AMPAK

AP6356SDXX

Evaluation Kits

User manual

Version 1.0

Revision History

Date	Revision Content	Revised By	Version
2015/12/28	Initial released	Aron	1.0

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

The product comply with the FCC portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

This device is intended only for OEM integrators under the following conditions:

1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The product can be kept as far as possible from the user body or set the device to lower output power if such function is available. The final end product must be labeled in a visible area with the following: “Contains FCC ID:ZQ6-AP6356SDXX”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Industry Canada statement:

This device complies with ISED's licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d' ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Radiation Exposure Statement:

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé.
Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The product can be kept as far as possible from the user body or set the device to lower output power if such function is available. The final end product must be labeled in a visible area with the following: “Contains IC: ”.

Plaque signalétique du produit final

L'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: ".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.
Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Caution :

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;

(iii) the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate; and

(iv) the worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in Section 6.2.2(3) shall be clearly indicated.

(v) Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Avertissement:

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5250 à 5

350 MHz et de 5470 à 5725 MHz doit être conforme à la limite de la p.i.r.e;

(iii) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée pour l'exploitation point à point et l'exploitation non point à point, selon le cas;

(iv) les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, et énoncée à la section 6.2.2 3), doivent être clairement indiqués.

(v) De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。
前項合法通信，指依電信法規定作業之無線電通信。
低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

1. 本模組於取得認證後將依規定於模組本體標示審驗合格標籤。
2. 系統廠商應於平台上標示「本產品內含射頻模組: XXXyyyLPDzzzz-x」字樣。

1. AP6356SDXX Evaluation Board Introduction

AP6356SDXX Evaluation board (EVB) likes as figure1. That is designed for IEEE802.11 a/b/g/n/ac 2x2 WLAN with integrated Bluetooth. It is subject to provide a convenient environment for customer's verification on WiFi or Bluetooth function. There are many controller pins and reserved GPIO on Evaluation board which describes as below.

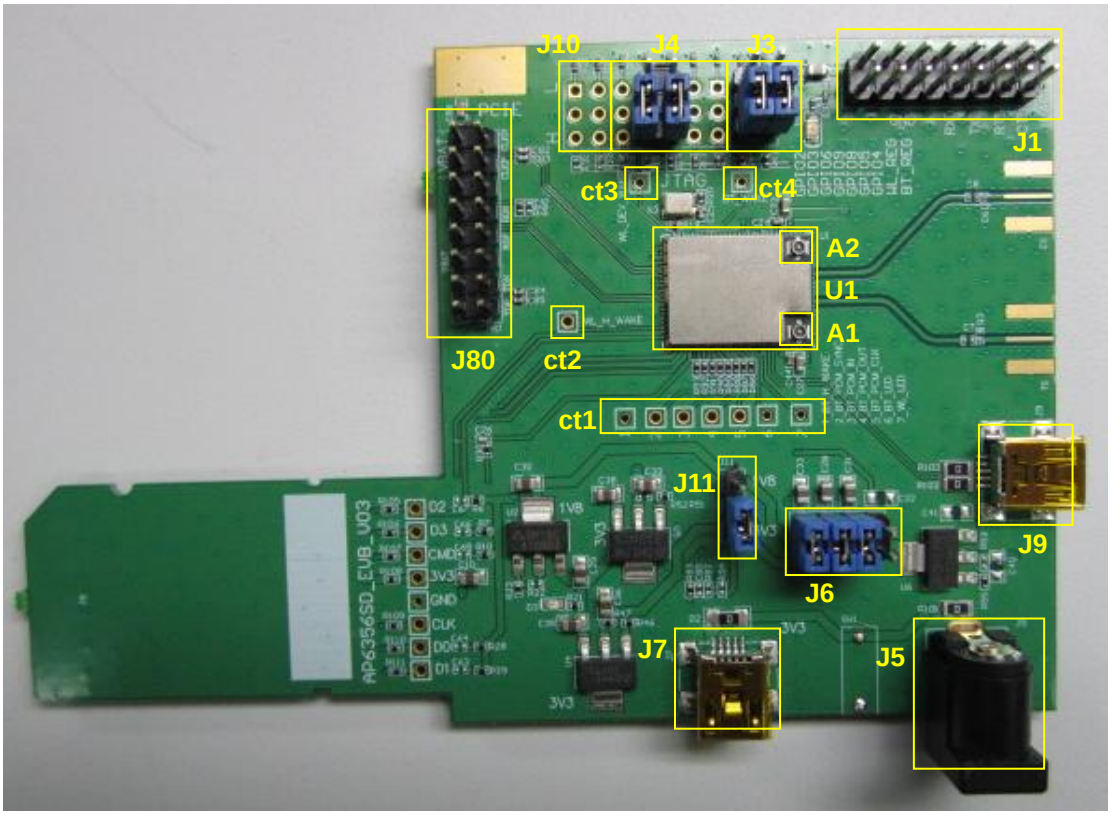


Figure1. Top view of AP6356SDXX EVB

Interface highlights:

1. U1: AP6356SDXX SIP module.
2. J1: UART interface connects with UART transport board for BT.
3. J80: PCIE interface connects with PCIE transport board for WIFI.
4. J3: Enable(H) or disable(L) Bluetooth and WiFi function.
5. J4: PCIE interface strapping option
6. J5: 5V DC adaptor input connector.
7. J6: 3V3 RF/ VBAT / WL_VIO / BT_VIO for main system I/O power path.
8. J7/J9: 5V DC mini USB input connector.
9. J10: GPIO_2 (input/output) and GPIO_3 (input/output)
10. J11: WL_VIO power path for 1V8 or 3V3 selection.
11. A1: I-PEX connector let RF signal in/out path, you could connect with RF cable or

Dipole antenna.

12. A2: I-PEX connector let RF signal in/out path, you could connect with RF cable or Dipole antenna.
13. Ct1-Ct4: WLAN and BT control pins, strongly recommended WL_H_WAKE(IRQ) connected to MCU.

2. WiFi function verification step

WIFI PCIe: PCIe interface definition as below J80 dip connector and this should be used 3.3V for PCIe voltage.

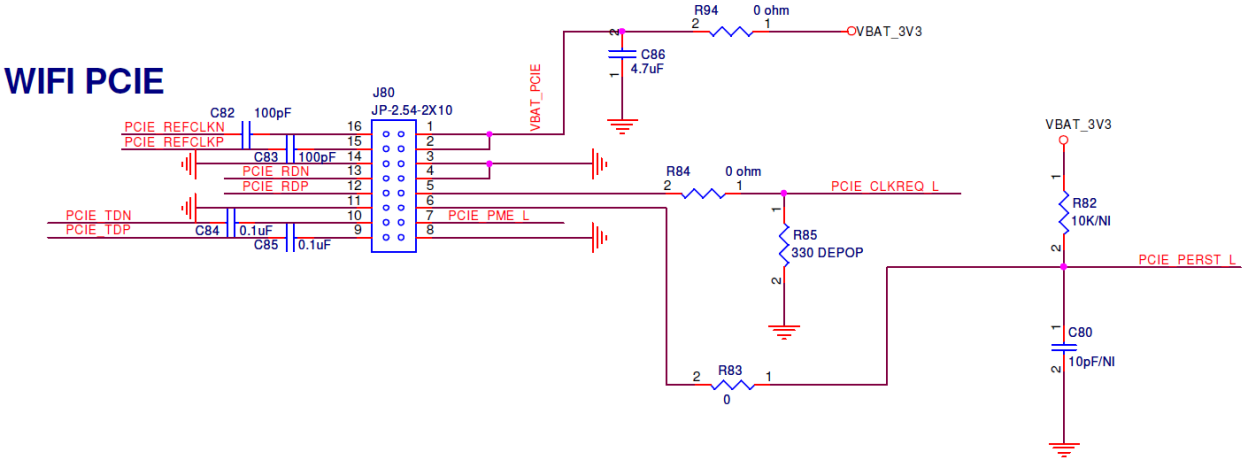


Figure3. WiFi verification connection interface to Host PCIE

Hardware Setup:

- ❖ Refer to Figure3 PCIE pin definition connects the J80 interface of AP6356SDXX evaluation board to Host PCIE control interface.
- ❖ Connects an external antenna at I-PEX connector on the evaluation board.
- ❖ Note to the VDDIO voltage level should be the same with GPIO voltage level of Host CPU. (VDDIO 3.3V or 1.8V selection by jump J11)
- ❖ Pull High J4 are necessary .

WiFi software setup:

Please follow up software guideline of Ampak official released.

3. Bluetooth function verification step

UART：

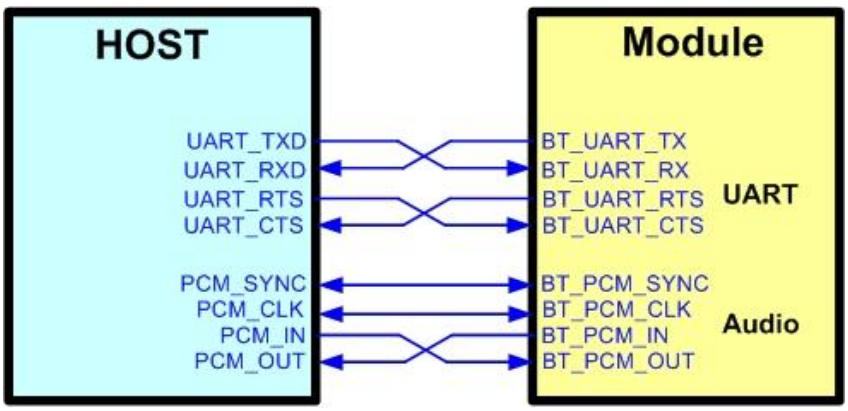


Figure4. Bluetooth verification connection interface to Host UART

Hardware Setup:

- ❖ Refer to Figure4 UART pin definition connects the J1 interface of AP6356SDXX evaluation board to Host UART control interface.
- ❖ Connects an external antenna at I-PEX connector on the evaluation board.
- ❖ Note to the VDDIO voltage level should be the same as GPIO voltage level of Host CPU.

USB：

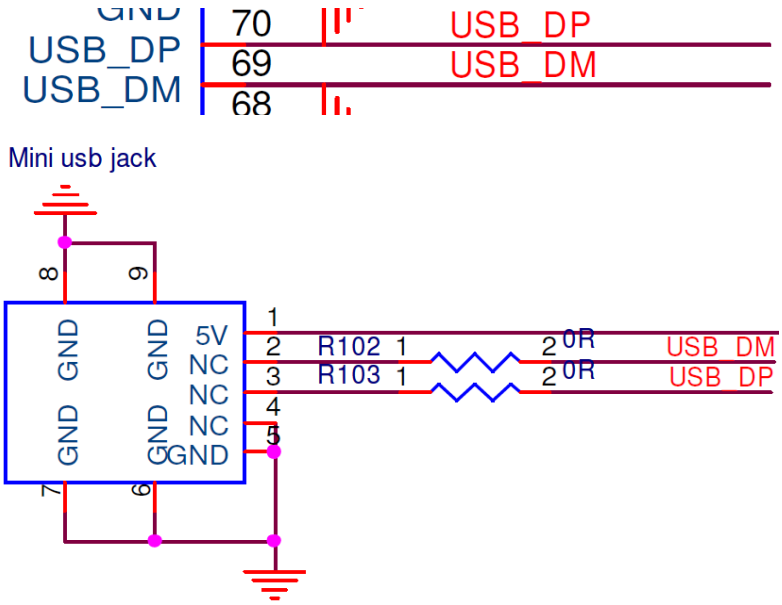


Figure5. Bluetooth verification connection interface to Host USB

Hardware Setup:

- ❖ Refer to Figure5 USB pin definition connects the J9 interface of AP6356SDXX evaluation board to Host USB control interface.
- ❖ Connects an external antenna at I-PEX connector on the evaluation board.

WiFi and Bluetooth software setup:

Please follow up software guideline of Ampak official released.

正基科技股份有限公司

SPECIFICATION

SPEC. NO.： _____ REV： 1.6

DATE： 09. 07.2015

PRODUCT NAME： AP6356SDXX

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW		APPROVED	DCC ISSUE
	PM	QA		

AMPAK

AP6356SDXX

2x2 WiFi + Bluetooth4.1

Module Spec Sheet

Revision History

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

Contents

1. Introduction

AMPAK Technology would like to announce a low-cost and low-power consumption module which has all of the WiFi and Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP, Bluetooth headsets applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n/ac 2x2 Access Points in the wireless LAN.

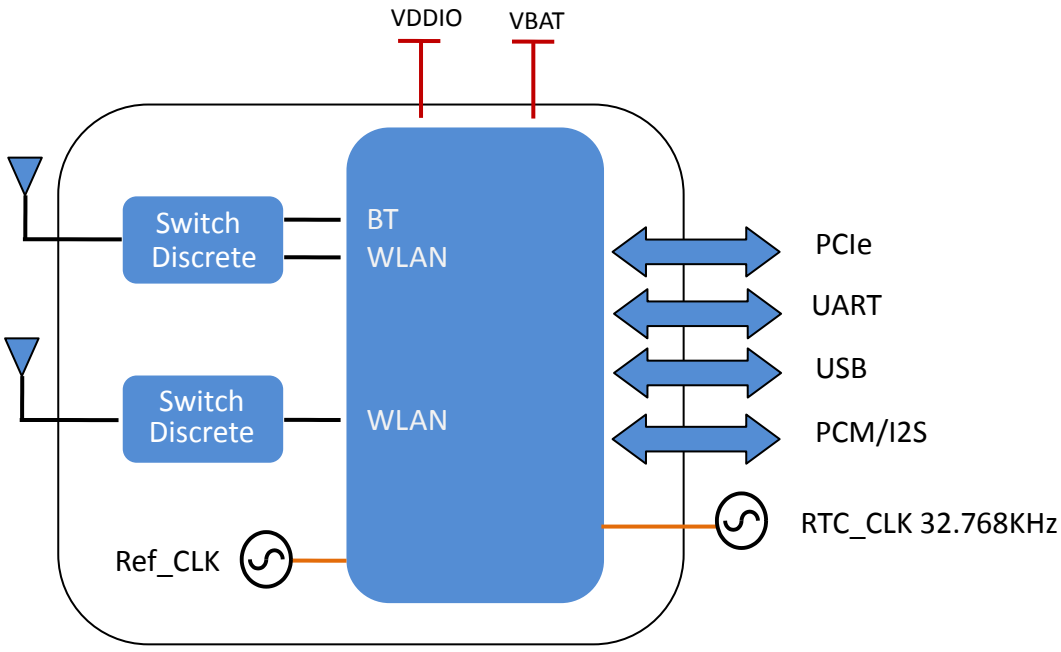
The wireless module complies with IEEE 802.11 a/b/g/n/ac 2x2 MIMO standard and it can achieve up to a speed of 867Mbps with dual stream in 802.11n to connect the wireless LAN. The integrated module provides SDIO/PCIe interface for WiFi, UART / USB/ PCM interface for Bluetooth.

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

2. Features

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

A simplified block diagram of the module is depicted in the figure below.



3. Deliverables

3.1 Deliverables

The following products and software will be part of the product.

- Module with packaging
- Evaluation Kits
- Software utility for integration, performance test.
- Product Datasheet.
- Agency certified pre-tested report with the adapter board.

3.2 Regulatory certifications

The product delivery is a pre-tested module, without the module level certification. For module approval, the platform's antennas are required for the certification.

4. General Specification

4.1 General Specification

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

4.2 Voltages

4.2.1 Absolute Maximum Ratings

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

4.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

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

5. WiFi RF Specification

5.1 2.4GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n/ac WiFi compliant
Frequency Range	2.400 GHz ~ 2.497 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz：Ch1 ~ Ch14
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11 g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11b /11Mbps : 16 dBm ± 1.5 dB @ EVM ≤ -9dB
	802.11g /54Mbps : 15 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /MCS7 : 14 dBm ± 1.5 dB @ EVM ≤ -28dB
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps PER @ -93 dBm, typical
	- 2Mbps PER @ -91 dBm, typical
	- 5.5Mbps PER @ -88 dBm, typical
	- 11Mbps PER @ -86 dBm, typical
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -89 dBm, typical
	- 12Mbps PER @ -88 dBm, typical
	- 18Mbps PER @ -85 dBm, typical
	- 24Mbps PER @ -82 dBm, typical
	- 36Mbps PER @ -79 dBm, typical
	- 48Mbps PER @ -74 dBm, typical
	- 54Mbps PER @ -72 dBm, typical
MIMO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -91 dBm, typical
	- 9Mbps PER @ -91 dBm, typical
	- 12Mbps PER @ -90 dBm, typical
	- 18Mbps PER @ -88 dBm, typical
	- 24Mbps PER @ -85 dBm, typical
	- 36Mbps PER @ -82 dBm, typical
	- 48Mbps PER @ -77 dBm, typical
	- 54Mbps PER @ -75 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -87 dBm, typical
	- MCS=2 PER @ -85 dBm, typical

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

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

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

5.2 5GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25°C

Feature	**Description**
WLAN Standard	IEEE 802.11a/n 2x2, WiFi compliant
Frequency Range	4.900 GHz ~ 5.845 GHz (5.0 GHz ISM Band)
Number of Channels	5.0GHz：Please see the table[1]
Modulation	802.11a : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11n : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11ac : OFDM /256-QAM
Output Power	802.11a /54Mbps : 13 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /MCS7 : 12 dBm ± 1.5 dB @ EVM ≤ -28dB
	802.11ac /MCS9 : 10 dBm ± 1.5 dB @ EVM ≤ -32dB
SISO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -88 dBm, typical
	- 12Mbps PER @ -87 dBm, typical
	- 18Mbps PER @ -84 dBm, typical
	- 24Mbps PER @ -81 dBm, typical
	- 36Mbps PER @ -78 dBm, typical
	- 48Mbps PER @ -73 dBm, typical
	- 54Mbps PER @ -71 dBm, typical
MIMO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -90 dBm, typical
	- 12Mbps PER @ -89 dBm, typical
	- 18Mbps PER @ -87 dBm, typical
	- 24Mbps PER @ -84 dBm, typical
	- 36Mbps PER @ -81 dBm, typical
	- 48Mbps PER @ -76 dBm, typical
	- 54Mbps PER @ -72 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -86 dBm, typical

	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -81 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -72 dBm, typical
	- MCS=6 PER @ -71 dBm, typical
	- MCS=7 PER @ -69 dBm, typical
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -89 dBm, typical
	- MCS=2 PER @ -87 dBm, typical
	- MCS=3 PER @ -84 dBm, typical
	- MCS=4 PER @ -80 dBm, typical
	- MCS=5 PER @ -75 dBm, typical
	- MCS=6 PER @ -74 dBm, typical
	- MCS=7 PER @ -72 dBm, typical
	- MCS=8 PER @ -89 dBm, typical
	- MCS=15 PER @ -69 dBm, typical
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -86 dBm, typical
	- MCS=1 PER @ -83 dBm, typical
	- MCS=2 PER @ -81 dBm, typical
	- MCS=3 PER @ -78 dBm, typical
	- MCS=4 PER @ -74 dBm, typical
	- MCS=5 PER @ -70 dBm, typical
	- MCS=6 PER @ -68 dBm, typical
	- MCS=7 PER @ -67 dBm, typical
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -88 dBm, typical
	- MCS=1 PER @ -86 dBm, typical
	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -81 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -73 dBm, typical
	- MCS=6 PER @ -71 dBm, typical
	- MCS=7 PER @ -70 dBm, typical
	- MCS=8 PER @ -86 dBm, typical
	- MCS=15 PER @ -67 dBm, typical
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -85 dBm, typical
	- MCS=2, NSS1 PER @ -83 dBm, typical

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

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

5GHz(20MHz) Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5.15GHz~5.25GHz	36	5180
	40	5200
	44	5220
	48	5240
5.25GHz~5.35GHz	52	5260
	56	5280
	60	5300
	64	5320
5.5GHz~5.7GHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
	140	5700
5.725GHz~5.825GHz	149	5745
	153	5765
	157	5785
	161	5805

6. Bluetooth Specification

6.1 Bluetooth Specification

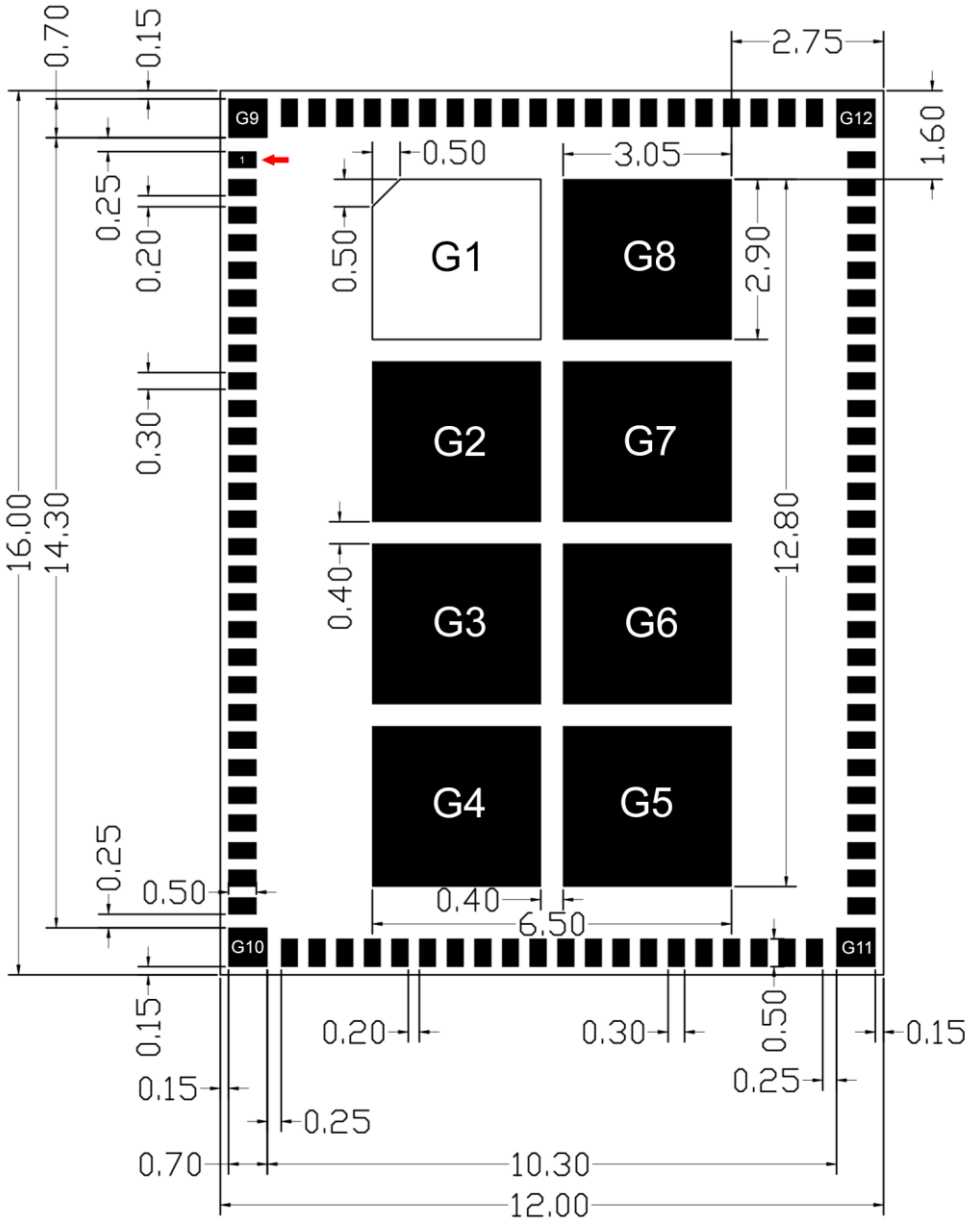
Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25°C

Feature	**Description**		
General Specification			
Bluetooth Standard	Bluetooth V4.1 of 1, 2 and 3 Mbps.		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2402 MHz ~ 2480 MHz		
Number of Channels	79 channels		
Modulation	FHSS, GFSK, DPSK, DQPSK		
RF Specification			
	Min.	**Typical.**	**Max.**
Output Power (Class 1.5)		7 dBm	
Output Power (Class 2)		2 dBm	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-80 dBm	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)		-80 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-78 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	π/4-DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

7. Pin Assignments

7.1 Pin Map

< TOP VIEW >



7.2 Pin Definition

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

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

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

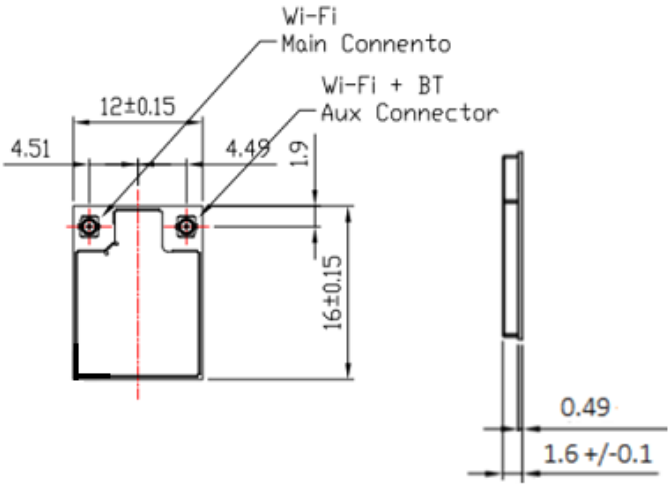
72	3V3_USB	I	3.3V power supply
73	VIO	I	Digital I/O power supply
74	GND	—	Ground connections
75	GND	—	Ground connections
76	GND	—	Ground connections
77	GND	—	Ground connections
78	GND	—	Ground connections
79	GND	—	Ground connections
80	GND	—	Ground connections
81	GND	—	Ground connections
82	GND	—	Ground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

8. Dimensions

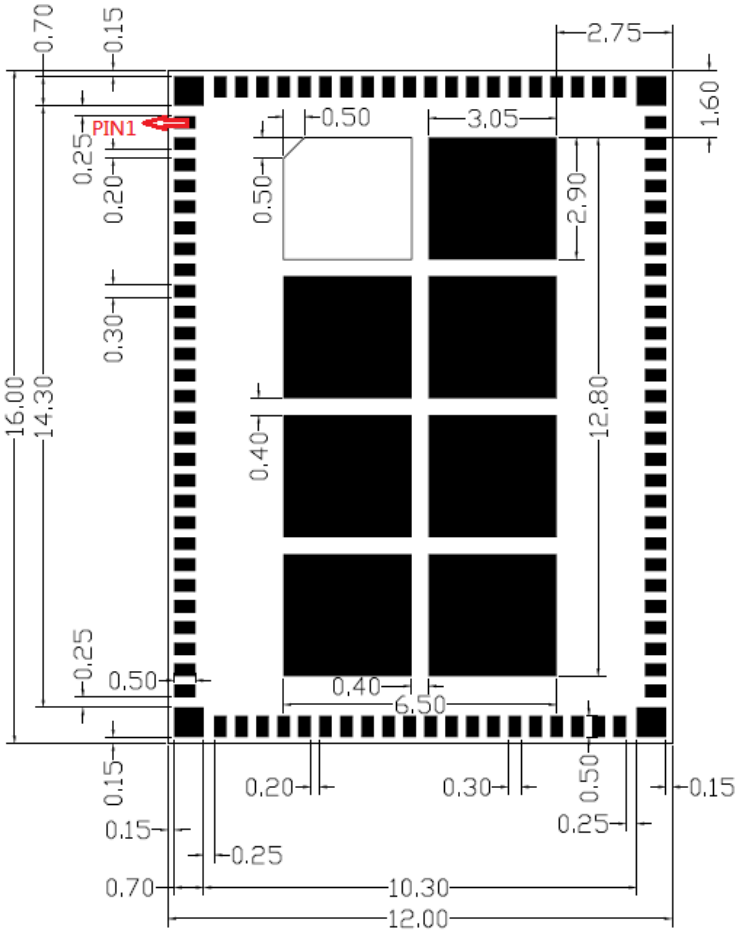
8.1 Physical Dimensions

(Unit: mm)

< TOP VIEW >



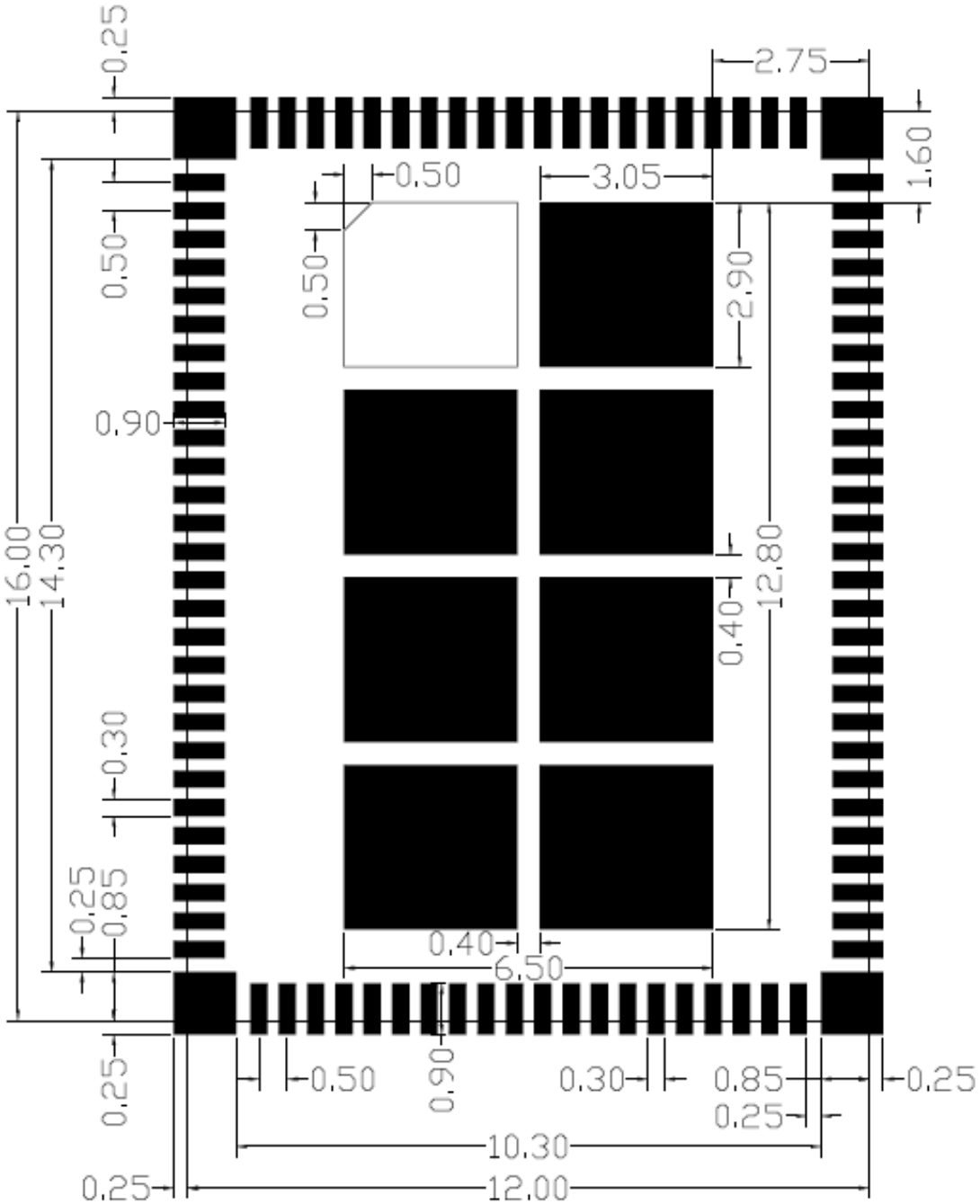
TOP VIEW >



8.2 Layout Recommendation

(Unit: mm)

< TOP VIEW >



9. External clock reference

External LPO signal characteristics

Parameter	Specification	Units
Nominal input frequency	32.768	kHz
Frequency accuracy	±30	ppm
Duty cycle	30 - 70	%
Input signal amplitude	1600 to 3300	mV, p-p
Signal type	Square-wave or sine-wave	-
Input impedance	>100k <5	Ω pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7Vio - Vio	V

9.1 SDIO Pin Description

The module supports SDIO version 3.0 for all 1.8V 4-bit UHSI speeds: SDR50(100 Mbps),SDR104(208MHz) and DDR50(50MHz, dual rates) in addition to the 3.3V default speed(25MHz) and high speed (50 MHz). It has the ability to stop the SDIO clock and map the interrupt signal into a GPIO pin. This 'out-of-band' interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force the control of the gated clocks from within the WLAN chip is also provided.

- ❖ Function 0 Standard SDIO function (Max BlockSize / ByteCount = 32B)
- ❖ Function 1 Backplane Function to access the internal System On Chip (SOC) address space (Max BlockSize / ByteCount = 64B)
- ❖ Function 2 WLAN Function for efficient WLAN packet transfer through DMA (Max BlockSize/ByteCount=512B)

SDIO Pin Description

SD 4-Bit Mode	
DATA0	Data Line 0
DATA1	Data Line 1 or Interrupt
DATA2	Data Line 2 or Read Wait
DATA3	Data Line 3
CLK	Clock
CMD	Command Line

10. Host Interface Timing Diagram

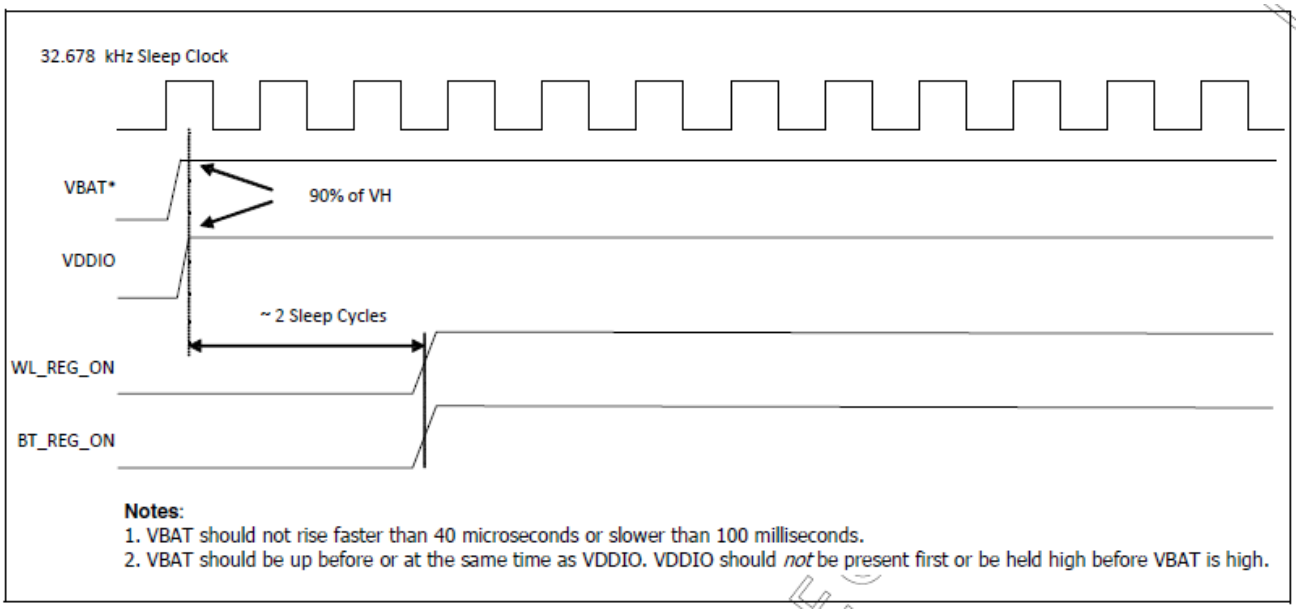
10.1 Power-up Sequence Timing Diagram

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

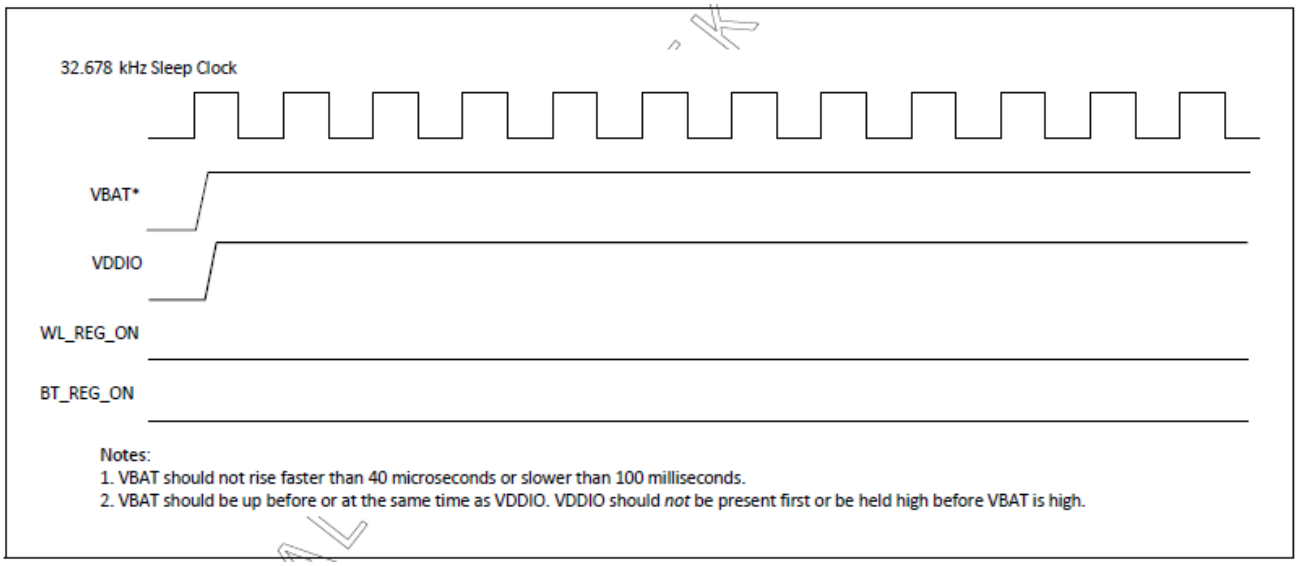
Additionally, diagrams are provided to indicate proper sequencing of the signals for carious operating states. The timing value indicated are minimum required values: longer delays are also acceptable.

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

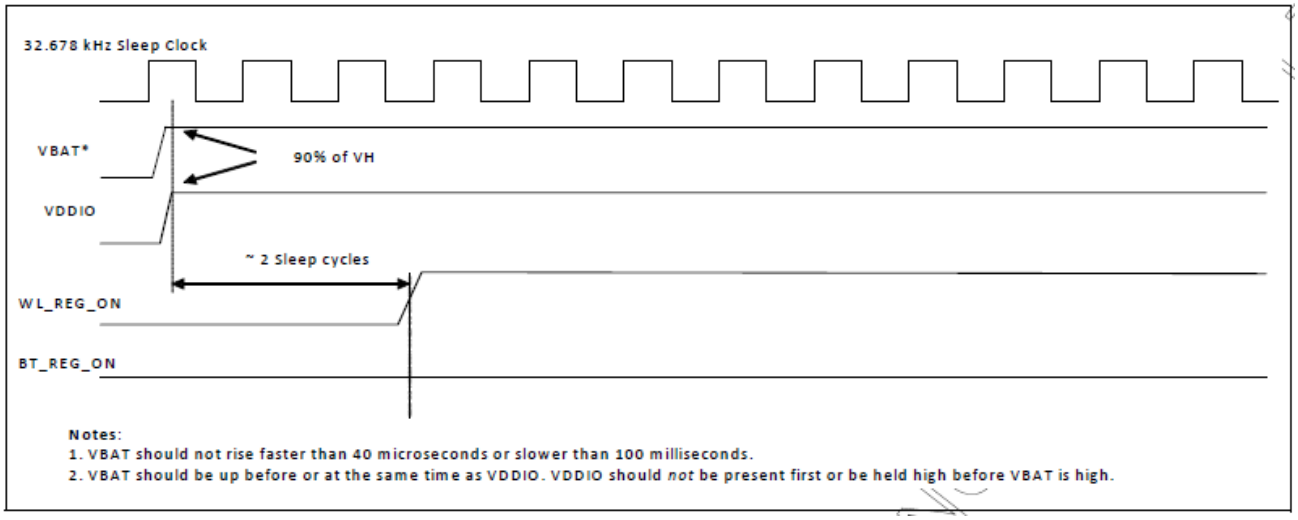
※ BT_REG_ON: Used by the PMU to power up or power down the internal regulators used by the BT section. Low asserting reset for Bluetooth. This pin has no effect on WLAN and does not control any PMU functions. This pin must be driven high or low (not left floating).



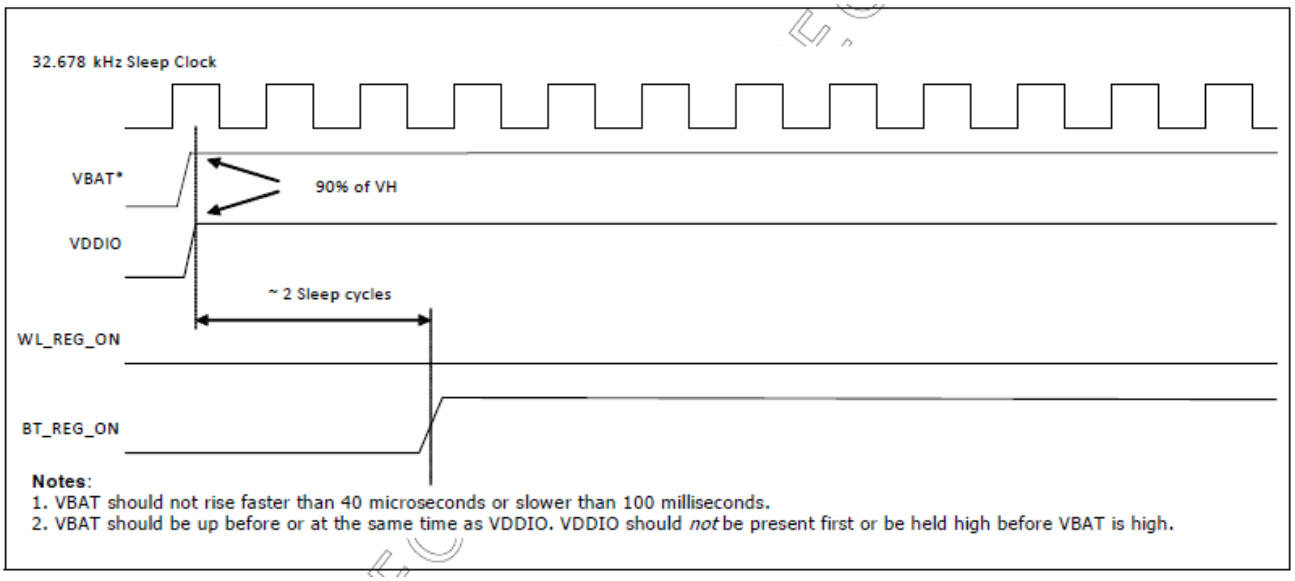
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF

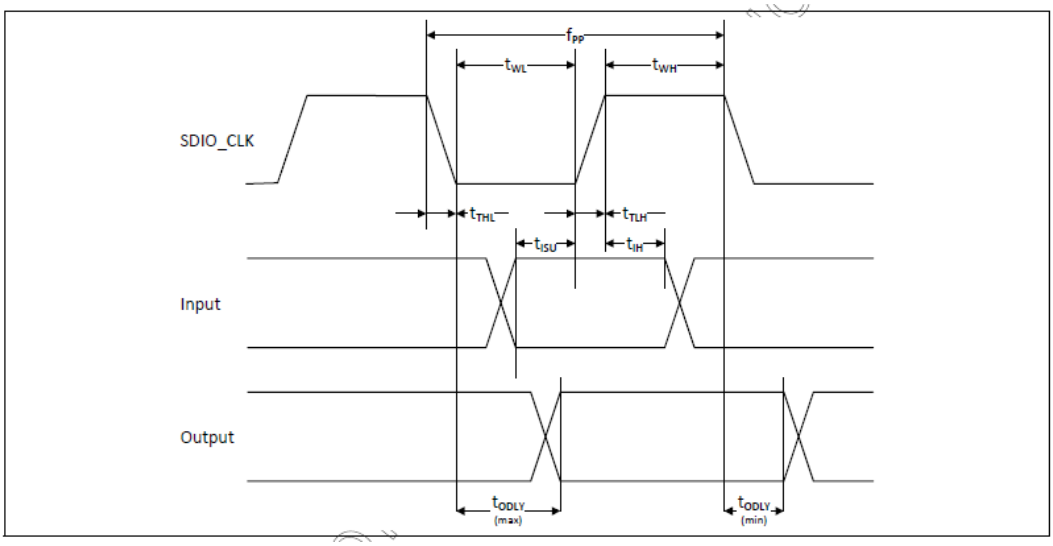


WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

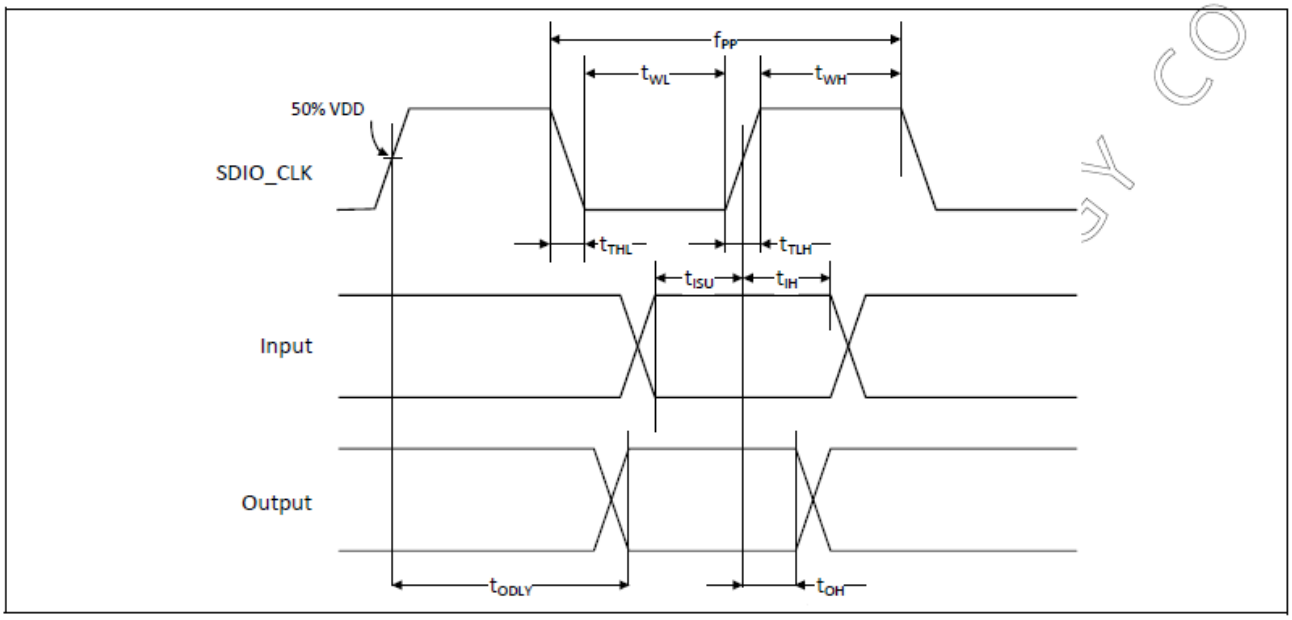
10.2 SDIO Default Mode Timing Diagram



Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
SDIO CLK (All values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer mode	fPP	0	–	25	MHz
Frequency – Identification mode	fOD	0	–	400	kHz
Clock low time	tWL	10	–	–	ns
Clock high time	tWH	10	–	–	ns
Clock rise time	tTLH	–	–	10	ns
Clock low time	tTHL	–	–	10	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup time	tISU	5	–	–	ns
Input hold time	tIH	5	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer mode	tODLY	0	–	14	ns
Output delay time – Identification mode	tODLY	0	–	50	ns

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

10.3 SDIO High Speed Mode Timing Diagram

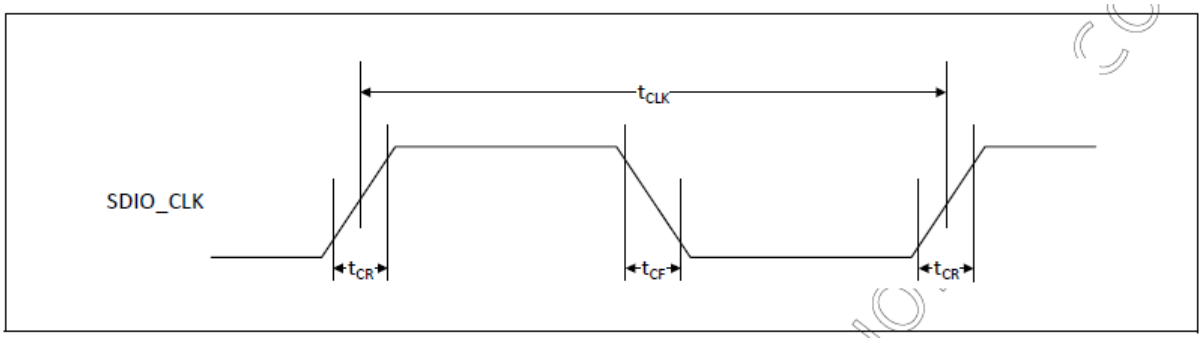


Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
SDIO CLK (all values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer Mode	fPP	0	–	50	MHz
Frequency – Identification Mode	fOD	0	–	400	kHz
Clock low time	tWL	7	–	–	ns
Clock high time	tWH	7	–	–	ns
Clock rise time	tTLH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

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

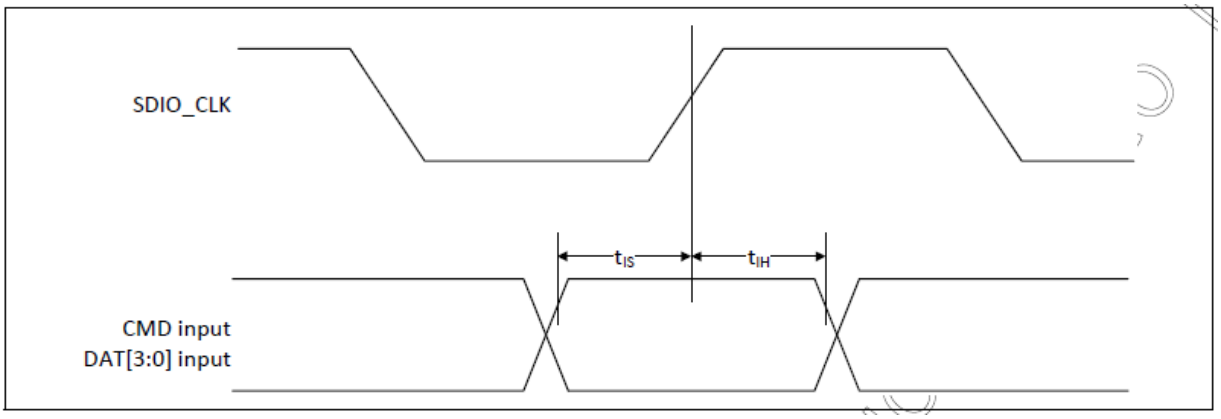
10.4 SDIO Bus Timing Specifications in SDR Modes

Clock timing(SDR Modes)



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

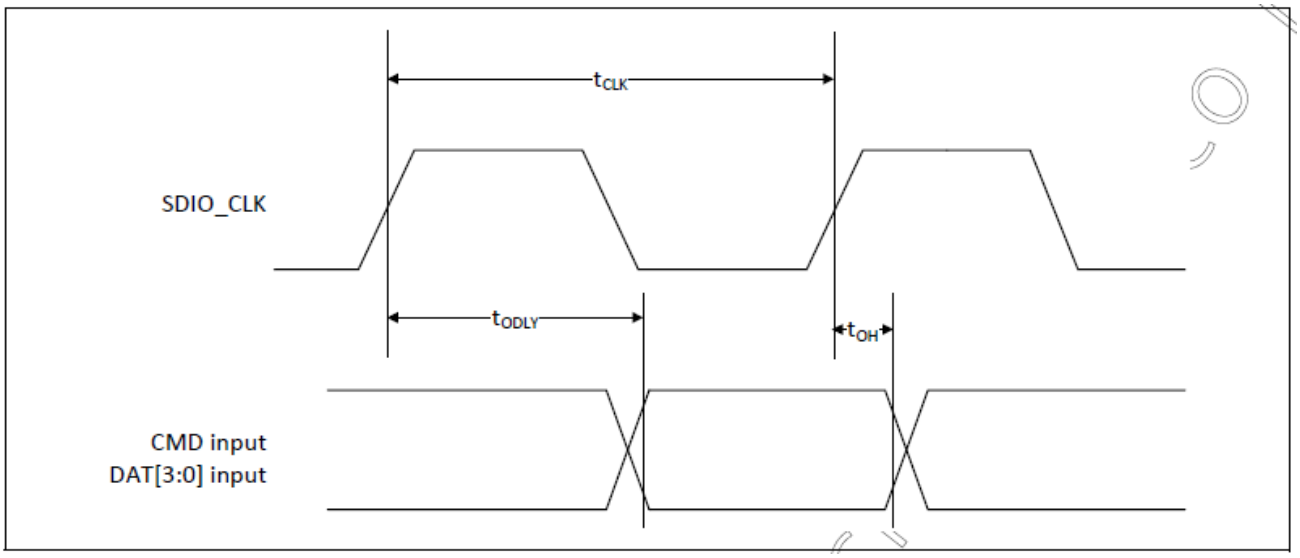
Card Input timing (SDR Modes)



Symbol	*Minimum*	*Maximum*	*Unit*	*Comments*
SDR104 Mode				
t_{IS}	1.70[a]	–	ns	C_{CARD} = 10 pF, VCT = 0.975V
t_{IH}	0.80	–	ns	C_{CARD} = 5 pF, VCT = 0.975V
SDR50 Mode				
t_{IS}	3.00	–	ns	C_{CARD} = 10 pF, VCT = 0.975V
t_{IH}	0.80	–	ns	C_{CARD} = 5 pF, VCT = 0.975V

a. SDIO 3.0 specification value is 1.40 ns.

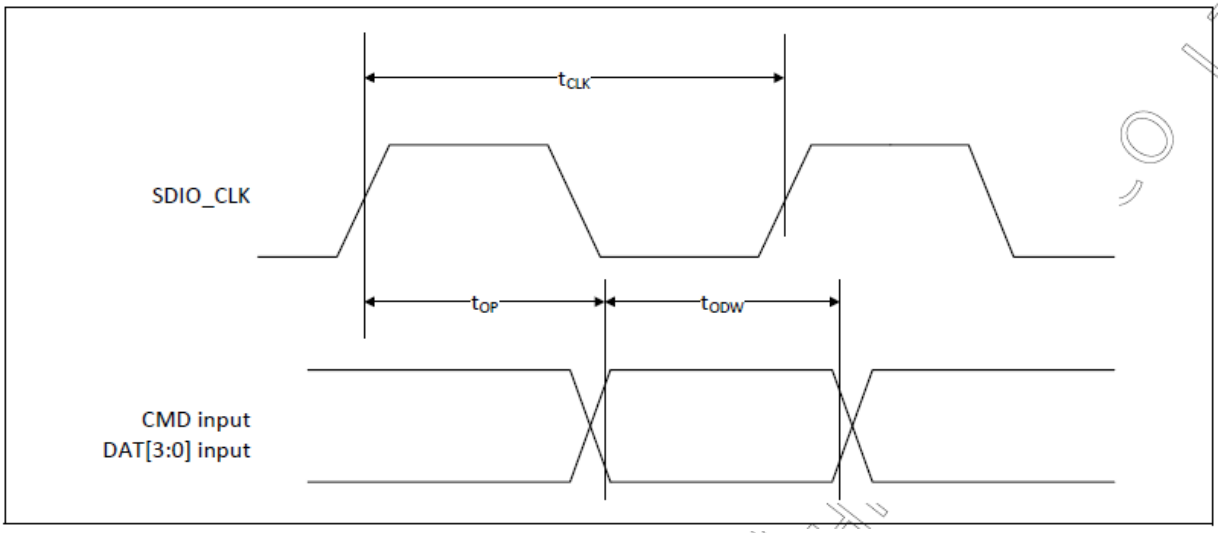
Card output timing (SDR Modes up to 100MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	–	7.85[a]	ns	$t_{CLK} \geq 10$ ns $C_L = 30$ pF using driver type B for SDR50
t_{ODLY}	–	14.0	ns	$t_{CLK} \geq 20$ ns $C_L = 40$ pF using for SDR12, SDR25
t_{OH}	1.5	–	ns	Hold time at the t_{ODLY} (min) $C_L = 15$ pF

a. SDIO 3.0 specification value is 7.5 ns.

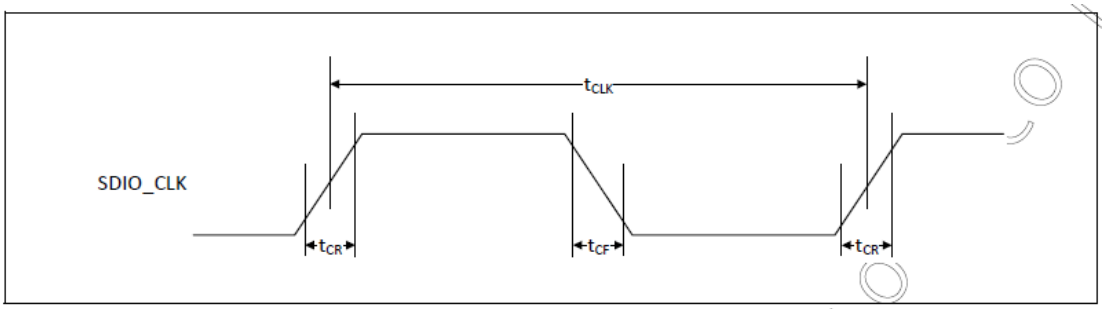
Card output timing (SDR Modes 100MHz to 208MHz)



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

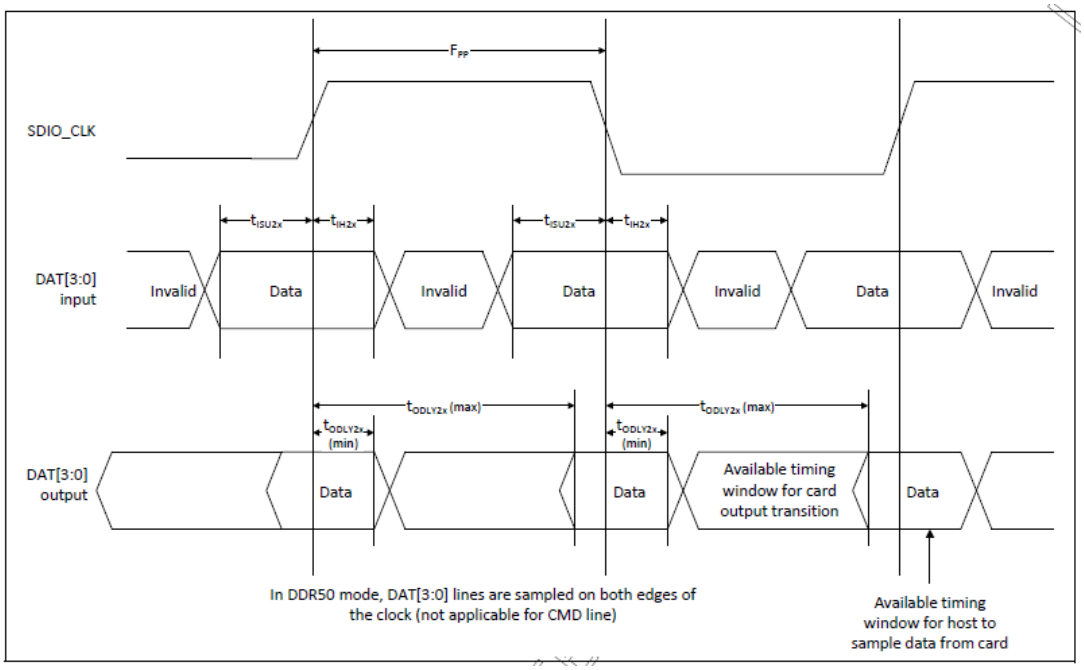
- Δt_{OP} = +1550 ps for junction temperature of Δt_{OP} = 90 degrees during operation
- Δt_{OP} = –350 ps for junction temperature of Δt_{OP} = –20 degrees during operation
- Δt_{OP} = +2600 ps for junction temperature of Δt_{OP} = –20 to +125 degrees during operation

10.5 SDIO Bus Timing Specifications in DDR50 Mode



Parameter	*Symbol*	*Minimum*	*Maximum*	*Unit*	*Comments*
–	t_{CLK}	20	–	ns	DDR50 mode
–	t_{CR},t_{CF}	–	0.2 × tCLK	ns	t_{CR}, t_{CF} < 4.00 ns (max) @50 MHz, C_{CARD} = 10 pF
Clock duty	–	45	55	%	–

Data Timing



Parameter	*Symbol*	*Minimum*	*Maximum*	*Unit*	*Comments*
Input CMD					
Input setup time	t_{ISU}	6	–	ns	C_{CARD} < 10pF (1 Card)
Input hold time	t_{IH}	0.8	–	ns	C_{CARD} < 10pF (1 Card)
Output CMD					
Output delay time	t_{ODLY}	–	13.7	ns	C_{CARD} < 30pF (1 Card)
Output hold time	t_{OH}	1.5	–	ns	C_{CARD} < 15pF (1 Card)
Input DAT					
Input setup time	t_{ISU2x}	3	–	ns	C_{CARD} < 10pF (1 Card)
Input hold time	t_{IH2x}	0.8	–	ns	C_{CARD} < 10pF (1 Card)
Output DAT					
Output delay time	t_{ODLY2x}	–	7.85[a]	ns	C_{CARD} < 25pF (1 Card)
Output hold time	t_{ODLY2x}	1.5	–	ns	C_{CARD} < 15pF (1 Card)

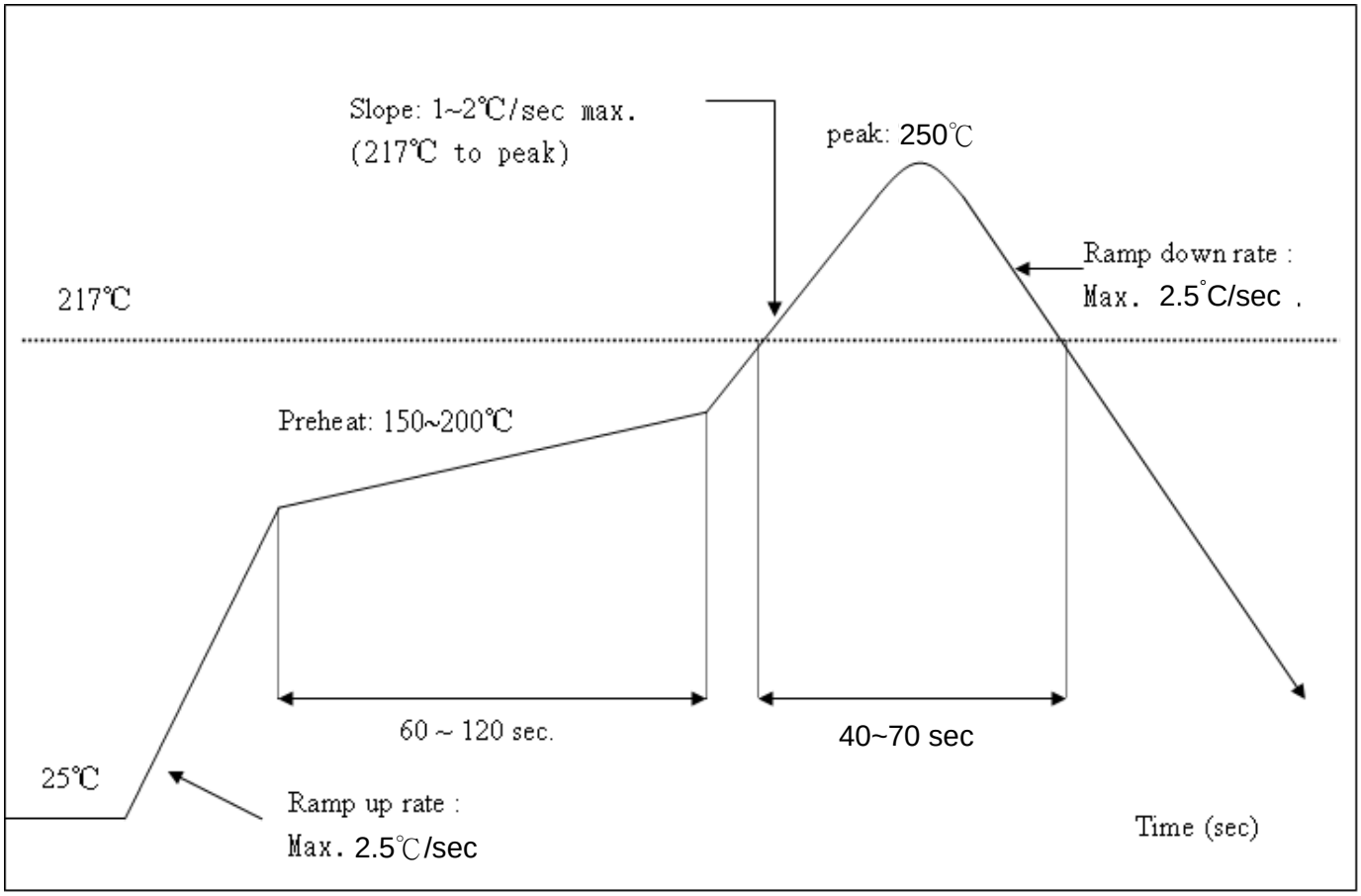
a. SDIO 3.0 specification value is 7.0 ns.

11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times

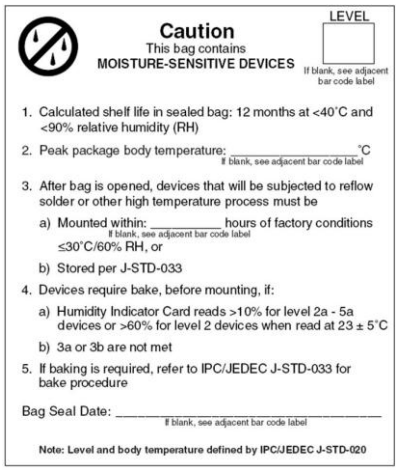


12. Package Information

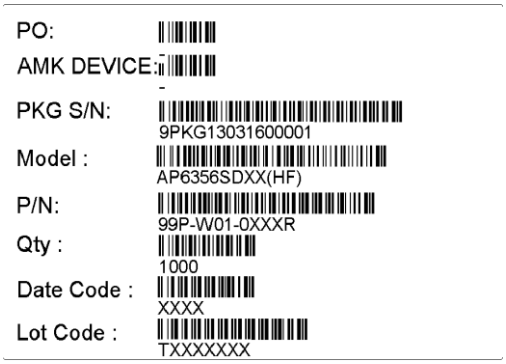
12.1Label

Label A→ Anti-static and humidity notice

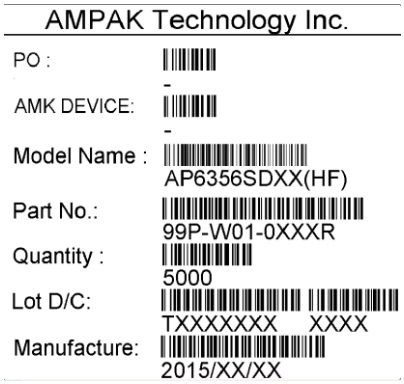
Label B→ MSL caution / Storage Condition



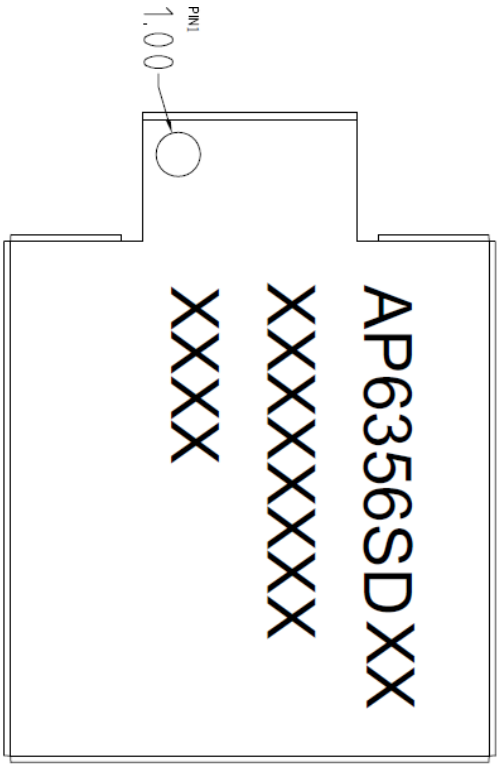
Label C→ Inner box label .



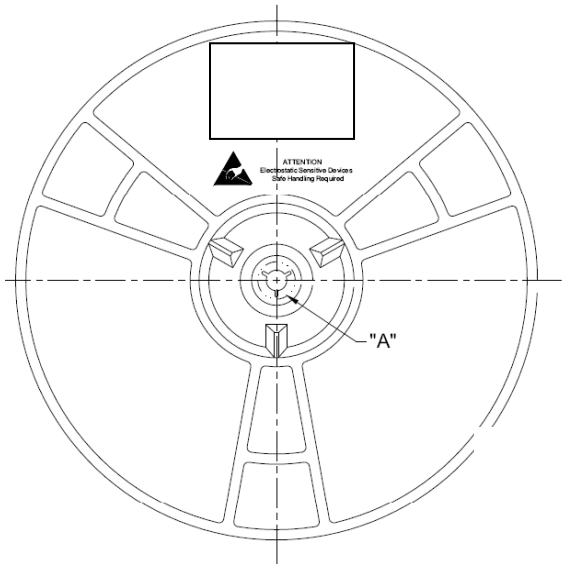
Label D→ Carton box label .

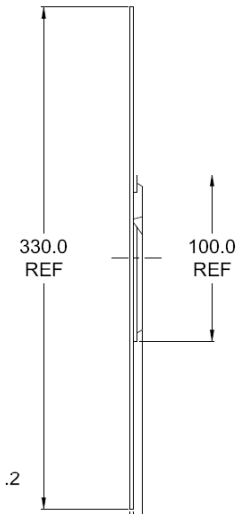


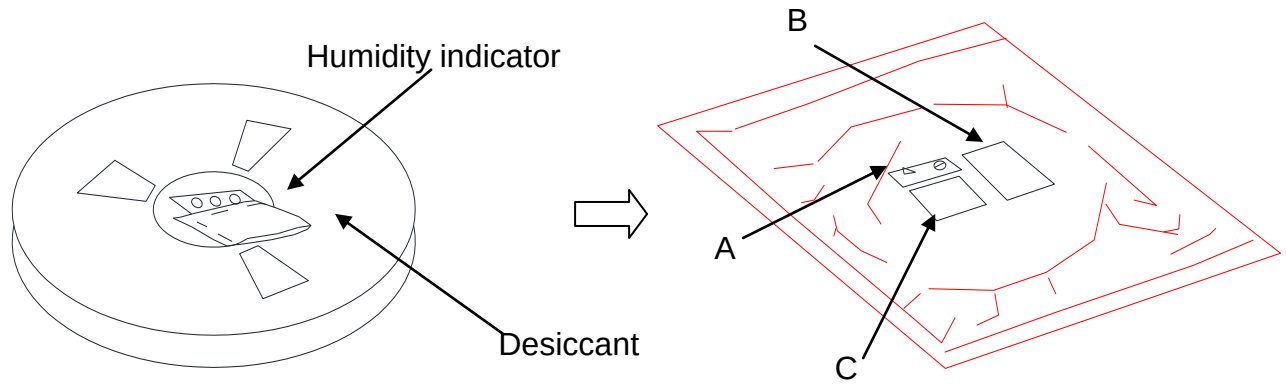
12.2 Dimension

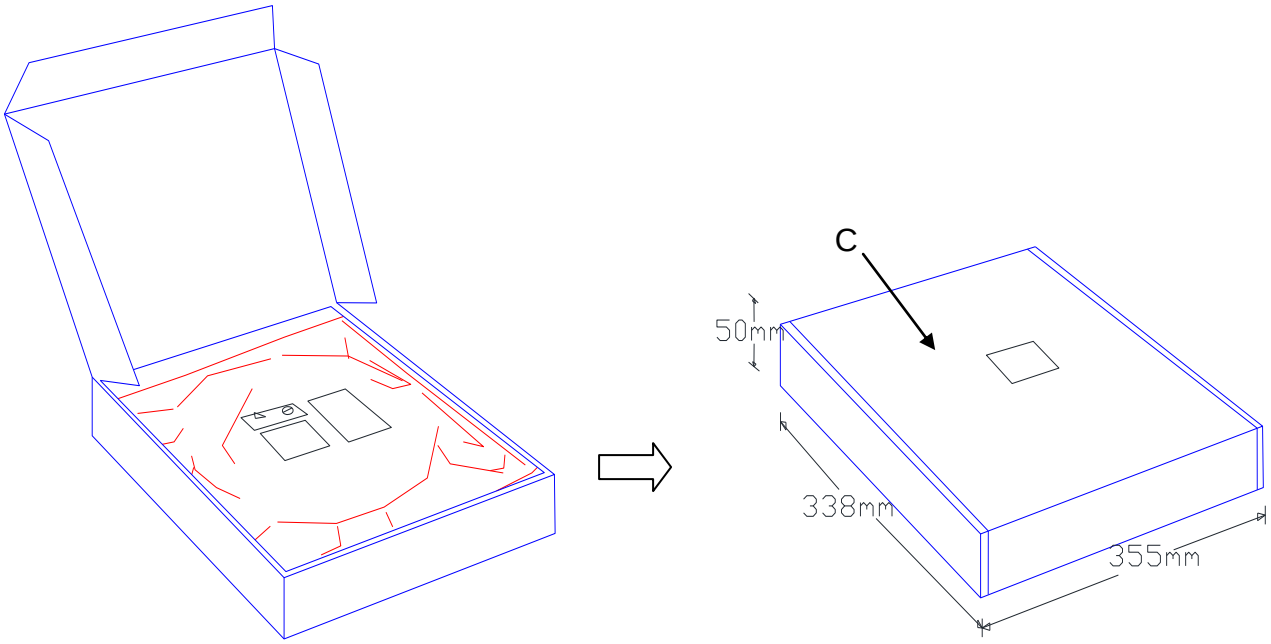


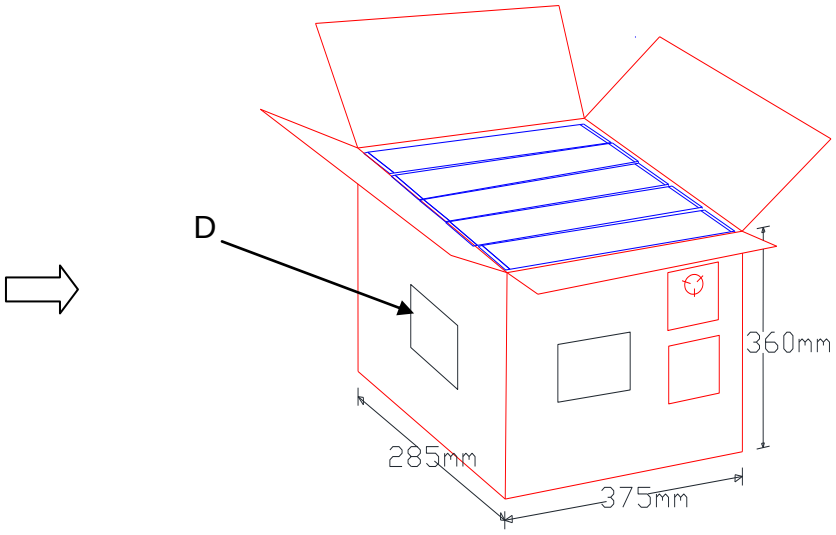
1. 10 sprocket hole pitch cumulative tolerance ±0.20.
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481-D requirements.
5. Thickness : 0.30±0.05mm.
6. Component load per 13" reel



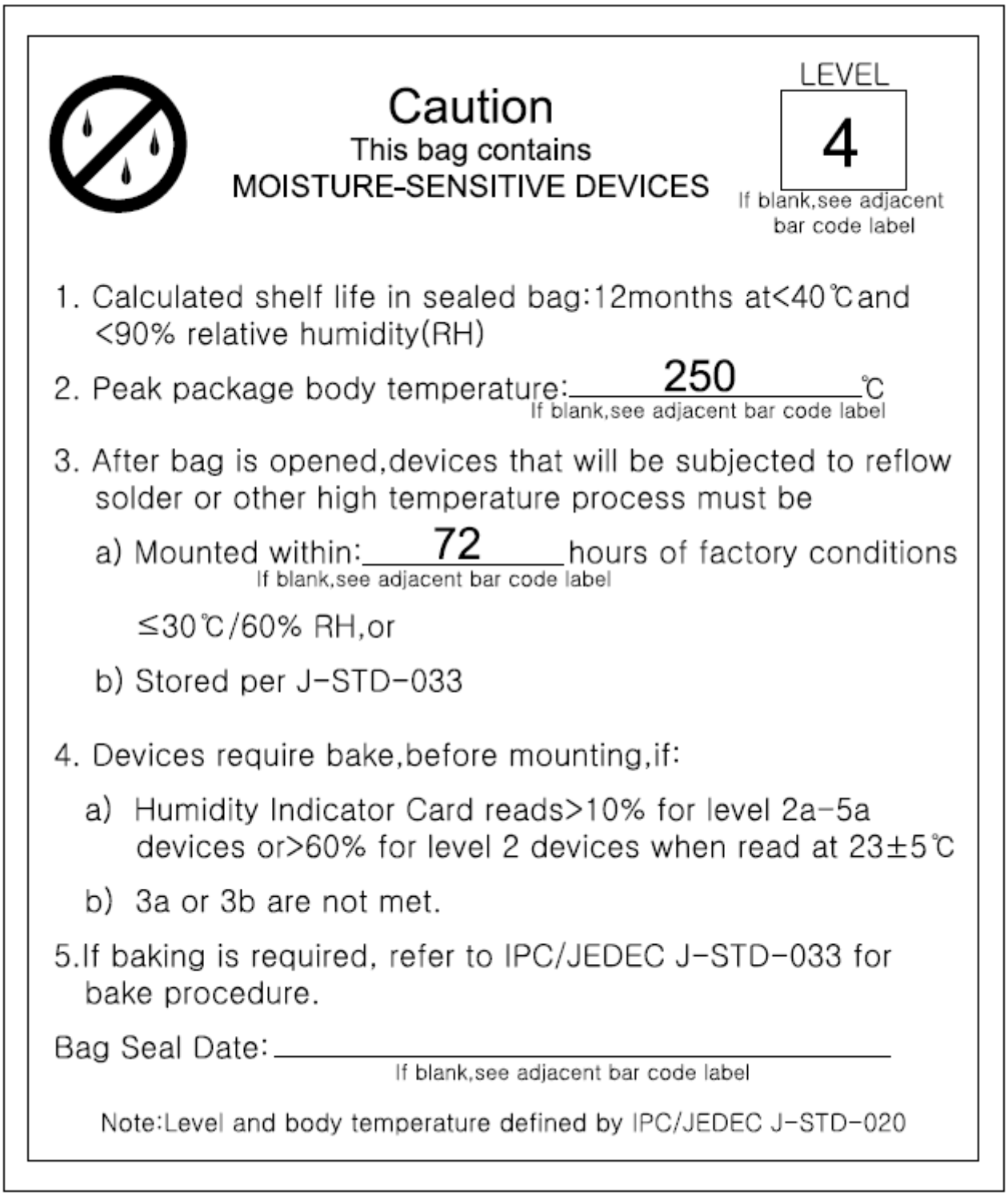



Humidity indicator
Desiccant
B
A
C


C
50mm
338mm
355mm


D
360mm
285mm
375mm

12.3 MSL Level / Storage Condition



※NOTE : Accumulated baking time should not exceed 96hrs