

正基科技股份有限公司

SPECIFICATION

PRODUCT NAME : AP5876EPA

REVISION : 0.5(WEB)

DATE : Dec. 16th , 2024

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		



正基科技股份有限公司

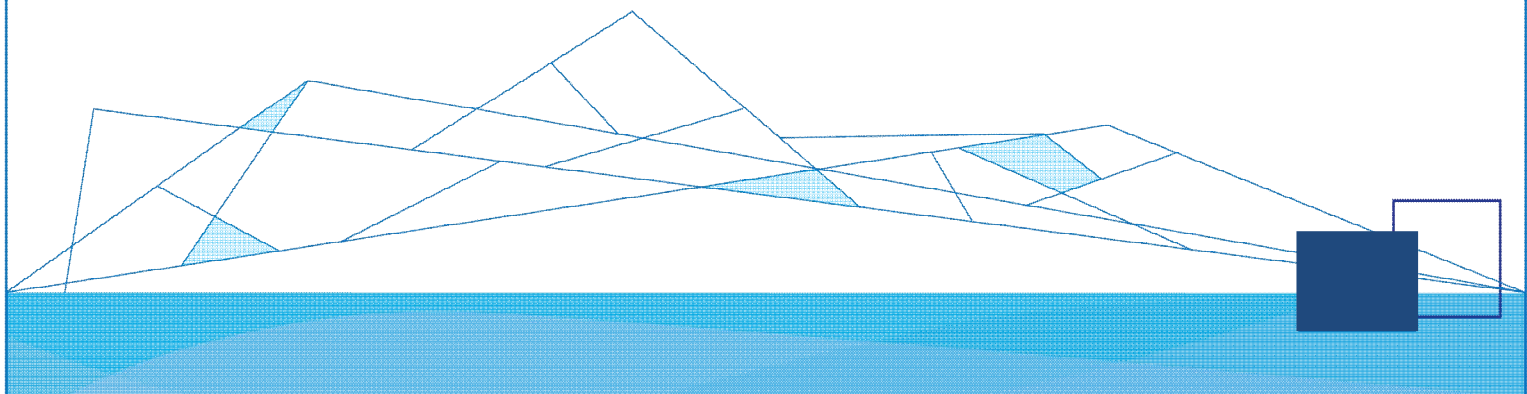
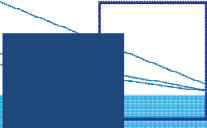


AP5876EPA Data Sheet

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Revision

Revision	Date	Description	Revised By
0.1	2024/10/30	--Preliminary Release	Gary
0.2	2024/11/04	--Pin18 from NC change to GND	Gary
0.3	2024/11/19	--Update dimensions	Gary
0.4	2024/12/05	--Add GND pin C15, C16	Gary
0.5	2024/12/16	--Modify general specification	Gary

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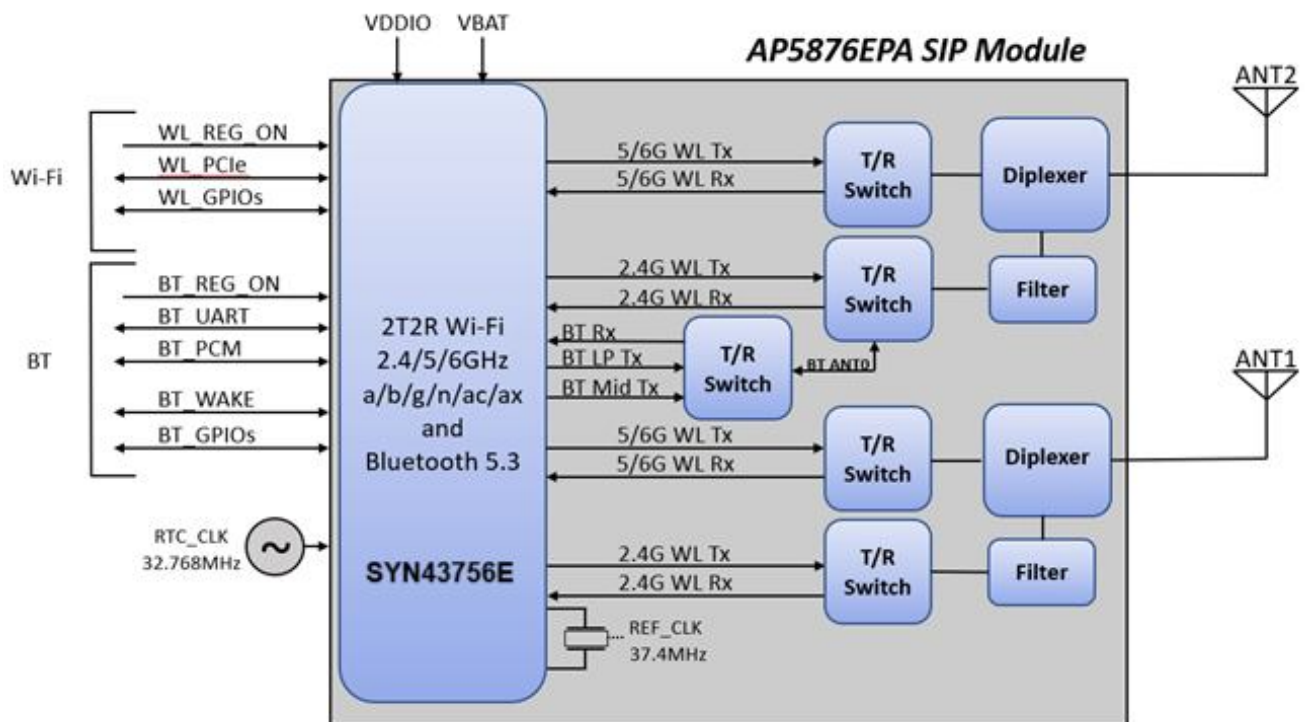
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1. Introduction

1.1 Overview

The AMPAK Technology® AP5876EPA is a fully Wi-Fi 6E(2.4/5/6GHz) 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 AP5876EPA included PCIE interface for Wi-Fi, UART/ PCM interface for Bluetooth.

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



1.2 Product Features

IEEE 802.11 Key Features

- 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 for 5GHz and 6GHz (U-NII-5, U-NII-6, U-NII-7 and U-NII-8) radio, and 20MHz channels for 2.4GHz radio.
- Client MU-MIMO
- Supports PCI express revision 3.0 and power management running at Gen1 speeds.

Bluetooth Key Features

- Bluetooth host digital interface:
 - HCI UART (up to 4 Mbps)
 - PCM for audio data
- Complies with Bluetooth Core Specification Version 5.3 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.
- Bluetooth Core Specification Version 5.3, including the following support:
 - Low energy (LE) isochronous channels
 - LE power control
 - LE enhanced connection update
 - LE channel classification
 - LE audio

2. General Specification

2.1 General Specification

Model Name	AP5876EPA
Product Description	2T2R 802.11 a/b/g/n/ac/ax Wi-Fi 6E + Bluetooth 5.3 Module
Dimension	L x W : 10 x 10 (typical) mm , H : 0.98 (Maximum) mm
WiFi Interface	Support PCIe v3.0 compliant and runs at Gen1 speeds
Bluetooth Interface	UART / PCM
Operating temperature	-30°C to 85°C
Storage temperature	-40°C to 125°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 < 4.8V without derating performance.

2.2 DC Characteristics

2.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	5.25	V
VDDIO	Digital/Bluetooth/ I/O Voltage	-0.5	2.07	V

Extreme caution must be exercised to prevent electrostatic discharge (ESD) damage.

Symbol	Condition	ESD Rating	Unit
ESD_HAND_HBM	Human body model contact discharge per JEDEC EID/JESD22-A114	1.5	kV
ESD_HAND_CDM	Charged device model contact discharge per JEDEC EIA/JESD22-C101	250	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	5.0	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
VIH = Input high voltage	$0.65 \times VDDIO$	NA	V
VIL = Input low voltage	NA	$0.4 \times VDDIO$	V
VOH = Output high voltage @ 2mA	$VDDIO - 0.4$	NA	V
VOL = Output low voltage @ 2mA	NA	0.4	V

Programmable 2mA to 16mA drive strength. Default is 10mA.

3. Wi-Fi RF Specification

3.1 2.4GHz RF Specification

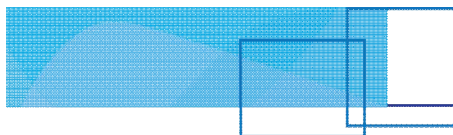
Conditions : VBAT=3.3V ; VDDIO=1.8V ; Temp:25°C

Feature		Description				
WLAN Standard		IEEE 802.11b/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 802.11 g/n：OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ax：OFDM /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	17	17	17	17	
	54Mbps					
	17					
802.11n 20MHz	MCS0~2	MCS3	MCS4	MCS5	MCS6	
	19	17.5	17.5	17	17	
	MCS7					
	16					
802.11ax 20MHz	HE0~2	HE3	HE4	HE5	HE6	
	19	17.5	17.5	17	17	
	HE7	HE8	HE9			
	16	15	14			
802.11ax_20MHz SISO_OFDMA	HE4	26	17.5	HE9	26	14
		52	17.5		52	14
		106	17.5		106	14
		242	17.5		242	14
	HE5	26	17			
		52	17			
		106	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	-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
	MCS1	-89	MCS5	-79
	MCS2	-87	MCS6	-76
	MCS3	-84	MCS7	-74
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	-92
	MCS4	-83	MCS15	-75
802.11ax_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-92	HE6	-75
	HE1	-88	HE7	-74
	HE2	-86	HE8	-71
	HE3	-83	HE9	-69
	HE4	-80		
	HE5	-77		
802.11ax_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-93	HE6	-77

802.11ax_20MHz MIMO	HE1	-90	HE7	-76
	HE2	-88	HE8	-73
	HE3	-85	HE9	-71
	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 、 OFDM /64-QAM 、 16-QAM 、 QPSK 、 BPSK 802.11ax ： OFDM/ 1024-QAM 、 OFDM /256-QAM 、 OFDM /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	15.5	15.5	15.5
	5470~5720	15.5	15.5	15.5	15.5
	5725~5845	15.5	15.5	15.5	15.5
	Frequency (MHz)	48Mbps	54Mbps		
	5150~5350	15.5	15.5		
	5470~5720	15.5	15.5		
	5725~5845	15.5	16		
802.11n 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	15.5	15.5	15.5
	5470~5720	15.5	15.5	15.5	15.5
	5725~5845	15.5	15.5	15.5	15.5
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	15.5	14.5		
	5470~5720	15.5	14.5		
	5725~5845	15.5	15		



802.11n 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	15.5	15	15
	5470~5720	15.5	15.5	15	15
	5725~5845	15.5	15.5	15	15
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	14.5	14.5		
	5470~5720	14.5	14.5		
	5725~5845	14.5	14		
802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	15.5	15.5	15.5
	5470~5720	15.5	15.5	15.5	15.5
	5725~5845	15.5	15.5	15.5	15.5
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5150~5350	15.5	14.5	12	
	5470~5720	15.5	14.5	12	
	5725~5845	15.5	14.5	13	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	15.5	15	15
	5470~5720	15.5	15.5	15	15
	5725~5845	15.5	15.5	15	15
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14.5	14.5	12	10
	5470~5720	14.5	14.5	12	10
	5725~5845	14.5	14.5	12	10
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	17	15	14.5	14.5
	5470~5720	15.5	15	14.5	14.5
	5725~5845	15.5	15	14.5	14.5
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14	14	10	10
	5470~5720	14	14	10	10
	5725~5845	14	14	10	10

802.11ax 20MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	17	15.5	15.5	15.5
	5470~5720	15.5	15.5	15.5	15.5
	5725~5845	15.5	15.5	15.5	15.5
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14.5	14.5	12	12
	5470~5720	14.5	14.5	12	12
	5725~5845	14.5	14.5	12	12
	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	15.5	15	15
	5470~5720	15.5	15.5	15	15
	5725~5845	15.5	15.5	15	15
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14.5	14.5	12	10
	5470~5720	14.5	14.5	12	10
	5725~5845	14.5	14.5	12	10
	Frequency (MHz)	HE10	HE11		
	5150~5350	8	8		
	5470~5720	8	8		
	5725~5845	8	8		
802.11ax 80MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	17	15	14.5	14.5
	5470~5720	17	15	14.5	14.5
	5725~5845	17	15	14.5	14.5
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14	14	10	10
	5470~5720	14	14	10	10
	5725~5845	14	14	10	10
	Frequency (MHz)	HE10	HE11		
	5150~5350	8	8		
	5470~5720	8	8		
	5725~5845	8	8		

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	15.5
			5470~5720	15.5
			5725~5845	15.5
		52	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		106	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		242	5150~5350	14.5
			5470~5720	14
			5725~5845	14
	HE1~2	26	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		52	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		106	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		242	5150~5350	14.5
			5470~5720	14
			5725~5845	14
	HE3~4	26	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		52	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		106	5150~5350	15.5
			5470~5720	15.5
			5725~5845	15.5
		242	5150~5350	14.5
			5470~5720	14
			5725~5845	14
	HE5~7	26	5150~5350	14.5

802.11ax_20MHz SISO_OFDMA	HE5~7		5470~5720	14.5
			5725~5845	14.5
		52	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		106	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		242	5150~5350	14.5
			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
	HE10~11	242	5150~5350	10
			5470~5720	9.5
			5725~5845	9.5

	Dara rate	Tones	Frequency	Spec.(dBm)
802.11ax_40MHz SISO_OFDMA	HE0	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
	HE1~2	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5

802.11ax_40MHz SISO_OFDMA	HE3~4	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
	HE5~7	26	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		52	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		106	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		242	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		484	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
	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	10

802.11ax_40MHz SISO_OFDMA	HE8~9	106	5470~5720	10
			5725~5845	10
		242	5150~5350	10
			5470~5720	10
			5725~5845	10
		484	5150~5350	10
			5470~5720	10
			5725~5845	10
	HE10~11	242	5150~5350	8
			5470~5720	8
			5725~5845	8
		484	5150~5350	8
			5470~5720	8
			5725~5845	8

	Dara rate	Tones	Frequency	Spec.(dBm)
802.11ax_80MHz SISO_OFDMA	HE0	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		996	5150~5350	15.5
			5470~5720	15
			5725~5845	15
	HE1~2	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		996	5150~5350	15.5
			5470~5720	15
			5725~5845	15

802.11ax_80MHz SISO_OFDMA	HE3~4	26	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		52	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		106	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		242	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		484	5150~5350	15.5
			5470~5720	15
			5725~5845	15
		996	5150~5350	15.5
			5470~5720	15
			5725~5845	15
	HE5~7	26	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		52	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		106	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		242	5150~5350	14.5
			5470~5720	14.5
			5725~5845	14.5
		484	5150~5350	14.5
			5470~5720	14
			5725~5845	14
		996	5150~5350	14
			5470~5720	14
			5725~5845	14

802.11ax_80MHz SISO_OFDMA	HE8~9	26	5150~5350	10
			5470~5720	10
			5725~5845	10
		52	5150~5350	10
			5470~5720	10
			5725~5845	10
		106	5150~5350	10
			5470~5720	10
			5725~5845	10
		242	5150~5350	10
			5470~5720	10
			5725~5845	10
		484	5150~5350	10
			5470~5720	10
			5725~5845	10
		996	5150~5350	10
			5470~5720	10
			5725~5845	10
	HE10~11	242	5150~5350	8
			5470~5720	8
			5725~5845	8
		484	5150~5350	8
			5470~5720	8
			5725~5845	8
		996	5150~5350	8
			5470~5720	8
			5725~5845	8

Sensitivity, tolerance ± 2 dB , OFDM modulation PER $\leq 10\%$				
802.11a SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-90	24Mbps	-83
	9Mbps	-89	36Mbps	-80
	12Mbps	-88	48Mbps	-75
	18Mbps	-86	54Mbps	-73
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	-90	MCS4	-79
	MCS1	-88	MCS5	-76
	MCS2	-86	MCS6	-73
	MCS3	-83	MCS7	-71
802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-92	MCS5	-78
	MCS1	-91	MCS6	-76
	MCS2	-89	MCS7	-74
	MCS3	-86	MCS8	-90
	MCS4	-82	MCS15	-70
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	-68
802.11n_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-71
	MCS3	-83	MCS8	-87
	MCS4	-79	MCS15	-67

802.11ac_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-70
	MCS3	-83	MCS8	-68
	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	-73
	MCS2, NSS=1	-88	MCS8, NSS=1	-71
	MCS3, NSS=1	-85	MCS0, NSS=2	-89
	MCS4, NSS=1	-82	MCS8, NSS=2	-65
	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	-86
	MCS5, NSS=1	-75	MCS9, NSS=2	-62
802.11ac_80MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-85	MCS5	-68
	MCS1	-82	MCS6	-67
	MCS2	-79	MCS7	-65
	MCS3	-76	MCS8	-62
	MCS4	-73	MCS9	-61

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	-65
	MCS3, NSS=1	-79	MCS9, NSS=1	-63
	MCS4, NSS=1	-76	MCS0, NSS=2	-83
	MCS5, NSS=1	-71	MCS9, NSS=2	-58
802.11ax_20MHz SISO	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	-57
802.11ax_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-88	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	-85	HE6	-67
	HE1	-82	HE7	-65
	HE2	-79	HE8	-62
	HE3	-76	HE9	-61
	HE4	-73	HE10	-55
	HE5	-68	HE11	-51
Maximum Input Level	802.11a/n/ac/ax : -30 dBm			

3.3 6GHz RF Specification

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

Feature		Description			
WLAN Standard		IEEE 802.11ax			
Frequency Range		5.925 ~ 7.125GHz (6GHz U-NII5/6/7/8 Band)			
Number of Channels		5955~5415MHz : 6G1 ~ 6G93、6435~6515MHz : 6G97 ~ 6G113 6535~6855MHz : 6G117 ~ 6G181、6875~7115MHz : 6G185 ~ 6G233			
Modulation		802.11ax : OFDMA /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK			
Output Power(dBm) , tolerance ± 2 dB					
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard					
802.11ax 20MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5955~5415	14.5	14	13.5	13.5
	6435~6515	14.5	14	13.5	13.5
	6535~6855	14.5	14	13.5	13.5
	6875~7115	14.5	14	13.5	13.5
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5955~5415	13.5	12.5	10.5	10.5
	6435~6515	13.5	12.5	10.5	10.5
	6535~6855	13.5	12.5	10.5	10.5
	6875~7115	13.5	12.5	10.5	10.5
	Frequency (MHz)	HE10	HE11		
	5955~5415	8.5	8.5		
	6435~6515	8.5	8.5		
	6535~6855	8.5	8.5		
	6875~7115	8.5	8.5		
802.11ax 40MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5955~5415	14.5	14	13	13
	6435~6515	14.5	14	13	13
	6535~6855	14.5	14	13	13
	6875~7115	14.5	14	13	13
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5955~5415	12.5	12.5	11	8
	6435~6515	12.5	12.5	11	8
	6535~6855	12.5	12.5	11	8
	6875~7115	12.5	12.5	11	8

	Frequency (MHz)	HE10	HE11		
	5955~5415	7	7		
	6435~6515	7	7		
	6535~6855	7	7		
	6875~7115	7	7		
802.11ax 80MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5955~5415	14.5	14	13	13
	6435~6515	14.5	14	13	13
	6535~6855	14.5	14	13	13
	6875~7115	14.5	14	13	13
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5955~5415	12.5	12.5	8	8
	6435~6515	12.5	12.5	8	8
	6535~6855	12.5	12.5	8	8
	6875~7115	12.5	12.5	8	8
	Frequency (MHz)	HE10	HE11		
	5955~5415	7	7		
	6435~6515	7	7		
	6535~6855	7	7		
	6875~7115	7	7		

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, OFDM modulation PER $\leq 10\%$

802.11ax_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-88	HE6	-71
	HE1	-86	HE7	-68
	HE2	-84	HE8	-66
	HE3	-83	HE9	-62
	HE4	-77	HE10	-57
	HE5	-73	HE11	-55
802.11ax_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-88	HE6	-71
	HE1	-86	HE7	-68
	HE2	-84	HE8	-66
	HE3	-81	HE9	-62
	HE4	-77	HE10	-57
	HE5	-73	HE11	-54

802.11ax_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-86	HE6	-68
	HE1	-84	HE7	-67
	HE2	-81	HE8	-63
	HE3	-78	HE9	-62
	HE4	-74	HE10	-68
	HE5	-70	HE11	-53
802.11ax_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-85	HE6	-68
	HE1	-84	HE7	-67
	HE2	-81	HE8	-63
	HE3	-78	HE9	-62
	HE4	-74	HE10	-58
	HE5	-70	HE11	-53
802.11ax_80MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-83	HE6	-65
	HE1	-80	HE7	-63
	HE2	-77	HE8	-60
	HE3	-74	HE9	-59
	HE4	-71	HE10	-55
	HE5	-66	HE11	-51
802.11ax_80MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-82	HE6	-65
	HE1	-80	HE7	-63
	HE2	-77	HE8	-60
	HE3	-74	HE9	-59
	HE4	-71	HE10	-55
	HE5	-66	HE11	-50
Maximum Input Level	802.11ax : -30dBm			

4. Bluetooth Specification

4.1 Bluetooth Specification

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

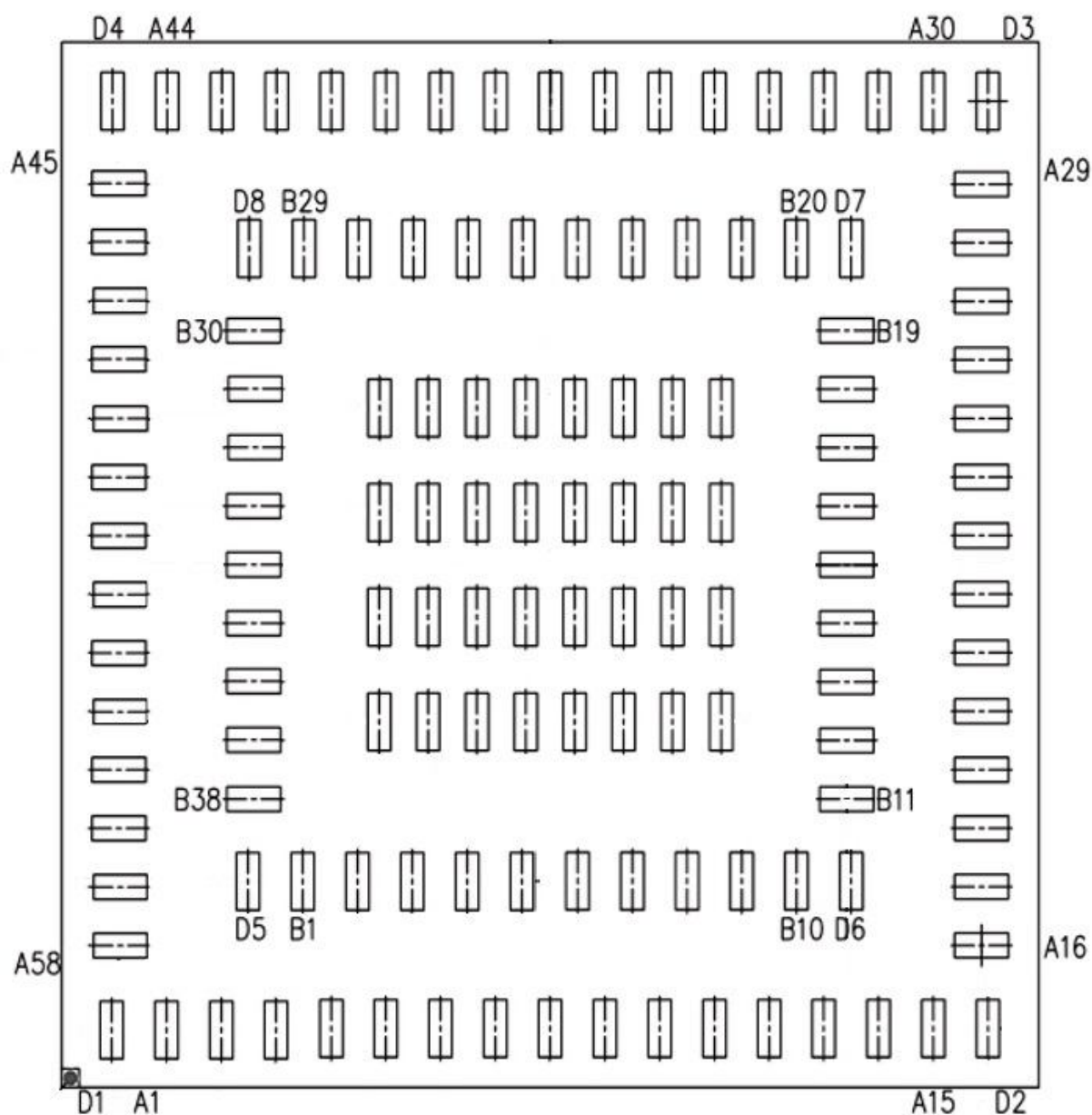
Feature	Description
General Specification	
Bluetooth Standard	BDR 、EDR(2Mbps & 3Mbps) 、LE(1/2Mbps) 、LELR(128/512Kbps)
Host Interface	UART
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels for classic 、40 channels for BLE
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK
RF Specification	
Output Power, tolerance ± 2 dB	
	CL1 (dBm)
BDR Output Power	16
EDR Output Power	10
BLE Output Power	16
Sensitivity, tolerance ± 2 dB	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-87 dBm
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-89 dBm
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-83 dBm
Sensitivity @ PER=30.8% for LE (1Mbps)	-90.5 dBm
Sensitivity @ PER=30.8% for 2LE (2Mbps)	-87.5dBm
Maximum Input Level	GFSK (1Mbps):-20dBm
	$\pi/4$ -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

Bottom View



5.2 Pin Assignment

NO	Name	Type	Description
A54	WL_ANT0	I/O	RF I/O port0
A44	WL_ANT1	I/O	RF I/O port1
B16	NC	—	NC
B15	NC	—	NC
B14	NC	—	NC
B13	NC	—	NC
B12	NC	—	NC
B18	NC	—	NC
A21	PCIE_RX_N	I	PCI Express receive data-Negative
A22	PCIE_RX_P	I	PCI Express receive data-Positive
A24	PCIE_RCLK_N	I	PCI Express differential clock input-Negative
A23	PCIE_RCLK_P	I	PCI Express differential clock input-Positive
A20	PCIE_TX_N	O	PCI Express transmit data-Negative
A19	PCIE_TX_P	O	PCI Express transmit data-Positive
D6	PCIE_PME_L	O	PCI power management event output
B10	PCIE_CLKREQ_L	O	PCIe clock request
B9	PCIE_PREST_L	I	PCIe host indication to reset the device
A5	BT_UART_TXD	O	Bluetooth UART serial data output
A6	BT_UART_CTS_N	I	Bluetooth UART clear to send
A7	BT_UART_RTS_N	O	Bluetooth UART request to send
A8	BT_UART_RXD	I	Bluetooth UART serial data input
A1	BT_PCM_OUT	O	PCM data output
A2	BT_PCM_SYNC	I/O	PCM sync signal
A3	BT_PCM_CLK	I	PCM clock
A4	BT_PCM_IN	I	PCM data input
A9	BT_I2S_DO	I/O	I2S data output
A10	BT_I2S_WS	I/O	I2S word select
A11	BT_I2S_CLK	I/O	I2S clock
A12	BT_I2S_DI	I/O	I2S data input
C10	LPO_IN	I	External Low Power Clock input (32.768KHz)
B21	WL_HOST_WAKE	O	WLAN to wake-up HOST
B20	WL_WAKE	I	Host wake-up WLAN
B8	DAP_SEL	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	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	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.
A58	WL_GPIO_12	I/O	This pin can be programmed to be a GPIO, DBG_UART_RX 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.
A56	WL_GPIO_14	I/O	This pin can be programmed to be a GPIO or the GCI external coexistence interface.
B7	WL_GPIO_15	I/O	This pin can be programmed to be a GPIO 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 or can be programmed to be
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 learning.
B5	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST
B6	BT_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 Wi-Fi core
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	I/O	This pin can be programmed to be a GPIO, the JTAG TDO signal, UART_RTS or the GCI external coexistence interface.
A16	SH_UART_RX/WL_JTAG_TCK	I/O	This pin can be programmed to be a GPIO, the JTAG TCK

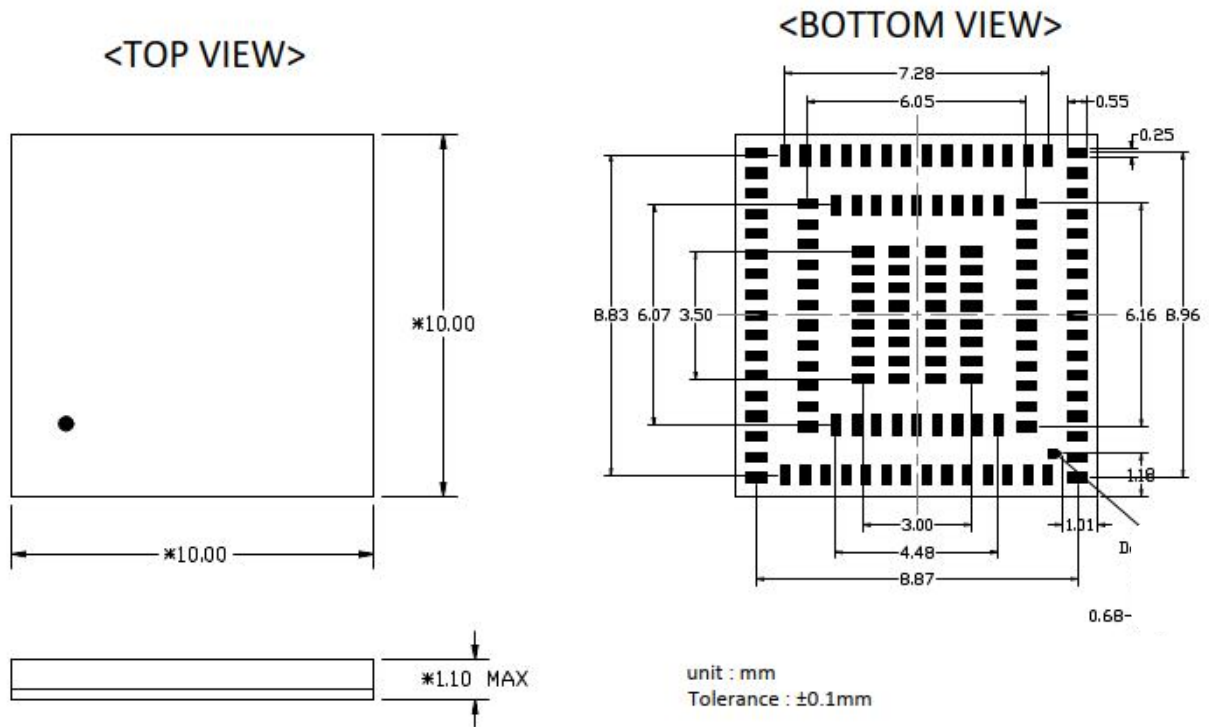
			signal, UART_RX or the GCI external coexistence interface.
A17	LTECOEX_UART_RX/WL_JTAG_TDI	I/O	This pin can be programmed to be a GPIO, the JTAG TDI signal, UART_CTS or the GCI external coexistence interface.
C12	JTAG_SEL	I/O	This pin must be connected to ground if the JTAG interface is not used.
A33	VBAT	P	Main power voltage source input
A34	VBAT	P	Main power voltage source input
A39	VDDIO	P	Main power voltage source input
A40	VDDIO	P	I/O Voltage supply input
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	ASR_VLX	O	Internal Analog Buck voltage generation pin
A36	ABUCK_1P12	I	Internal Analog Buck voltage generation pin
A37	ABUCK_1P12	I	Internal Analog Buck voltage generation pin
A18	GND	—	Ground connections
A25	GND	—	Ground connections
A26	GND	—	Ground connections
A28	GND	—	Ground connections
A32	GND	—	Ground connections
A35	GND	—	Ground connections
A38	GND	—	Ground connections
A41	GND	—	Ground connections
A42	GND	—	Ground connections
A43	GND	—	Ground connections
A45	GND	—	Ground connections
A46	GND	—	Ground connections
A47	GND	—	Ground connections
A48	GND	—	Ground connections
A49	GND	—	Ground connections
A50	GND	—	Ground connections
A51	GND	—	Ground connections
A52	GND	—	Ground connections
A53	GND	—	Ground connections
A55	GND	—	Ground connections
B4	GND	—	Ground connections
B11	GND	—	Ground connections

B17	GND	—	Ground connections
B19	GND	—	Ground connections
B28	GND	—	Ground connections
B29	GND	—	Ground connections
B30	GND	—	Ground connections
B31	GND	—	Ground connections
B32	GND	—	Ground connections
B33	GND	—	Ground connections
B34	GND	—	Ground connections
B35	GND	—	Ground connections
B36	GND	—	Ground connections
B37	GND	—	Ground connections
B38	GND	—	Ground connections
C1	GND	—	Ground connections
C2	GND	—	Ground connections
C3	GND	—	Ground connections
C4	GND	—	Ground connections
C5	GND	—	Ground connections
C6	GND	—	Ground connections
C7	GND	—	Ground connections
C8	GND	—	Ground connections
C9	GND	—	Ground connections
C11	GND	—	Ground connections
C13	GND	—	Ground connections
C14	GND	—	Ground connections
C15	GND	—	Ground connections
C16	GND	—	Ground connections
D1	GND	—	Ground connections
D2	GND	—	Ground connections
D3	GND	—	Ground connections
D4	GND	—	Ground connections
D7	GND	—	Ground connections
D8	GND	—	Ground connections
D9	GND	—	Ground connections
D10	GND	—	Ground connections
D11	GND	—	Ground connections
D12	GND	—	Ground connections

E1	GND	—	Ground connections
E2	GND	—	Ground connections
E3	GND	—	Ground connections
E4	GND	—	Ground connections
E5	GND	—	Ground connections
E6	GND	—	Ground connections
E7	GND	—	Ground connections
E8	GND	—	Ground connections
E9	GND	—	Ground connections
E10	GND	—	Ground connections
E11	GND	—	Ground connections
E12	GND	—	Ground connections

6. Dimensions

6.1 Module Dimensions



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: This signal is used by the PMU to power up the WLAN section. It is also OR-gated with the BT_REG_ON input to control the internal regulators. 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. If BT_REG_ON and WL_REG_ON are both low, the regulators are disabled.
- BT_REG_ON: This signal is used by the PMU to decide whether or not to power down the internal regulators. If BT_REG_ON and WL_REG_ON are low, the regulators will be disabled.
- It suggests customers connect WL_REG_ON and BT_REG_ON to GPIOs for control, otherwise unexpected errors may occur when boot-up the device.
- In the figure, The VDDIO power supply has been included in the module. When VBAT is power-up, VDDIO will rise to high level after 15 ms.
- The module main chip has an internal power-on reset (POR) circuit. The device will be held in reset for a maximum of 110 ms after VDDC and VDDIO have both passed the POR threshold. Wait at least 150 ms after VDDC and VDDIO are available before initiating PCIe accesses.



***Notes:**

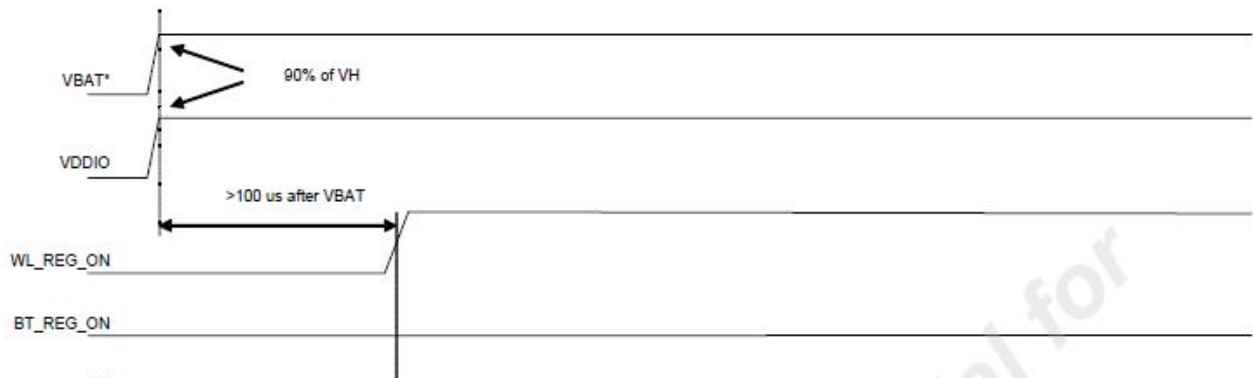
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 microseconds/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

WLAN=ON, Bluetooth=ON

***Notes:**

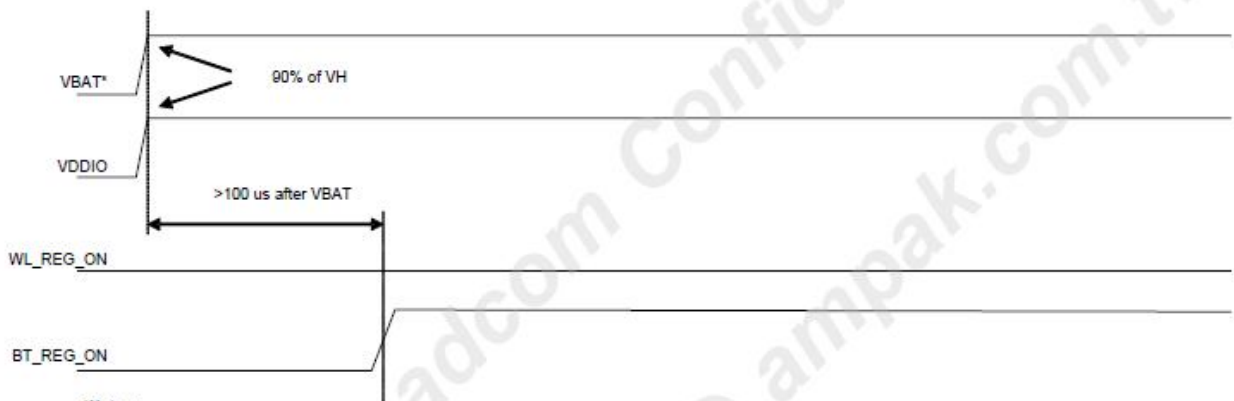
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 microseconds/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

WLAN=OFF, Bluetooth=OFF

***Notes:**

1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 microseconds/V.
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

***Notes:**

1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 microseconds/V.
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 PCIe Interface Description

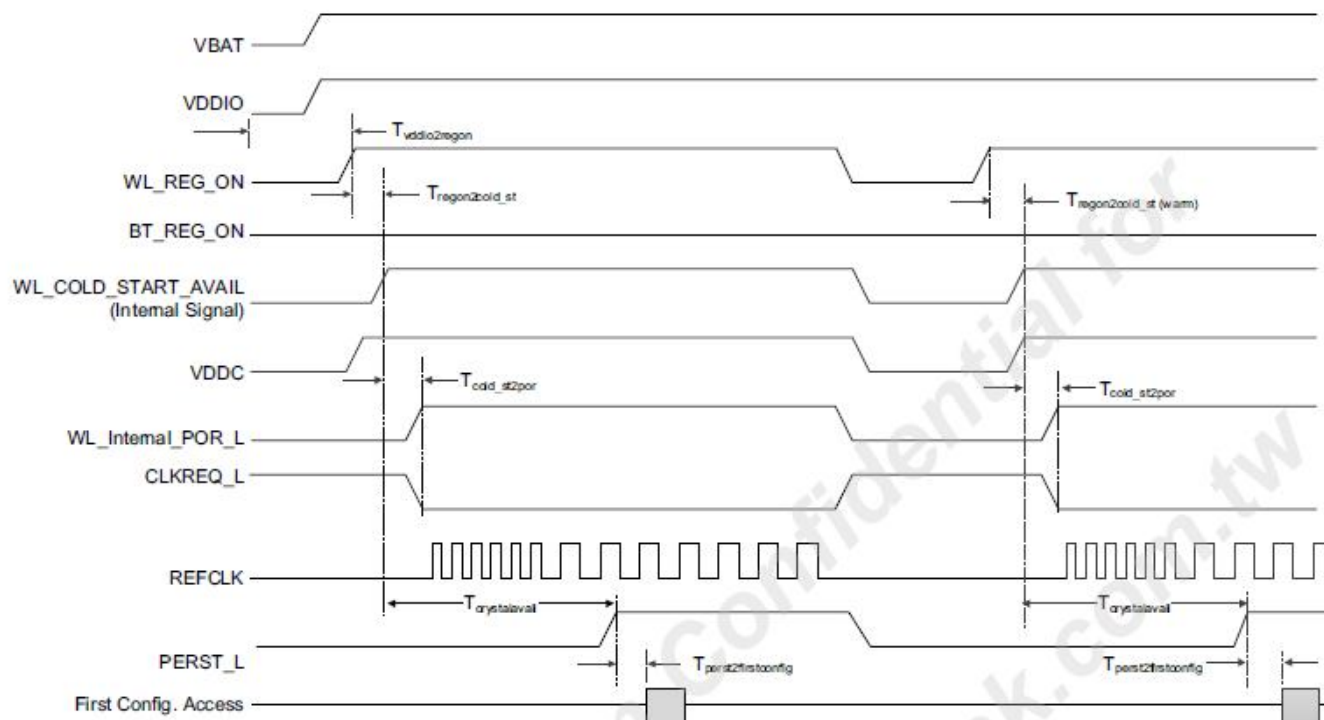
The PCI Express (PCIe) core on the AP5876EPA is a high-performance serial I/O interconnect that is protocol compliant and electrically compatible with the PCI Express Base Specification v3.0 running at Gen1 speeds.

Parameter	Symbol	Comments	Minimum	Typical	Maximum	Unit
General¹						
Baud rate	BPS	—	—	5	—	Gbaud
Reference clock peak-to-peak differential ²	Vref	LVPECL, AC coupled	0.95	—	—	V
Receiver						
Differential termination	ZRX-DIFF-DC	Differential termination	80	100	120	Ω
DC impedance	ZRX-DC	DC common-mode impedance	40	50	60	Ω
Powered down termination (POS)	ZRX-HIGH-IMP-DC-POS	Power-down or RESET high impedance	100k	—	—	Ω
Powered down termination (NEG)	ZRX-HIGH-IMP-DC-NEG	Power-down or RESET high impedance	1k	—	—	Ω
Input voltage	VRX-DIFFp-p	AC coupled, differential p-p	175	—	—	mV
Jitter tolerance	TRX-EYE	Minimum receiver eye width	0.4	—	—	UI
Differential return loss	RLRX-DIFF	Differential return loss	10	—	—	dB
Common-mode returnloss	RLRX-CM	Common-mode return loss	6	—	—	dB
Unexpected electrical idle enter detect threshold integration time	TRX-IDEL-DET-DIFF-ENTERTIME	An unexpected electrical idle must be recognized no longer than this time to signal an unexpected idle condition.	—	—	10	ms
Signal detect threshold	VRX-IDLE-DET-DIFFp-p	Electrical idle detect threshold	65	—	175	mV

Transmitter						
Output voltage	VTX-DIFFp-p	Differential p-p, programmable in 16 steps	0.8	—	1200	mV
RX detection voltage swing	VTX-RCV-DETECT	The amount of voltage change allowed during receiver detection.	—	—	600	mV
TX AC peak common-mode voltage (2.5 GT/s)	VTX-CM-AC-P	TX AC common-mode voltage (2.5 GT/s)	—	—	20	mV
Absolute delta of DC common-mode voltage during L0 and electrical idle	VTX-CM-DC-ACTIVE-IDLE-DELTA	Absolute delta of DC common-mode voltage during L0 and electrical idle.	0	—	100	mV
Absolute delta of DC common-mode voltage between D+ and D-	VTX-CM-DC-LINE-DELTA	DC offset between D+ and D-	0	—	25	mV
Electrical idle differential peak output voltage	VTX-IDLE-DIFF-AC-p	Peak-to-peak voltage	0	—	20	mV
Parameter	Symbol	Comments	Minimum	Typical	Maximum	Unit
TX short circuit current	ITX-SHORT	Current limit when TX output is shorted to ground.	—	—	90	mA
DC differential TX termination	ZTX-DIFF-DC	Low impedance defined during signaling (parameter is captured for 5.0 GHz by RLTX-DIFF)	80	—	120	Ω
Differential return loss	RLTX-DIFF	Differential return loss	10 (min) for 0.05: 1.25 GHz	—	—	dB
Common-mode return loss	RLTX-CM	Common-mode return loss	6	—	—	dB
TX eye width	TTX-EYE	Minimum TX eye width	0.75	—	—	UI

The reference clock inputs comply with the requirements of the PCI Express CEM v2.0 Specification.

PCIe Power-On Timing



Timing Parameter	Notes	Value ^a	Unit
$T_{vddio2regon}$	—	0.1	ms
$T_{regon2cold_st}$	3.4 ms + 162 instruction-level parallelism (ILP) cycles	10.13	ms
T_{cold_st2por}	54 ILP cycles	2.24	ms
$T_{crystalavail}$	509 ILP cycles	21.17	ms
$T_{perst2firstconfig}$	—	6.0	ms
$T_{vddioon2firstconfig}$	$T_{vddio2regon} + T_{regon2cold_st} + T_{crystalavail} + T_{perst2firstconfig}$	37.4 ^b	ms
$T_{regon2cold_st (warm)}$	162 ILP cycles	6.73	ms

a. The time values assume an ILP tolerance of $\pm 30\%$.

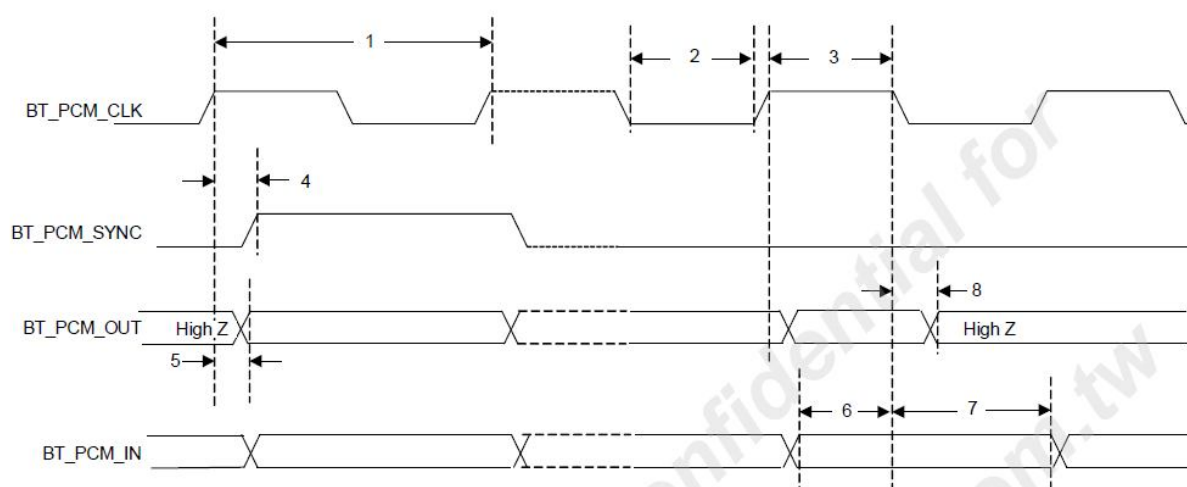
b. With VDDIO as a reference, 37.4 ms is the minimum system wait time before issuing the first configuration access.

8.3 PCM Interface Description

The PCM Interface on the AP5876EPA can connect to linear PCM Codec devices in master or slave mode. In master mode, the AP5876EPA generates the PCM_CLK and PCM_SYNC signals, and in slave mode, these signals are provided by another master on the PCM interface and are inputs to the AP5876EPA. The configuration of the PCM interface may be adjusted by the host through the use of vendor-specific HCI commands.

PCM Timing

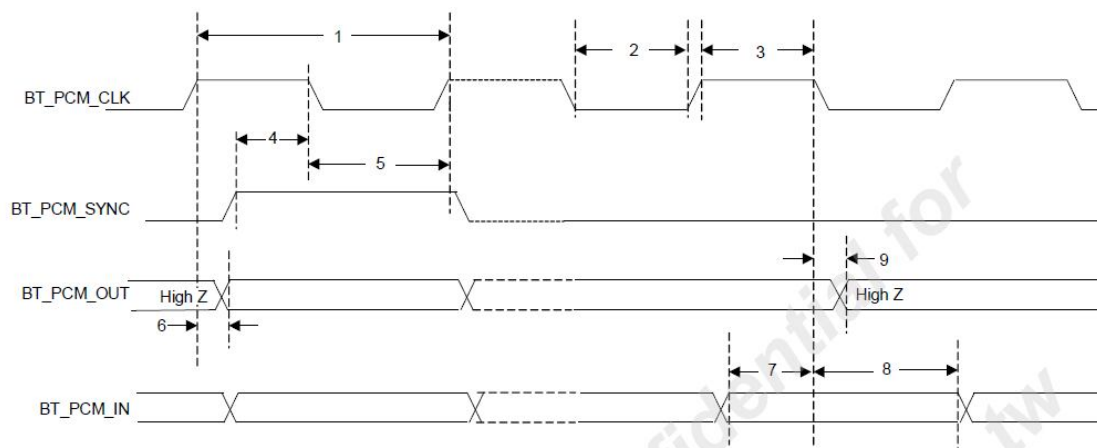
Short Frame Sync, Master Mode



PCM interfcd timing spec(short frame sync, master mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	41	—	—	ns
4	BT_PCM_SYNC delay	0	—	25	ns
5	BT_PCM_OUT delay	0	—	25	ns
6	BT_PCM_IN setup	8	—	—	ns
7	BT_PCM_IN hold	8	—	—	ns
8	Delay from falling edge of BT_PCM_CLK during the last bit period to BT_PCM_OUT becoming high impedance.	0	—	25	ns

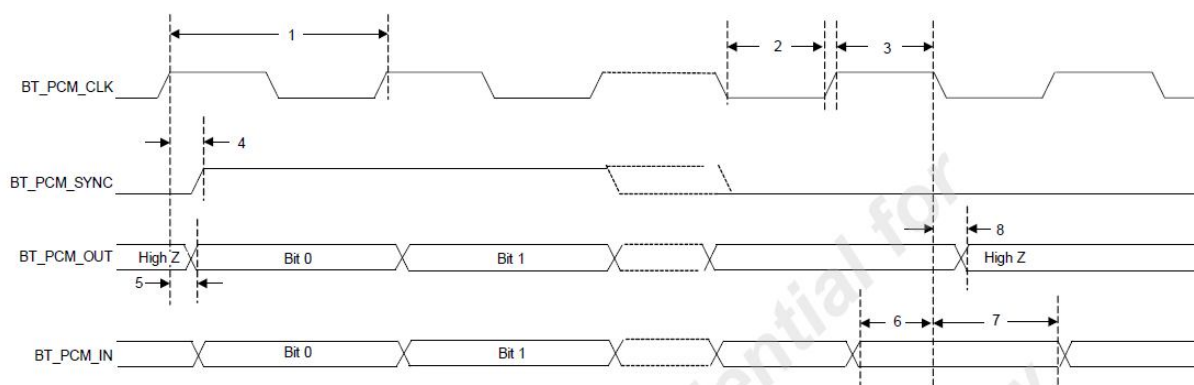
Short Frame Sync, Slave Mode



PCM interface timing spec (short frame sync, slave mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	41	—	—	ns
4	BT_PCM_SYNC setup	8	—	—	ns
5	BT_PCM_SYNC hold	8	—	—	ns
6	BT_PCM_OUT delay	0	—	25	ns
7	BT_PCM_IN setup	8	—	—	ns
8	BT_PCM_IN hold	8	—	—	ns
9	Delay from falling edge of BT_PCM_CLK during the last bit period to BT_PCM_OUT becoming high impedance.	0	—	25	ns

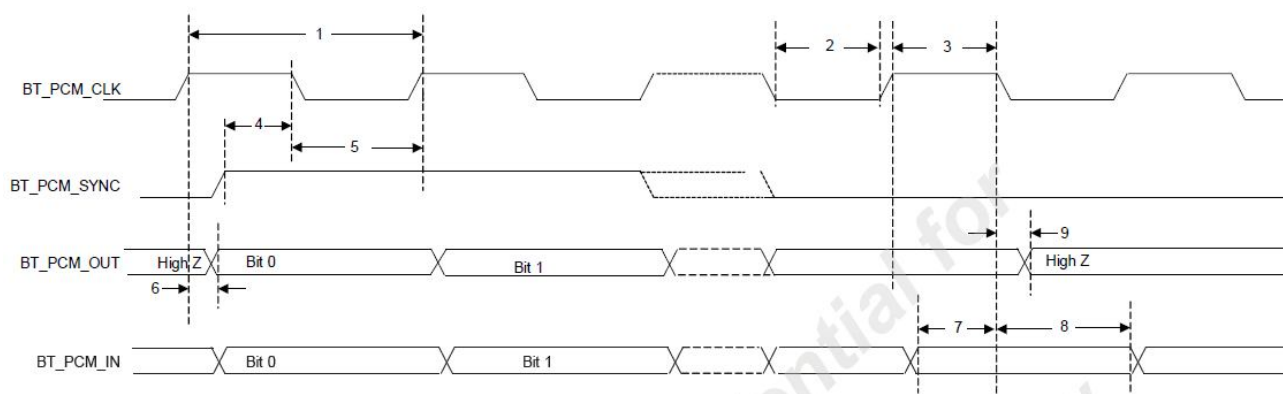
Long Frame Sync, Master Mode



PCM interface timing spec (long frame sync, master mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	41	—	—	ns
4	BT_PCM_SYNC delay	0	—	25	ns
5	BT_PCM_OUT delay	0	—	25	ns
6	BT_PCM_IN setup	8	—	—	ns
7	BT_PCM_IN hold	8	—	—	ns
8	Delay from falling edge of BT_PCM_CLK during the last bit period to BT_PCM_OUT becoming high impedance.	0	—	25	ns

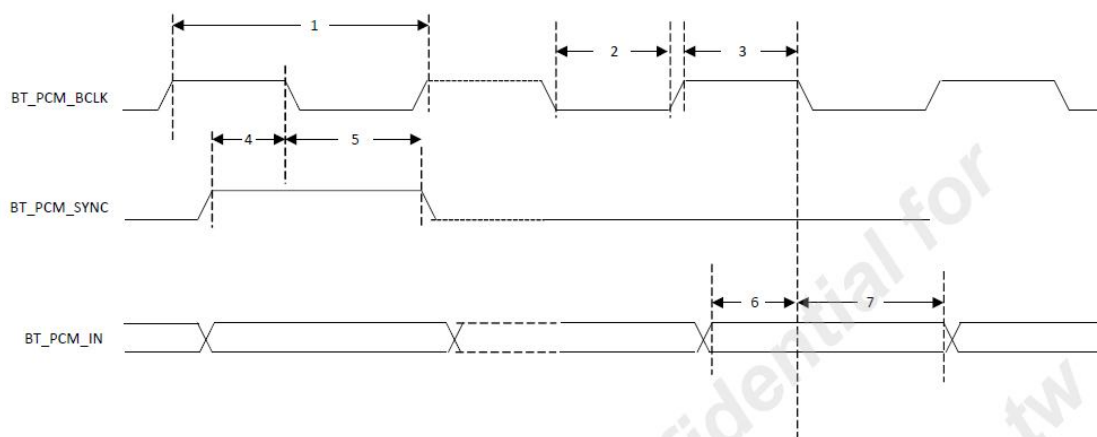
Long Frame Sync, Slave Mode



PCM interface timing spec (long frame sync, slave mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	41	—	—	ns
4	BT_PCM_SYNC setup	8	—	—	ns
5	BT_PCM_SYNC hold	8	—	—	ns
6	BT_PCM_OUT delay	0	—	25	ns
7	BT_PCM_IN setup	8	—	—	ns
8	BT_PCM_IN hold	8	—	—	ns
9	Delay from falling edge of BT_PCM_CLK during the last bit period to BT_PCM_OUT becoming high impedance.	0	—	25	ns

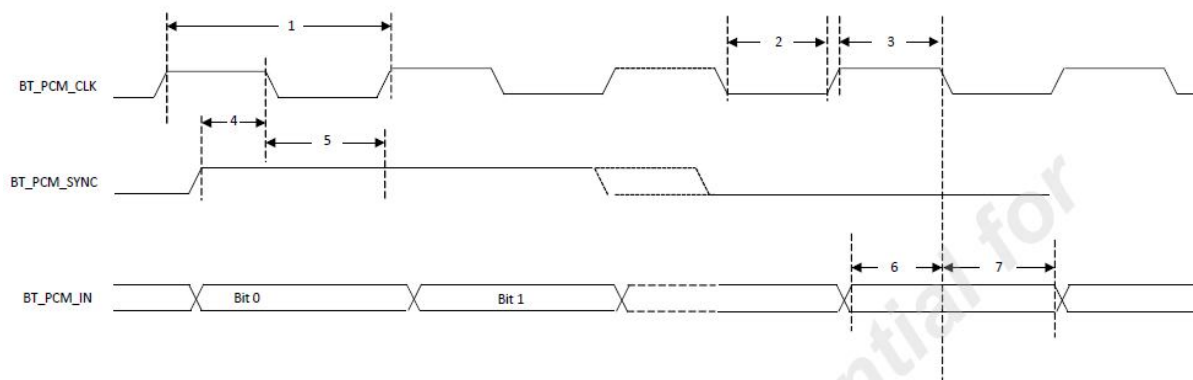
Short Frame Sync, Burst Mod



PCM burst mode (receive only, short frame sync)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	24	MHz
2	PCM bit clock low	20.8	—	—	ns
3	PCM bit clock high	20.8	—	—	ns
4	BT_PCM_SYNC setup	8	—	—	ns
5	BT_PCM_SYNC hold	8	—	—	ns
6	BT_PCM_IN setup	8	—	—	ns
7	BT_PCM_IN hold	8	—	—	ns

Long Frame Sync, Burst Mode



PCM burst mode (receive only, long frames sync)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	24	MHz
2	PCM bit clock low	20.8	—	—	ns
3	PCM bit clock high	20.8	—	—	ns
4	BT_PCM_SYNC setup	8	—	—	ns
5	BT_PCM_SYNC hold	8	—	—	ns
6	BT_PCM_IN setup	8	—	—	ns
7	BT_PCM_IN hold	8	—	—	ns

8.4 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 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.

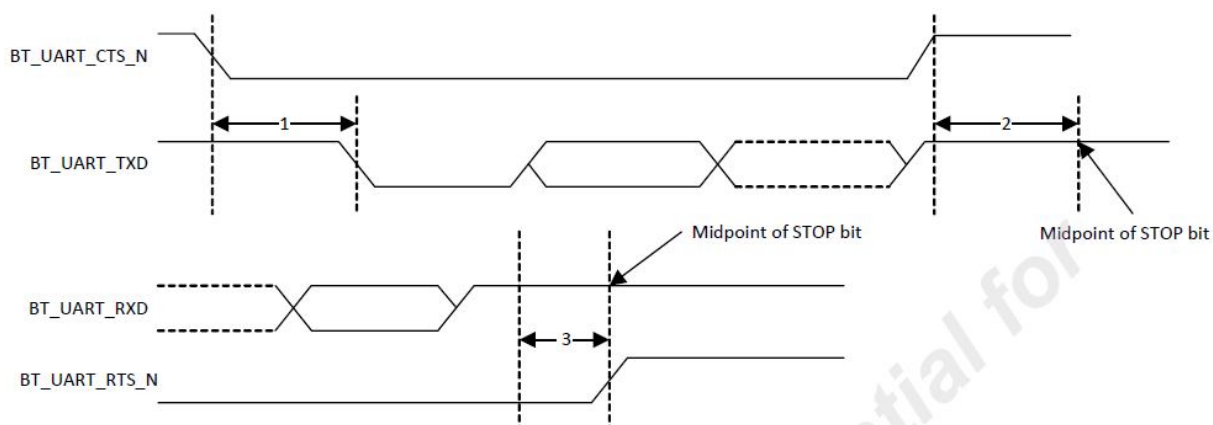
The UART can perform XON/XOFF flow control and includes hardware support for the Serial Line Input Protocol (SLIP). It can also perform wake-on activity. For example, activity on the RX or CTS inputs can wake the chip from a sleep state.

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

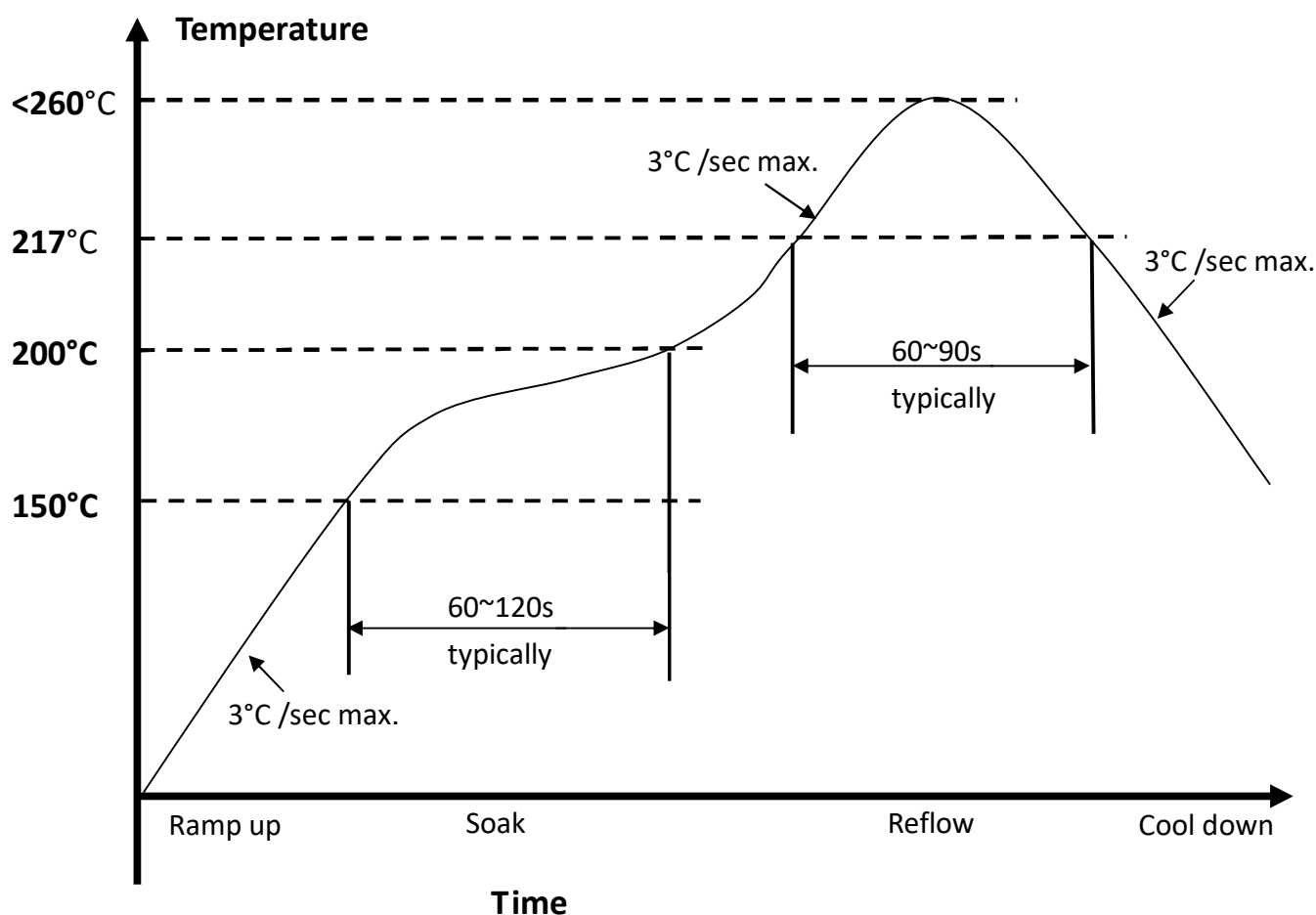
Desired Rate	Actual Rate	Error (%)
4000000	4000000	0.00
3692000	3692308	0.01
3000000	3000000	0.00
2000000	2000000	0.00
1500000	1500000	0.00
1444444	1454544	0.70
921600	923077	0.16
460800	461538	0.16
230400	230796	0.17
115200	115385	0.16
57600	57692	0.16
38400	38400	0.00
28800	28846	0.16
19200	19200	0.00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

UART Timing



Reference	Characteristics	Minimum	Typical	Maximum	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

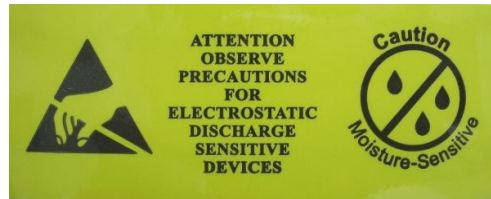


1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C (Time within 5°C of actual Peak Temperature 20-40 seconds)
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N₂) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, 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 This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL If blank, see adjacent bar code label
	- Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH) - Peak package body temperature: _____ °C If blank, see adjacent bar code label - After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be - Mounted within: _____ hours of factory conditions If blank, see adjacent bar code label ≤30°C/60% RH, or - Stored per J-STD-033 - Devices require bake, before mounting, if: - Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at 23 ± 5°C 3a or 3b are not met - 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

TBD

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: <u>260</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>168</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		