正基科技股份有限公司

SPECIFICATION

PRODUCT NAME：AP6275S

REVISION：0.2

DATE：MAY 7th , 2019

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		

正基科技股份有限公司

AMPAK Technology Inc.

AP6275S
Data Sheet

Revision

Revision	Date	Description	Revised By
0.1	2017/07/04	- Preliminary	Richard
0.2	2019/05/07	- Preliminary	Ares

Contents

1. Introduction

1.1 Overview

The AMPAK Technology® AP6275S is a fully Wi-Fi and Bluetooth functionalities module with seamless roaming capabilities and advance security, also it could interact with different vendors' 802.11a/b/g/n/ac /ax 2x2 Access Points with MIMO standard and can accomplish up to speed of 1200Mbps with dual stream in 802.1ax to connect the wireless LAN. Furthermore AP6275S included SDIO interface for Wi-Fi, UART/ PCM interface for Bluetooth.

In addition, this compact module is a total solution for a combination of Wi-Fi + BT technologies. The module is specifically developed for tablet, OTT box and portable devices.
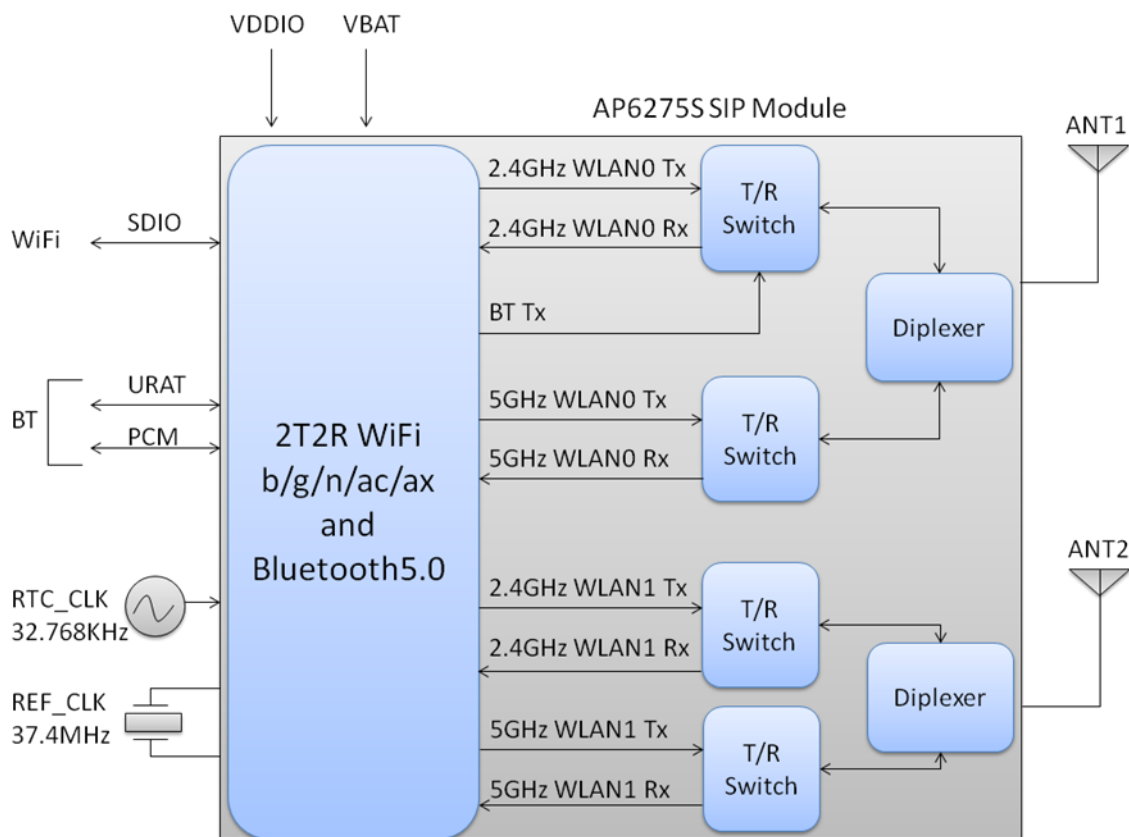
1.2 Product Features

IEEE 802.11 Key Feature
- Lead Free design which is compliant with ROHS requirements.
- TX and RX low-density parity check (LDPC) support for improved range and power efficiency.
- Dual-stream spatial multiplexing up to 1200 Mbps data rate.
- 20, 40, 80 MHz channels with optional SGI (1024 QAM modulation)
- Real simultaneous dual-band
- Client MU-MIMO
- Supports standard SDIO v3.0, compatible with SDIO v2.0 HOST interfaces.

Bluetooth Key Feature
- BT host digital interface:
    - HCI UART (up to 4 Mbps)
    - PCM for audio data
- Complies with Bluetooth Core Specification Version 5.0 with provisions for supporting future specifications. With Bluetooth Class 1 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 above.

2. General Specification

2.1 General Specification

Model Name	AP6275S
Product Description	2T2R 802.11 a/b/g/n/ac/ax Wi-Fi + BT 5.0 Module
Dimension	L x W : 15 x 13 (typical) mm，H : 1.6 (Maximum) mm
WiFi Interface	Support SDIO V3.0/2.0
BT Interface	UART / PCM
Operating temperature	-30°C to 85°C
Storage temperature	-40°C to 105°C
Humidity	Operating Humidity 10% to 95% Non-Condensing

Note: The optimal RF performance specified in the data sheet, however, is guaranteed only -10 °C to +55 °C and 3.2V < VBAT < 3.8V without derating performance.

2.2 DC Characteristics

2.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	4.5	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	2.07	V

2.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

Voltage rails	Min.	Typ.	Max.	Unit
VBAT	3.0	3.3	3.8	V
VDDIO	1.68	1.8	1.98	V

VBAT current consumption 1200mA(Peak), when VBAT = 3.3V

3. Wi-Fi RF Specification

3.1 2.4GHz RF Specification

Conditions : VBAT=3.3V ; VDDIO=1.8V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11 b/g/n/ax & Wi-Fi compliant
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4GHz ISM Band)
Number of Channels	2.4GHz：Ch1 ~ Ch13
Modulation	802.11b : DQPSK、DBPSK、CCK 802.11g/n : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ax : OFDMA /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK

Output Power , tolerance ± 1.5 dB				
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard				

802.11b	1Mbps	2Mbps	5.5Mbps	11Mbps	
	20	20	19.5	19.5	

802.11g	6、9Mbps	12、18Mbps	24Mbps	36Mbps	48Mbps
	19	19	18.5	18.5	18
	54Mbps				
	18				

802.11n 20MHz	MCS0~2	MCS3	MCS4	MCS5	MCS6
	19	18	18	17.5	17.5
	MCS7				
	17				

	Dara rate	Tones	Spec.(dBm)	Dara rate	Tones	Spec.(dBm)
802.11ax_20MHz SISO	MCS0~2	26		MCS7	26	
		52			52	
		106			106	
		242			242	
	MCS3	26		MCS8	26	
		52			52	
		106			106	
		242			242	
	MCS4	26		MCS9	26	
		52			52	
		106			106	
		242			242	

802.11ax_20MHz SISO	MCS5	26		MCS10	242	
		52				
		106		MCS11	242	
		242				
	MCS6	26				
		52				
		106				
		242				

Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.

Sensitivity, tolerance ± 2 dB
CCK modulation PER ≦ 8%、OFDM modulation PER ≦ 10%

802.11b	Data Rate	Spec.(dBm)		
	1Mbps	-98		
	2Mbps	-93		
	5.5Mbps	-91		
	11Mbps	-89		

802.11g SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-93	24Mbps	-85
	9Mbps	-92	36Mbps	-82
	12Mbps	-91	48Mbps	-78
	18Mbps	-88	54Mbps	-76

802.11g MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-95	24Mbps	-87
	9Mbps	-94	36Mbps	-84
	12Mbps	-93	48Mbps	-81
	18Mbps	-90	54Mbps	-78

802.11n_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-93	MCS4	-81.5
	MCS1	-89	MCS5	-79
	MCS2	-87	MCS6	-76
	MCS3	-84	MCS7	-76

802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-93	MCS5	-80
	MCS1	-92	MCS6	-78
	MCS2	-90	MCS7	-76
	MCS3	-87	MCS8	-72
	MCS4	-83	MCS15	-73

	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
802.11ax_20MHz SISO	**MCS0**	-93	**MCS6**	-76
	MCS1	-89	**MCS7**	-76
	MCS2	-87	**MCS8**	TBD
	MCS3	-84	**MCS9**	TBD
	MCS4	-81.5	**MCS10**	TBD
	MCS5	-79	**MCS11**	TBD
Maximum Input Level	802.11b : -10 dBm			
	802.11g/n/ax : -20 dBm			

4.2 5GHz RF Specification

Conditions : VBAT=3.3V ; VDDIO=1.8V ; Temp:25°C

Feature	Description			
WLAN Standard	IEEE 802.11a/n/ac/ax & Wi-Fi compliant			
Frequency Range	5.15~5.35GHz、5.47~5.725GHz、5.725~5.85GHz　(5GHz UNII Band)			
Number of Channels	5.15~5.35GHz：Ch36 ~ Ch64 5.47~5.725GHz：Ch100 ~ Ch140 5.725~5.85GHz：Ch149 ~ Ch165			
Modulation	802.11a : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11n : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ac : OFDM /256-QAM、64-QAM、16-QAM、QPSK、BPSK 802.11ax : OFDMA /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK			
Output Power , tolerance ± 2 dB				
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard				
	Frequency (MHz)	6~9Mbps	12~18Mbps	24Mbps	36Mbps
	5150~5350	17	17	16.5	16.5
	5470~5720	17	17	16.5	16.5
	5725~5845	17	17	16.5	16.5
802.11a	Frequency (MHz)	48Mbps	54Mbps		
	5150~5350	16	16		
	5470~5720	16	16		
	5725~5845	16	16		
	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	16.5	16.5	16
	5470~5720	17	16.5	16.5	16
802.11n **20MHz**	5725~5845	17	16.5	16.5	16
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	16	15.5		
	5470~5720	16	15.5		
	5725~5845	16	15.5		
	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16.5	15.5	15.5	15
	5470~5720	16.5	15.5	15.5	15
802.11n **40MHz**	5725~5845	16.5	15.5	15.5	15
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	15	14.5		
	5470~5720	15	14.5		
	5725~5845	15	14.5		

802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	16.5	16.5	16
	5470~5720	17	16.5	16.5	16
	5725~5845	17	16.5	16.5	16
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5150~5350	16	15.5	14.5	
	5470~5720	16	15.5	14.5	
	5725~5845	16	15.5	14.5	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16.5	15.5	15.5	15
	5470~5720	16.5	15.5	15.5	15
	5725~5845	16.5	15.5	15.5	15
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	15	14.5	13	11
	5470~5720	15	14.5	13	11
	5725~5845	15	14.5	13	11
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	15	15	15
	5470~5720	16	15	15	15
	5725~5845	16	15	15	15
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14	13.5	13	11
	5470~5720	14	13.5	13	11
	5725~5845	14	13.5	13	11
802.11ax 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	16.5	16.5	16
	5470~5720	17	16.5	16.5	16
	5725~5845	17	16.5	16.5	16
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	16	15.5	14.5	14.5
	5470~5720	16	15.5	14.5	14.5
	5725~5845	16	15.5	14.5	14.5
	Frequency (MHz)	MCS10	MCS11		
	5150~5350	14.5	13		
	5470~5720	14.5	13		
	5725~5845	14.5	13		

	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
802.11ax 40MHz	5150~5350	16.5	15.5	15.5	15
	5470~5720	16.5	15.5	15.5	15
	5725~5845	16.5	15.5	15.5	15
	Frequency (MHz)	**MCS6**	**MCS7**	**MCS8**	**MCS9**
	5150~5350	15	14.5	13	11
	5470~5720	15	14.5	13	11
	5725~5845	15	14.5	13	11
	Frequency (MHz)	**MCS10**	**MCS11**		
	5150~5350	11	9.5		
	5470~5720	11	9.5		
	5725~5845	11	9.5		
802.11ax 80MHz	**Frequency (MHz)**	**MCS0~2**	**MCS3**	**MCS4**	**MCS5**
	5150~5350	16	15	15	15
	5470~5720	16	15	15	15
	5725~5845	16	15	15	15
	Frequency (MHz)	**MCS6**	**MCS7**	**MCS8**	**MCS9**
	5150~5350	14	13.5	13	11
	5470~5720	14	13.5	13	11
	5725~5845	14	13.5	13	11
	Frequency (MHz)	**MCS10**	**MCS11**		
	5150~5350	10	9.5		
	5470~5720	10	9.5		
	5725~5845	10	9.5		

Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.

Sensitivity, tolerance ± 1.5 dB
CCK modulation PER ≦ 8%、OFDM modulation PER ≦ 10%

	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
802.11a SISO	6Mbps	-90.5	24Mbps	-83
	9Mbps	-90	36Mbps	-80
	12Mbps	-88	48Mbps	-75
	18Mbps	-86	54Mbps	-73
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11a MIMO	6Mbps	-92	24Mbps	-86
	9Mbps	-91	36Mbps	-83
	12Mbps	-90	48Mbps	-78
	18Mbps	-89	54Mbps	-77

	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
802.11n_20MHz SISO	MCS0	-90	MCS4	-79
	MCS1	-88	MCS5	-76
	MCS2	-86	MCS6	-73
	MCS3	-83	MCS7	-72
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11n_20MHz MIMO	MCS0	-92	MCS5	-78
	MCS1	-91	MCS6	-76
	MCS2	-89	MCS7	-75
	MCS3	-86	MCS8	-89
	MCS4	-82	MCS15	-70
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11n_40MHz SISO	MCS0	-88	MCS4	-77
	MCS1	-86	MCS5	-72
	MCS2	-83	MCS6	-70
	MCS3	-80	MCS7	-69
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11n_40MHz MIMO	MCS0	-88	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-72
	MCS3	-83	MCS8	-86
	MCS4	-79	MCS15	-67
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ac_20MHz SISO	MCS0	-90	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-70
	MCS3	-83	MCS8	-68
	MCS4	-79		
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ac_20MHz MIMO	MCS0,NSS=1	-92	MCS6,NSS=1	-76
	MCS1,NSS=1	-91	MCS7,NSS=1	-75
	MCS2,NSS=1	-88	MCS8,NSS=1	-72
	MCS3,NSS=1	-85	MCS0,NSS=2	-88
	MCS4,NSS=1	-82	MCS8,NSS=2	-65
	MCS5,NSS=1	-77		

	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
802.11ac_40MHz SISO	MCS0	-88	MCS5	-72
	MCS1	-86	MCS6	-70
	MCS2	-83	MCS7	-69
	MCS3	-80	MCS8	-65
	MCS4	-76	MCS9	-64
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ac_40MHz MIMO	MCS0,NSS=1	-90	MCS6,NSS=1	-73
	MCS1,NSS=1	-88	MCS7,NSS=1	-72
	MCS2,NSS=1	-86	MCS8,NSS=1	-68
	MCS3,NSS=1	-82	MCS9,NSS=1	-66
	MCS4,NSS=1	-79	MCS0,NSS=2	-86
	MCS5,NSS=1	-77	MCS9,NSS=2	-60
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ac_80MHz SISO	MCS0	-85	MCS5	-68
	MCS1	-82	MCS6	-67
	MCS2	-79	MCS7	-65
	MCS3	-76	MCS8	-62
	MCS4	-73	MCS9	-61
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ac_80MHz MIMO	MCS0,NSS=1	-87	MCS6,NSS=1	-70
	MCS1,NSS=1	-85	MCS7,NSS=1	-68
	MCS2,NSS=1	-82	MCS8,NSS=1	-66
	MCS3,NSS=1	-79	MCS9,NSS=1	-63
	MCS4,NSS=1	-76	MCS0,NSS=2	-83
	MCS5,NSS=1	-71	MCS9,NSS=2	-58
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ax_20MHz SISO	MCS0	-90	MCS6	-73
	MCS1	-88	MCS7	-70
	MCS2	-86	MCS8	-68
	MCS3	-83	MCS9	TBD
	MCS4	-79	MCS10	TBD
	MCS5	-75	MCS11	TBD
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ax_40MHz SISO	MCS0	-90	MCS6	-73
	MCS1	-88	MCS7	-70
	MCS2	-86	MCS8	-68
	MCS3	-83	MCS9	TBD

	MCS4	-79	MCS10	TBD
	MCS5	-75	MCS11	TBD
	Data Rate	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
802.11ax_80MHz SISO	MCS0	-90	MCS6	-73
	MCS1	-88	MCS7	-70
	MCS2	-86	MCS8	-68
	MCS3	-83	MCS9	TBD
	MCS4	-79	MCS10	TBD
	MCS5	-75	MCS11	TBD
Maximum Input Level	802.11a/n/ac : -30 dBm			

4. Bluetooth Specification

4.1 Bluetooth Specification

Conditions : VBAT=3.3V ; VDDIO=1.8V ; Temp:25°C

Feature	Description
General Specification	
Bluetooth Standard	GFSK、DQPSK、8DPSK、LE(1Mbps)、2LE(2Mbps)
Host Interface	UART
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels for classic、40 channels for BLE
Modulation	FHSS, GFSK, DPSK, DQPSK
RF Specification	

Output Power , tolerance ± 1.5 dB		
	CL1 (dBm)	**CL2** (dBm)
BDR Output Power	8	TBD
EDR Output Power	6	TBD
BLE Output Power	7	TBD

Sensitivity, tolerance ± 1.5 dB	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-88 dBm
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)	-91 dBm
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-85 dBm
Sensitivity @ BER=0.01% for LE (1Mbps)	-90 dBm
Sensitivity @ BER=0.01% for 2LE (2Mbps)	TBD
Maximum Input Level	GFSK (1Mbps):-20dBm
	π/4-DQPSK (2Mbps) :-20dBm
	8DPSK (3Mbps) :-20dBm

Note*：The Bluetooth BDR output power is able to be configured by firmware (hcd file).

5. Pin Definition

5.1   Pin Outline

<TOP VIEW>

```
              50 49 48 47 46 45 44 43 42 41 40 39 38 37

         ▷  1                                         36
            2                                         35
            3                                         34
            4                                         33
            5                                         32
            6                                         31
            7                                         30
            8                                         29
            9                                         28
           10                                         27
           11                                         26

              12 13 14 15 16 17 18 19 20 21 22 23 24 25
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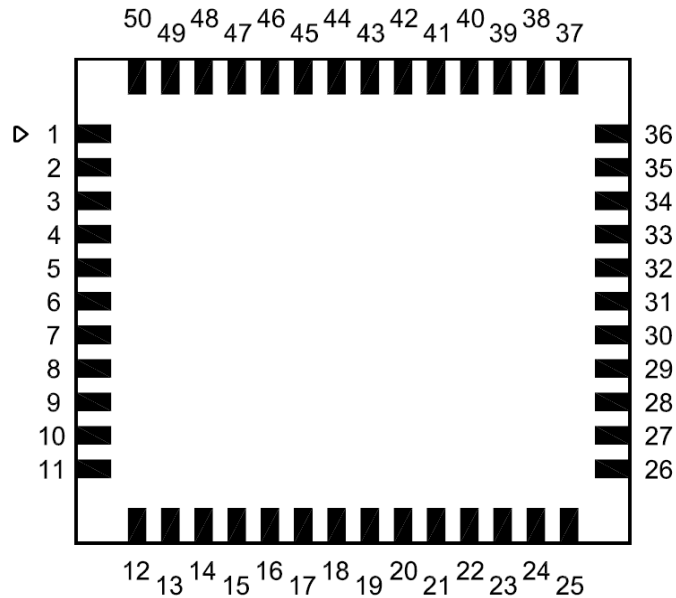
5.2   Pin Assignment

NO	Name	Type	Description
1	GND	—	Ground connections
2	WL_ANT0	I/O	RF I/O port0
3	GND	—	Ground connections
4	GND	—	Ground connections
5	GND	—	Ground connections
6	GND	—	Ground connections
7	GND	—	Ground connections
8	GND	—	Ground connections
9	WL_ANT1	I/O	RF I/O port1
10	GND	—	Ground connections
11	GND	—	Ground connections
12	NC	—	Floating (Don't connected to ground)
13	XTAL_IN	I	External Crystal in/ Single clock source in
14	XTAL_OUT	O	External Crystal out
15	WL_REG_ON	I	Low asserting reset for WiFi core

16	WL_HOST_WAKE	O	WLAN to wake-up HOST
17	SDIO_DATA_CMD	I/O	SDIO command line
18	SDIO_DATA_CLK	I/O	SDIO clock line
19	SDIO_DATA_3	I/O	SDIO data line 3
20	SDIO_DATA_2	I/O	SDIO data line 2
21	SDIO_DATA_0	I/O	SDIO data line 0
22	SDIO_DATA_1	I/O	SDIO data line 1
23	GND	—	Ground connections
24	NC	—	Floating (Don't connected to ground)
25	CBUCK_0P9	I	Internal Buck voltage generation pin
26	CSR_VLX	O	Internal Buck voltage generation pin
27	GND	—	Ground connections
28	ASR_VLX	O	Internal Analog Buck voltage generation pin
29	ABUCK_1P12	I	Internal Analog Buck voltage generation pin
30	GND	—	Ground connections
31	LPO	I	External Low Power Clock input (32.768KHz)
32	GND	—	Ground connections
33	NC	—	Floating (Don't connected to ground)
34	VDDIO	P	I/O Voltage supply input
35	NC	—	Floating (Don't connected to ground)
36	VBAT	P	Main power voltage source input
37	NC	—	Floating (Don't connected to ground)
38	BT_REG_ON	I	Low asserting reset for Bluetooth core
39	GND	—	Ground connections
40	UART_TXD	O	Bluetooth UART interface
41	UART_RXD	I	Bluetooth UART interface
42	UART_RTS_N	O	Bluetooth UART interface
43	UART_CTS_N	I	Bluetooth UART interface
44	PCM_CLK	I/O	PCM clock
45	PCM_SYNC	I/O	PCM sync signal
46	PCM_IN	I	PCM data input
47	PCM_OUT	O	PCM Data output
48	BT_ANT	—	BT RF port
49	BT_WAKE	I	HOST wake-up Bluetooth device
50	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST

6. Dimensions

6.1 Module Dimensions
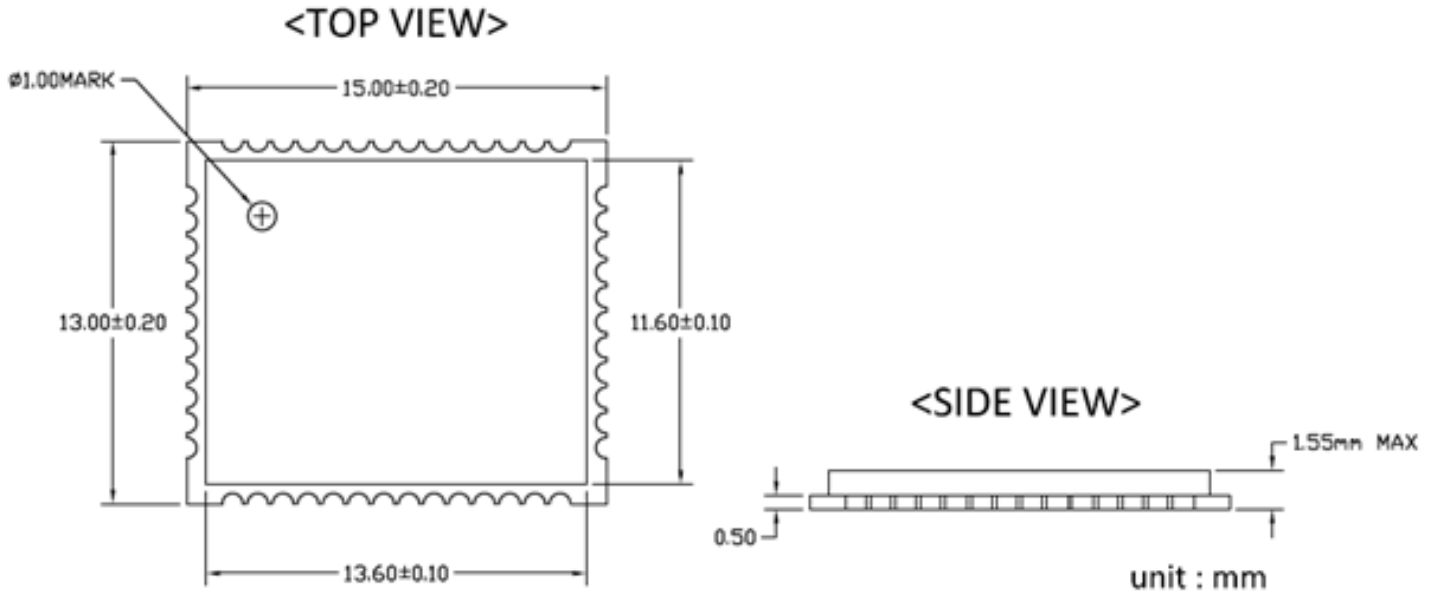
6.2 Recommended footprint

<TOP VIEW>
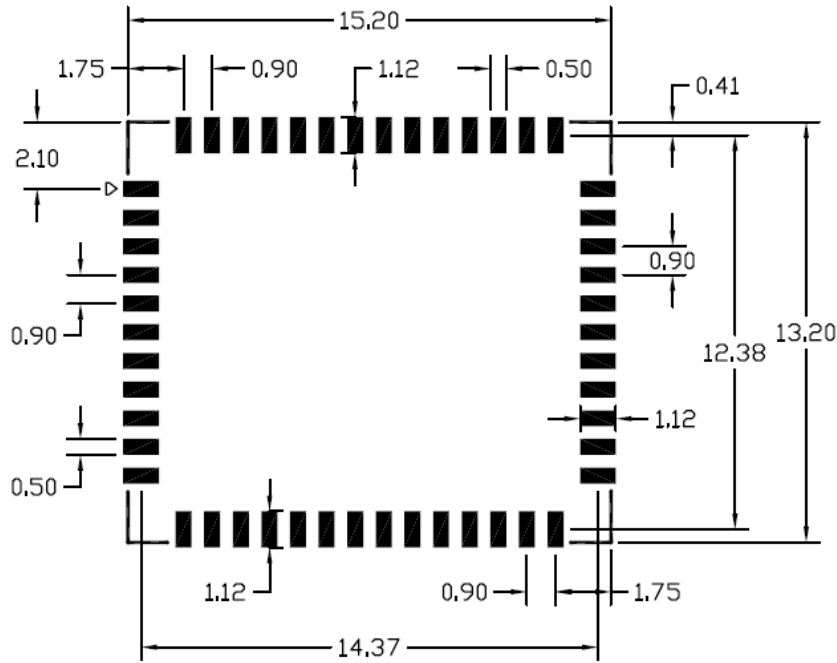
unit : mm

- 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).
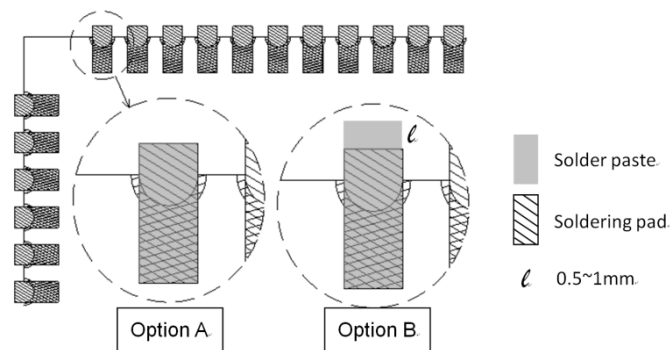
7. External clock reference

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	Ω
	<5	pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7Vio - Vio	V

8. Host Interface Timing Diagram

8.1 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

32.678 kHz Sleep Clock

VBAT*

VDDIO

WL_REG_ON

BT_REG_ON

Notes:
1. VBAT should not rise faster than 40 microseconds or slower than 100 milliseconds.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should *not* be present first or be held high before VBAT is high.

WLAN=OFF, Bluetooth=OFF

32.678 kHz Sleep Clock

VBAT*   90% of VH

VDDIO

                ~ 2 Sleep cycles

WL_REG_ON

BT_REG_ON

Notes:
1. VBAT should not rise faster than 40 microseconds or slower than 100 milliseconds.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should *not* be present first or be held high before VBAT is high.

WLAN=ON, Bluetooth=OFF

32.678 kHz Sleep Clock

VBAT*   90% of VH

VDDIO

                ~ 2 Sleep cycles

WL_REG_ON

BT_REG_ON

Notes:
1. VBAT should not rise faster than 40 microseconds or slower than 100 milliseconds.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should *not* be present first or be held high before VBAT is high.

WLAN=OFF, Bluetooth=ON

8.2 SDIO Interface 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). 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

8.3 SDIO Default Mode Timing Diagram
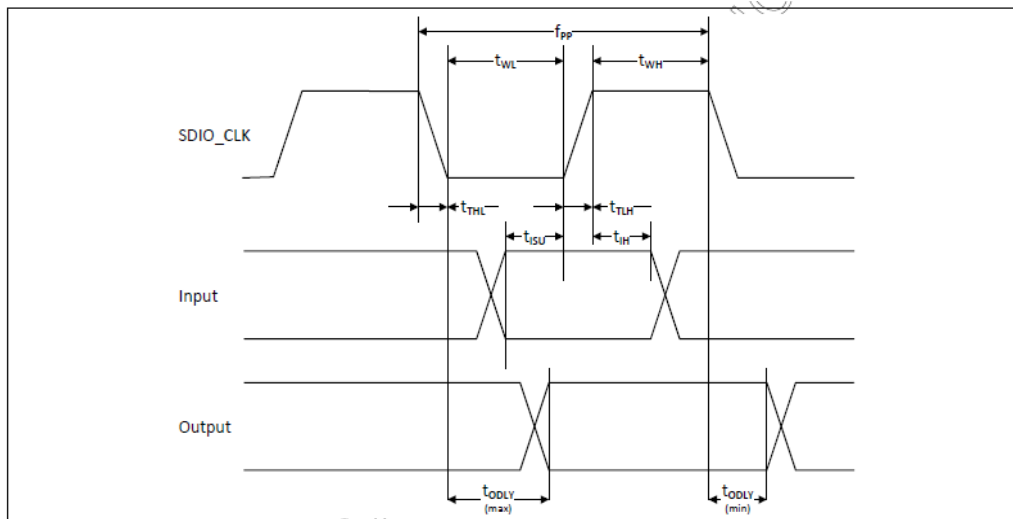
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer mode	fPP	0	–	25	MHz
Frequency – Identification mode	fOD	0	–	400	kHz
Clock low time	tWL	10	–	–	ns
Clock high time	tWH	10	–	–	ns
Clock rise time	tTLH	–	–	10	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.

8.4   SDIO High Speed Mode Timing Diagram
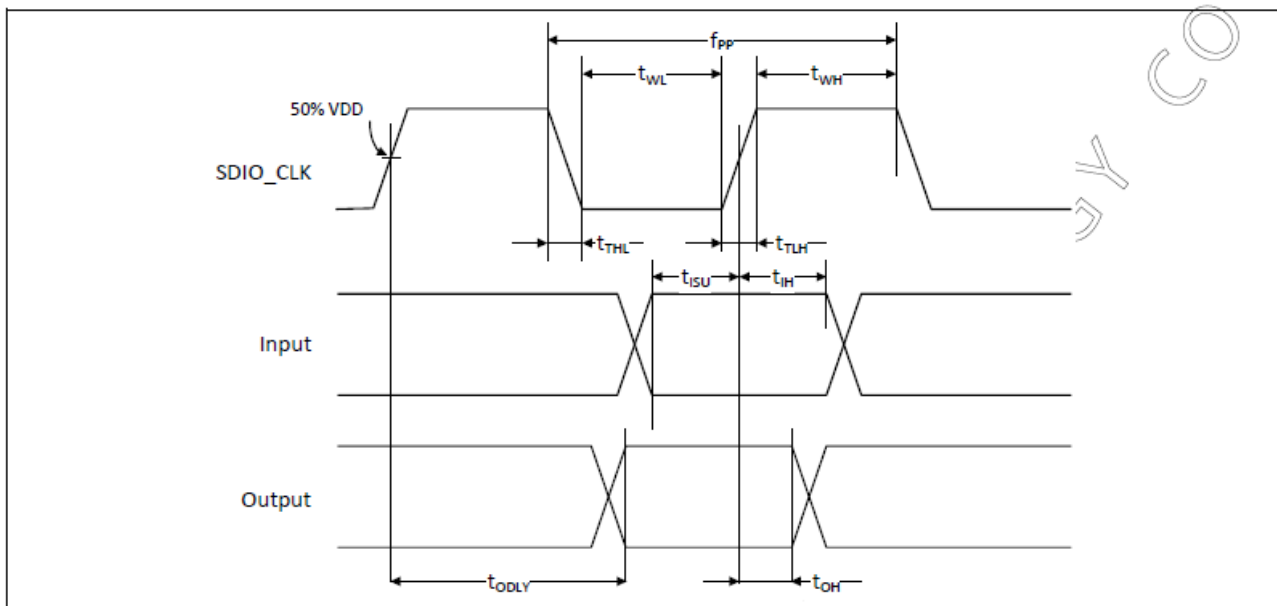
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (all values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer Mode	fPP	0	–	50	MHz
Frequency – Identification Mode	fOD	0	–	400	kHz
Clock low time	tWL	7	–	–	ns
Clock high time	tWH	7	–	–	ns
Clock rise time	tTLH	–	–	3	ns
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.

8.5 SDIO Bus Timing Specifications in SDR Modes

Clock timing(SDR Modes)
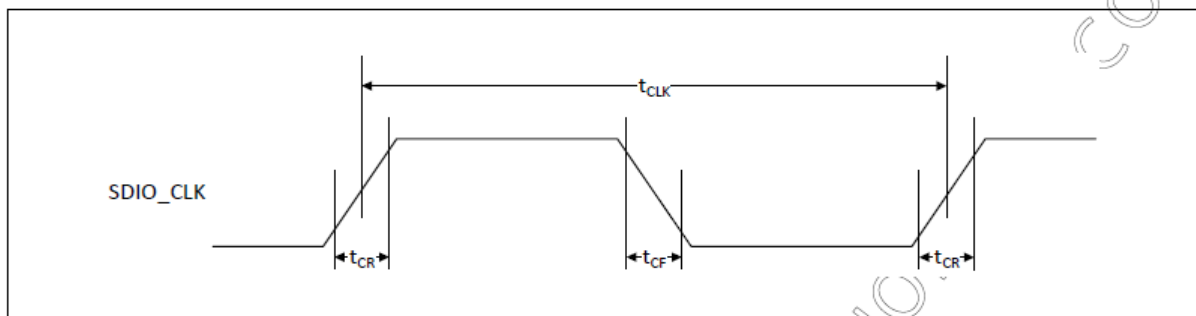
Parameter	Symbol	Minimum	Maximum	Unit	Comments
–	t$_{CLK}$	40	–	ns	SDR12 mode
		20	–	ns	SDR25 mode
		10	–	ns	SDR50 mode
		4.8	–	ns	SDR104 mode
–	t$_{CR}$, t$_{CF}$	–	0.2 × t$_{CLK}$	ns	t$_{CR}$, t$_{CF}$ < 2.00 ns (max) @100 MHz, C$_{CARD}$ = 10 pF t$_{CR}$, t$_{CF}$ < 0.96 ns (max) @208 MHz, C$_{CARD}$ = 10 pF
Clock duty	–	30	70	%	–

SDIO Bus Input timing (SDR Modes)
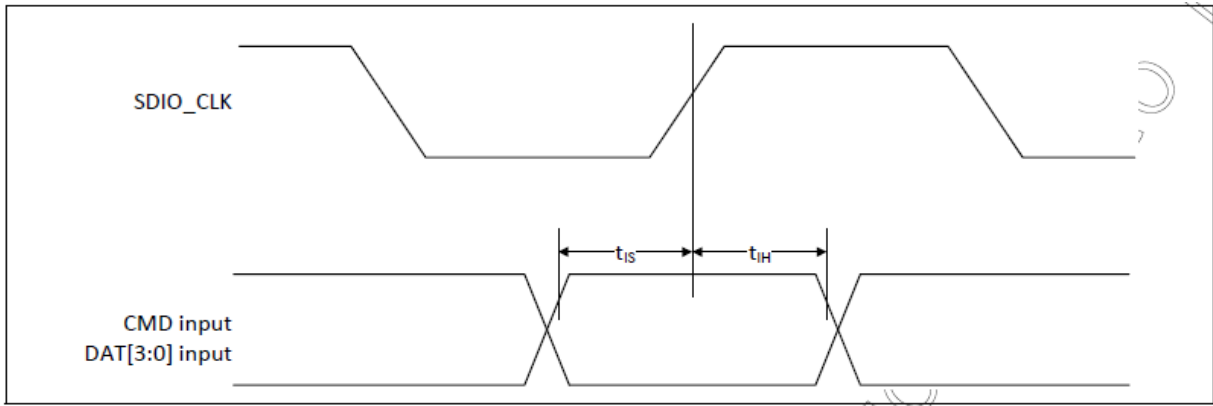
Symbol	Minimum	Maximum	Unit	Comments
SDR104 Mode				
t_{IS}	1.4	–	ns	C_{CARD} = 10 pF, VCT = 0.975V
t_{IH}	0.80	–	ns	C_{CARD} = 5 pF, VCT = 0.975V
SDR50 Mode				
t_{IS}	3.00	–	ns	C_{CARD} = 10 pF, VCT = 0.975V
t_{IH}	0.80	–	ns	C_{CARD} = 5 pF, VCT = 0.975V

SDIO Bus output timing (SDR Modes up to 100MHz)
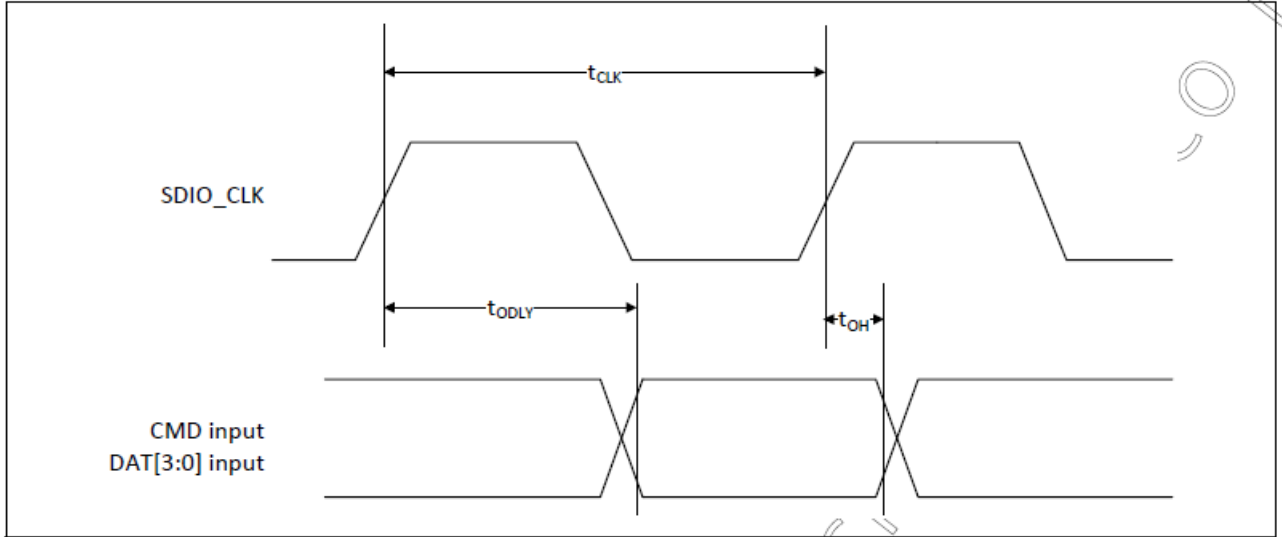
Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	–	7.5	ns	t_{CLK} ≥ 10 ns C_L = 30 pF using driver type B for SDR50
t_{ODLY}	–	14.0	ns	t_{CLK} ≥ 20 ns C_L = 40 pF using for SDR12, SDR25
t_{OH}	1.5	–	ns	Hold time at the t_{ODLY} (min) C_L = 15 pF

Card output timing (SDR Modes 100MHz to 208MHz)
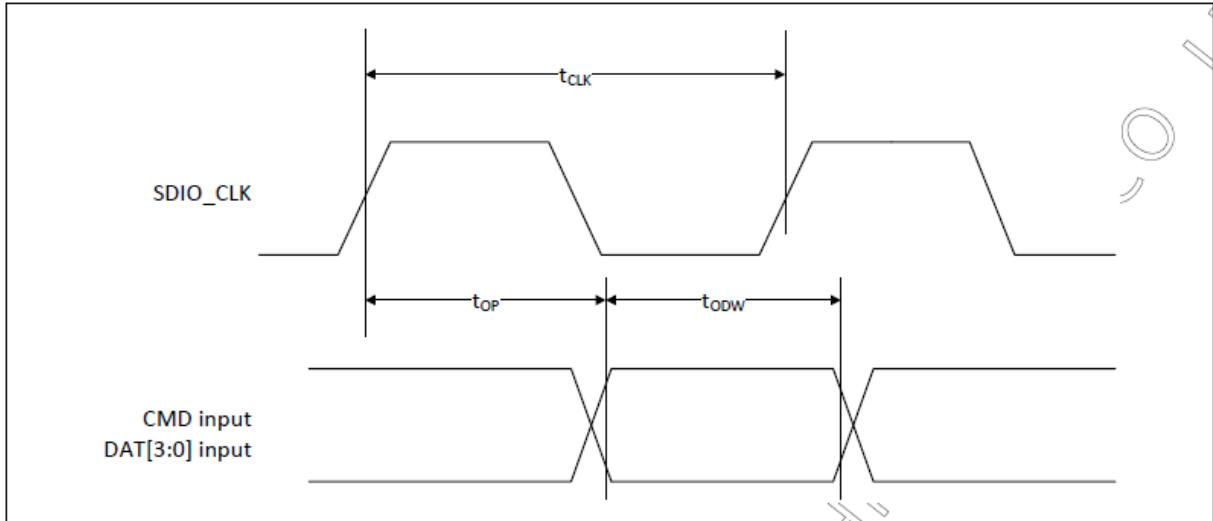
Symbol	Minimum	Maximum	Unit	Comments
t_{OP}	0	2	UI	Card output phase
Δt_{OP}	−350	+1550	ps	Delay variation due to temp change after tuning
t_{ODW}	0.60	−	UI	t_{ODW}=2.88 ns @ 208 MHz

- 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

Δt_{OP} Consideration for Variable Data Window (SDR 104 Mode)
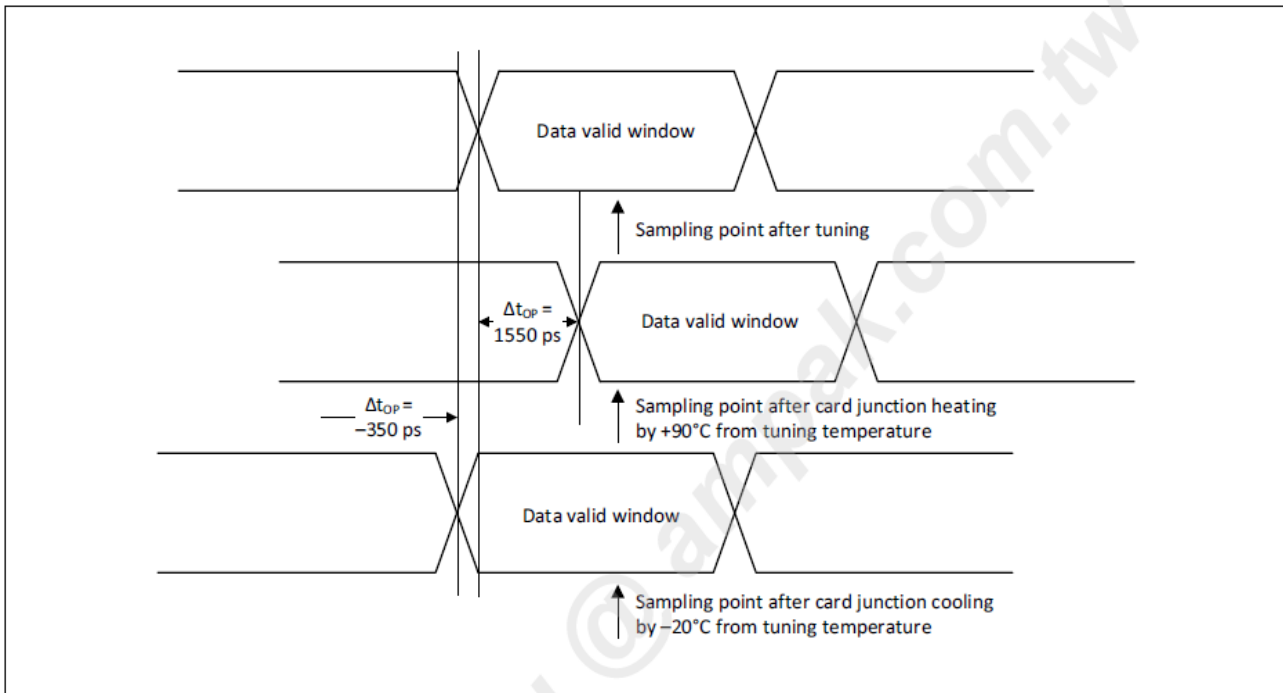
8.6 SDIO Bus Timing Specifications in DDR50 Mode
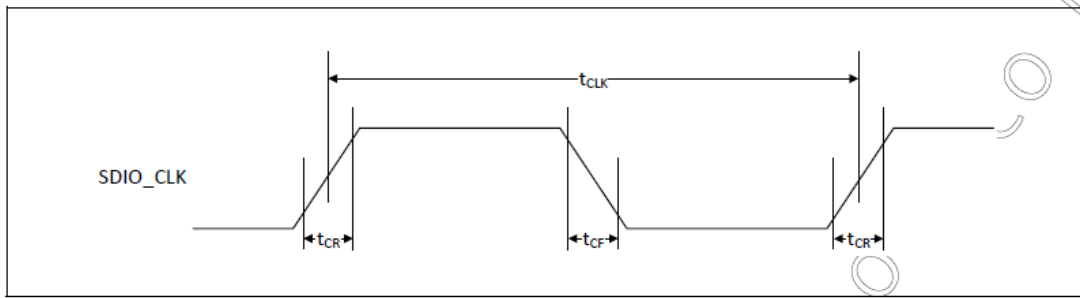
Parameter	Symbol	Minimum	Maximum	Unit	Comments
–	t_{CLK}	20	–	ns	DDR50 mode
–	t_{CR}, t_{CF}	–	$0.2 \times tCLK$	ns	$t_{CR}, t_{CF} < 4.00$ ns (max) @50 MHz, $C_{CARD} = 10$ pF
Clock duty	–	45	55	%	–

Data Timing
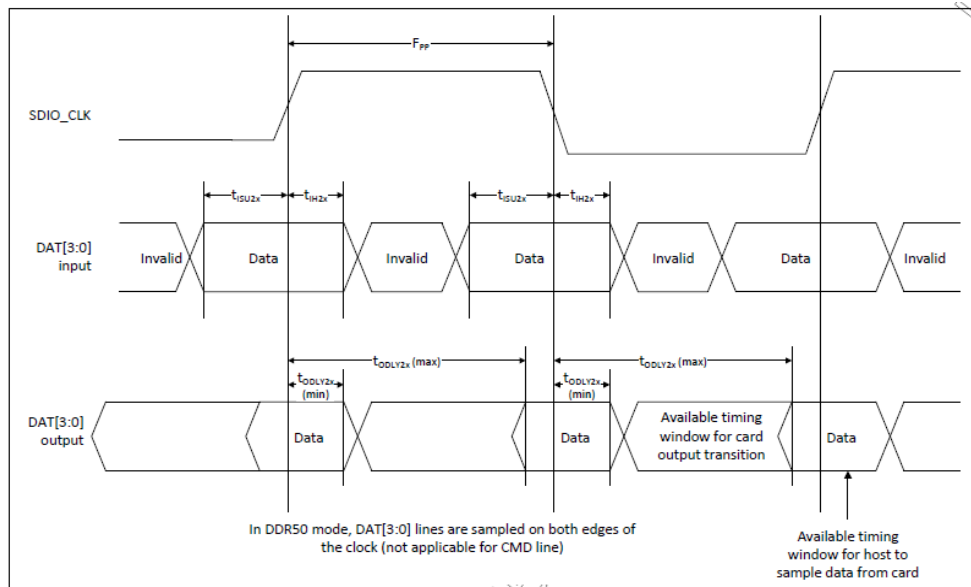
Parameter	Symbol	Minimum	Maximum	Unit	Comments
Input CMD					
Input setup time	t_{ISU}	6	–	ns	$C_{CARD} < 10$ pF (1 Card)
Input hold time	t_{IH}	0.8	–	ns	$C_{CARD} < 10$ pF (1 Card)
Output CMD					
Output delay time	t_{ODLY}	–	13.7	ns	$C_{CARD} < 30$ pF (1 Card)
Output hold time	t_{OH}	1.5	–	ns	$C_{CARD} < 15$ pF (1 Card)
Input DAT					
Input setup time	t_{ISU2x}	3	–	ns	$C_{CARD} < 10$ pF (1 Card)
Input hold time	t_{IH2x}	0.8	–	ns	$C_{CARD} < 10$ pF (1 Card)
Output DAT					
Output delay time	t_{ODLY2x}	–	7.5	ns	$C_{CARD} < 25$ pF (1 Card)
Output hold time	t_{ODLY2x}	1.5	–	ns	$C_{CARD} < 15$ pF (1 Card)

9. Recommended Reflow Profile
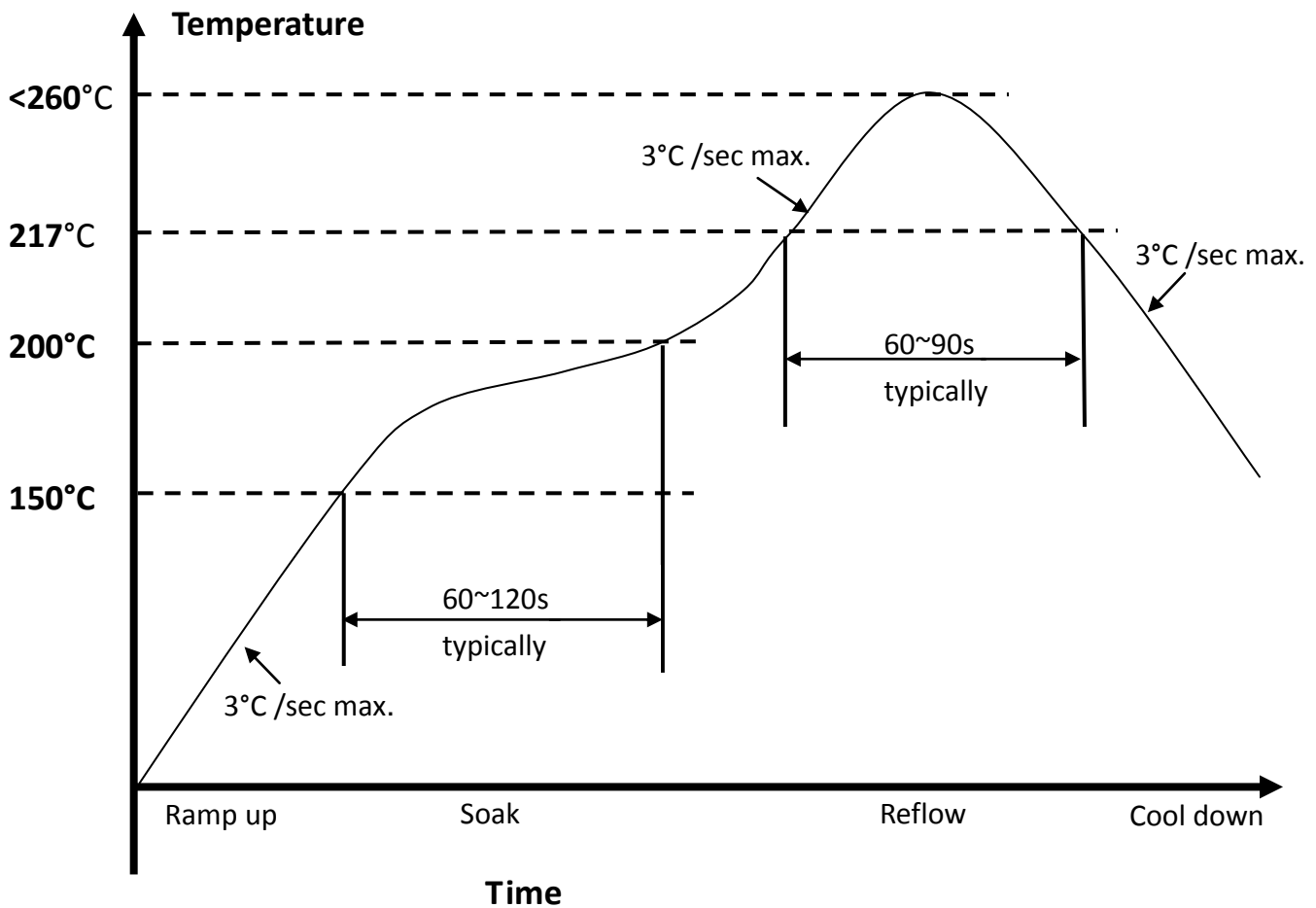
1. Referred to IPC/JEDEC standard

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

10. Package Information

10.1   Label

Label A→ Anti-static and humidity notice
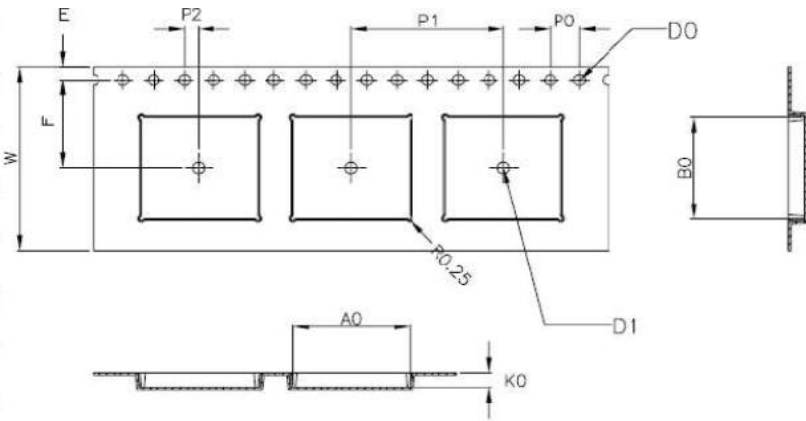

Label B→ MSL caution / Storage Condition
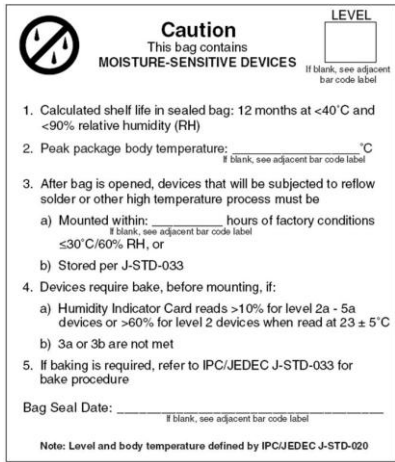
Label C→ Inner box label .

Label D→ Carton box label .

10.2   Dimension
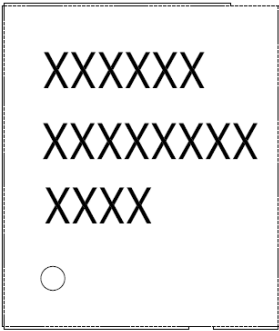
XXXXXX — Part Number
XXXXXXXX — Lot Code
XXXX — Date Code

W	24.00±0.30
A0	15.30±0.10
B0	13.30±0.10
K0	2.00±0.10
E	1.75±0.10
F	11.50±0.10
P0	4.00±0.10
P1	20.00±0.10
P2	2.00±0.10
D0	1.50 +0.10 -0.00
D1	⌀1.50MIN

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 : 1000 pcs

330.0 REF

100.0 REF

.2

Humidity indicator

Desiccant

B

A

C

C

50mm

338mm

355mm

D

360mm

285mm

375mm
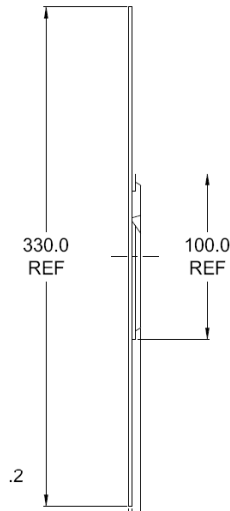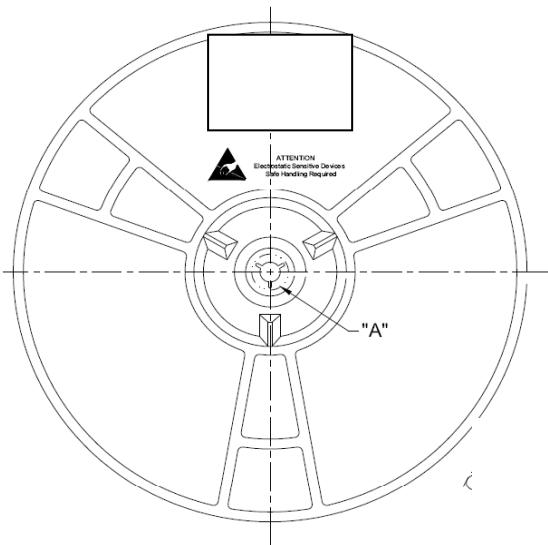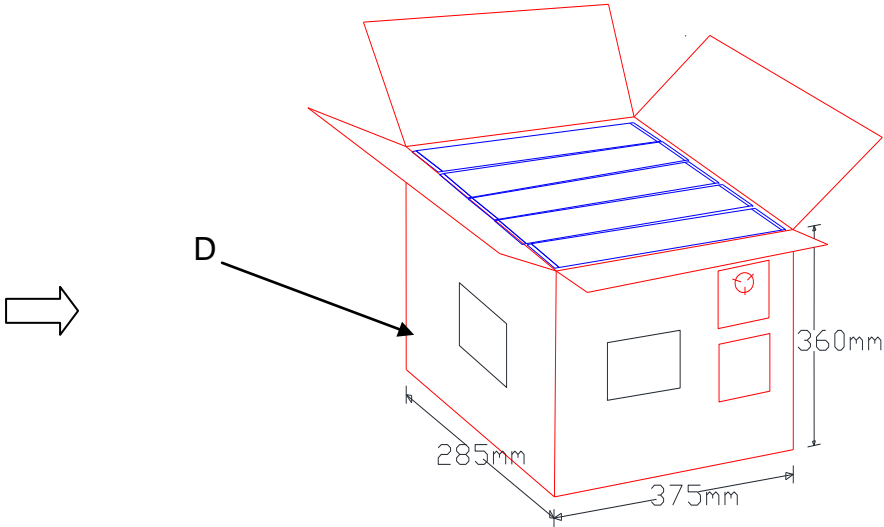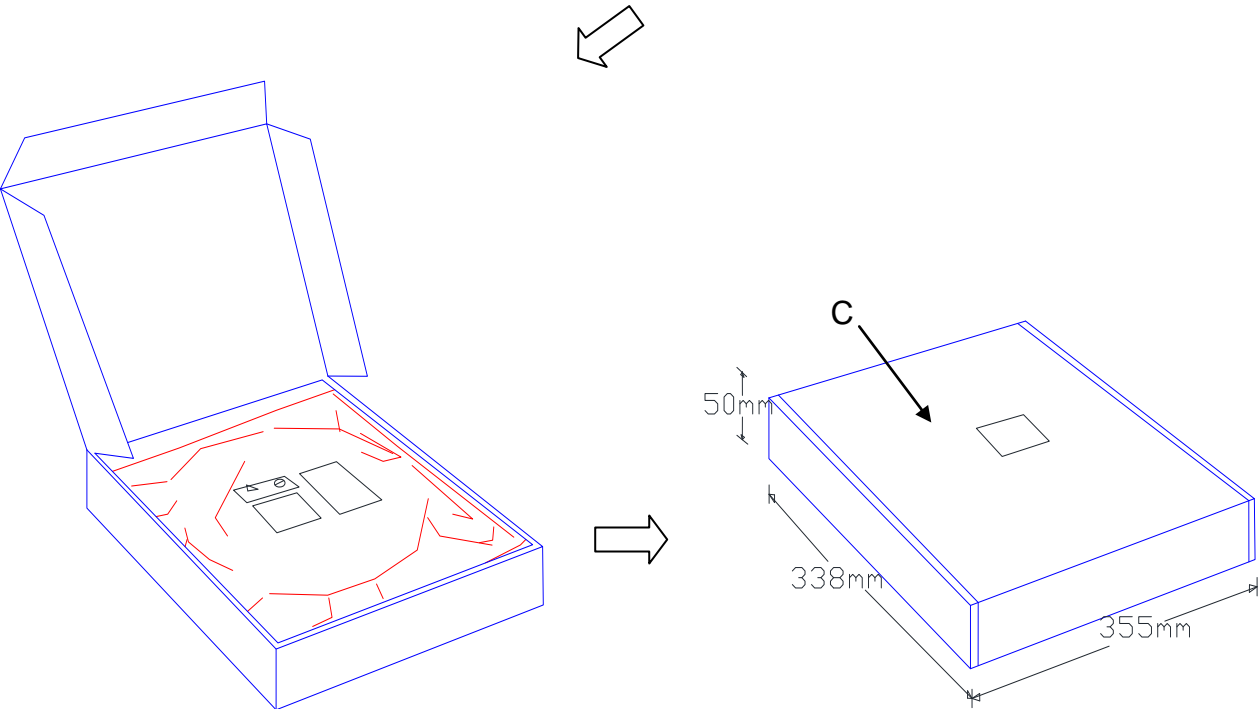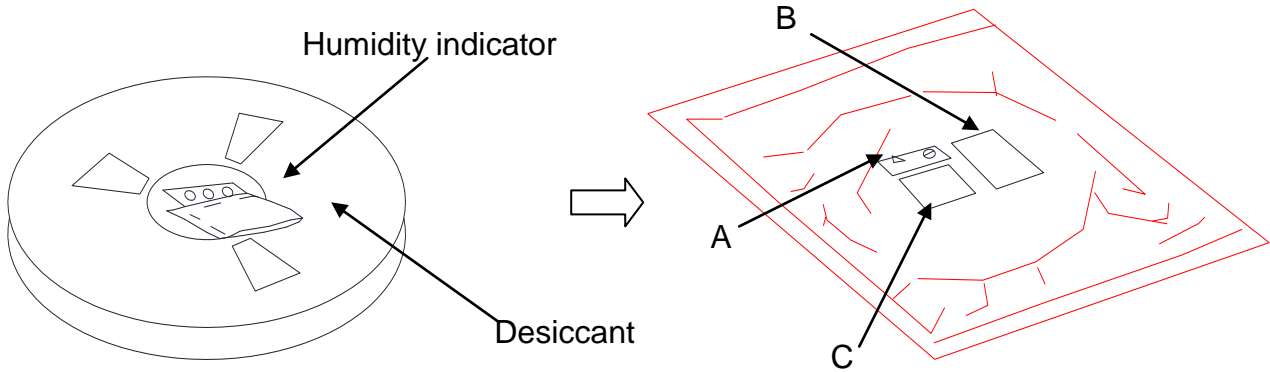
10.3 MSL Level / Storage Condition

⊘ **Caution**
This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL
4
If blank,see adjacent
bar code label

1. Calculated shelf life in sealed bag:12months at<40℃ and
   <90% relative humidity(RH)

2. Peak package body temperature:_____250_____℃
   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:_____72_____ hours of factory conditions
   If blank,see adjacent bar code label

   ≤30℃/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℃

   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