

正基科技股份有限公司

SPECIFICATION

PRODUCT NAME : AP6214A

REVISION : V2.0

DATE : Sep. 30th,2021

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		

正基科技股份有限公司



AP6214A Data Sheet

Address:

8F, No.15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou,
Hsinchu, Taiwan, 30352

<http://www.ampak.com.tw>

Revision

Revision	Date	Description	Revised By
1.0	2015/01/13	- Preliminary	Brian
1.1	2015/03/26	- Pin Definition Modified	Brian
1.2	2016/02/21	- Pin Definition Modified	Richard
1.3	2016/08/16	- Updated Operating temperature	Richard
1.4	2017/01/03	- Updated BT 4.0 to BT 4.1	Richard
1.5	2017/09/22	- Updated Recommended Reflow Profile - Updated RF Spec.	Richard
1.6	2018/02/06	- Updated 2.4GHz supported channels.	Richard
1.7	2018/12/14	- Updated the Block Diagram	Richard
1.8	2019/10/04	- Revise package information	Milk
1.9	2021/01/27	- Updated BT 4.1 to 5.2	Richard
2.0	2021/09/30	- Updated Wi-Fi/BT RF specification	Richard

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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 and Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP, Bluetooth headsets and other applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11b/g/n Access Points in the wireless LAN.

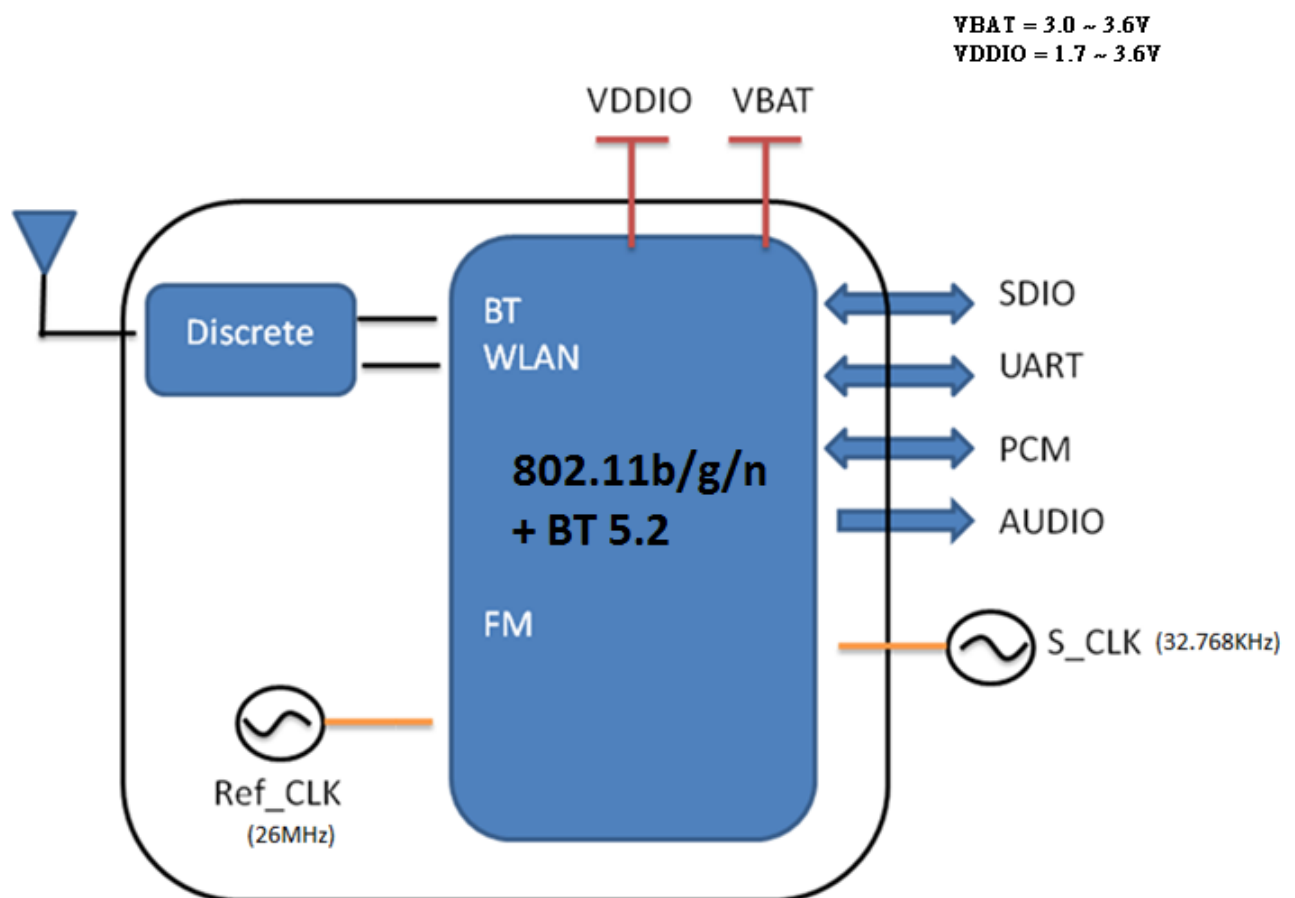
The wireless module complies with IEEE 802.11 b/g/n standard and it can achieve up to a speed of 72.2Mbps with single stream in 802.11n draft, 54Mbps as specified in IEEE 802.11g, or 11Mbps for IEEE 802.11b to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi, UART / 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

- 802.11b/g/n single-band radio
- Bluetooth V5.2 with integrated Class 1.5 PA and Low Energy (BLE) support
- Concurrent Bluetooth, and WLAN operation
- Simultaneous BT/WLAN receive with single antenna
- WLAN host interface options:
 - SDIO v2.0 — up to 50 MHz clock rate
- 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	AP6214A
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 7 x 7 x 1.5 (typical) mm
Wi-Fi Interface	SDIOV2.0
BT Interface	UART / PCM
Operating temperature	-30°C to 65°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 85% Non-Condensing Storage Humidity 5% to 60% Non-Condensing

Functionality is guaranteed across this range of temperature. Optimal RF performance as specified in the data sheet, however, is guaranteed only for -10°C to 55°C.

4.2 Voltages

4.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	4.8	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	3.6	V

VBAT current consumption 1A (Peak), when VBAT = 3.3V

4.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

	Min.	Typ.	Max.	Unit
Operating Temperature	-30	25	65	deg.C
VBAT	3.0	3.3	3.6	V
VDDIO	1.7	3.3	3.6	V

5. Wi-Fi RF Specification

5.1 2.4GHz RF Specification

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

Feature	Description
WLAN Standard	IEEE 802.11b/g/n, Wi-Fi compliant
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz : Ch1 ~ Ch13
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11 g/n : OFDM /64-QAM, 16-QAM, QPSK, BPSK
Output Power	802.11b /11Mbps : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -9dB
	802.11g /54Mbps : 15 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /65Mbps : 14 dBm $\pm$ 1.5 dB @ EVM $\leq$ -27dB
Receive Sensitivity (11n, 20MHz) @10% PER	- MCS=0 PER @ -88 dBm, +/-2dB
	- MCS=1 PER @ -86 dBm, +/-2dB
	- MCS=2 PER @ -84 dBm, +/-2dB
	- MCS=3 PER @ -82 dBm, +/-2dB
	- MCS=4 PER @ -78 dBm, +/-2dB
	- MCS=5 PER @ -75 dBm, +/-2dB
	- MCS=6 PER @ -73 dBm, +/-2dB
	- MCS=7 PER @ -71 dBm, +/-2dB
Receive Sensitivity (11g) @10% PER	- 6Mbps PER @ -89 dBm, +/-2dB
	- 9Mbps PER @ -88 dBm, +/-2dB
	- 12Mbps PER @ -87 dBm, +/-2dB
	- 18Mbps PER @ -85 dBm, +/-2dB
	- 24Mbps PER @ -83 dBm, +/-2dB
	- 36Mbps PER @ -79 dBm, +/-2dB
	- 48Mbps PER @ -75 dBm, +/-2dB
	- 54Mbps PER @ -74 dBm, +/-2dB
Receive Sensitivity (11b) @8% PER	- 1Mbps PER @ -93 dBm, +/-2dB
	- 2Mbps PER @ -92 dBm, +/-2dB
	- 5.5Mbps PER @ -90 dBm, +/-2dB
	- 11Mbps PER @ -88 dBm, +/-2dB
Data Rate	802.11b : 1, 2, 5.5, 11Mbps
	802.11g : 6, 9, 12, 18, 24, 36, 48, 54Mbps

Data Rate (20MHz ,Long GI,800ns)	802.11n: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps
Data Rate (20MHz ,short GI,400ns)	802.11n : 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65,72.2Mbps
Maximum Input Level	802.11b : -10 dBm
	802.11g/n : -20 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

6. Bluetooth Specification

6.1 Bluetooth Specification

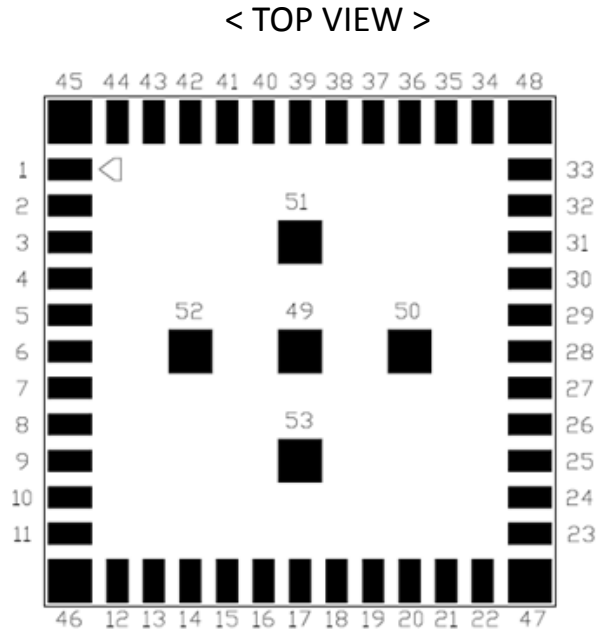
Conditions : VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	Description		
General Specification			
Bluetooth Standard	BDR, EDR(2Mbps 、 3Mbps), BLE(1Mbps)		
Host Interface	UART		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2402MHz ~ 2480MHz		
Number of Channels	79 channels for classic, 40 channels for BLE.		
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK		
RF Specification			
	Min.	Typical.	Max.
Output Power ¹		7	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-89 dBm	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-89 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-85 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

NOTE¹ : Output power can be configured by HCD firmware.

7. Pin Assignments

7.1 Pin Outline



7.2 Pin Definition

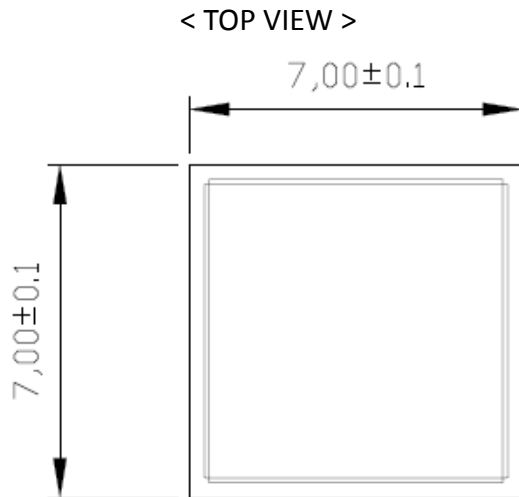
NO	Name	Type	Description
1	WL_BT_ANT	I/O	RF I/O port
2	GND	—	Ground connections
3	BT_WAKE	I	HOST wake-up Bluetooth device
4	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST
5	BT_REG_ON	I	Bluetooth device enable/disable pin
6	NC	—	Floating (Don't connected to ground)
7	NC	—	Floating (Don't connected to ground)
8	NC	—	Floating (Don't connected to ground)
9	GND	—	Ground connections
10	NC	—	Floating (Don't connected to ground)
11	NC	—	Floating (Don't connected to ground)
12	NC	—	Floating (Don't connected to ground)
13	NC	—	Floating (Don't connected to ground)
14	GND	—	Ground connections
15	NC	—	Floating (Don't connected to ground)
16	NC	—	Floating (Don't connected to ground)

17	WL_GPIO2	I/O	WLAN GPIO
18	WL_GPIO1	I/O	WLAN GPIO
19	WL_HOST_WAKE	O	WLAN device to wake-up HOST
20	WL_REG_ON	I	WLAN device enable/disable pin
21	GND	—	Ground connections
22	NC	—	Floating (Don't connected to ground)
23	SDIO_DATA_CMD	I/O	SDIO command line
24	SDIO_DATA_CLK	I/O	SDIO clock line
25	SDIO_DATA_2	I/O	SDIO data line 2
26	SDIO_DATA_0	I/O	SDIO data line 0
27	SDIO_DATA_3	I/O	SDIO data line 3
28	SDIO_DATA_1	I/O	SDIO data line 1
29	GND	—	Ground connections
30	VDDIO	P	I/O Voltage supply input
31	LPO	I	External Low Power Clock input (32.768KHz)
32	VIN_LDO	P	Internal Buck voltage generation pin
33	VBAT	P	Main power voltage source input
34	VIN_LDO_OUT	P	Internal Buck voltage generation pin
35	GND	—	Ground connections
36	PCM_CLK	I/O	PCM clock
37	PCM_SYNC	I/O	PCM sync signal
38	PCM_OUT	O	PCM Data output
39	PCM_IN	I	PCM data input
40	UART_TXD	O	Bluetooth UART interface
41	UART_RXD	I	Bluetooth UART interface
42	UART_CTS_N	I	Bluetooth UART interface
43	UART_RTS_N	O	Bluetooth UART interface
44	GND	—	Ground connections
45	GND	—	Ground connections
46	GND	—	Ground connections
47	GND	—	Ground connections
48	GND	—	Ground connections
49	GND	—	Ground connections
50	GND	—	Ground connections
51	GND	—	Ground connections
52	GND	—	Ground connections
53	GND	—	Ground connections

8. Dimensions

8.1 Physical Dimensions

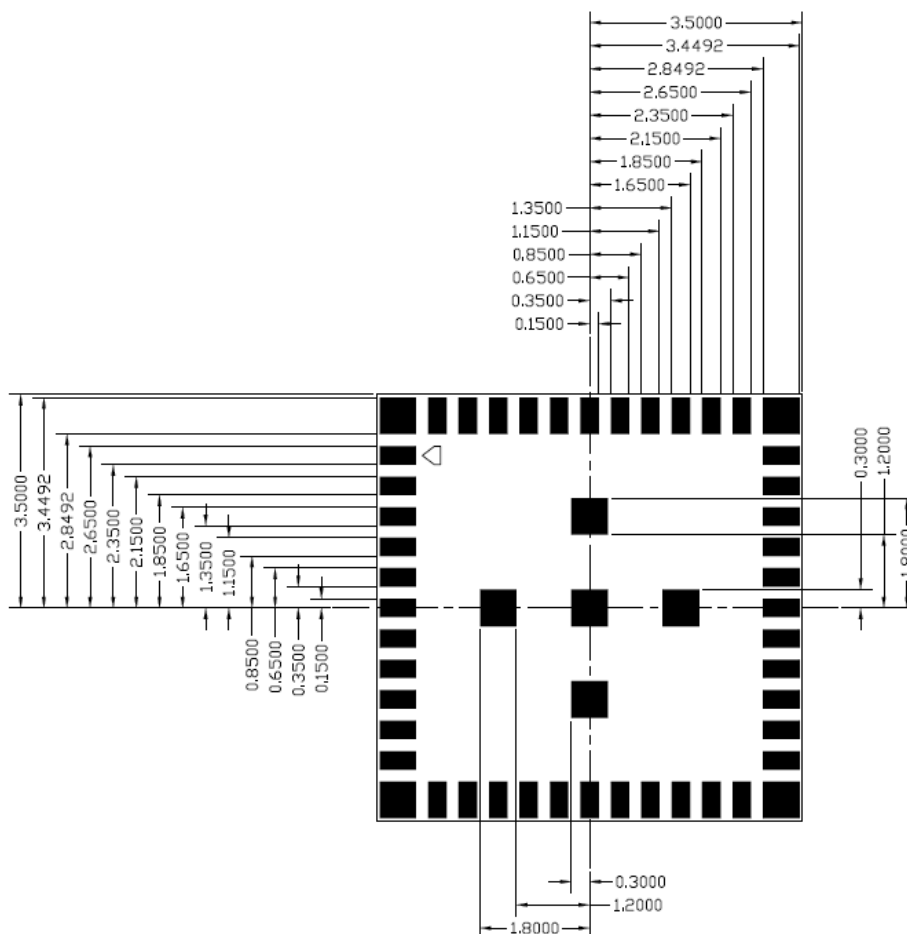
(Unit: mm)



< Side View >



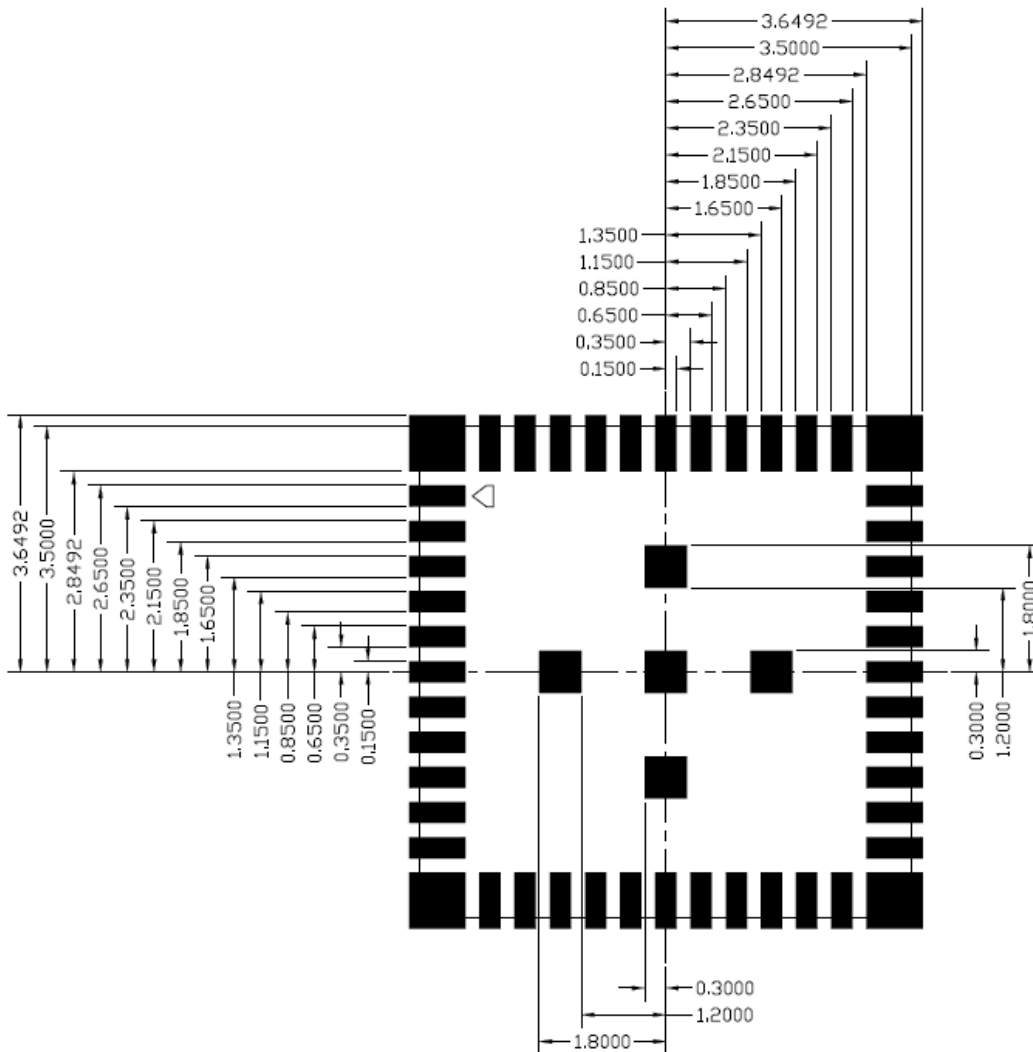
< TOP VIEW >



8.2 Layout Recommendation

(Unit: mm)

< TOP VIEW >



- Solder paste layer design is generally the same as recommended footprint.
(錫膏層設計通常建議和焊墊尺寸相同)
- If soldering quality with good wetting on upright side is essential for PQC, how to optimize the aperture design in the stencil to adjust the amount of solder paste would be crucial.
In addition, a kind of stencil design with stepped thickness in partial area would be considered if the thickness of stencil is about 0.1mm or thinner. Please optimize the stencil design by manufacture engineer or contact AMPAK FAE for assistance.
(如果模組吃錫品質考量側面爬錫，如何優化鋼網開孔設計以調整適當的錫膏量是非常重要的。尤其鋼網的厚度大約是 0.1mm 或更薄時，可考慮局部加厚鋼網的設計。請諮詢製程工程師以優化鋼網的設計,或是聯絡正基科技技術支持團隊).

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

9.1 SDIO Pin Description

The module supports SDIO version 2.0 for 4-bit modes (100 Mbps), and high speed 4-bit (50 MHz clocks – 200 Mbps). 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

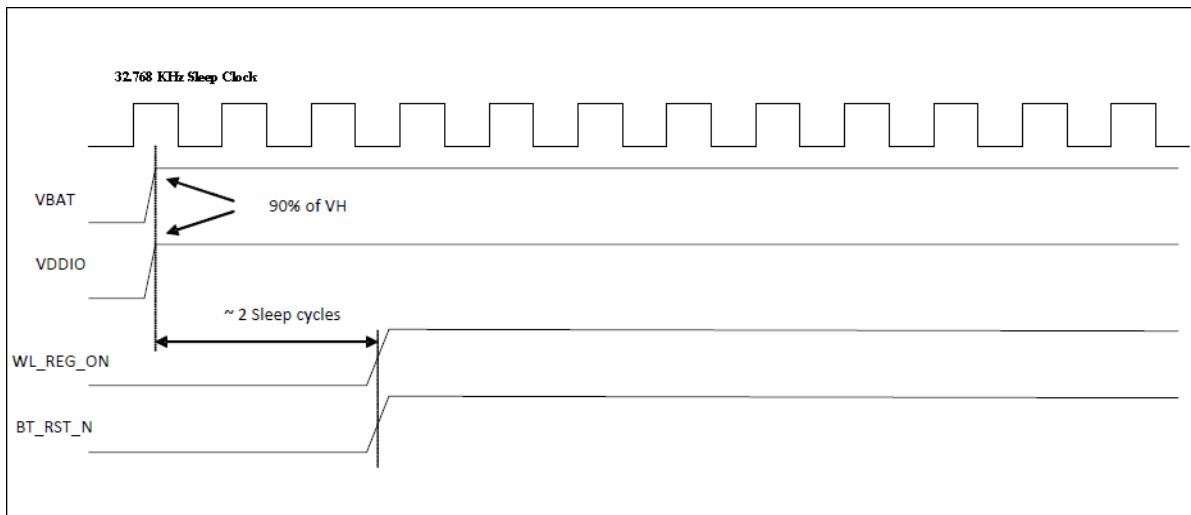
10. Host Interface Timing Diagram

10.1 Power-up Sequence Timing Diagram

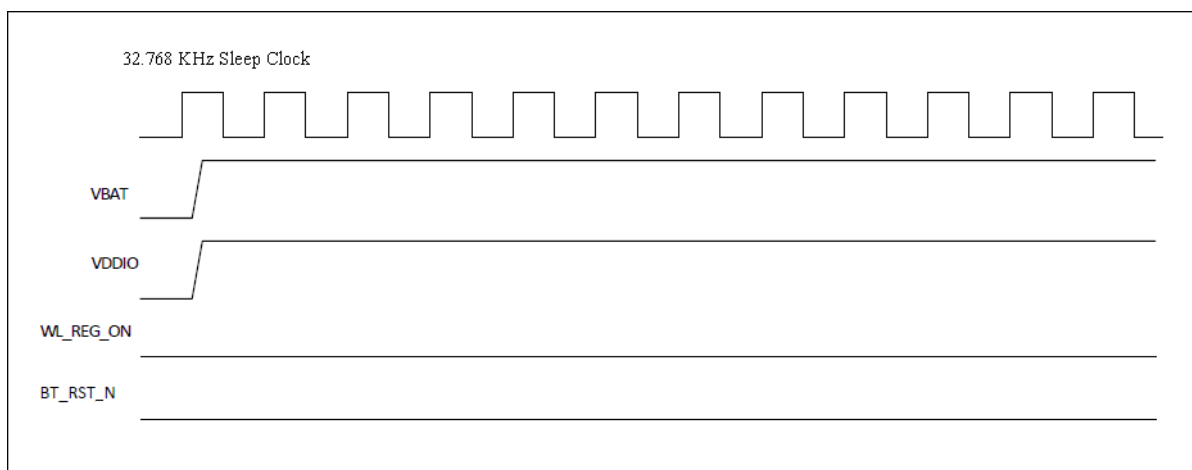
The module has signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN and internal regulator blocks. These signals are described below.

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

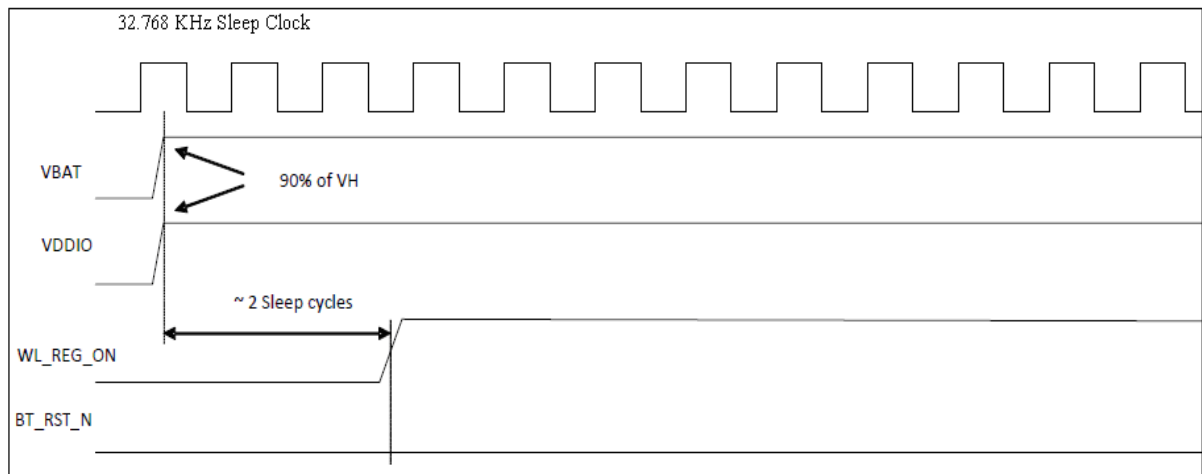
- ✧ WL_REG_ON: Used by the PMU to power up the WLAN section. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset.
- ✧ BT_RST_N: Low asserting reset for Bluetooth. This pin has no effect on WLAN and does not control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



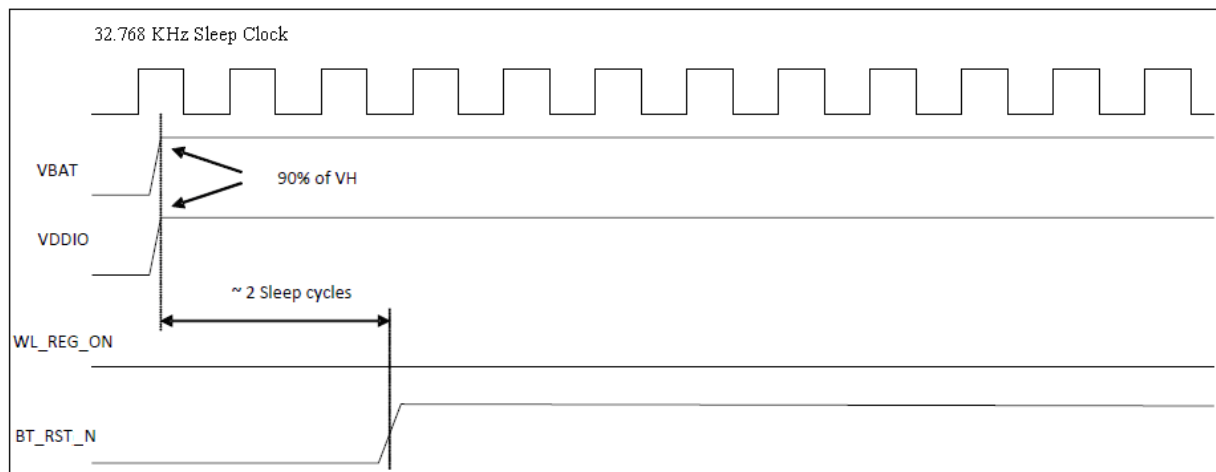
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF

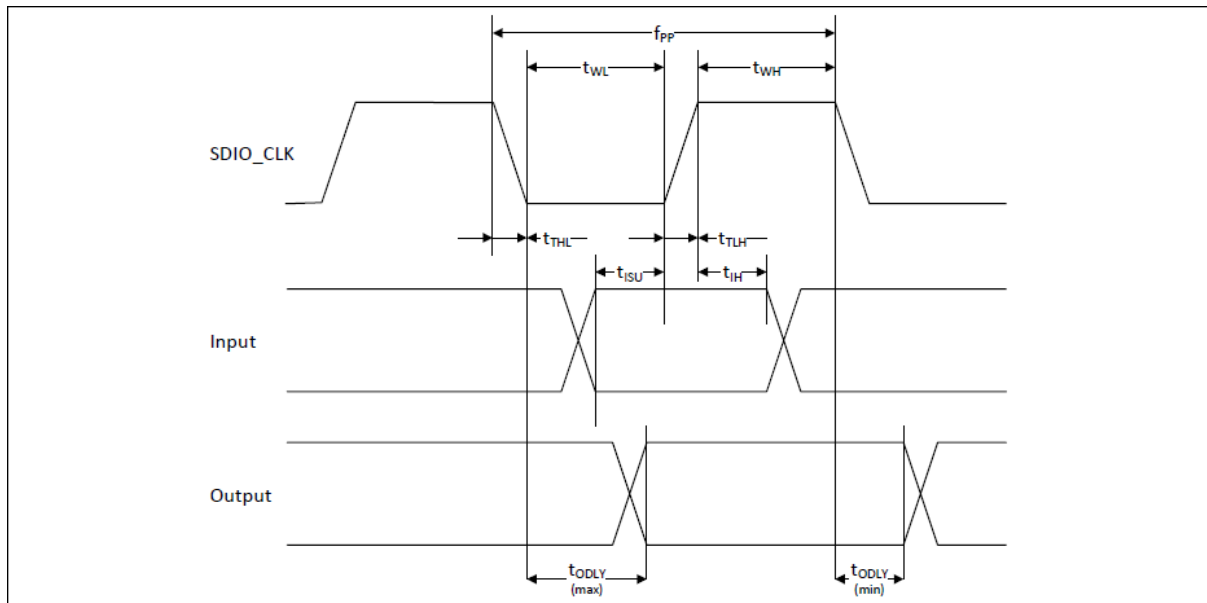


WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

10.2 SDIO Default Mode Timing Diagram

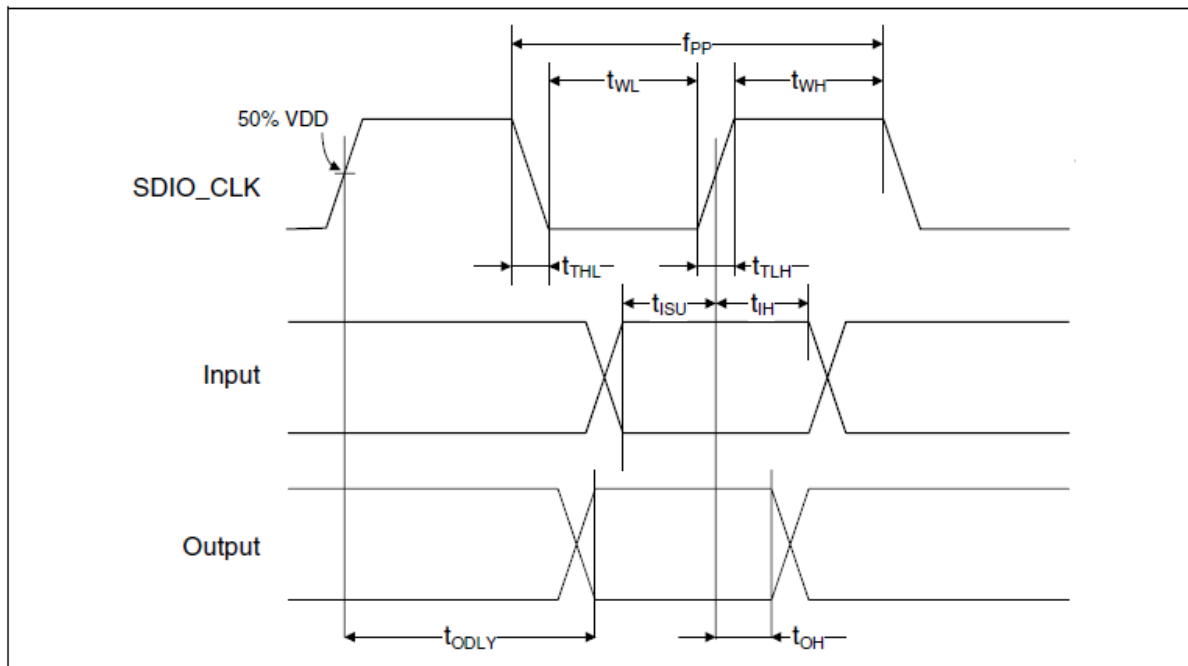


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency-Data Transfer mode	f_{PP}	0	-	25	MHz
Frequency-Identification mode	f_{OD}	0	-	400	kHz
Clock low time	t_{WL}	10	-	-	ns
Clock high time	t_{WH}	10	-	-	ns
Clock rise time	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

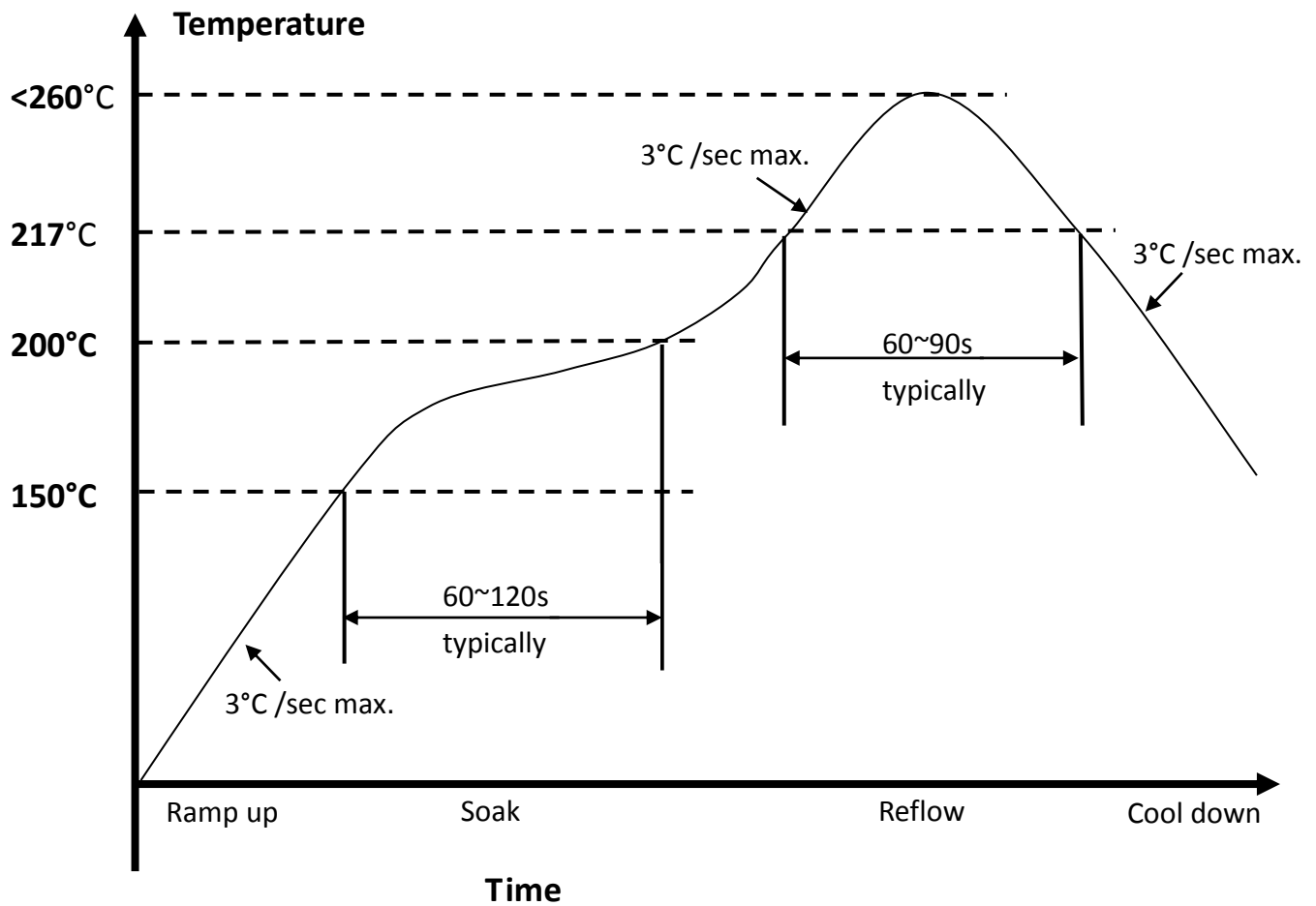


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency-Data Transfer mode	f_{PP}	0	-	50	MHz
Frequency-Identification mode	f_{OD}	0	-	400	kHz
Clock low time	t_{WL}	7	-	-	ns
Clock high time	t_{WH}	7	-	-	ns
Clock rise time	t_{TLH}	-	-	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 $CL \leq 40\text{pF}$ load on CMD and Data.

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

11. Recommended Reflow Profile



1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N₂) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, be sure baking step to remove the moisture from the component.

12. Package Information

12.1 Label

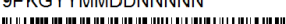
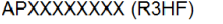
Label A → Anti-static and humidity notice



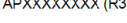
Label B → MSL caution / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 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		

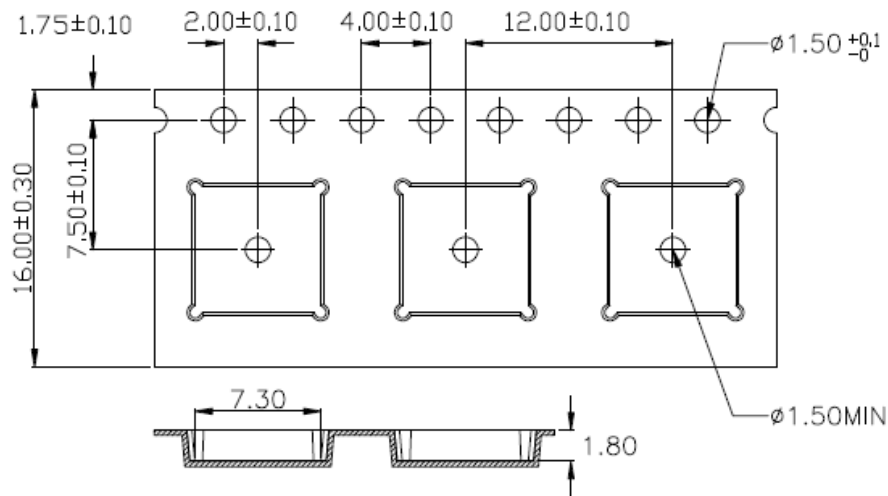
Label C → Inner box label .

PO:	
AMK DEVICE:	
PKG S/N:	 9PKGYYMDDNNNNN
Model Name:	 APXXXXXXXX (R3HF)
P/N:	 99X-XXX-XXXXR
Quantity:	 QQQQ
Date Code:	 YYWW
Lot Code:	 XXXXXXXXXX

Label D → Carton box label .

AMPAK Technology Inc.	
PO:	
AMK DEVICE:	
Model Name:	 APXXXXXXXX (R3HF)
Part No.:	 99X-XXX-XXXXR
Quantity:	 QQQQ
Lot D/C:	 XXXXXXXX YYWW QQQQ
Manufacture:	 YYYY/MM/DD

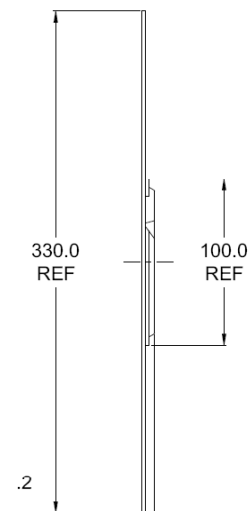
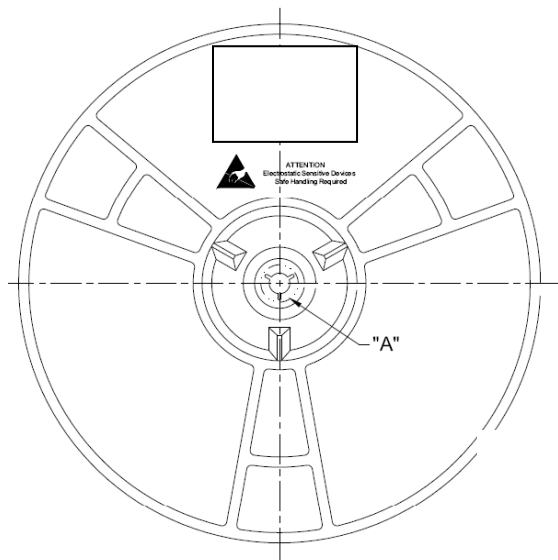
12.2 Dimension

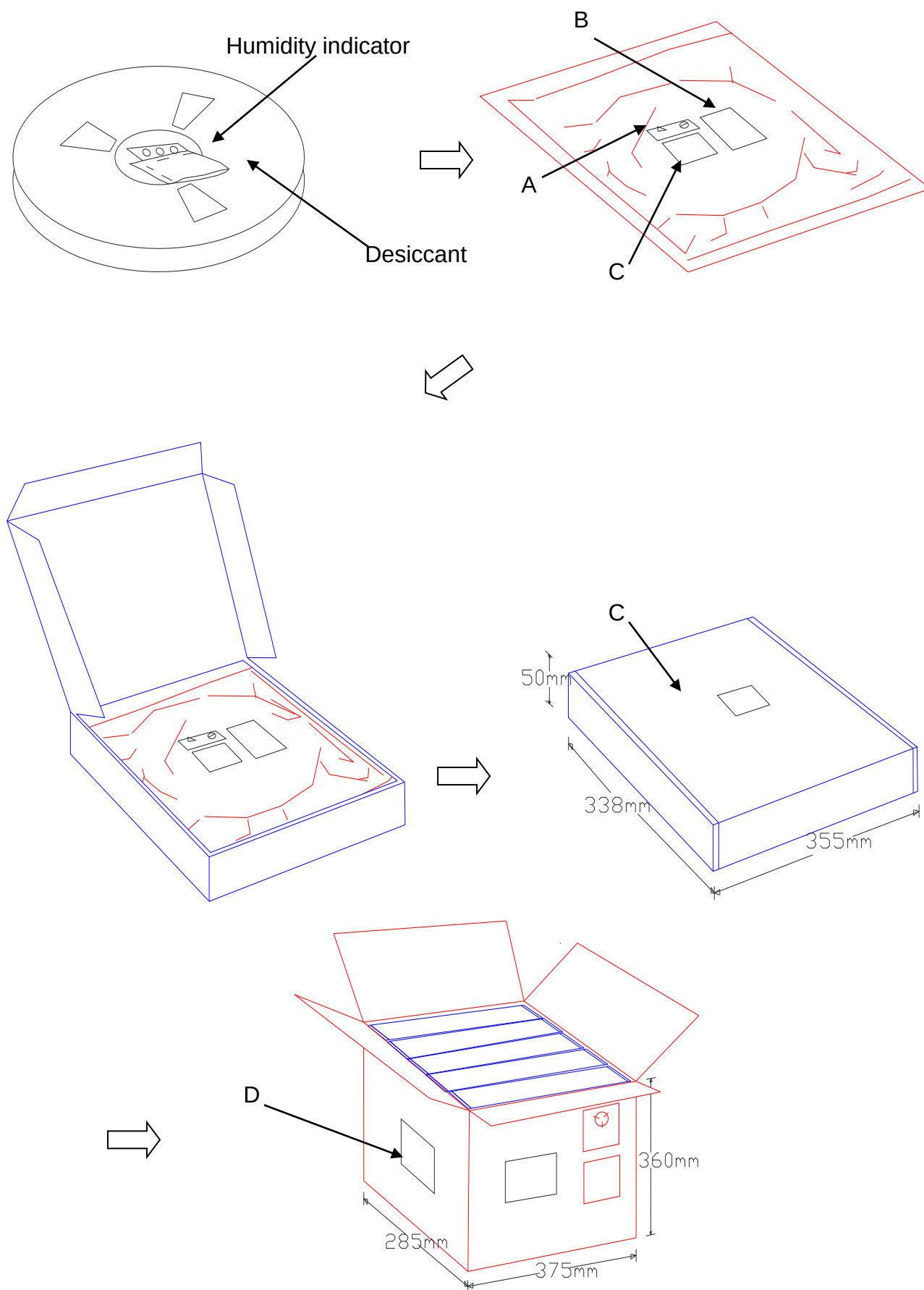


Taiwan Patent No : 157713
China Patent No : 01224591.7

W	16.00±0.30
A0	7.30±0.10
B0	7.30±0.10
K0	1.80±0.10

1. Material : Black Conductive Polystyrene Alloy.
2. All dimensions meet EIA-481-D requirements.
3. Component load per 13" reel : 2000pcs.





12.3 MSL Level / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 4 If blank, see adjacent bar code label
1. Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH) 2. Peak package body temperature: <u>250</u> $^{\circ}\text{C}$ 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: <u>72</u> hours of factory conditions If blank, see adjacent bar code label $\leq 30^{\circ}\text{C} / 60\% \text{ RH}$, 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 $23 \pm 5^{\circ}\text{C}$ 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		