



正基科技股份有限公司

SPECIFICATION

PRODUCT NAME : AP5875SA

REVISION : 0.2

DATE : Apr. 08st , 2024

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		



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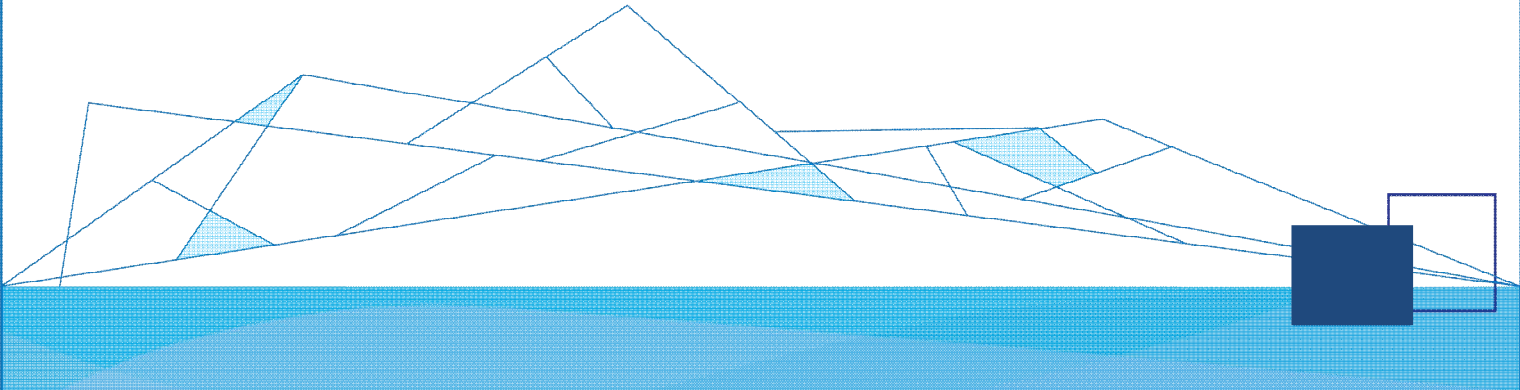


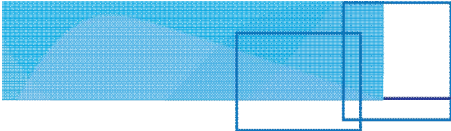
AP5875SA Data Sheet

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Revision

Revision	Date	Description	Revised By
0.1	2024/04/02	-- Preliminary	Gary
0.2	2024/04/08	--Updated RF specification	Gary



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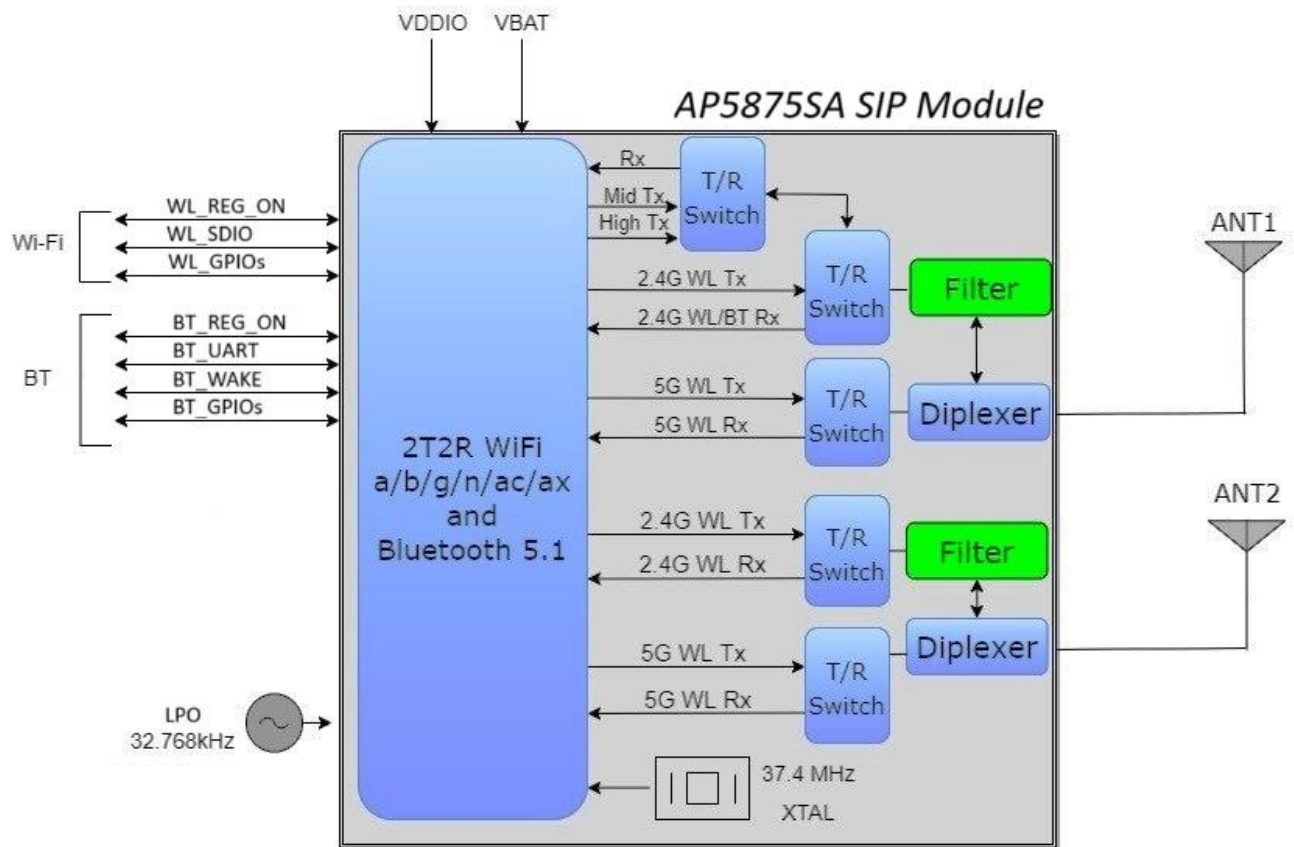
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1. Introduction

1.1 Overview

The AMPAK Technology® AP5875SA 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 802.11ax to connect the wireless LAN. Furthermore AP5875SA included SDIO v3.0 alternative interface for Wi-Fi, UART 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)
- Client MU-MIMO
- Supports standard SDIO v3.0 and compatible with SDIO v2.0 HOST interfaces.

Bluetooth Key Feature

- BT host digital interface:
 - HCI UART (up to 4 Mbps)

2. General Specification

2.1 General Specification

Model Name	AP5875SA
Product Description	2T2R 802.11 a/b/g/n/ac/ax Wi-Fi + BT 5.1 Module
Dimension	L x W : 10 x 10 (typical) mm , H : 0.98 (Maximum) mm
WiFi Interface	Support SDIO V3.0/2.0
BT Interface	UART
Operating temperature	-30°C to 85°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 80% 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	3	4.8	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	1.62	1.98	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	3.6	4.8	V
VDDIO	1.68	1.8	1.98	V

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

The module requires two power supplies: other Digital I/O Pins.

For VDDIO=1.8V	Min.	Max.	Unit
Input high voltage	$0.65 \times \text{VDDIO}$	NA	V
Input low voltage	NA	$0.4 \times \text{VDDIO}$	V
Output high voltage @ 2mA	$\text{VDDIO} - 0.4$	NA	V
Output low voltage @ 2mA	NA	0.4	V

3. Wi-Fi RF Specification

3.1 2.4GHz RF Specification

Conditions : VBAT=3.6V ; 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 /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	
	19	19	19	19	
802.11g	6、9Mbps	12、18Mbps	24Mbps	36Mbps	48Mbps
	19	19	18	18	17
	54Mbps				
	17				
802.11n 20MHz	MCS0~2	MCS3	MCS4	MCS5	MCS6
	19	19	18	17	16
	MCS7				
	16				
802.11ax 20MHz	HE0~2	HE3	HE4	HE5	HE6
	19	19	18	17	16
	HE7	HE8	HE9		
	16	15	14		

802.11ax_20MHz SISO_OFDMA	Dara rate		Tones	Spec.(dBm)	Dara rate		Tones	Spec.(dBm)
	HE0		26	19	HE6		26	16
			52	19			52	16
			106	19			106	16
			242	19			242	16
	HE1~2		26	19	HE7		26	16
			52	19			52	16
			106	19			106	16

	HE3	242	19	HE8	242	16
		26	19		26	15
		52	19		52	15
		106	19		106	15
		242	19		242	15

802.11ax_20MHz SISO_OFDMA	HE4	26	18	HE9	26	14
		52	18		52	14
		106	18		106	14
		242	18		242	14
	HE5	26	17			
		52	17			
		106	17			
		242	17			

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 $\leq 8\%$ 、OFDM modulation PER $\leq 10\%$				
802.11b	Data Rate	Spec.(dBm)		
	1Mbps	-97		
	2Mbps	-92		
	5.5Mbps	-90		
	11Mbps	-88		
802.11g SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-92	24Mbps	-84
	9Mbps	-91	36Mbps	-81
	12Mbps	-90	48Mbps	-77
	18Mbps	-87	54Mbps	-75
802.11g MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-94	24Mbps	-86
	9Mbps	-93	36Mbps	-83
	12Mbps	-92	48Mbps	-79
	18Mbps	-89	54Mbps	-77
802.11n_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-92	MCS4	-80.5
	MCS1	-88	MCS5	-78
	MCS2	-86	MCS6	-75
	MCS3	-83	MCS7	-75

802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-92	MCS5	-79
	MCS1	-91	MCS6	-77
	MCS2	-89	MCS7	-75
	MCS3	-86	MCS8	-91.5
	MCS4	-82	MCS15	-74
802.11ax_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-92	HE6	-76
	HE1	-89	HE7	-76
	HE2	-87	HE8	-72
	HE3	-84	HE9	-70
	HE4	-81.5		
	HE5	-79		
802.11ax_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-92	HE6	-75
	HE1	-88	HE7	-75
	HE2	-86	HE8	-71
	HE3	-83	HE9	-69
	HE4	-81		
	HE5	-78		
Maximum Input Level	802.11b : -10 dBm			
	802.11g/n/ax : -20 dBm			

3.2 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					
802.11a	Frequency (MHz)	6~9Mbps	12~18Mbps	24Mbps	36Mbps
	5150~5350	18	16.5	16.5	16.5
	5470~5720	16.5	16.5	16.5	16.5
	5725~5845	16.5	16.5	16.5	16.5
	Frequency (MHz)	48Mbps	54Mbps		
	5150~5350	16.5	16		
	5470~5720	16.5	16		
	5725~5845	16.5	16		
802.11n 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	16.5	16.5	16.5
	5470~5720	16.5	16.5	16.5	16.5
	5725~5845	16.5	16.5	16.5	16.5
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	16	15		
	5470~5720	16	15		
	5725~5845	16	15		

802.11n 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	17	16	16
	5470~5720	17	17	16	16
	5725~5845	17	17	16	16
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	15	14		
	5470~5720	15	14		
	5725~5845	15	14		
802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	16	16	16
	5470~5720	16	16	16	16
	5725~5845	16	16	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5150~5350	16	15	13	
	5470~5720	16	15	13	
	5725~5845	16	15	13	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	17	16	16
	5470~5720	17	17	16	16
	5725~5845	17	17	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	15	14	14	14
	5470~5720	15	14	14	14
	5725~5845	15	14	14	14
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	17	16	16
	5470~5720	17	17	16	16
	5725~5845	17	17	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	15.5	14.5	12.5	12
	5470~5720	15.5	14.5	12.5	12
	5725~5845	15.5	14.5	12.5	12
802.11ax 20MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	17	17	16.5	16.5
	5470~5720	17	17	16.5	16.5
	5725~5845	17	17	16.5	16.5

802.11ax 20MHz	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	16	15	13	13
	5470~5720	16	15	13	13
	5725~5845	16	15	13	13
	Frequency (MHz)	HE10	HE11		
	5150~5350	10	10		
	5470~5720	10	10		
	5725~5845	10	10		
802.11ax 40MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	17	17	16	16
	5470~5720	17	17	16	16
	5725~5845	17	17	16	16
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	15	14	13	12
	5470~5720	15	14	13	12
	5725~5845	15	14	13	12
	Frequency (MHz)	HE10	HE11		
	5150~5350	10	10		
	5470~5720	10	10		
	5725~5845	10	10		
802.11ax 80MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	17	17	16	16
	5470~5720	17	17	16	16
	5725~5845	17	17	16	16
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	15	14	13	12
	5470~5720	15	14	13	12
	5725~5845	15	14	13	12
	Frequency (MHz)	HE10	HE11		
	5150~5350	9	9		
	5470~5720	9	9		
	5725~5845	9	9		

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

802.11ax_20MHz SISO_OFDMA	Dara rate	Tones	Frequency	Spec.(dBm)
	HE0	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
	HE1~2	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
	HE3~4	26	5150~5350	16.5
			5470~5720	16.5
			5725~5845	16.5
		52	5150~5350	16.5
			5470~5720	16.5
			5725~5845	16.5
		106	5150~5350	16.5
			5470~5720	16.5
			5725~5845	16.5
		242	5150~5350	16.5
			5470~5720	16.5
			5725~5845	16.5

	HE5~7	26	5150~5350	15
			5470~5720	15
			5725~5845	15
		52	5150~5350	15
			5470~5720	15
			5725~5845	15
		106	5150~5350	15
			5470~5720	15
			5725~5845	15
		242	5150~5350	15
			5470~5720	15
			5725~5845	15
	HE8~9	26	5150~5350	12
			5470~5720	12
			5725~5845	12
		52	5150~5350	12
			5470~5720	12
			5725~5845	12
		106	5150~5350	12
			5470~5720	12
			5725~5845	12
		242	5150~5350	12
			5470~5720	12
			5725~5845	12
	HE10~11	242	5150~5350	10
			5470~5720	10
			5725~5845	10

802.11ax_40MHz SISO_OFDMA	Dara rate	Tones	Frequency	Spec.(dBm)
	HE0	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
		484	5150~5350	17
			5470~5720	17
			5725~5845	17
	HE1~2	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
		484	5150~5350	17
			5470~5720	17
			5725~5845	17

	HE3~4	26	5150~5350	16
			5470~5720	16
			5725~5845	16
		52	5150~5350	16
			5470~5720	16
			5725~5845	16
		106	5150~5350	16
			5470~5720	16
			5725~5845	16
		242	5150~5350	16
			5470~5720	16
			5725~5845	16
		484	5150~5350	16
			5470~5720	16
			5725~5845	16
	HE5~7	26	5150~5350	14
			5470~5720	14
			5725~5845	14
		52	5150~5350	14
			5470~5720	14
			5725~5845	14
		106	5150~5350	14
			5470~5720	14
			5725~5845	14
		242	5150~5350	14
			5470~5720	14
			5725~5845	14
		484	5150~5350	14
			5470~5720	14
			5725~5845	14
	HE8~9	26	5150~5350	13
			5470~5720	13
			5725~5845	13
		52	5150~5350	13
			5470~5720	13
			5725~5845	13
		106	5150~5350	13

			5470~5720	13
			5725~5845	13
		242	5150~5350	13
			5470~5720	13
			5725~5845	13
		484	5150~5350	13
			5470~5720	13
			5725~5845	13
	HE10~11	242	5150~5350	10
			5470~5720	10
			5725~5845	10
		484	5150~5350	10
			5470~5720	10
			5725~5845	10

	Dara rate	Tones	Frequency	Spec.(dBm)
802.11ax_80MHz SISO_OFDMA	HE0	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
		484	5150~5350	17
			5470~5720	17
			5725~5845	17
		996	5150~5350	17
			5470~5720	17
			5725~5845	17
	HE1~2	26	5150~5350	17
			5470~5720	17
			5725~5845	17
		52	5150~5350	17
			5470~5720	17
			5725~5845	17
		106	5150~5350	17
			5470~5720	17
			5725~5845	17
		242	5150~5350	17
			5470~5720	17
			5725~5845	17
		484	5150~5350	17
			5470~5720	17
			5725~5845	17
		996	5150~5350	17
			5470~5720	17
			5725~5845	17

	HE3~4	26	5150~5350	16
			5470~5720	16
			5725~5845	16
		52	5150~5350	16
			5470~5720	16
			5725~5845	16
		106	5150~5350	16
			5470~5720	16
			5725~5845	16
		242	5150~5350	16
			5470~5720	16
			5725~5845	16
		484	5150~5350	16
			5470~5720	16
			5725~5845	16
		996	5150~5350	16
			5470~5720	16
			5725~5845	16
	HE5~7	26	5150~5350	14
			5470~5720	14
			5725~5845	14
		52	5150~5350	14
			5470~5720	14
			5725~5845	14
		106	5150~5350	14
			5470~5720	14
			5725~5845	14
		242	5150~5350	14
			5470~5720	14
			5725~5845	14
		484	5150~5350	14
			5470~5720	14
			5725~5845	14
		996	5150~5350	14
			5470~5720	14
			5725~5845	14

	HE8~9	26	5150~5350	12
			5470~5720	12
			5725~5845	12
		52	5150~5350	12
			5470~5720	12
			5725~5845	12
		106	5150~5350	12
			5470~5720	12
			5725~5845	12
		242	5150~5350	12
			5470~5720	12
			5725~5845	12
		484	5150~5350	12
			5470~5720	12
			5725~5845	12
		996	5150~5350	12
			5470~5720	12
			5725~5845	12
	HE10~11	242	5150~5350	9
			5470~5720	9
			5725~5845	9
		484	5150~5350	9
			5470~5720	9
			5725~5845	9
		996	5150~5350	9
			5470~5720	9
			5725~5845	9

Sensitivity, tolerance ± 1.5 dB				
CCK modulation PER $\leq 8\%$ 、OFDM modulation PER $\leq 10\%$				
802.11a SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-91	24Mbps	-83
	9Mbps	-90	36Mbps	-80
	12Mbps	-88	48Mbps	-75
	18Mbps	-86	54Mbps	-74
802.11a MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-92	24Mbps	-86
	9Mbps	-91	36Mbps	-83
	12Mbps	-90	48Mbps	-78
	18Mbps	-89	54Mbps	-76
802.11n_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS4	-79
	MCS1	-88	MCS5	-76
	MCS2	-86	MCS6	-73
	MCS3	-83	MCS7	-73
802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-92	MCS5	-78
	MCS1	-91	MCS6	-76
	MCS2	-89	MCS7	-75
	MCS3	-86	MCS8	-90
	MCS4	-82	MCS15	-71
802.11n_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS4	-77
	MCS1	-86	MCS5	-72
	MCS2	-83	MCS6	-70
	MCS3	-80	MCS7	-70
802.11n_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-72
	MCS3	-83	MCS8	-87
	MCS4	-79	MCS15	-68

802.11ac_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-70
	MCS3	-83	MCS8	-69
	MCS4	-79		
802.11ac_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	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	-89
	MCS4,NSS=1	-82	MCS8,NSS=2	-67
	MCS5,NSS=1	-77		
802.11ac_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-72
	MCS1	-86	MCS6	-70
	MCS2	-83	MCS7	-69
	MCS3	-80	MCS8	-65
	MCS4	-76	MCS9	-64
802.11ac_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	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	-87
	MCS5,NSS=1	-77	MCS9,NSS=2	-63
802.11ac_80MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-86	MCS5	-68
	MCS1	-82	MCS6	-67
	MCS2	-79	MCS7	-65
	MCS3	-76	MCS8	-62
	MCS4	-73	MCS9	-62

802.11ac_80MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	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	-84
	MCS5,NSS=1	-71	MCS9,NSS=2	-60
802.11ax_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-91	HE6	-73
	HE1	-88	HE7	-70
	HE2	-86	HE8	-68
	HE3	-83	HE9	-64
	HE4	-79	HE10	-59
	HE5	-75	HE11	-60
802.11ax_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-90	HE6	-73
	HE1	-88	HE7	-70
	HE2	-86	HE8	-68
	HE3	-83	HE9	-64
	HE4	-79	HE10	-59
	HE5	-75	HE11	-56
802.11ax_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-89	HE6	-70
	HE1	-86	HE7	-69
	HE2	-83	HE8	-65
	HE3	-80	HE9	-64
	HE4	-76	HE10	-60
	HE5	-72	HE11	-58
802.11ax_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-87	HE6	-70
	HE1	-86	HE7	-69
	HE2	-83	HE8	-65
	HE3	-80	HE9	-64
	HE4	-76	HE10	-60
	HE5	-72	HE11	-55

802.11ax_80MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-86	HE6	-67
	HE1	-82	HE7	-65
	HE2	-79	HE8	-62
	HE3	-76	HE9	-61
	HE4	-73	HE10	-57
	HE5	-68	HE11	-55
802.11ax_80MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-84	HE6	-67
	HE1	-82	HE7	-65
	HE2	-79	HE8	-62
	HE3	-76	HE9	-61
	HE4	-73	HE10	-57
	HE5	-68	HE11	-52
Maximum Input Level	802.11a/n/ac/ax : -30 dBm			

4. Bluetooth Specification

4.1 Bluetooth Specification

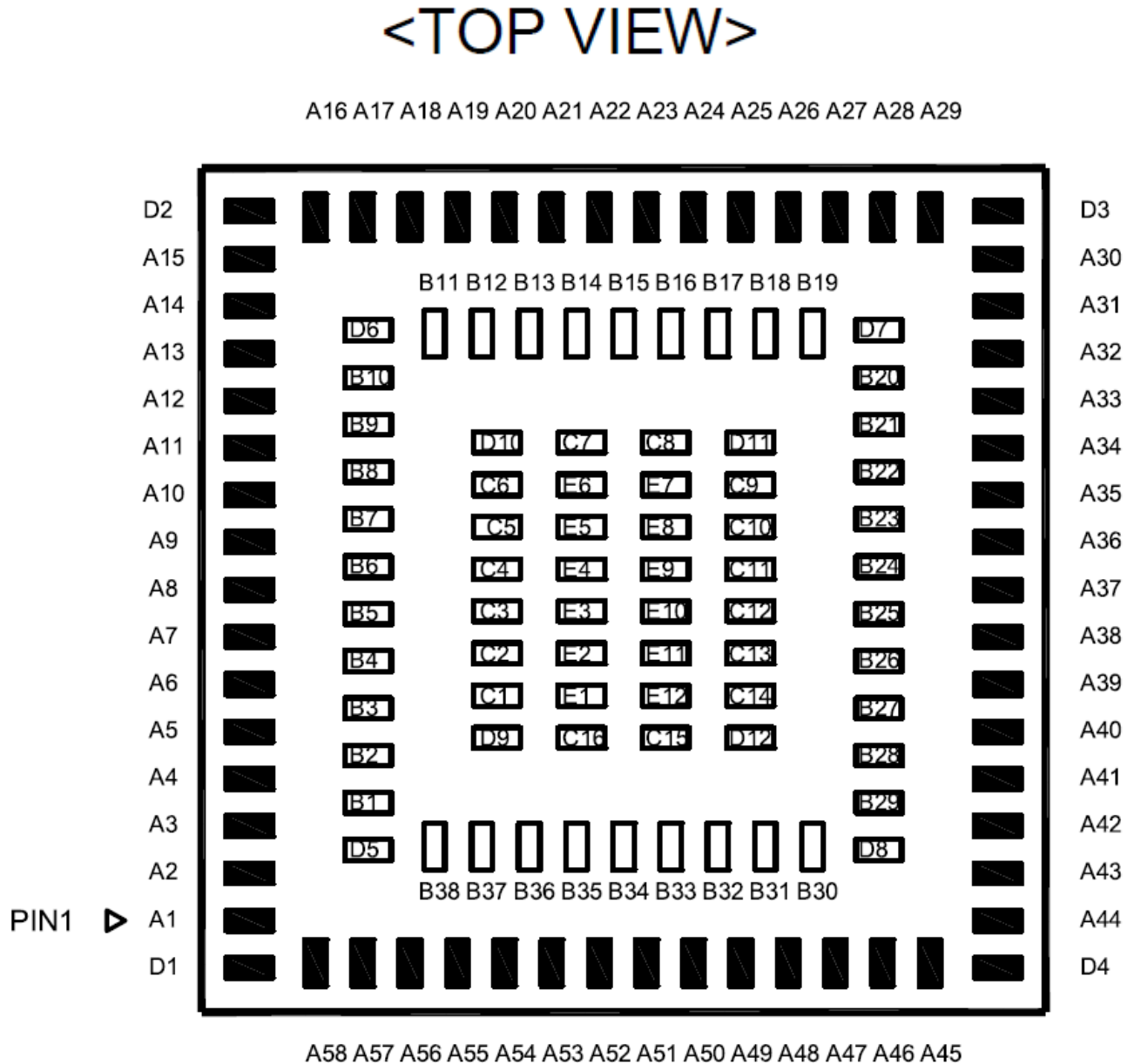
Conditions : VBAT=3.3V ; VDDIO=1.8V ; Temp:25°C

Feature	Description
General Specification	
Bluetooth Standard	BDR 、 EDR(1Mbps & 2Mbps) 、 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	GFSK, $\pi/4$ -DQPSK, 8DPSK
RF Specification	
Output Power , tolerance ± 1.5 dB	
	CL1 (dBm)
BDR Output Power	16
EDR Output Power	10
BLE Output Power	16
Sensitivity, tolerance ± 1.5 dB	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-91 dBm
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-93 dBm
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-87 dBm
Sensitivity @ PER=30.8% for LE (1Mbps)	-94 dBm
Sensitivity @ PER=30.8% for 2LE (2Mbps)	-91dBm
Maximum Input Level	GFSK (1Mbps):-17dBm
	$\pi/4$ -DQPSK (2Mbps) :-17dBm
	8DPSK (3Mbps) :-17dBm

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

5. Pin Definition

5.1 Pin Outline



5.2 Pin Assignment

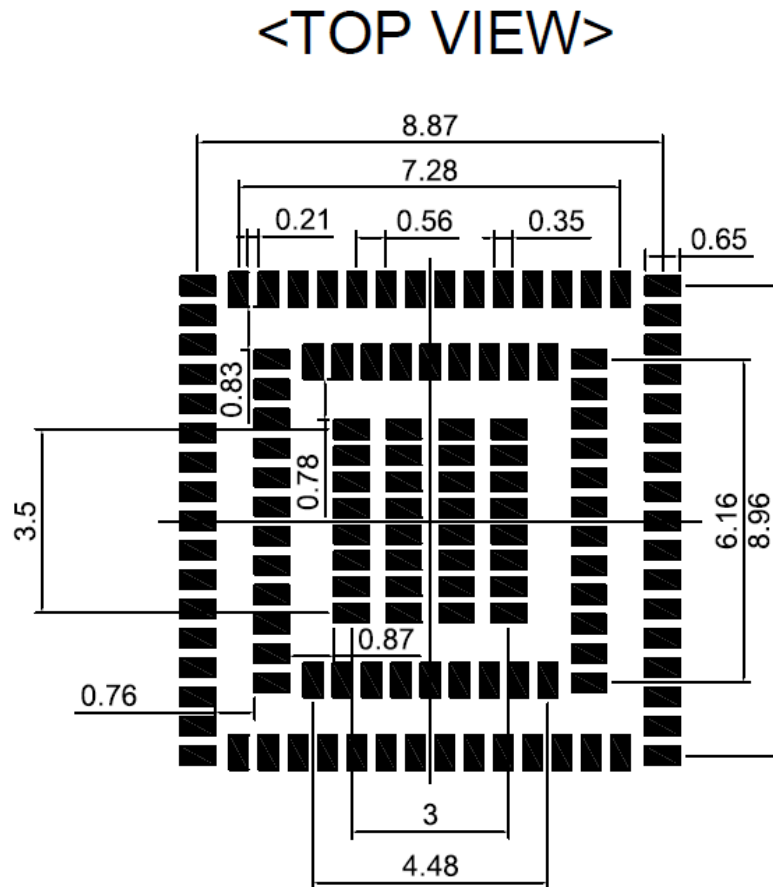
NO	Name	Type	Description
RF Port			
A54	WL_ANT0	I/O	RF I/O port0
A44	WL_ANT1	I/O	RF I/O port1
WLAN PCI Express Interface			
A19	NC	-	NC
A20	NC	-	NC
A21	NC	-	NC
A22	NC	-	NC
A23	NC	-	NC
A24	NC	-	NC
D6	NC	-	NC
B10	NC	-	NC
B9	NC	-	NC
WLAN SDIO Interface			
B12	SDIO_DATA_CMD	I/O	SDIO command line
B13	SDIO_DATA_3	I/O	SDIO data line 3
B14	SDIO_DATA_2	I/O	SDIO data line 2
B15	SDIO_DATA_1	I/O	SDIO data line 1
B16	SDIO_DATA_0	I/O	SDIO data line 0
B18	SDIO_DATA_CLK	I/O	SDIO clock line
Bluetooth UART Interface (level referred by VDDIO)			
A5	BT_UART_TXD	O	Bluetooth UART interface
A6	BT_UART_CTS_N	I	Bluetooth UART interface
A7	BT_UART_RTS_N	O	Bluetooth UART interface
A8	BT_UART_RXD	I	Bluetooth UART interface
Bluetooth PCM Interface (lever referred by VDDIO)			
A1	NC	-	NC
A2	NC	-	NC
A3	NC	-	NC
A4	NC	-	NC
Bluetooth PCM Interface (lever referred by VDDIO)			
A9	NC	-	NC
A10	NC	-	NC
A11	NC	-	NC

A12	NC	-	NC
Reference Clock			
C10	LPO	I	External Low Power Clock input (32.768KHz)
GPIO and Control Signal (level referred by VDDIO)			
B21	WL_HOST_WAKE	O	WLAN to wake-up HOST and WL_GPIO_0
B20	WL_DEV_WAKE	I/O	This pin can be programmed by software to be a GPIO or a WLAN_DEV_WAKE output indicating that host wake-up should be performed.
B8	DAP_SEL	I/O	This pin can be programmed to be a GPIO, the DAP_SEL signal, UART_DBG_TX or the GCI external coexistence interface. Debug access port select (DAP_SEL) 0 : Not selected 1 : Selected
B24	LTECOEX_UART_TX/ WL_UART_TX	I/O	This pin can be programmed to be a GPIO, SPI_DATA_OUT signal, UART_TX or the GCI external coexistence interface.
B25	SH_WLAN_WAKE/ WL_UART_RX	I/O	This pin can be programmed to be a GPIO, SPI_DATA_IN signal, UART_RX or the GCI external coexistence interface.
B26	DBG_UART_TX/ WL_UART_RTS	I/O	This pin can be programmed to be a GPIO, SPI_DATA_CLK signal, UART_RTS or the GCI external coexistence interface.
B27	DBG_UART_RX/ WL_UART_CTS	I/O	This pin can be programmed to be a GPIO, SPI_DATA_CS signal, UART_CTS or the GCI external coexistence interface.
A56	WL_GPIO_14	I/O	This pin can be programmed to be a GPIO, or the GCI external coexistence interface.
A57	WL_GPIO_13	I/O	This pin can be programmed to be a GPIO, DBG_UART_TX or the GCI external coexistence interface.
A58	WL_GPIO_12	I/O	This pin can be programmed to be a GPIO, DBG_UART_RX or the GCI external coexistence interface.
B7	GPIO15_SDIO_PCIE_SEL	I/O	This pin can be programmed to be a GPIO, DBG_UART_RX or the GCI external coexistence interface.
D5	BT_GPIO_2	I/O	Bluetooth general-purpose I/O
B1	BT_GPIO_3	I/O	Bluetooth general-purpose I/O
B2	GPIR_TX	I/O	Bluetooth general-purpose I/O or can be programmed to be Bluetooth IR transmit
B3	GPIR_RX	I/O	Bluetooth general-purpose I/O or can be programmed to be Bluetooth IR transmit
B5	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST
B6	BT_DEV_WAKE	I	HOST wake-up Bluetooth device
B22	BT_REG_ON	I	Low asserting reset for Bluetooth core

B23	WL_REG_ON	I	Low asserting reset for WiFi core
JTAG Interface			
A13	WL_JTAG_TRST	I/O	This pin can be programmed to be a GPIO, the JTAG TRST signal, DBG_UART_RX or the GCI external coexistence interface.
A14	SH_UART_TX/WL_JTAG_TMS	I/O	This pin can be programmed to be a GPIO, the JTAG TMS signal, UART_TX or the GCI external coexistence interface.
A15	SH_WAKE/WL_JTAG_TDO		This pin can be programmed to be a GPIO, the JTAG TDO signal, UART_TRTS or the GCI external coexistence interface.
A16	SH_UART_RX/WL_JTAG_TCK		This pin can be programmed to be a GPIO, the JTAG TCK signal, UART_RX or the GCI external coexistence interface.
A17	LTECOEX_UART_RX/ WL_JTAG_TDI		This pin can be programmed to be a GPIO, the JTAG TDI signal, UART_CTS or the GCI external coexistence interface.
C12	JTAG_SEL	I/O	JTAG select. This pin must be connected to ground if the JTAG interface is not used.
Power Supplies			
A33	VBAT	P	Main power voltage source input
A34			
A39	VDDIO	P	I/O Voltage supply input
A40			
A29	CSR_VLX	O	Internal Buck voltage generation pin
A27	CBUCK_OP9	I	Internal Buck voltage generation pin
A30	ASR_VLX	O	Internal Analog Buck voltage generation pin
A31			
A36	ABUCK_1P12	I	Internal Analog Buck voltage generation pin
A37			
Ground			
A18	GND	-	Ground
A25		-	
A26		-	
A28		-	
A32		-	
A35		-	
A38		-	

A41-A43	GND	-	Ground
A45-A53		-	
A55		-	
B4		-	
B11		-	
B17		-	
B19		-	
B28-B38		-	
C1-C9		-	
C11		-	
C13-C14		-	
D1-D4		-	
D7-D12		-	
E1-E12		-	

6.2 Recommended footprint



- 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	+/-25	ppm
Duty cycle	30 - 70	%
Input signal amplitude	1.8±0.09	V
Signal type	Square-wave or sine-wave	-
Input impedance	>100k	Ω
	<5	pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7V _{io} - V _{io}	V

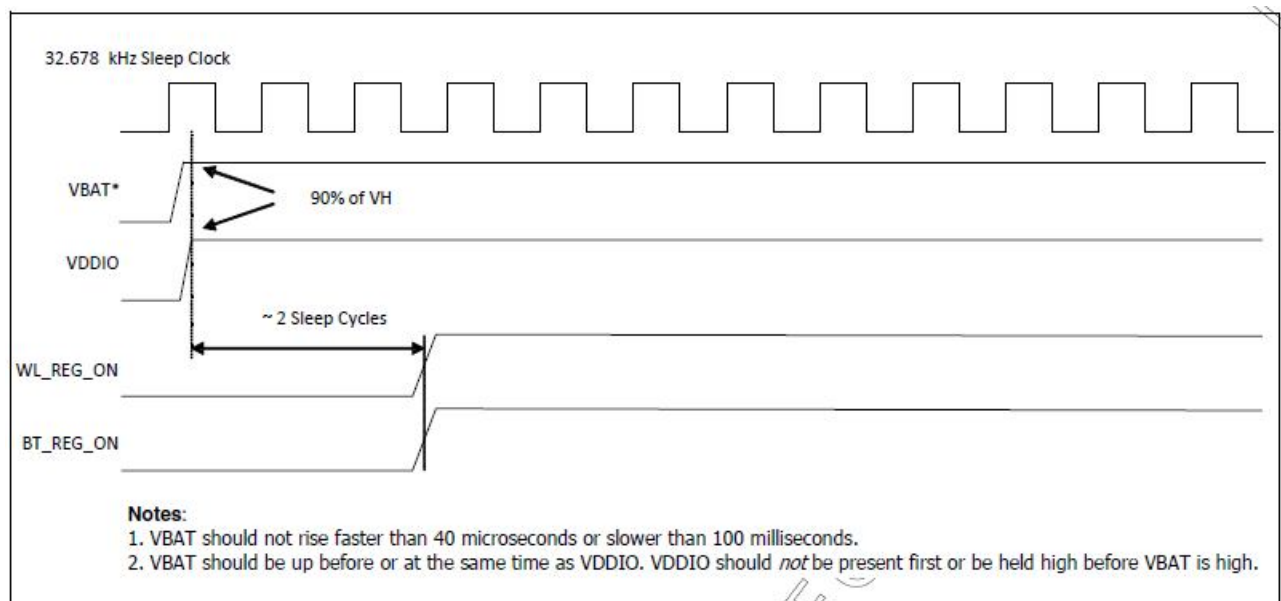
8. Host Interface Timing Diagram

8.1 Power-up Sequence Timing Diagram

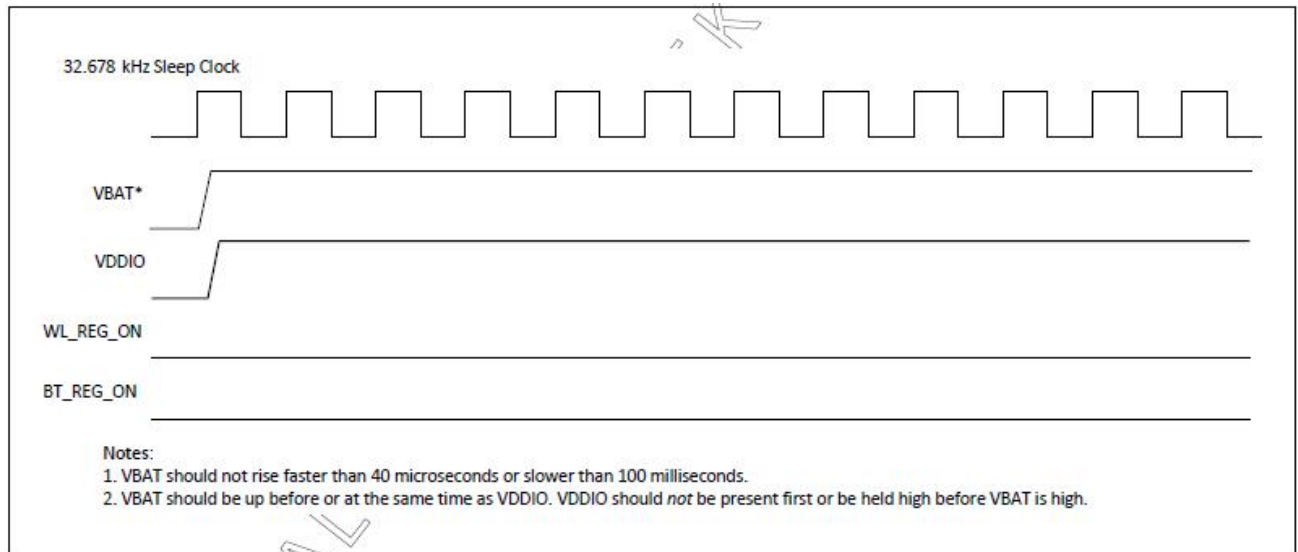
The module has signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN and internal regulator blocks. These signals are described below.

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

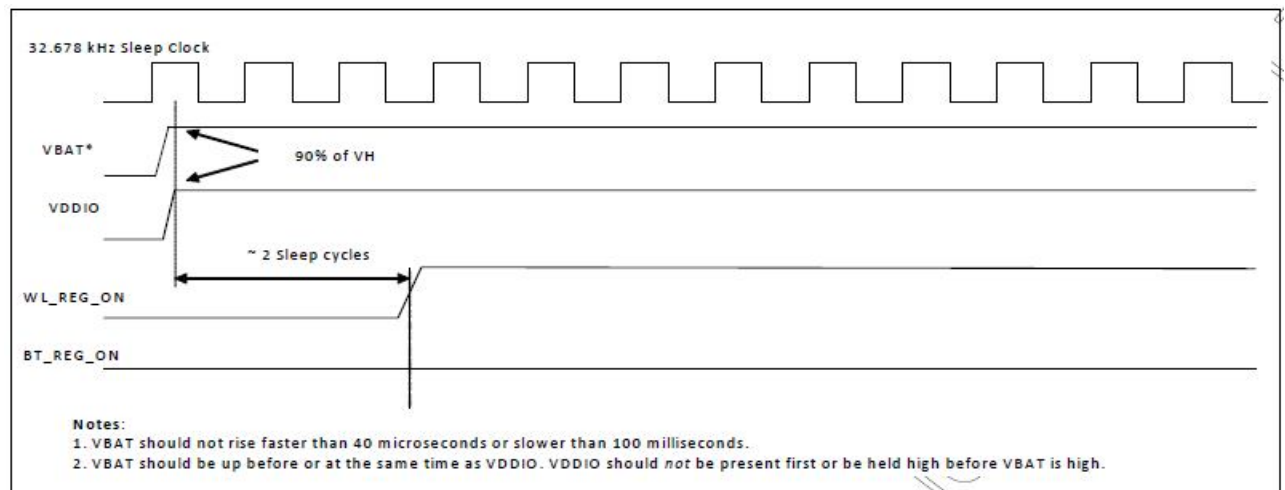
- WL_REG_ON: Used by the PMU to power up or power down the internal regulators used by the WLAN section. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset.
- BT_REG_ON: Used by the PMU to power up or power down the 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).



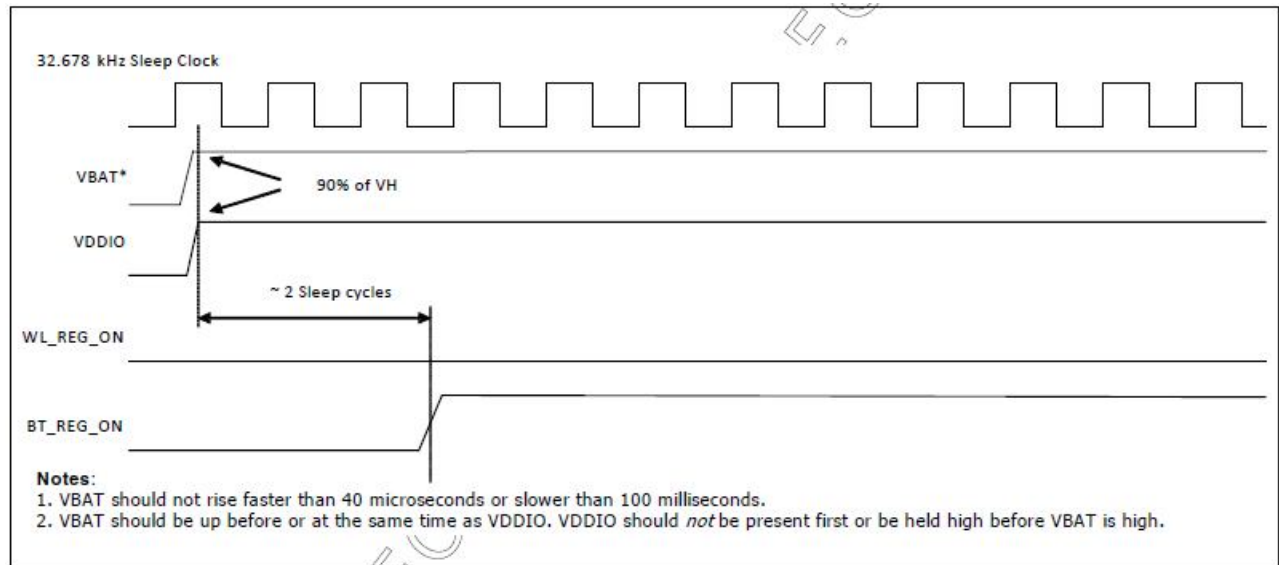
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF



WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

8.2 UART Interface Description

The UART is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps. The interface features an automatic baud rate detection capability that returns a baud rate selection. Alternatively, the baud rate may be selected through a vendor-specific UART HCI command.

UART has a 1040-byte receive FIFO and a 1040-byte transmit FIFO to support EDR. Access to the FIFOs is conducted through the AHB interface through either DMA or the CPU. The UART supports the Bluetooth 5.0 UART HCI specification: H4, a custom Extended H4, and H5. The default baud rate is 115.2 Kbaud.

The UART supports the 3-wire H5 UART transport, as described in the Bluetooth specification (Three-wire UART Transport Layer). Compared to H4, the H5 UART transport reduces the number of signal lines required by eliminating the CTS and RTS signals.

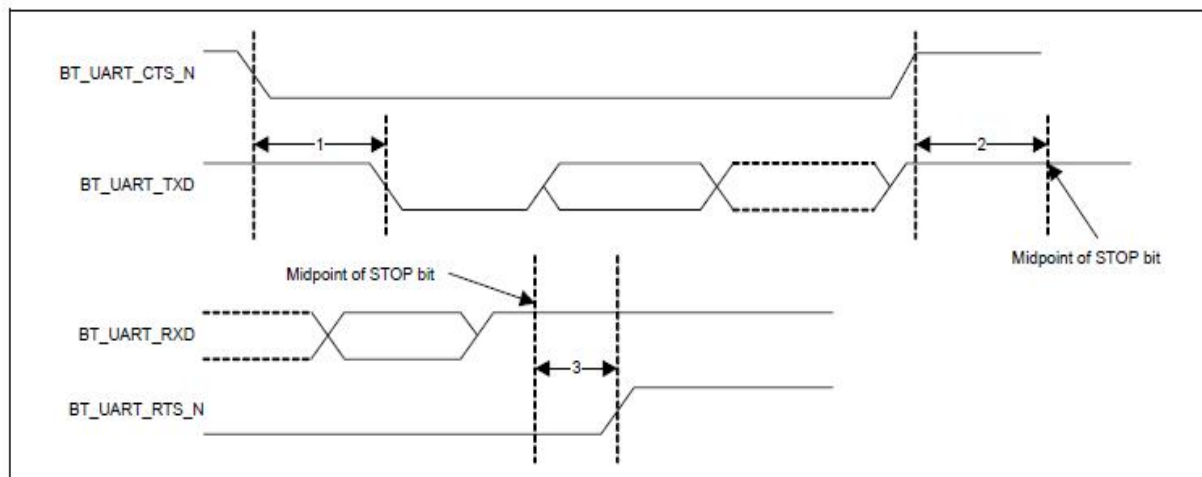
The UART can perform XON/XOFF flow control and includes hardware support for the Serial Line Input Protocol (SLIP). It can also perform wake-on activity. For example, activity on the RX or CTS inputs can wake the chip from a sleep state.

Normally, the UART baud rate is set by a configuration record downloaded after device reset, or by automatic baud rate detection, and the host does not need to adjust the baud rate. Support for changing the baud rate during normal HCI UART operation is included through a vendor-specific command that allows the host to adjust the contents of the baud rate registers. The UARTs operate correctly with the host UART as long as the combined baud rate error of the two devices is within $\pm 2\%$.

Example of Common Baud Rates

Desired Rate	Actual Rate	Error (%)
4000000	4000000	0.00
3692000	3692308	0.01
3000000	3000000	0.00
2000000	2000000	0.00
1500000	1500000	0.00
1444444	1454544	0.70
921600	923077	0.16
460800	461538	0.16
230400	230796	0.17
115200	115385	0.16
57600	57692	0.16
38400	38400	0.00
28800	28846	0.16
19200	19200	0.00
14400	14423	0.16
9600	9600	0.00

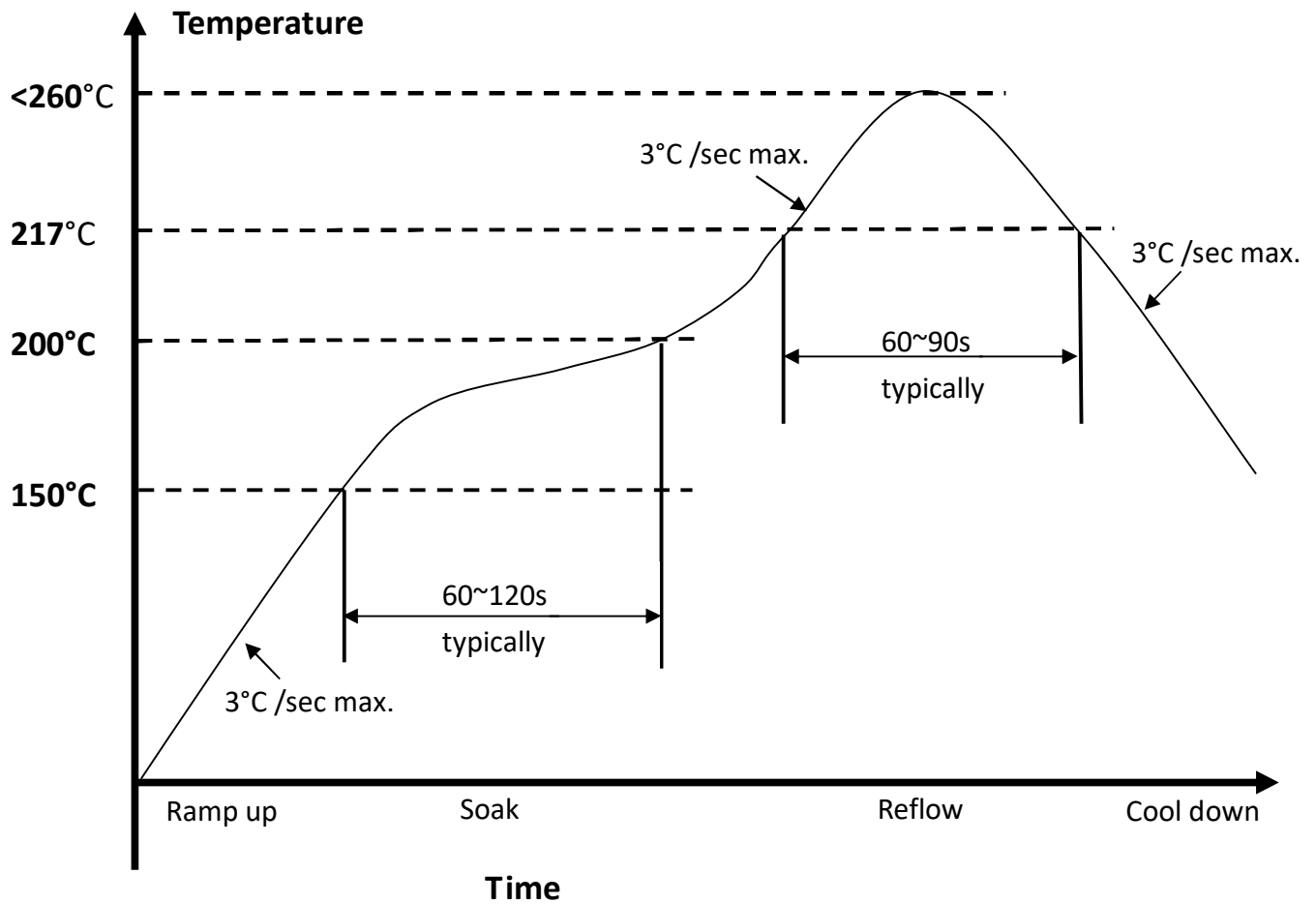
UART Timing



UART Timing Specifications

Ref	Characteristics	Min.	Typ.	Max.	Unit
1	Delay time, BT_UART_CTS_N low to BT_UART_TXD valid	–	–	1.5	Bit periods
2	Setup time, BT_UART_CTS_N high before midpoint of stop bit	–	–	0.5	Bit periods
3	Delay time, midpoint of stop bit to BT_UART_RTS_N high	–	–	0.5	Bit periods

9. Recommended Reflow Profile



1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C (Time within 5°C of actual Peak Temperature 20-40 seconds)
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

	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		

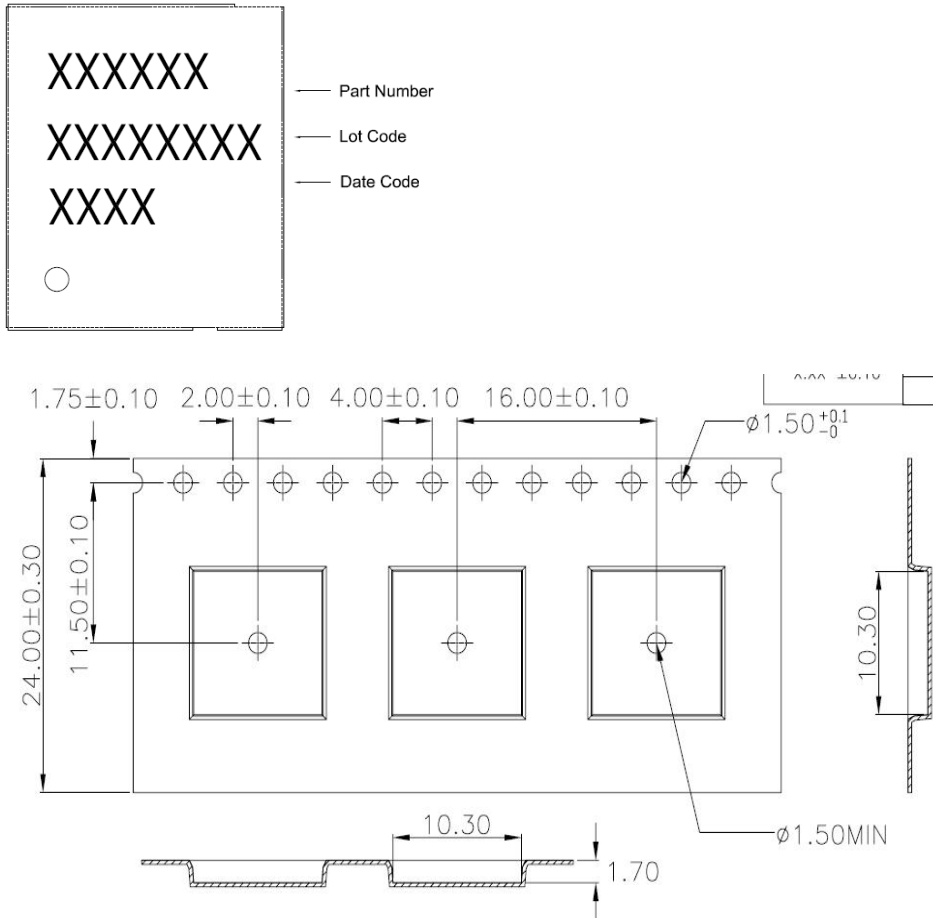
Label C → Inner box label .

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

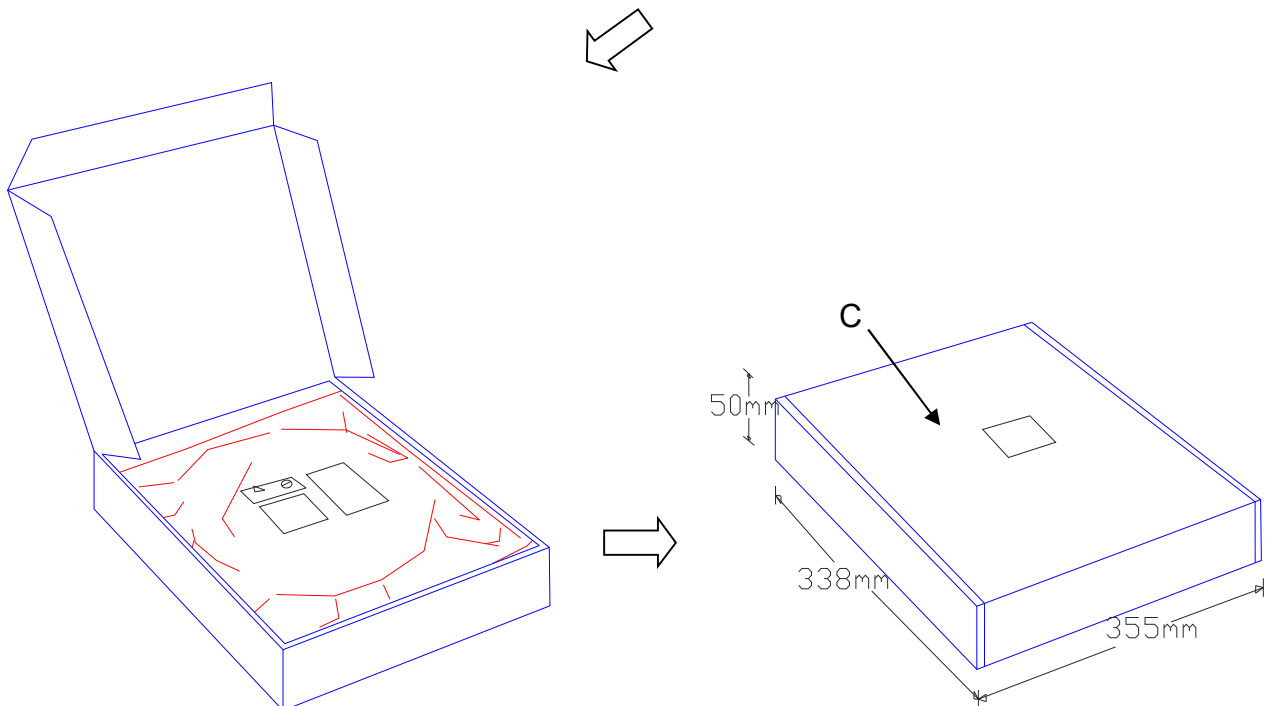
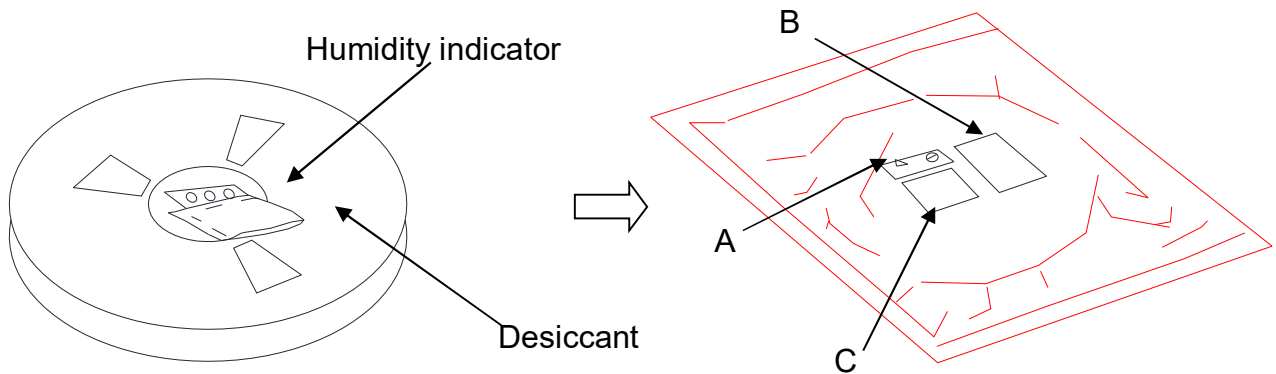
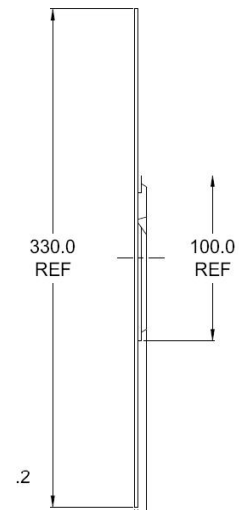
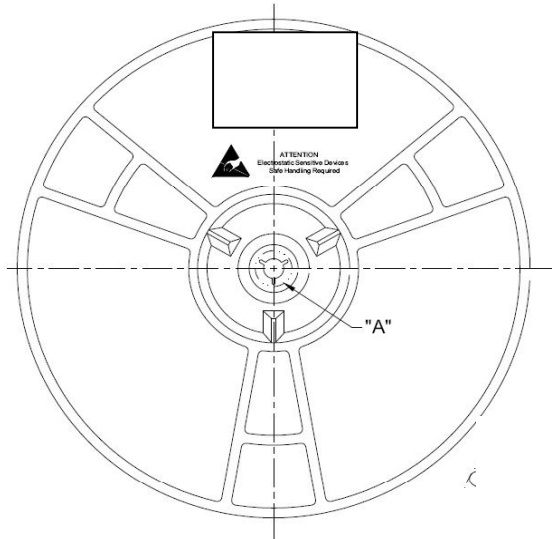
Label D → Carton box label .

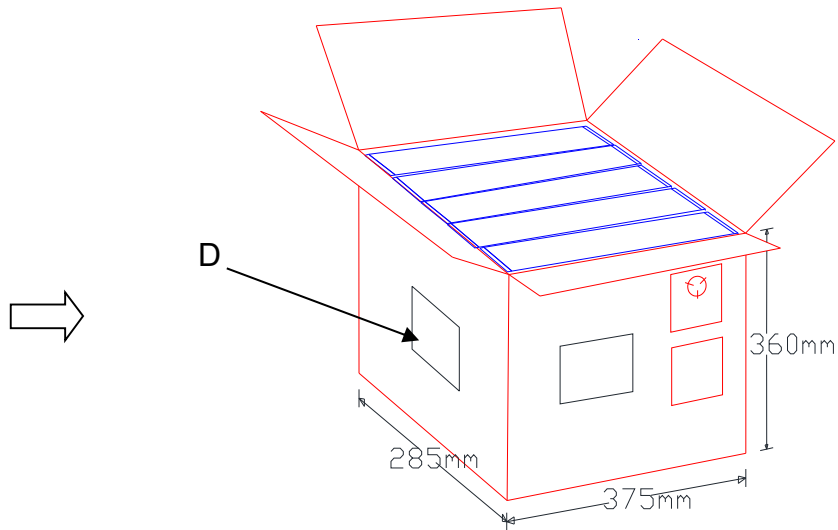
AMPAK Technology Inc.	
PO:	
AMK DEVICE:	
Model Name:	 APXXXXXXXX (R3HF)
Part No.:	 99X-XXX-XXXXR
Quantity:	 QQQQ
Lot D/C:	 XXXXXXXX YYWW QQQQ
Manufacture:	 YYYY/MM/DD

10.2 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. Component load per 13" reel : 1000 pcs





10.3 MSL Level / Storage Condition



Caution
This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL

3

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: 260 $^{\circ}\text{C}$
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: 168 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