正基科技股份有限公司

SPECIFICATION

SPEC. NO.： _____ REV： 1.6

DATE： 09. 07.2015

PRODUCT NAME： AP6356SDXX

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW		APPROVED	DCC ISSUE
	PM	QA		

AMPAK

AP6356SDXX

2x2 WiFi + Bluetooth4.1
Module Spec Sheet

Revision History

Date	Revision Content	Revised By	Version
2014/09/25	-Preliminary	Brian	1.0
2014/10/26	-Pin definition modified	Brian	1.1
2014/12/11	-Pin definition modified	Brian	1.2
2015/03/18	-Layout and Bluetooth Spec modified - Pin map and physical dimension modified	Dora	1.3
2015/05/12	-Add Part Number Description	Dora	1.4
2015/06/29	-Add Packet type and total pins	Dora	1.5
2015/09/07	-Modify label quantity and MSL	Dora	1.6

Contents

1. Introduction

AMPAK Technology would like to announce a low-cost and low-power consumption module which has all of the WiFi and 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 2x2 Access Points in the wireless LAN.

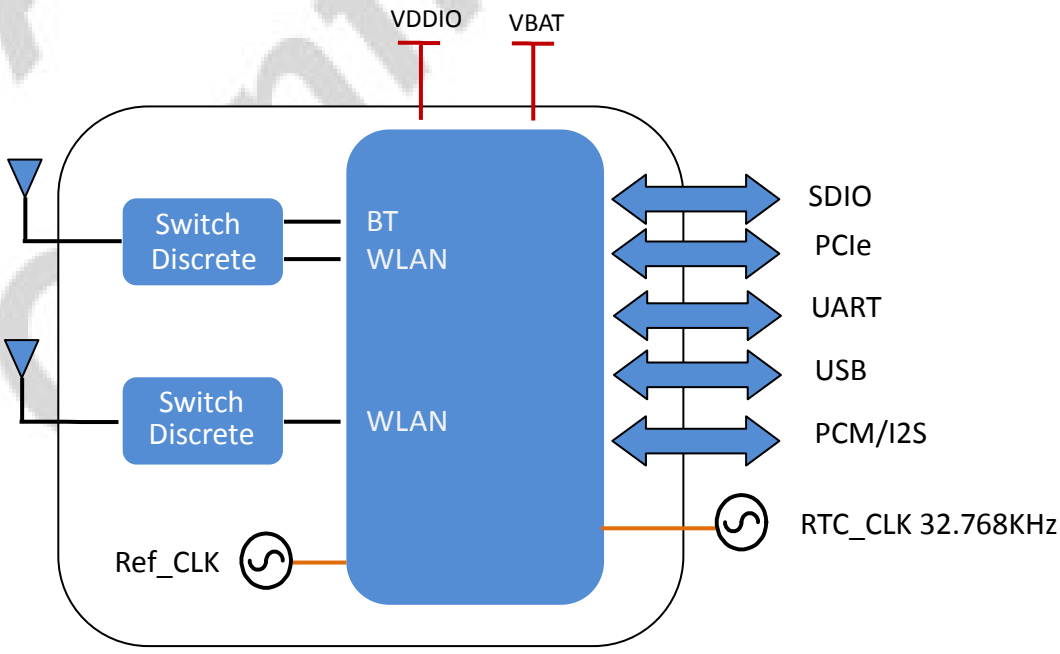
The wireless module complies with IEEE 802.11 a/b/g/n/ac 2x2 MIMO standard and it can achieve up to a speed of 867Mbps with dual stream in 802.11n to connect the wireless LAN. The integrated module provides SDIO/PCIe interface for WiFi, UART / USB/ PCM interface for Bluetooth.

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

2. Features

- Lead Free design which is compliant with ROHS requirements.
- 802.11a/b/g/n/ac dual-band radio with virtual-simultaneous dual-band operation
- Dual-stream spatial multiplexing up to 867 Mbps data rate.
- Supports 20, 40, 80 MHz channels with optional SGI(256 QAM modulation)
- Supports IEEE 802.11 ac/n beam forming.
- Supports IEEE 802.15.2 external coexistence interface to optimize bandwidth utilization with other co-located wireless technologies such as LTE, GPS, or WiMAX.
    - Supports standard SDIO/PCIe interfaces.
- BT host digital interface:
    - HCI UART (up to 4 Mbps)
    - PCM for audio data
- Complies with Bluetooth Core Specification Version 4.1 with provisions for supporting future specifications. With Bluetooth Class1 or Class2 transmitter operation.
- Supports extended synchronous connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets.
- Adaptive frequency hopping (AFH) for reducing radio frequency interference.

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	AP6356SDXX
Product Description	Support WiFi/Bluetooth functionalities
Dimension	L x W x H: 16 x 12 x 1.6 (typical) mm
WiFi Interface	Support SDIO V3.0 / PCIe
BT Interface	UART / USB / PCM
Package	M.2 1216 Solder down
Total Pin	108 Pins
Operating temperature	-10℃ to 65℃
Storage temperature	-40℃ to 85℃
Humidity	Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing

4.2 Voltages

4.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	5.5	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	3.8	V

4.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

	Min.	Typ.	Max.	Unit
Operating Temperature	-10	25	65	deg.C
VBAT	3.0	3.6	4.8	V
VDDIO	1.7	-	3.6	V

5. WiFi RF Specification

5.1 2.4GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25℃

Feature	Description
WLAN Standard	IEEE 802.11a/b/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 802.11 g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11b /11Mbps : 16 dBm ± 1.5 dB @ EVM ≤ -9dB
	802.11g /54Mbps : 15 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /MCS7 : 14 dBm ± 1.5 dB @ EVM ≤ -28dB
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps PER @ -93 dBm, typical
	- 2Mbps PER @ -91 dBm, typical
	- 5.5Mbps PER @ -88 dBm, typical
	- 11Mbps PER @ -86 dBm, typical
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -89 dBm, typical
	- 12Mbps PER @ -88 dBm, typical
	- 18Mbps PER @ -85 dBm, typical
	- 24Mbps PER @ -82 dBm, typical
	- 36Mbps PER @ -79 dBm, typical
	- 48Mbps PER @ -74 dBm, typical
	- 54Mbps PER @ -72 dBm, typical
MIMO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -91 dBm, typical
	- 9Mbps PER @ -91 dBm, typical
	- 12Mbps PER @ -90 dBm, typical
	- 18Mbps PER @ -88 dBm, typical
	- 24Mbps PER @ -85 dBm, typical
	- 36Mbps PER @ -82 dBm, typical
	- 48Mbps PER @ -77 dBm, typical
	- 54Mbps PER @ -75 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -87 dBm, typical
	- MCS=2 PER @ -85 dBm, typical

	- MCS=3 PER @ -81 dBm, typical
	- MCS=4 PER @ -78 dBm, typical
	- MCS=5 PER @ -73 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -70 dBm, typical
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -91 dBm, typical
	- MCS=1 PER @ -90 dBm, typical
	- MCS=2 PER @ -88 dBm, typical
	- MCS=3 PER @ -85 dBm, typical
	- MCS=4 PER @ -81 dBm, typical
	- MCS=5 PER @ -76 dBm, typical
	- MCS=6 PER @ -74 dBm, typical
	- MCS=7 PER @ -71 dBm, typical
	- MCS=8 PER @ -88 dBm, typical
	- MCS=15 PER @ -69 dBm, typical
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -87 dBm, typical
	- MCS=1 PER @ -83 dBm, typical
	- MCS=2 PER @ -82 dBm, typical
	- MCS=3 PER @ -79 dBm, typical
	- MCS=4 PER @ -75 dBm, typical
	- MCS=5 PER @ -71 dBm, typical
	- MCS=6 PER @ -69 dBm, typical
	- MCS=7 PER @ -68 dBm, typical
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -87 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
	- MCS=8 PER @ -87 dBm, typical
	- MCS=15 PER @ -68 dBm, typical
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -89 dBm, typical
	- MCS=1, NSS1 PER @ -86 dBm, typical
	- MCS=2, NSS1 PER @ -85 dBm, typical
	- MCS=3, NSS1 PER @ -81 dBm, typical

	- MCS=4, NSS1 PER @ -78 dBm, typical
	- MCS=5, NSS1 PER @ -73 dBm, typical
	- MCS=6, NSS1 PER @ -71 dBm, typical
	- MCS=7, NSS1 PER @ -70 dBm, typical
	- MCS=8, NSS1 PER @ -67 dBm, typical
MIMO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -89 dBm, typical
	- MCS=1, NSS1 PER @ -88 dBm, typical
	- MCS=2, NSS1 PER @ -87 dBm, typical
	- MCS=3, NSS1 PER @ -84 dBm, typical
	- MCS=4, NSS1 PER @ -81 dBm, typical
	- MCS=5, NSS1 PER @ -76 dBm, typical
	- MCS=6, NSS1 PER @ -75 dBm, typical
	- MCS=7, NSS1 PER @ -73 dBm, typical
	- MCS=8, NSS1 PER @ -69 dBm, typical
	- MCS=0, NSS2 PER @ -89 dBm, typical
	- MCS=8, NSS2 PER @ -65 dBm, typical
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -86 dBm, typical
	- MCS=1, NSS1 PER @ -84 dBm, typical
	- MCS=2, NSS1 PER @ -82 dBm, typical
	- MCS=3, NSS1 PER @ -79 dBm, typical
	- MCS=4, NSS1 PER @ -75 dBm, typical
	- MCS=5, NSS1 PER @ -71 dBm, typical
	- MCS=6, NSS1 PER @ -69 dBm, typical
	- MCS=7, NSS1 PER @ -68 dBm, typical
	- MCS=8, NSS1 PER @ -63 dBm, typical
	- MCS=9, NSS1 PER @ -62 dBm, typical
MIMO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -88 dBm, typical
	- MCS=1, NSS1 PER @ -87 dBm, typical
	- MCS=2, NSS1 PER @ -85 dBm, typical
	- MCS=3, NSS1 PER @ -82 dBm, typical
	- MCS=4, NSS1 PER @ -77 dBm, typical
	- MCS=5, NSS1 PER @ -74 dBm, typical
	- MCS=6, NSS1 PER @ -72 dBm, typical
	- MCS=7, NSS1 PER @ -71 dBm, typical
	- MCS=8, NSS1 PER @ -67 dBm, typical
	- MCS=9, NSS1 PER @ -65 dBm, typical
	- MCS=0, NSS2 PER @ -86 dBm, typical

	- MCS=9, NSS2 PER @ -61 dBm, typical
Maximum Input Level	802.11b : -10 dBm
	802.11g/n : -20 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

5.2 5GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25℃

Feature	**Description**
WLAN Standard	IEEE 802.11a/n 2x2, WiFi 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 : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11n : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11ac : OFDM /256-QAM
Output Power	802.11a /54Mbps : 13 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /MCS7 : 12 dBm ± 1.5 dB @ EVM ≤ -28dB
	802.11ac /MCS9 : 10 dBm ± 1.5 dB @ EVM ≤ -32dB
SISO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -88 dBm, typical
	- 12Mbps PER @ -87 dBm, typical
	- 18Mbps PER @ -84 dBm, typical
	- 24Mbps PER @ -81 dBm, typical
	- 36Mbps PER @ -78 dBm, typical
	- 48Mbps PER @ -73 dBm, typical
	- 54Mbps PER @ -71 dBm, typical
MIMO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -90 dBm, typical
	- 12Mbps PER @ -89 dBm, typical
	- 18Mbps PER @ -87 dBm, typical
	- 24Mbps PER @ -84 dBm, typical
	- 36Mbps PER @ -81 dBm, typical
	- 48Mbps PER @ -76 dBm, typical
	- 54Mbps PER @ -72 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -86 dBm, typical

	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -81 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
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -89 dBm, typical
	- MCS=2 PER @ -87 dBm, typical
	- MCS=3 PER @ -84 dBm, typical
	- MCS=4 PER @ -80 dBm, typical
	- MCS=5 PER @ -75 dBm, typical
	- MCS=6 PER @ -74 dBm, typical
	- MCS=7 PER @ -72 dBm, typical
	- MCS=8 PER @ -89 dBm, typical
	- MCS=15 PER @ -69 dBm, typical
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -86 dBm, typical
	- MCS=1 PER @ -83 dBm, typical
	- MCS=2 PER @ -81 dBm, typical
	- MCS=3 PER @ -78 dBm, typical
	- MCS=4 PER @ -74 dBm, typical
	- MCS=5 PER @ -70 dBm, typical
	- MCS=6 PER @ -68 dBm, typical
	- MCS=7 PER @ -67 dBm, typical
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -88 dBm, typical
	- MCS=1 PER @ -86 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 @ -86 dBm, typical
	- MCS=15 PER @ -67 dBm, typical
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -85 dBm, typical
	- MCS=2, NSS1 PER @ -83 dBm, typical

	- MCS=3, NSS1 PER @ -80 dBm, typical
	- MCS=4, NSS1 PER @ -76 dBm, typical
	- MCS=5, NSS1 PER @ -71 dBm, typical
	- MCS=6, NSS1 PER @ -70 dBm, typical
	- MCS=7, NSS1 PER @ -69 dBm, typical
	- MCS=8, NSS1 PER @ -65 dBm, typical
MIMO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -89 dBm, typical
	- MCS=1, NSS1 PER @ -88 dBm, typical
	- MCS=2, NSS1 PER @ -86 dBm, typical
	- MCS=3, NSS1 PER @ -83 dBm, typical
	- MCS=4, NSS1 PER @ -79 dBm, typical
	- MCS=5, NSS1 PER @ -74 dBm, typical
	- MCS=6, NSS1 PER @ -73 dBm, typical
	- MCS=7, NSS1 PER @ -72 dBm, typical
	- MCS=8, NSS1 PER @ -68 dBm, typical
	- MCS=0, NSS2 PER @ -88 dBm, typical
	- MCS=8, NSS2 PER @ -64 dBm, typical
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -85 dBm, typical
	- MCS=1, NSS1 PER @ -82 dBm, typical
	- MCS=2, NSS1 PER @ -80 dBm, typical
	- MCS=3, NSS1 PER @ -77 dBm, typical
	- MCS=4, NSS1 PER @ -74 dBm, typical
	- MCS=5, NSS1 PER @ -69 dBm, typical
	- MCS=6, NSS1 PER @ -68 dBm, typical
	- MCS=7, NSS1 PER @ -67 dBm, typical
	- MCS=8, NSS1 PER @ -62 dBm, typical
	- MCS=9, NSS1 PER @ -61 dBm, typical
MIMO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -85 dBm, typical
	- MCS=2, NSS1 PER @ -83 dBm, typical
	- MCS=3, NSS1 PER @ -80 dBm, typical
	- MCS=4, NSS1 PER @ -77 dBm, typical
	- MCS=5, NSS1 PER @ -72 dBm, typical
	- MCS=6, NSS1 PER @ -71 dBm, typical
	- MCS=7, NSS1 PER @ -70 dBm, typical
	- MCS=8, NSS1 PER @ -65 dBm, typical
	- MCS=9, NSS1 PER @ -64 dBm, typical

	- MCS=0, NSS2 PER @ -85 dBm, typical
	- MCS=9, NSS2 PER @ -60 dBm, typical
SISO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 PER @ -82 dBm, typical
	- MCS=1, NSS1 PER @ -79 dBm, typical
	- MCS=2, NSS1 PER @ -77 dBm, typical
	- MCS=3, NSS1 PER @ -73 dBm, typical
	- MCS=4, NSS1 PER @ -70 dBm, typical
	- MCS=5, NSS1 PER @ -67 dBm, typical
	- MCS=6, NSS1 PER @ -65 dBm, typical
	- MCS=7, NSS1 PER @ -63 dBm, typical
	- MCS=9, NSS1 PER @ -59 dBm, typical
	- MCS=9, NSS1 PER @ -57 dBm, typical
MIMO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 PER @ -83 dBm, typical
	- MCS=1, NSS1 PER @ -82 dBm, typical
	- MCS=2, NSS1 PER @ -80 dBm, typical
	- MCS=3, NSS1 PER @ -76 dBm, typical
	- MCS=4, NSS1 PER @ -73 dBm, typical
	- MCS=5, NSS1 PER @ -70 dBm, typical
	- MCS=6, NSS1 PER @ -68 dBm, typical
	- MCS=7, NSS1 PER @ -66 dBm, typical
	- MCS=8, NSS1 PER @ -62 dBm, typical
	- MCS=9, NSS1 PER @ -60 dBm, typical
	- MCS=0, NSS2 PER @ -81 dBm, typical
	- MCS=9, NSS2 PER @ -56 dBm, typical
Maximum Input Level	802.11a/n : -30 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

*5*GHz(20MHz) 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
	140	5700
5.725GHz~5.825GHz	149	5745
	153	5765
	157	5785
	161	5805

6. Bluetooth Specification

6.1 Bluetooth Specification

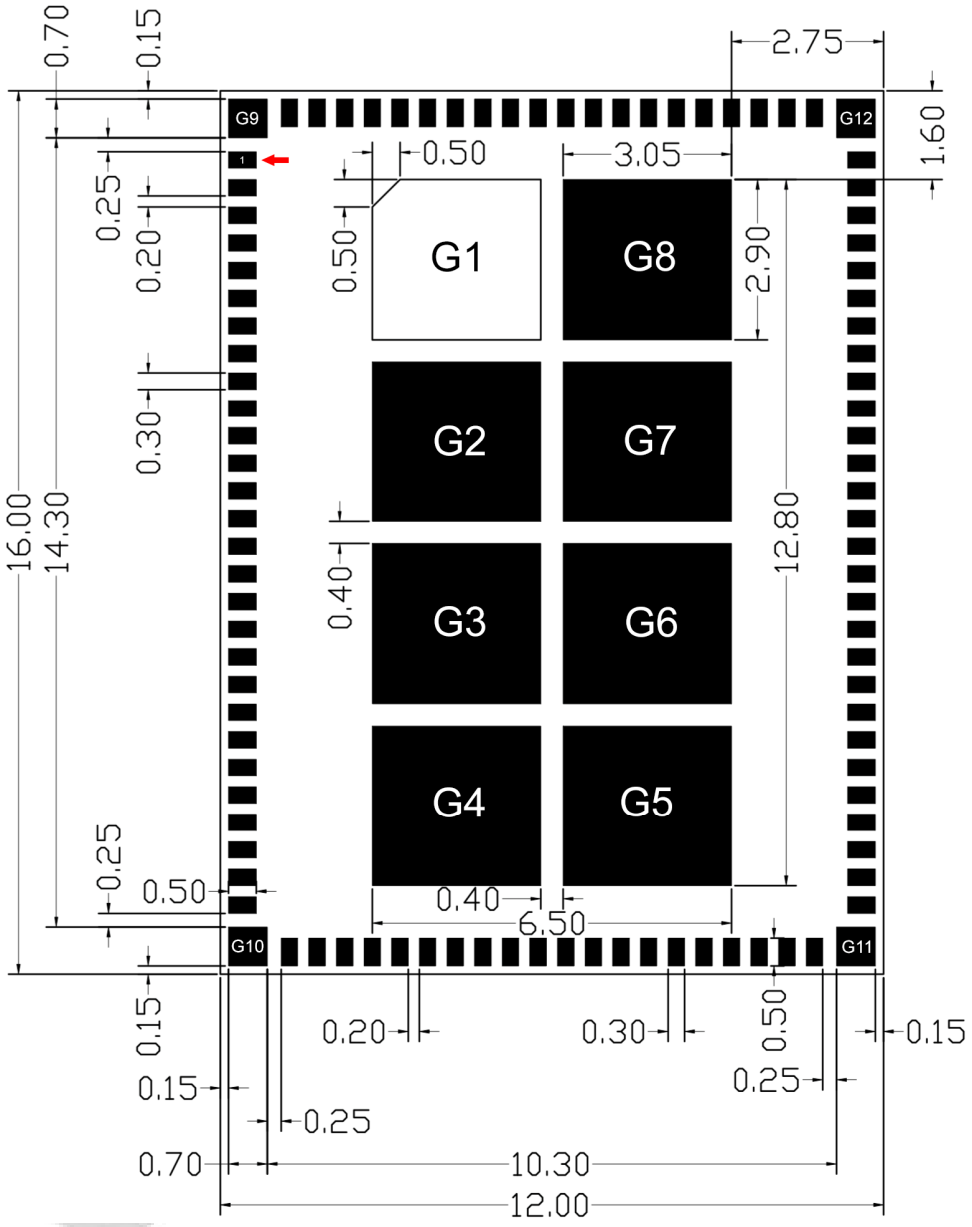
Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25℃

Feature	**Description**		
General Specification			
Bluetooth Standard	Bluetooth V4.1 of 1, 2 and 3 Mbps.		
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			
	Min.	**Typical.**	**Max.**
Output Power (Class 1.5)		7 dBm	
Output Power (Class 2)		2 dBm	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-80 dBm	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)		-80 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-78 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	π/4-DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

7. Pin Assignments

7.1 Pin Map

< TOP VIEW >



7.2 Pin Definition

NO	Name	Type	Description
1	NC	—	No connect
2	NC	—	No connect
3	JTAG_TDI_GPIO4	I	1: SPROM is present 0: SPROM is absent (default). Applicable in PCIe HOST mode

4	NC	—	No connect
5	3V3_VBAT	I	VBAT system power supply input
6	GND	—	Ground connections
7	JTAG_TDO_GPIO_5	I/O	GPIO_5
8	GPIO_8	I/O	SDIO and PCIe interface strapping option
9	GPIO_9	I/O	SDIO and PCIe interface strapping option
10	NC	—	No connect
11	JTAG_TRST_N_COEX0_ GPIO_6	I/O	GPIO_6
12	JTAG_TCK_COEX1_ GPIO_2	I/O	GPIO_2
13	JTAG_TMS_COEX2_ GPIO_3	I/O	GPIO_3
14	NC	—	No connect
15	NC	—	No connect
16	NC	—	No connect
17	GND	—	Ground connections
18	NC	—	No connect
19	NC	—	No connect
20	GND	—	Ground connections
21	NC	—	No connect
22	NC	—	No connect
23	GND	—	Ground connections
24	BT_DEV_WAKE	I/O	Bluetooth DEV_WAKE
25	NC	—	No connect
26	GND	—	Ground connections
27	SLP_CLK	I	External sleep clock input (32.768KHz)
28	WL_RFDISABLE_L_GPIO1	I/O	WL_DEV_WAKE
29	PCIE_WAKEn	O	PCIe wake signal
30	PCIE_CLKREQn	I/O	PCIe clock request
31	PCIE_PERSTn	I	PCIe host indication to reset the device
32	GND	—	Ground connections
33	PCIE_RCLK_N	I	PCI Express differential clock input-Negative
34	PCIE_RCLK_P	I	PCI Express differential clock input-Positive
35	GND	—	Ground connections
36	PCIE_TX_N	O	PCI Express transmit data-Negative
37	PCIE_TX_P	O	PCI Express transmit data-Positive

38	GND	—	Ground connections
39	PCIE_RX_N	I	PCI Express receive data-Negative
40	PCIE_RX_P	I	PCI Express receive data-Positive
41	GND	—	Ground connections
42	NC	—	No connect
43	BT_I2S_WS	I/O	I2S data command line
44	VIO_SD	I	Digital I/O SDIO power supply
45	SDIO_RESET_L_ WL_REG_ON	I	Used by PMU to power up or power down the internal module regulators used by the WLAN section.
46	SDIO_WAKE_L_GPIO_0	I	WL_HOST_WAKE
47	SDIO_DATA3	I/O	SDIO data line bit3
48	SDIO_DATA2	I/O	SDIO data line bit2
49	SDIO_DATA1	I/O	SDIO data line bit1
50	SDIO_DATA0	I/O	SDIO data line bit0
51	SDIO_CMD	I/O	SDIO command/response
52	SDIO_CLK	I	SDIO clock input
53	BT_HOST_WAKE	O	Bluetooth HOST_WAKE
54	UART_CTS	I	UART_CTS
55	UART_SOUT	O	UART_SOUT
56	UART_SIN	I	UART_SIN
57	UART_RTS	O	UART_RTS
58	PCM_SYNC	I/O	PCM sync
59	PCM_IN	I	PCM data in
60	PCM_OUT	O	PCM data out
61	PCM_CLK	I/O	PCM bus clock
62	GND	—	Ground connections
63	BT_ENABLE	I	Used by PMU to power up or power down the internal module regulators used by the Bluetooth section.
64	BT_I2S_DO_ BT_LED	O	I2S data line output It can be used as BT_LED
65	WL_LED_GPIO_7	O	It can be used as WL_LED
66	BT_I2S_DI	I	I2S data line input
67	BT_I2S_CLK	I/O	I2S data line clock
68	GND	—	Ground connections
69	USB_DM	I/O	USB serial differential data Negative
70	USB_DP	I/O	USB serial differential dataPositive
71	GND	—	Ground connections

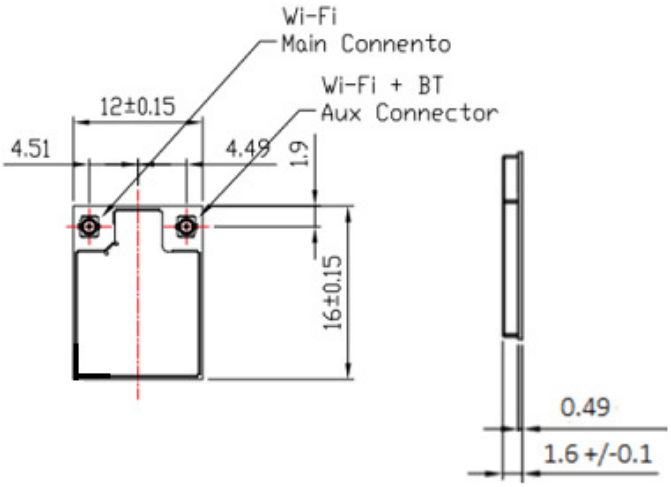
72	3V3_USB	I	3.3V power supply
73	VIO	I	Digital I/O power supply
74	GND	—	Ground connections
75	GND	—	Ground connections
76	GND	—	Ground connections
77	GND	—	Ground connections
78	GND	—	Ground connections
79	GND	—	Ground connections
80	GND	—	Ground connections
81	GND	—	Ground connections
82	GND	—	Ground connections
83	GND	—	Ground connections
84	GND	—	Ground connections
85	GND	—	Ground connections
86	GND	—	Ground connections
87	GND	—	Ground connections
88	GND	—	Ground connections
89	GND	—	Ground connections
90	GND	—	Ground connections
91	GND	—	Ground connections
92	GND	—	Ground connections
93	GND	—	Ground connections
94	GND	—	Ground connections
95	GND	—	Ground connections
96	GND	—	Ground connections
G1	GND	—	Ground connections
G2	GND	—	Ground connections
G3	GND	—	Ground connections
G4	GND	—	Ground connections
G5	GND	—	Ground connections
G6	GND	—	Ground connections
G7	GND	—	Ground connections
G8	GND	—	Ground connections
G9	GND	—	Ground connections
G10	GND	—	Ground connections
G11	GND	—	Ground connections
G12	GND	—	Ground connections

8. Dimensions

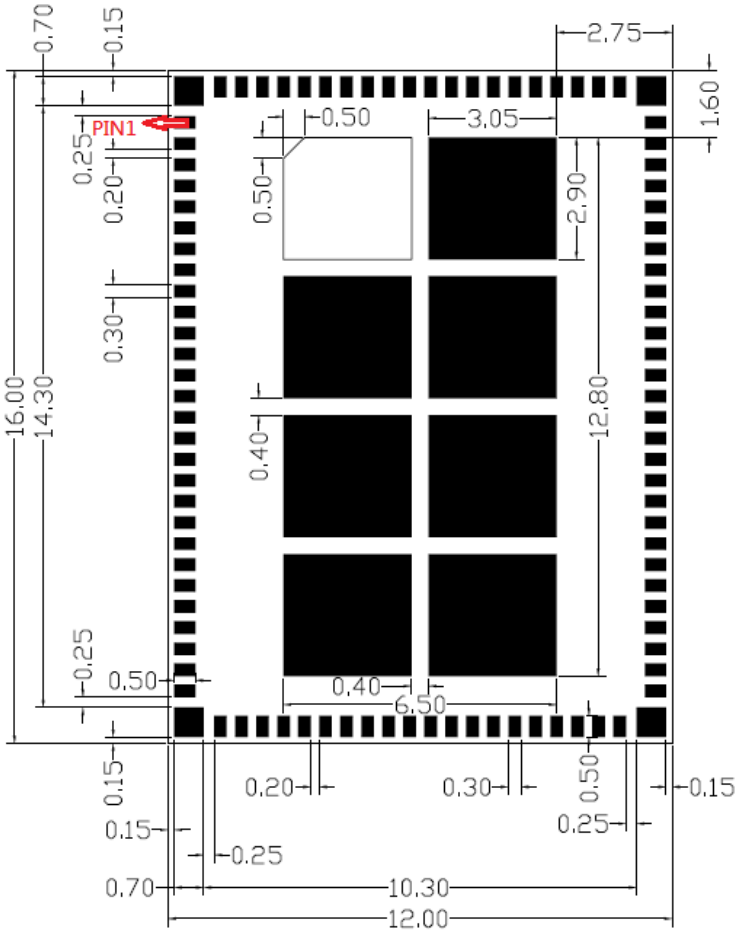
8.1 Physical Dimensions

(Unit: mm)

< TOP VIEW >



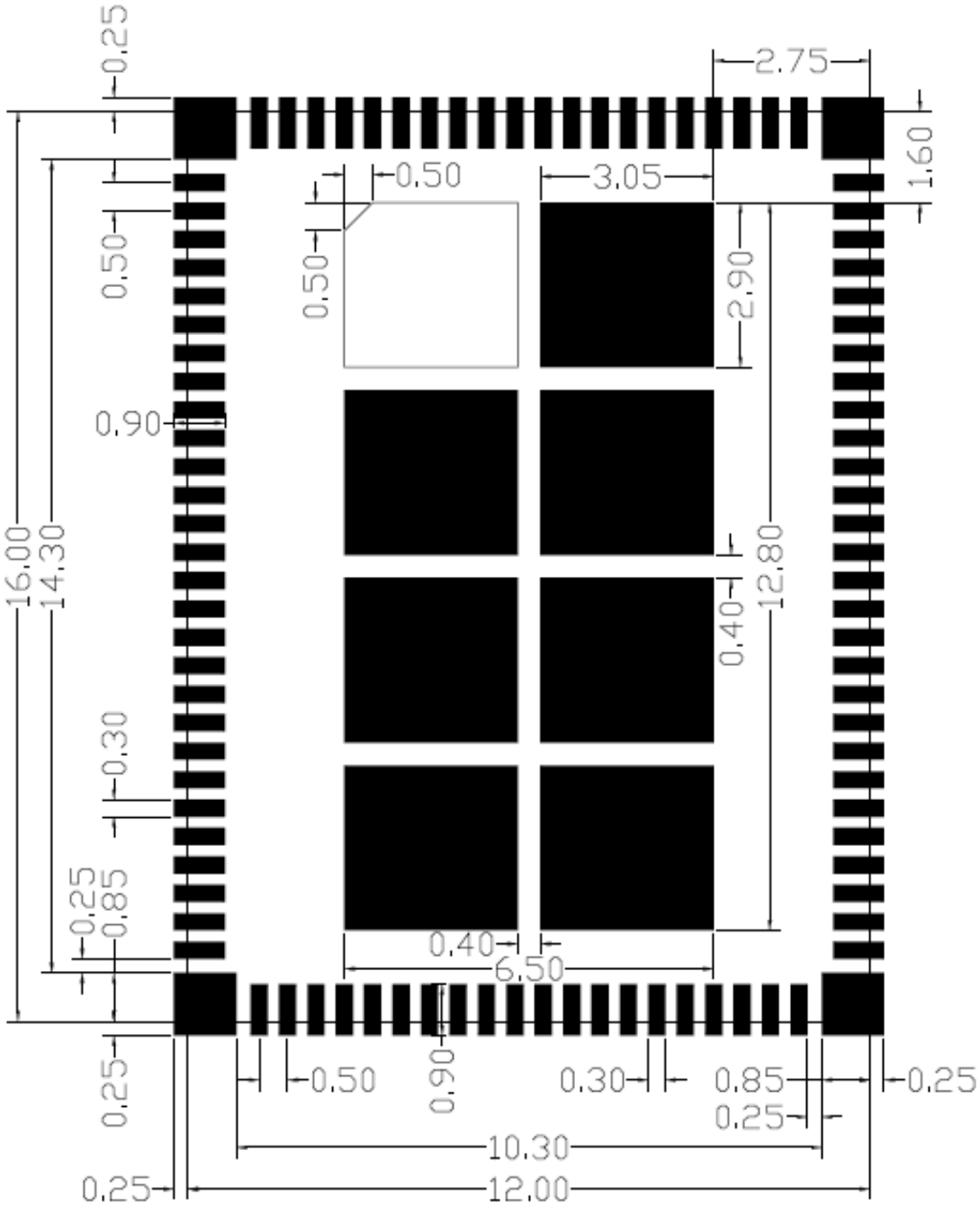
TOP VIEW >



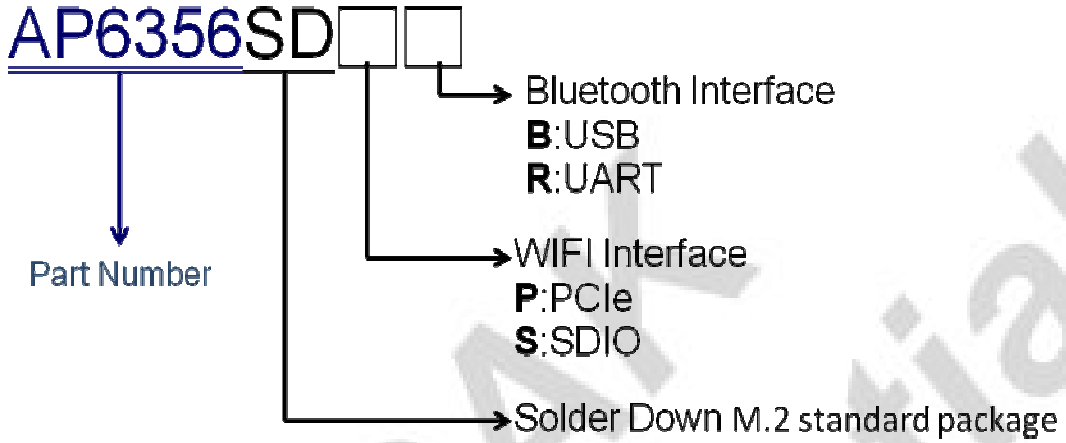
8.2 Layout Recommendation

(Unit: mm)

< TOP VIEW >



8.3 Part Number Description



Order Information	
Module Name	**Interface Description**
AP6356SDPR	PCIe+UART
AP6356SDPB	PCIe+USB
AP6356SDSR	SDIO+UART
AP6356SDSB	SDIO+USB

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	1600 to 3300	mV, p-p
Signal type	Square-wave or sine-wave	-
Input impedance	>100k <5	Ω pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7Vio - Vio	V

9.1 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.

- ❖ 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

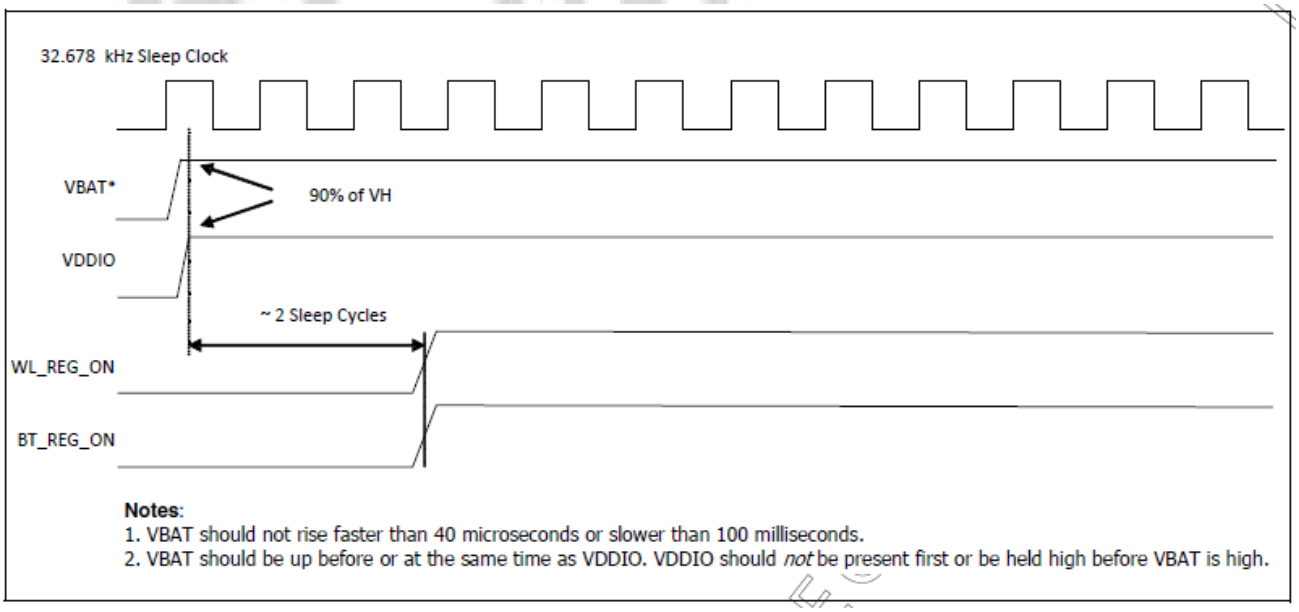
10.1 Power-up Sequence Timing Diagram

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.

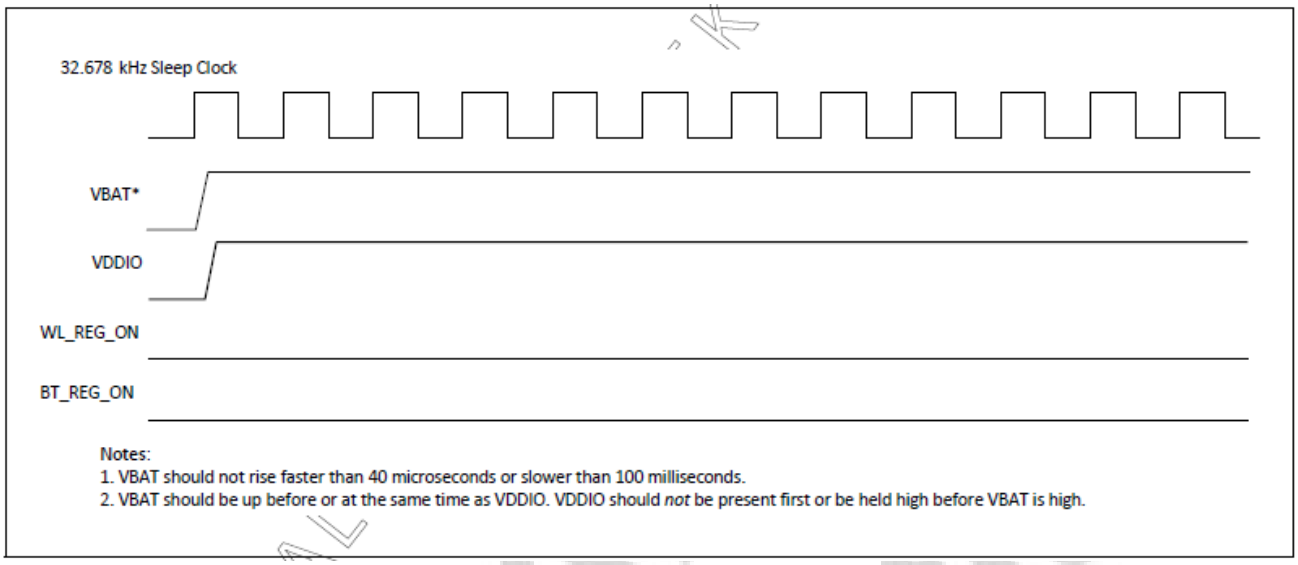
Additionally, diagrams are provided to indicate proper sequencing of the signals for carious operating states. The timing value indicated are minimum required values: longer delays are also acceptable.

※ 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.

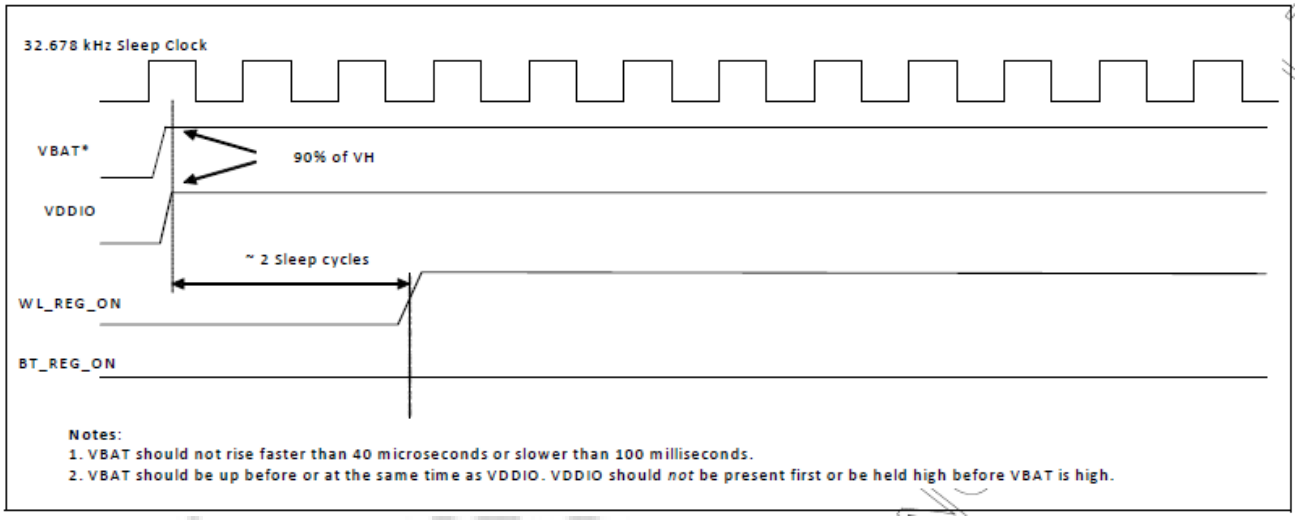
※ BT_REG_ON: Used by the PMU to power up or power down the internal regulators used by the BT section. Low asserting reset for Bluetooth. This pin has no effect on WLAN and does not control any PMU functions. This pin must be driven high or low (not left floating).



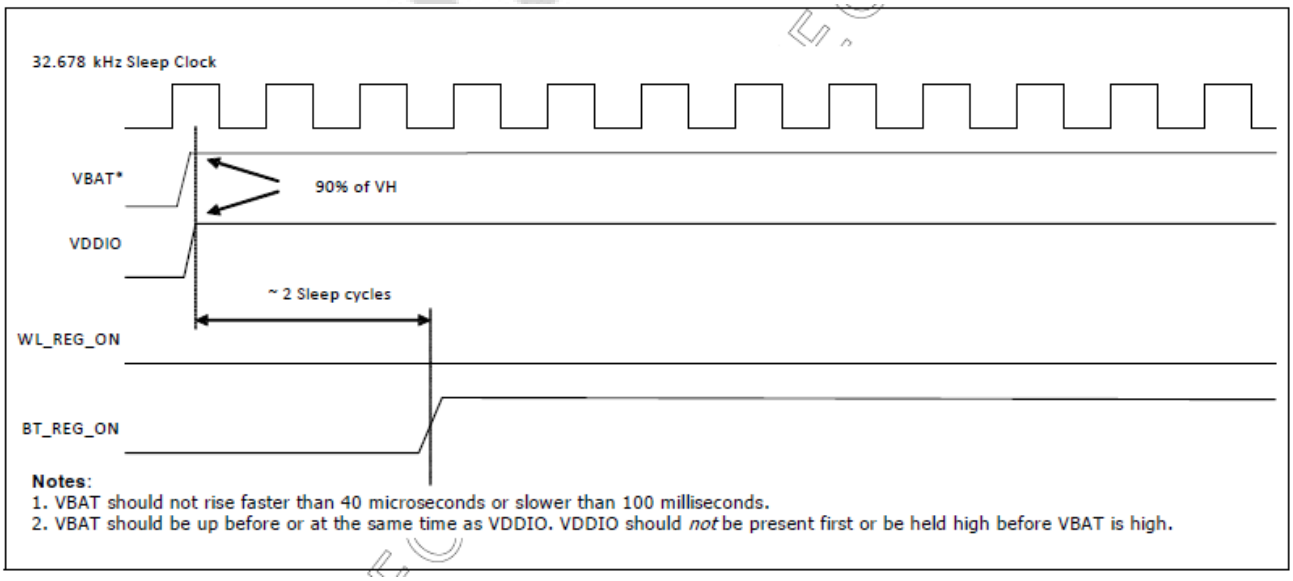
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF

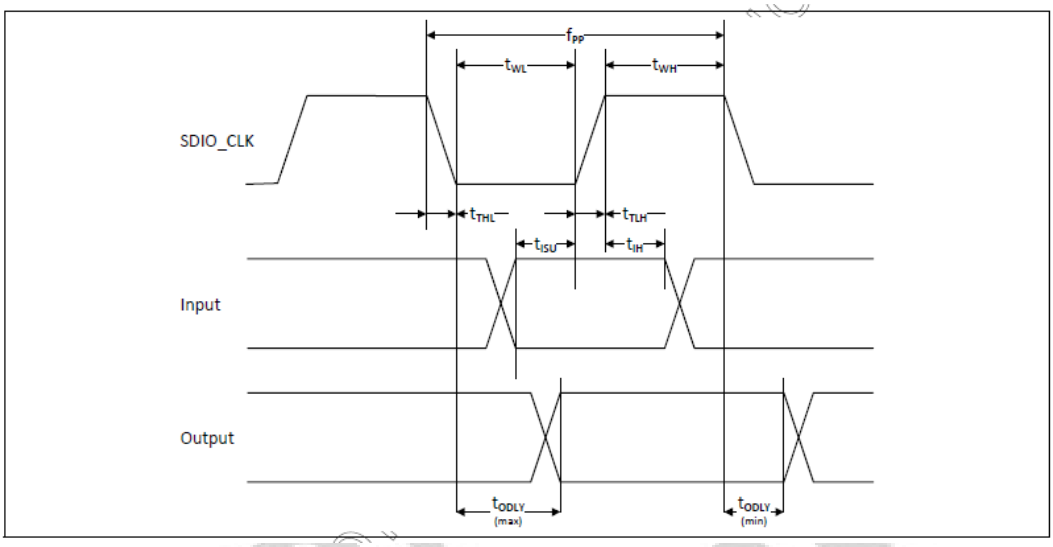


WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

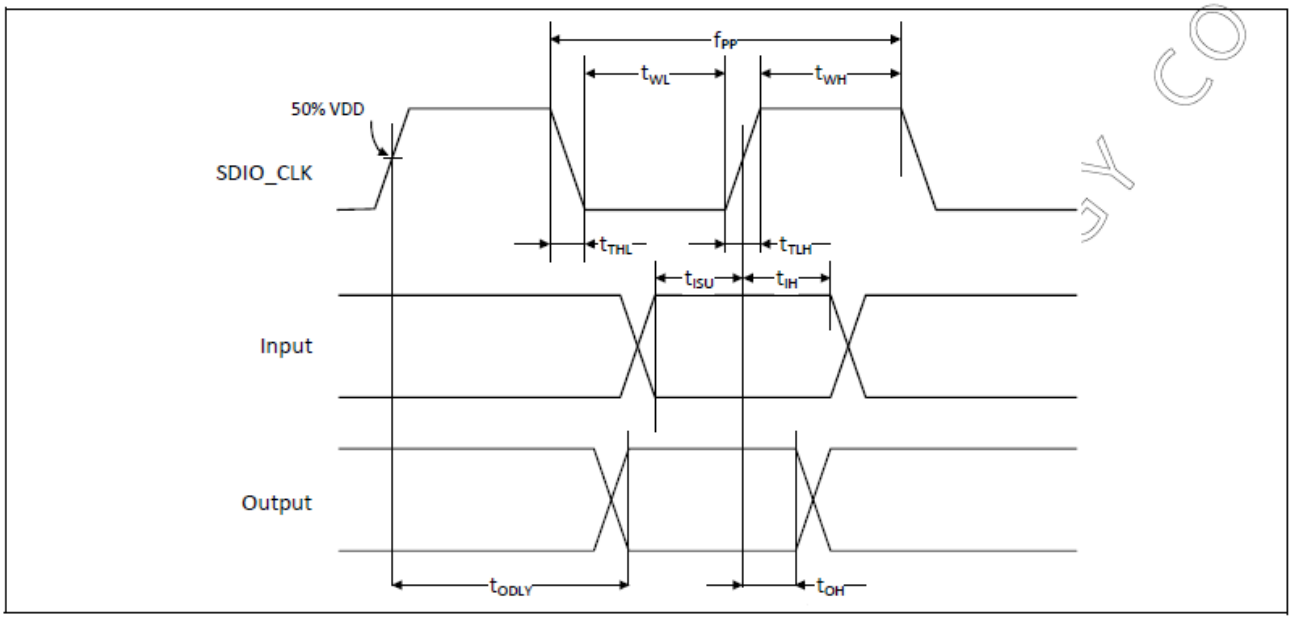
10.2 SDIO Default Mode Timing Diagram



Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
SDIO CLK (All values are referred to minimum 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 ≤ 40pF load on CMD and Data.
b. min(Vih) = 0.7 × VDDIO and max(Vil) = 0.2 × VDDIO.

10.3 SDIO High Speed Mode Timing Diagram

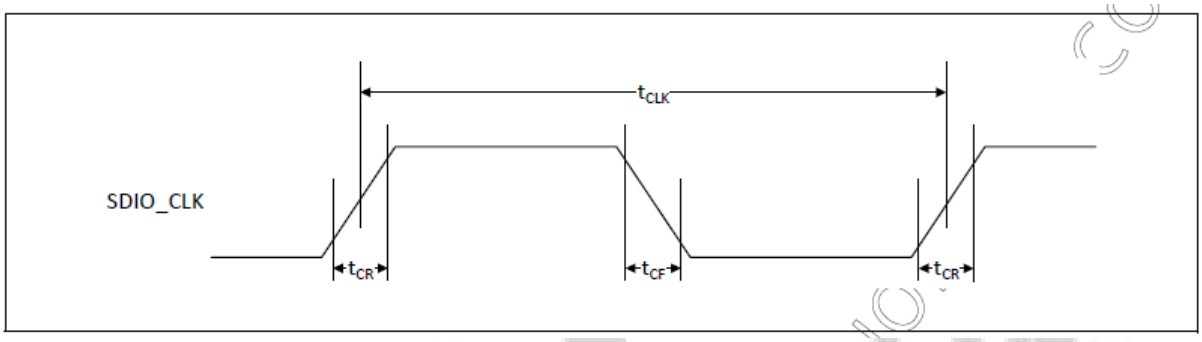


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (all values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer Mode	fPP	0	–	50	MHz
Frequency – Identification Mode	fOD	0	–	400	kHz
Clock low time	tWL	7	–	–	ns
Clock high time	tWH	7	–	–	ns
Clock rise time	tTLH	–	–	3	ns
Clock low time	tTHL	–	–	3	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup Time	tISU	6	–	–	ns
Input hold Time	tIH	2	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer Mode	tODLY	–	–	14	ns
Output hold time	tOH	2.5	–	–	ns
Total system capacitance (each line)	CL	–	–	40	pF

a. Timing is based on CL ≤ 40 pF load on CMD and Data.
b. min(Vih) = 0.7 × VDDIO and max(Vil) = 0.2 × VDDIO.

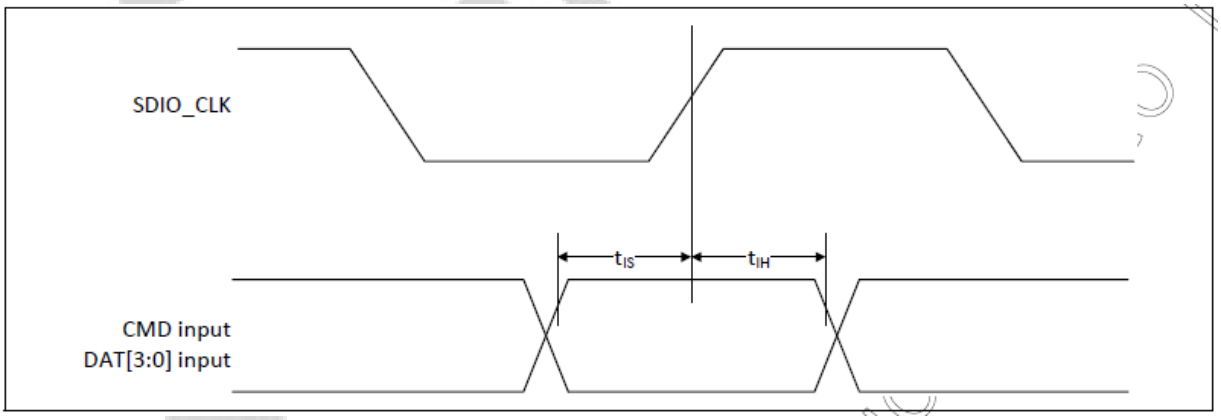
10.4 SDIO Bus Timing Specifications in SDR Modes

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 × 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	%	–

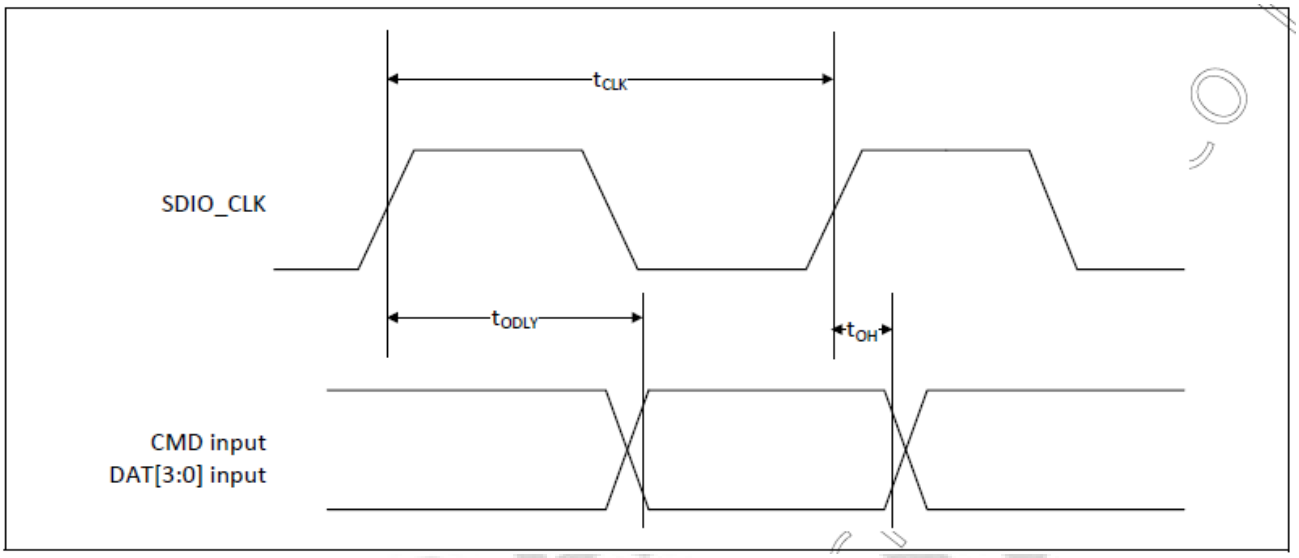
Card Input timing (SDR Modes)



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.

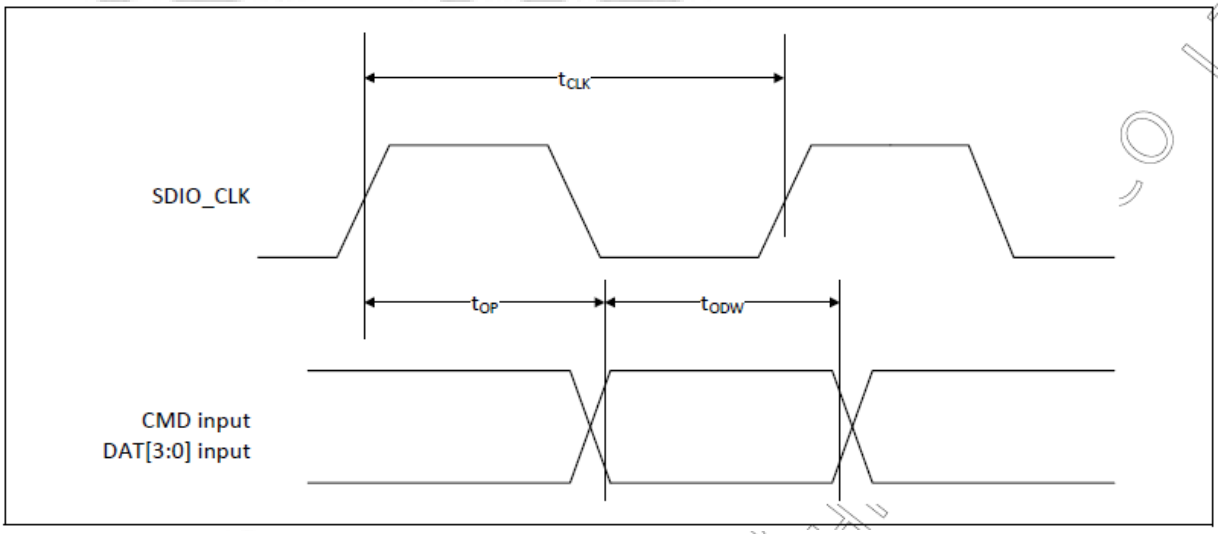
Card output timing (SDR Modes up to 100MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	–	7.85[a]	ns	t_{CLK} ≥ 10 ns C_L= 30 pF using driver type B for SDR50
t_{ODLY}	–	14.0	ns	t_{CLK} ≥ 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.

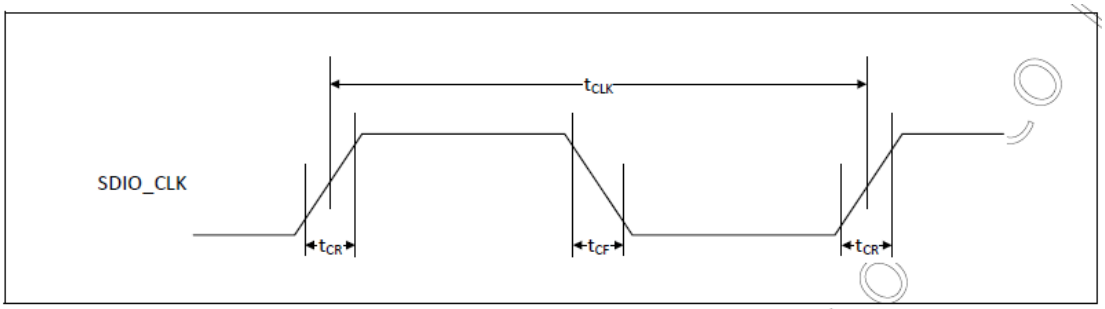
Card output timing (SDR Modes 100MHz to 208MHz)



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

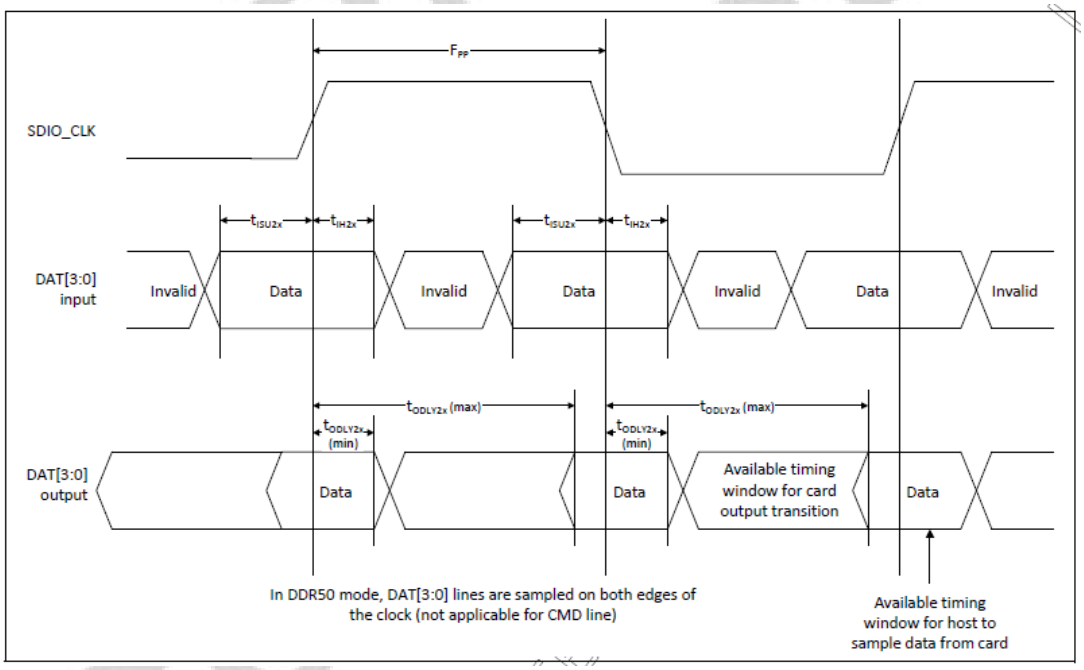
- Δt_{OP} = +1550 ps for junction temperature of Δt_{OP} = 90 degrees during operation
- Δt_{OP} = –350 ps for junction temperature of Δt_{OP} = –20 degrees during operation
- Δt_{OP} = +2600 ps for junction temperature of Δt_{OP} = –20 to +125 degrees during operation

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 × tCLK	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} < 10pF (1 Card)
Input hold time	t_{IH}	0.8	–	ns	C_{CARD} < 10pF (1 Card)
Output CMD					
Output delay time	t_{ODLY}	–	13.7	ns	C_{CARD} < 30pF (1 Card)
Output hold time	t_{OH}	1.5	–	ns	C_{CARD} < 15pF (1 Card)
Input DAT					
Input setup time	t_{ISU2x}	3	–	ns	C_{CARD} < 10pF (1 Card)
Input hold time	t_{IH2x}	0.8	–	ns	C_{CARD} < 10pF (1 Card)
Output DAT					
Output delay time	t_{ODLY2x}	–	7.85[a]	ns	C_{CARD} < 25pF (1 Card)
Output hold time	t_{ODLY2x}	1.5	–	ns	C_{CARD} < 15pF (1 Card)

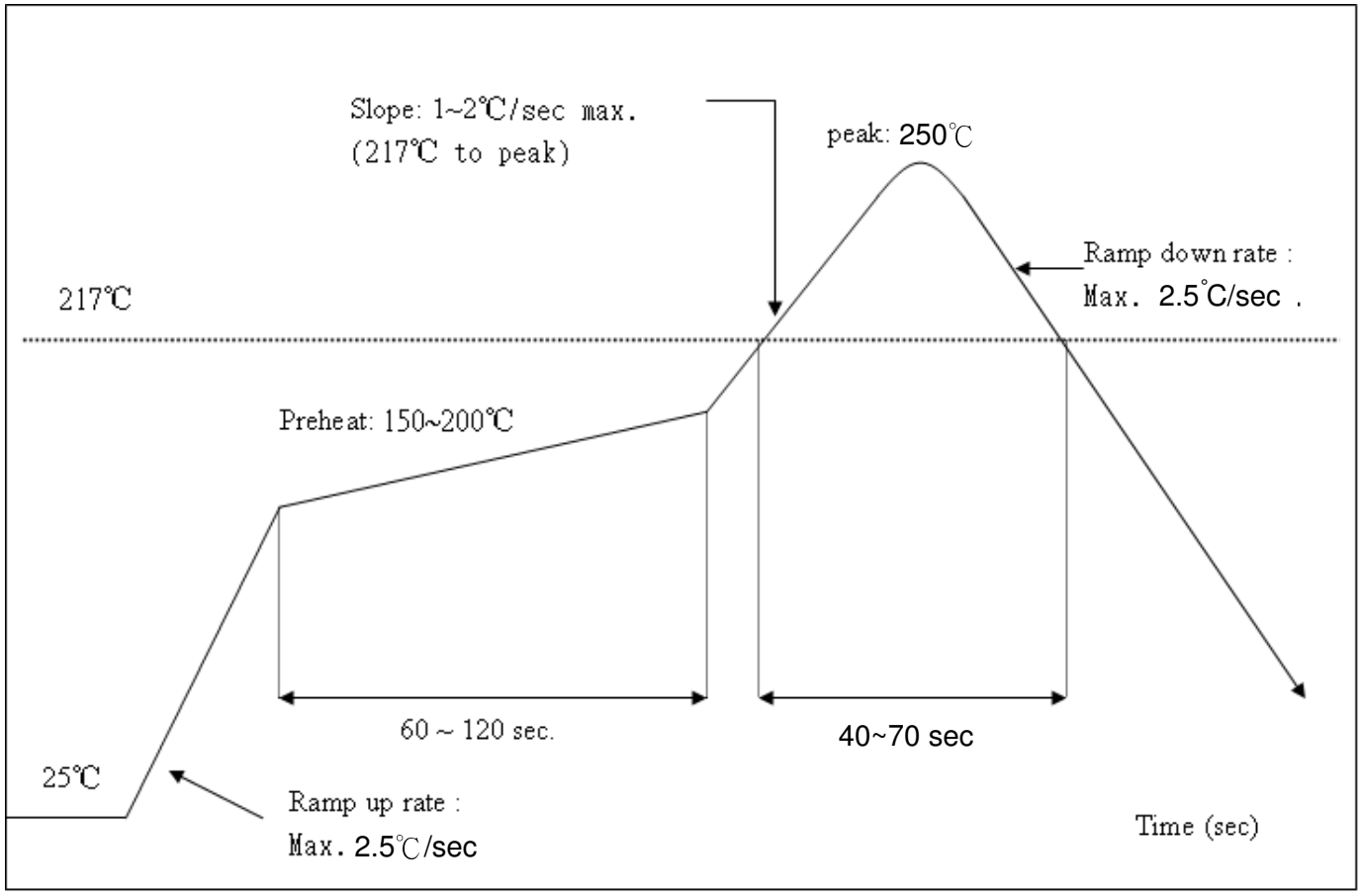
a. SDIO 3.0 specification value is 7.0 ns.

11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250℃

Number of Times : ≤2 times

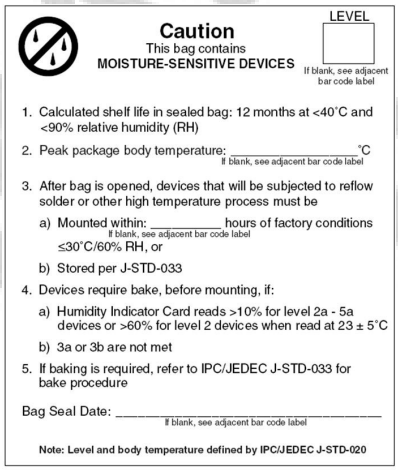


12. Package Information

12.1Label

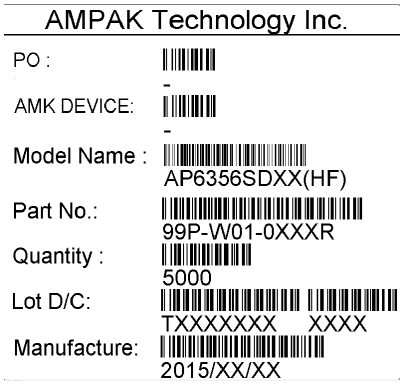
Label A→ Anti-static and humidity notice

Label B→ MSL caution / Storage Condition

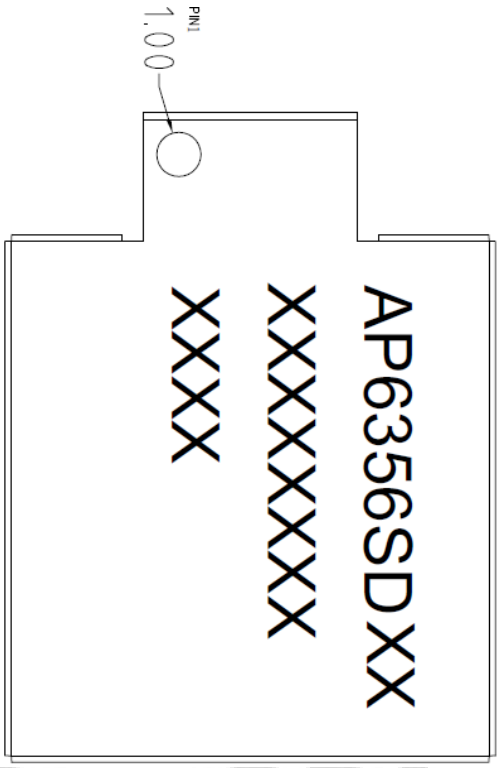


Label C→ Inner box label .

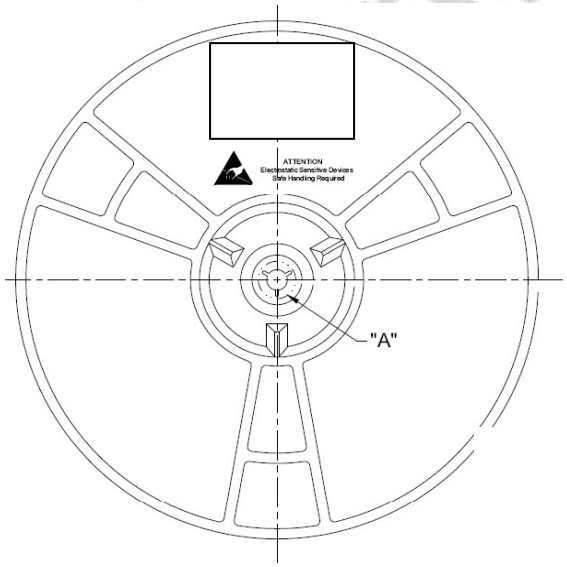
Label D→ Carton box label .

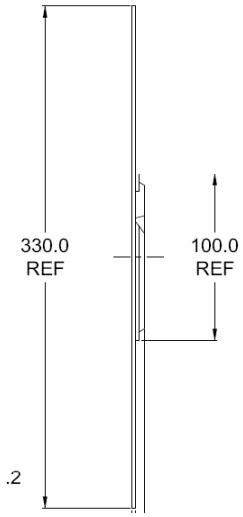


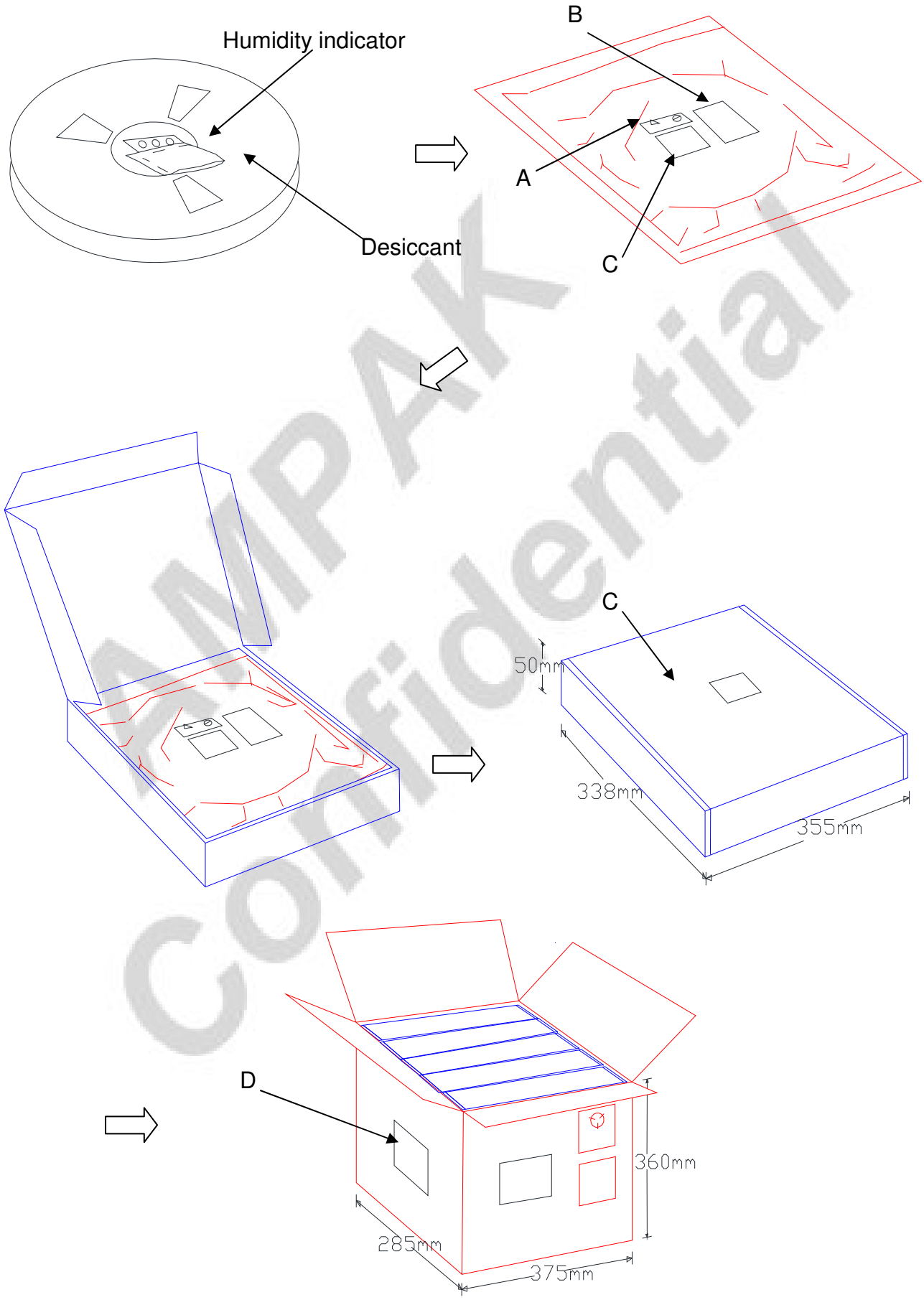
12.2 Dimension



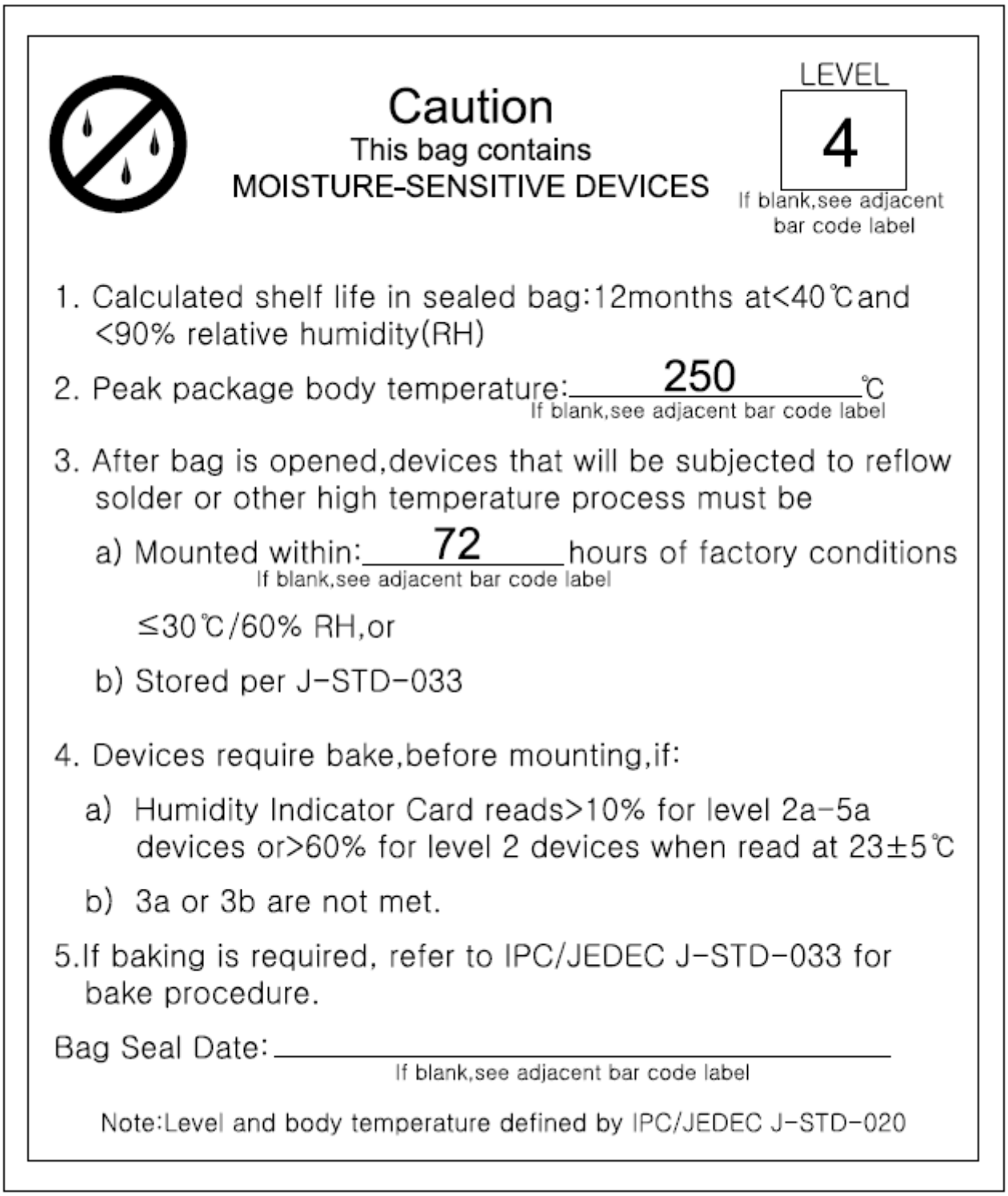
1. 10 sprocket hole pitch cumulative tolerance ±0.20.
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481-D requirements.
5. Thickness : 0.30±0.05mm.
6. Component load per 13" reel







12.3 MSL Level / Storage Condition



※NOTE : Accumulated baking time should not exceed 96hrs