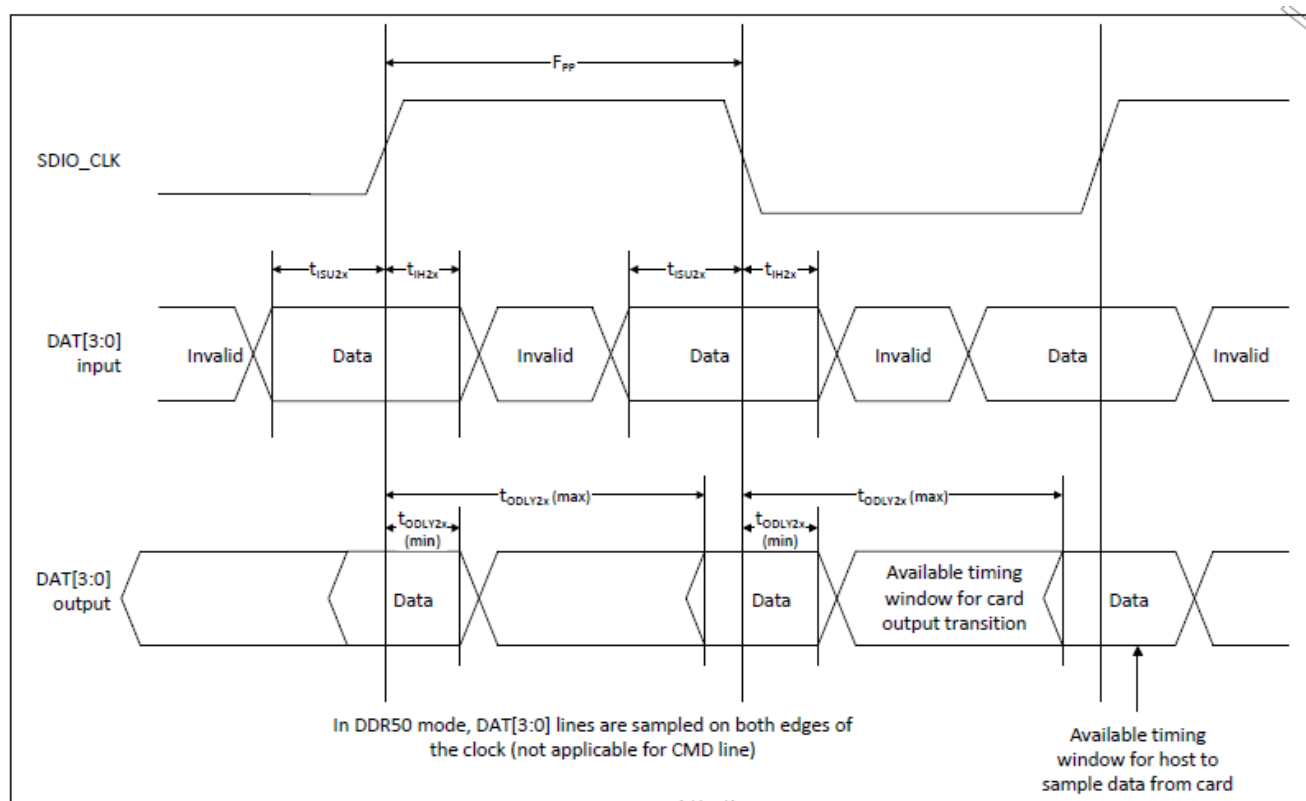


10.5 SDIO Bus Timing Specifications in DDR50 Mode



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	$C_{CARD} < 10\text{pF}$ (1 Card)
Input hold time	t_{IH}	0.8	—	ns	$C_{CARD} < 10\text{pF}$ (1 Card)
Output CMD					
Output delay time	t_{ODLY}	—	13.7	ns	$C_{CARD} < 30\text{pF}$ (1 Card)
Output hold time	t_{OH}	1.5	—	ns	$C_{CARD} < 15\text{pF}$ (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 DAT					
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)

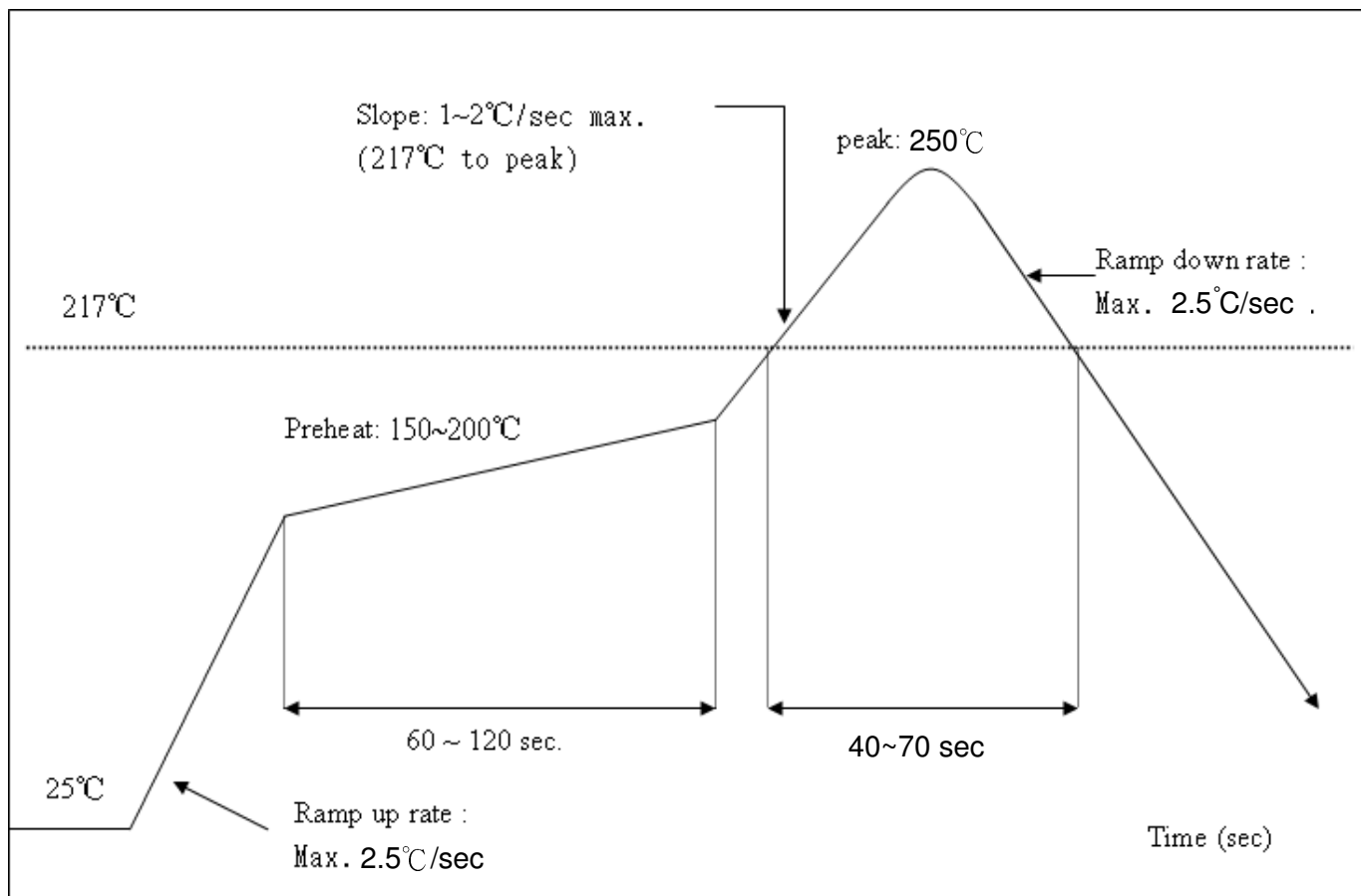
a. SDIO 3.0 specification value is 7.0 ns.

11. Recommended Reflow Profile

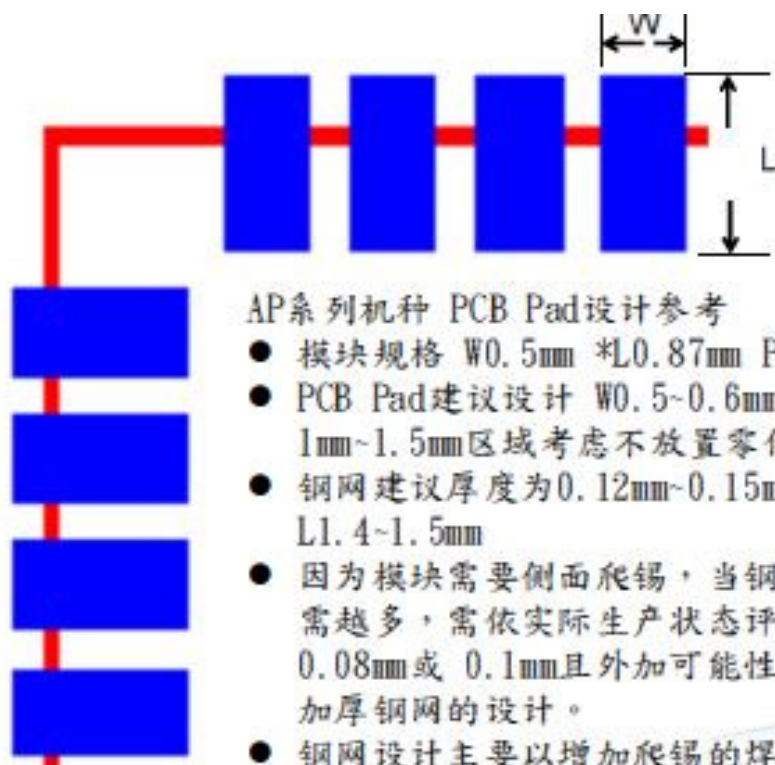
Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



Solder Paste definition



12. Package Information

12.1 Label

Label A→ Anti-static and humidity notice



Label B→ MSL caution / Storage Condition

Caution		LEVEL
This bag contains MOISTURE-SENSITIVE DEVICES		 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		

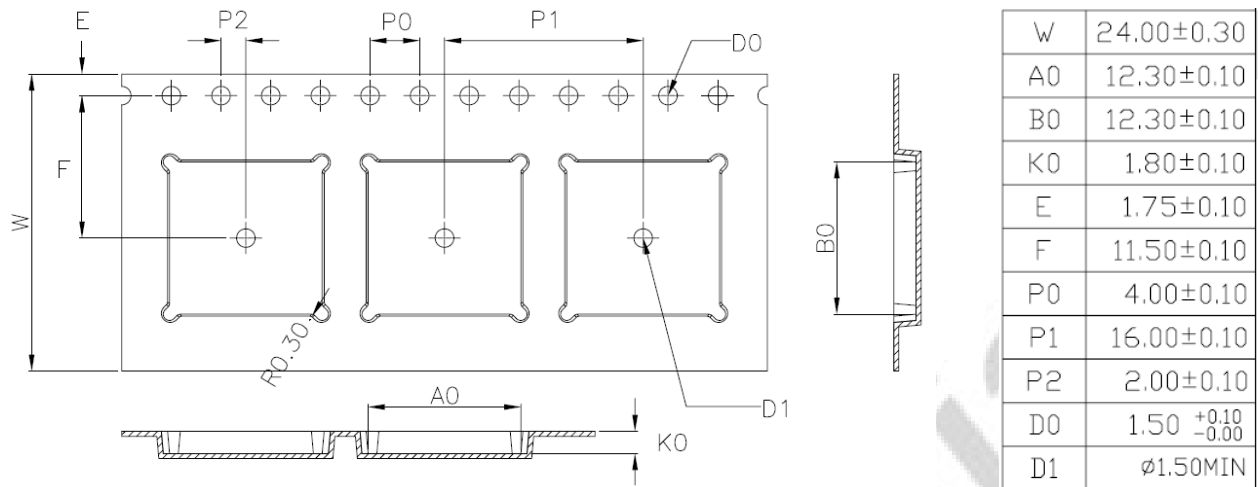
Label C→ Inner box label .

PKG S/N :	 9PKG12013100001
Model:	 XXXXXXXXXXXX
P/N :	 99P-W01-0048R
Qty :	 1500
Date Code :	 1205
Lot Code :	 T0C102B

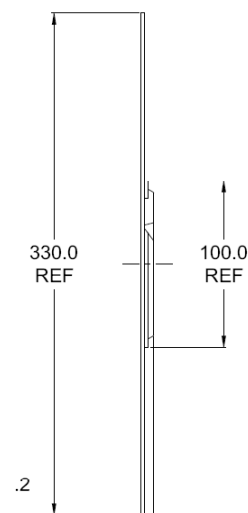
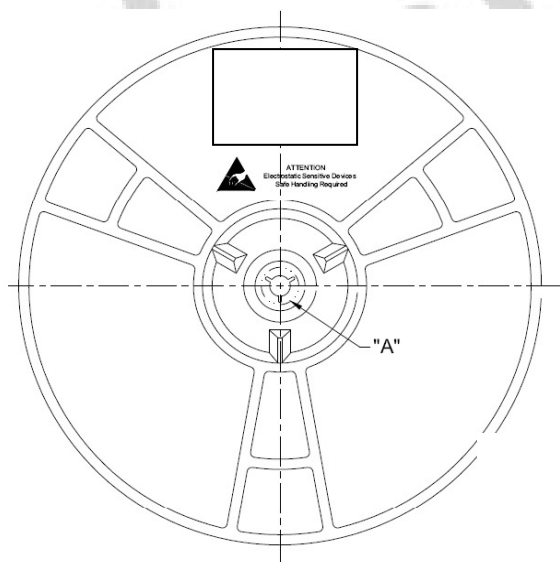
Label D→ Carton box label .

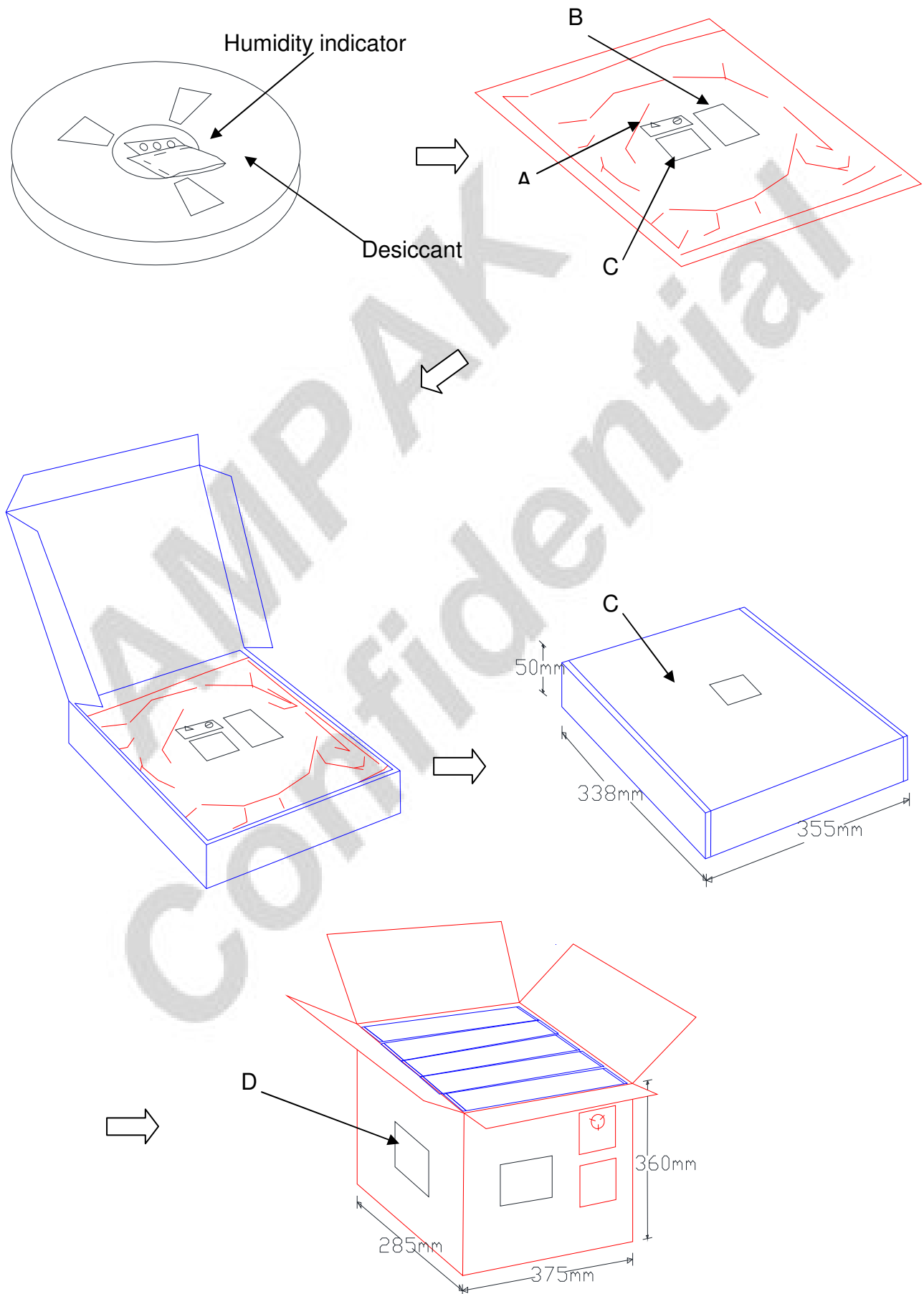
AMPAK Technology	
Model Name :	 XXXXXXXXXXXX
Part No :	 99P-W01-0048R
Quantity :	 7500 ea
Lot D/C :	 20081000033
Manufacture :	 2012/02/22

12.2 Dimension



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 : 1500 pcs.





12.3 MSL Level / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES Do not open except under controlled conditions 1. Calculated shelf life in sealed bag: 12 months at $< 40^{\circ}\text{C}$ and $< 90\%$ relative humidity(RH) 2. Peak package body temperature: 225°C 240°C 250°C 260°C ☐ ☐ ☒ ☐ 3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must a) Mounted within: 48 hours of factory conditions $< 30^{\circ}\text{C}/60\% \text{ RH}$, OR b) Stored at $< 10\% \text{ RH}$ 4. Devices require bake, before mounting, if: a) Humidity Indicator Card is $> 10\%$ when read at $23 \pm 5^{\circ}\text{C}$ b) 3a or 3b not met 5. If baking is required, devices may be baked for 24 hours at $125 \pm 5^{\circ}\text{C}$ Note : If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure Bag Seal Date: See-SEAL DATE LABEL Note: Level and body temperature defined by IPC/JEDEC J-STD-020	LEVEL 4
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※NOTE : Accumulated baking time should not exceed 96hrs

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

IMPORTANT NOTE:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following:
"Contains FCC ID: 2AFG6-RK3399".

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage;
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Caution Exposure:

This device meets the exemption from the routine evaluation limits in section 2.5 of RSS102 and users can obtain Canadian information on RF exposure and compliance.

Le dispositif répond à l'exemption des limites d'évaluation de routine dans la section 2.5 de RSS102 et les utilisateurs peuvent obtenir des renseignements canadiens sur l'exposition aux RF et le respect.

the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems

les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) des bandes de 5 250 à 5 350 MHz et de 5 650 à 5 850 MHz et, d'autre part, que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs de RL-EL.

for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate.

le gain maximal d’antenne permis (pour les dispositifs utilisant la bande 5 725-5 825 MHz) doit se conformer à la limite de p.i.r.e. spécifiée pour l’exploitation point à point et non point à point, selon le cas.

The final end product must be labelled in a visible area with the following:

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 22166-RK3399

The module must be installed in Android Module

This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

The end user manual shall include all required regulatory information/warning as show in this manual.

This radio transmitter (RK3399) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (RK3399) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

2.4G:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1	N/A	N/A	Dipole	N/A	2.55	N/A

5G:

Ant.	Manufacturer	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1	N/A	N/A	Dipole	N/A	4.03	N/A