AMPAK Technology Inc.

正基科技股份有限公司

產品規格書

SPECIFICATION

PRODUCT NAME： AP12356_I

SPEC. NO.： _____ REV： 0.0

DATE： 10.11.2016

PREPARED	REVIEW		APPROVED	DCC ISSUE
	PM	QA		

AMPAK

AP12356_I

2x2 Wi-Fi + Bluetooth4.1 Module
with PCI-e Half-Mini Card
Spec Sheet

Revision History

Date	Revision Content	Revised By	Version
2016/10/11	- **Initial Released**	Rue	0.0
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	-		
	-		
	-		

Contents

1. Introduction

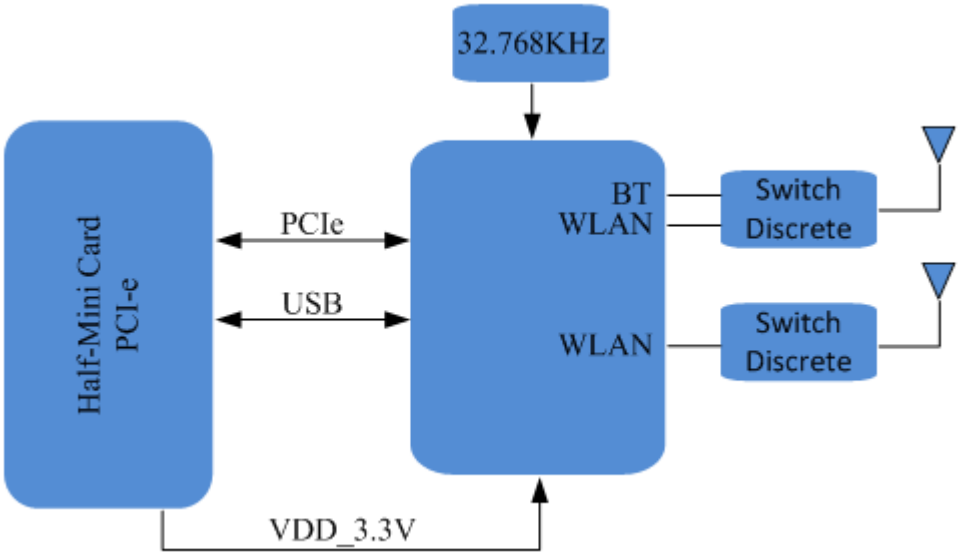
AMPAK Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi and Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP, Bluetooth headsets and other applications. With seamless roaming capabilities and advanced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

The wireless module complies with IEEE 802.11a/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 PCI-e interface for WiFi, USB interface for Bluetooth.

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 PCI-e interfaces.
- BT host interface:
  - USB
- Support Bluetooth 4.1 compliant with Bluetooth 3.0, Bluetooth 2.1+EDR and Low Energy (BLE).
- Complies with Bluetooth Core Specification Version 4.1 with provisions for supporting future specifications. With Bluetooth Class1 or Class2 transmitter operation.

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



3. General Specification

3.1 General Specification

Model Name	AP12356_I
Product Description	Support Wi-Fi / Bluetooth functionalities
Dimension	L x W x H: 29.85(±0.15) x 26.65(±0.15) x 2.64(±0.2) mm
WiFi Interface	Support PCI-e with Half-Mini Card
BT Interface	USB with Half-Mini Card
Operating temperature	-40°C to 85°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing
WiFi PCIE VID	0x14E4
WiFi PCIE PID	0x43EC
WiFi PCIE SVID	0x17F9
WiFi PCIE SSID	0x0035
BT USB VID	0x2B54
BT USB PID	0x5600

3.2 Voltages

3.2.1 Recommended Operating Rating

	Min.	**Typ.**	**Max.**	**Unit**
Operating Temperature	-40	25	85	deg.C
VDD	3.0	3.3	3.6	V

4. WiFi RF Specification

4.1 2.4GHz RF Specification

Conditions : VDD=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 802.11g/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 @ -91 dBm, typical
	- 2Mbps PER @ -89 dBm, typical
	- 5.5Mbps PER @ -87 dBm, typical
	- 11Mbps PER @ -84 dBm, typical
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -88 dBm, typical
	- 9Mbps PER @ -87 dBm, typical
	- 12Mbps PER @ -86 dBm, typical
	- 18Mbps PER @ -84 dBm, typical
	- 24Mbps PER @ -80 dBm, typical
	- 36Mbps PER @ -77 dBm, typical
	- 48Mbps PER @ -72 dBm, typical
	- 54Mbps PER @ -70 dBm, typical
MIMO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -89 dBm, typical
	- 9Mbps PER @ -89 dBm, typical
	- 12Mbps PER @ -88 dBm, typical
	- 18Mbps PER @ -87 dBm, typical
	- 24Mbps PER @ -83 dBm, typical
	- 36Mbps PER @ -80 dBm, typical
	- 48Mbps PER @ -75 dBm, typical
	- 54Mbps PER @ -73 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -88 dBm, typical
	- MCS=1 PER @ -85 dBm, typical
	- MCS=2 PER @ -83 dBm, typical

	- MCS=3 PER @ -79 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -71 dBm, typical
	- MCS=6 PER @ -70 dBm, typical
	- MCS=7 PER @ -68 dBm, typical
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -88 dBm, typical
	- MCS=2 PER @ -87 dBm, typical
	- MCS=3 PER @ -83 dBm, typical
	- MCS=4 PER @ -79 dBm, typical
	- MCS=5 PER @ -74 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -69 dBm, typical
	- MCS=8 PER @ -86 dBm, typical
	- MCS=15 PER @ -67 dBm, typical
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -85 dBm, typical
	- MCS=1 PER @ -81 dBm, typical
	- MCS=2 PER @ -80 dBm, typical
	- MCS=3 PER @ -77 dBm, typical
	- MCS=4 PER @ -73 dBm, typical
	- MCS=5 PER @ -69 dBm, typical
	- MCS=6 PER @ -67 dBm, typical
	- MCS=7 PER @ -66 dBm, typical
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -87 dBm, typical
	- MCS=1 PER @ -85 dBm, typical
	- MCS=2 PER @ -83 dBm, typical
	- MCS=3 PER @ -80 dBm, typical
	- MCS=4 PER @ -76 dBm, typical
	- MCS=5 PER @ -72 dBm, typical
	- MCS=6 PER @ -74 dBm, typical
	- MCS=7 PER @ -69 dBm, typical
	- MCS=8 PER @ -85 dBm, typical
	- MCS=15 PER @ -66 dBm, typical
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -84 dBm, typical
	- MCS=2, NSS1 PER @ -83 dBm, typical
	- MCS=3, NSS1 PER @ -79 dBm, typical

	- MCS=4, NSS1 PER @ -76 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 @ -65 dBm, typical
MIMO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -86 dBm, typical
	- MCS=2, NSS1 PER @ -85 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 @ -71 dBm, typical
	- MCS=8, NSS1 PER @ -67 dBm, typical
	- MCS=0, NSS2 PER @ -87 dBm, typical
	- MCS=8, NSS2 PER @ -63 dBm, typical
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -84 dBm, typical
	- MCS=1, NSS1 PER @ -83 dBm, typical
	- MCS=2, NSS1 PER @ -80 dBm, typical
	- MCS=3, NSS1 PER @ -77 dBm, typical
	- MCS=4, NSS1 PER @ -73 dBm, typical
	- MCS=5, NSS1 PER @ -69 dBm, typical
	- MCS=6, NSS1 PER @ -67 dBm, typical
	- MCS=7, NSS1 PER @ -66 dBm, typical
	- MCS=8, NSS1 PER @ -61 dBm, typical
	- MCS=9, NSS1 PER @ -60 dBm, typical
MIMO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -86 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 @ -75 dBm, typical
	- MCS=5, NSS1 PER @ -72 dBm, typical
	- MCS=6, NSS1 PER @ -70 dBm, typical
	- MCS=7, NSS1 PER @ -69 dBm, typical
	- MCS=8, NSS1 PER @ -65 dBm, typical
	- MCS=9, NSS1 PER @ -63 dBm, typical
	- MCS=0, NSS2 PER @ -84 dBm, typical

	- MCS=9, NSS2 PER @ -59 dBm, typical
Maximum Input Level	802.11b : -10 dBm
	802.11g/n : -20 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

4.2 5GHz RF Specification

Conditions : VDD=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 @ -88 dBm, typical
	- 9Mbps PER @ -87 dBm, typical
	- 12Mbps PER @ -85 dBm, typical
	- 18Mbps PER @ -82 dBm, typical
	- 24Mbps PER @ -79 dBm, typical
	- 36Mbps PER @ -76 dBm, typical
	- 48Mbps PER @ -71 dBm, typical
	- 54Mbps PER @ -69 dBm, typical
MIMO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -88 dBm, typical
	- 9Mbps PER @ -88 dBm, typical
	- 12Mbps PER @ -87 dBm, typical
	- 18Mbps PER @ -85 dBm, typical
	- 24Mbps PER @ -82 dBm, typical
	- 36Mbps PER @ -79 dBm, typical
	- 48Mbps PER @ -74 dBm, typical
	- 54Mbps PER @ -70 dBm, typical
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -87 dBm, typical
	- MCS=1 PER @ -84 dBm, typical
	- MCS=2 PER @ -82 dBm, typical

	- MCS=3 PER @ -79 dBm, typical
	- MCS=4 PER @ -75 dBm, typical
	- MCS=5 PER @ -70 dBm, typical
	- MCS=6 PER @ -69 dBm, typical
	- MCS=7 PER @ -67 dBm, typical
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -88 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 @ -73 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -70 dBm, typical
	- MCS=8 PER @ -87 dBm, typical
	- MCS=15 PER @ -67 dBm, typical
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -84 dBm, typical
	- MCS=1 PER @ -81 dBm, typical
	- MCS=2 PER @ -79 dBm, typical
	- MCS=3 PER @ -76 dBm, typical
	- MCS=4 PER @ -72 dBm, typical
	- MCS=5 PER @ -68 dBm, typical
	- MCS=6 PER @ -66 dBm, typical
	- MCS=7 PER @ -65 dBm, typical
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -86 dBm, typical
	- MCS=1 PER @ -84 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
	- MCS=8 PER @ -84 dBm, typical
	- MCS=15 PER @ -65 dBm, typical
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -85 dBm, typical
	- MCS=1, NSS1 PER @ -83 dBm, typical
	- MCS=2, NSS1 PER @ -81 dBm, typical
	- MCS=3, NSS1 PER @ -78 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 @ -63 dBm, typical
MIMO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -87 dBm, typical
	- MCS=1, NSS1 PER @ -86 dBm, typical
	- MCS=2, NSS1 PER @ -84 dBm, typical
	- MCS=3, NSS1 PER @ -81 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 @ -67 dBm, typical
	- MCS=0, NSS2 PER @ -86 dBm, typical
	- MCS=8, NSS2 PER @ -62 dBm, typical
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -83 dBm, typical
	- MCS=1, NSS1 PER @ -80 dBm, typical
	- MCS=2, NSS1 PER @ -78 dBm, typical
	- MCS=3, NSS1 PER @ -75 dBm, typical
	- MCS=4, NSS1 PER @ -72 dBm, typical
	- MCS=5, NSS1 PER @ -67 dBm, typical
	- MCS=6, NSS1 PER @ -66 dBm, typical
	- MCS=7, NSS1 PER @ -65 dBm, typical
	- MCS=8, NSS1 PER @ -60 dBm, typical
	- MCS=9, NSS1 PER @ -59 dBm, typical
MIMO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -85 dBm, typical
	- MCS=1, NSS1 PER @ -83 dBm, typical
	- MCS=2, NSS1 PER @ -83 dBm, typical
	- MCS=3, NSS1 PER @ -78 dBm, typical
	- MCS=4, NSS1 PER @ -75 dBm, typical
	- MCS=5, NSS1 PER @ -70 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
	- MCS=0, NSS2 PER @ -83 dBm, typical

	- MCS=9, NSS2 PER @ -58 dBm, typical
SISO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 PER @ -80 dBm, typical
	- MCS=1, NSS1 PER @ -77 dBm, typical
	- MCS=2, NSS1 PER @ -75 dBm, typical
	- MCS=3, NSS1 PER @ -71 dBm, typical
	- MCS=4, NSS1 PER @ -68 dBm, typical
	- MCS=5, NSS1 PER @ -65 dBm, typical
	- MCS=6, NSS1 PER @ -63 dBm, typical
	- MCS=7, NSS1 PER @ -61 dBm, typical
	- MCS=9, NSS1 PER @ -57 dBm, typical
	- MCS=9, NSS1 PER @ -55 dBm, typical
MIMO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 PER @ -81 dBm, typical
	- MCS=1, NSS1 PER @ -80 dBm, typical
	- MCS=2, NSS1 PER @ -78 dBm, typical
	- MCS=3, NSS1 PER @ -74 dBm, typical
	- MCS=4, NSS1 PER @ -72 dBm, typical
	- MCS=5, NSS1 PER @ -68 dBm, typical
	- MCS=6, NSS1 PER @ -66 dBm, typical
	- MCS=7, NSS1 PER @ -64 dBm, typical
	- MCS=8, NSS1 PER @ -60 dBm, typical
	- MCS=9, NSS1 PER @ -58 dBm, typical
	- MCS=0, NSS2 PER @ -79 dBm, typical
	- MCS=9, NSS2 PER @ -54 dBm, typical
Maximum Input Level	802.11a/n : -30 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

5 GHz (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

5. Bluetooth Specification

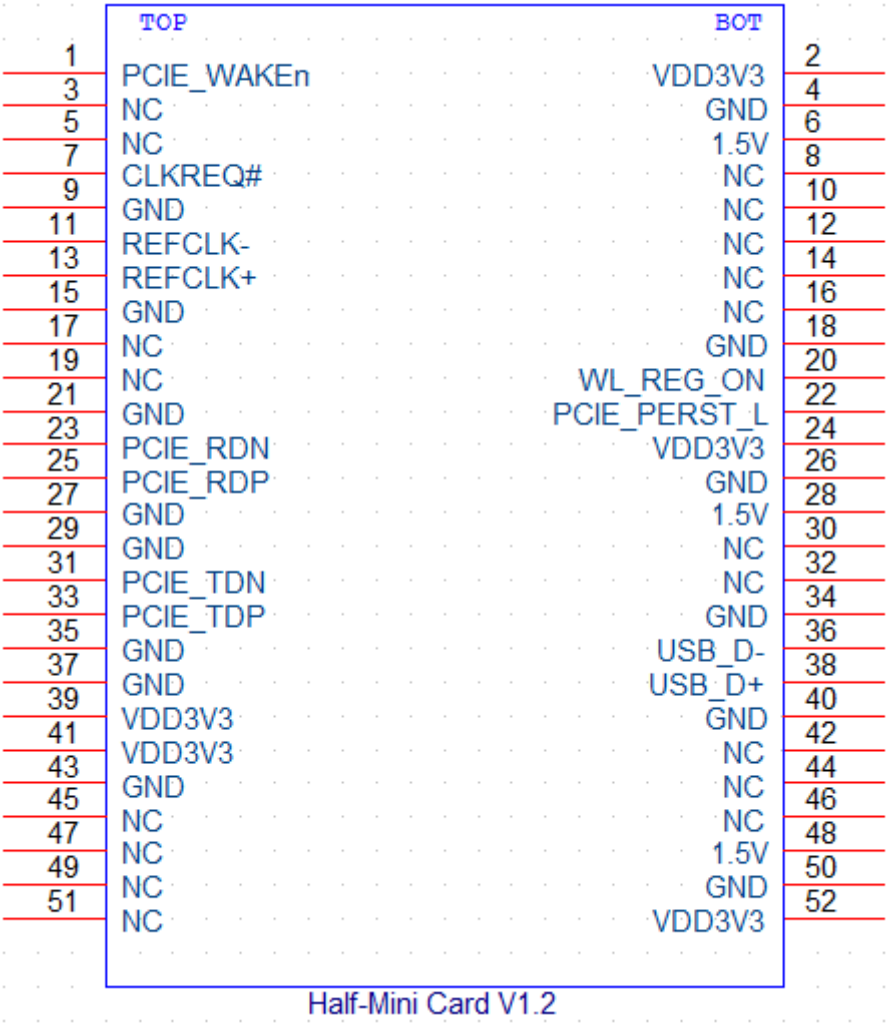
5.1 Bluetooth Specification

Conditions : VDD=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		

6. Pin Assignments

6.1 Pin Definition

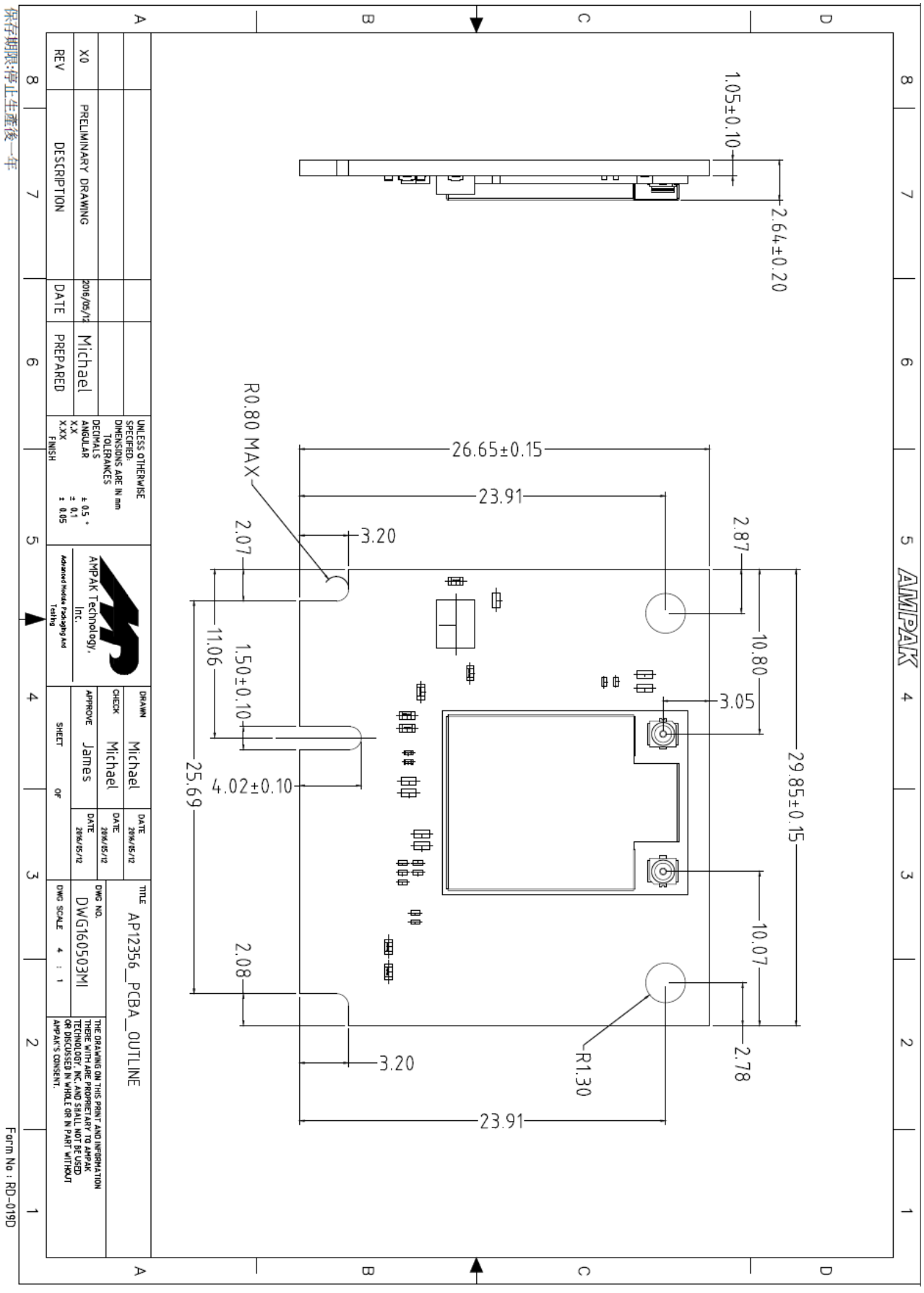


NO	Name	Type	Description
			TOP
1	PCIE_WAKEn	O	PCIe wake signal
3	NC	—	No connect
5	NC	—	No connect
7	PCIE_CLKREQn	I/O	PCIe clock request
9	GND	—	Ground connections
11	PCIE_RCLK_N	I	PCI Express differential clock input-Negative
13	PCIE_RCLK_P	I	PCI Express differential clock input-Positive
15	GND	—	Ground connections
17	NC	—	No connect
19	NC	—	No connect

21	GND	—	Ground connections
23	PCIE_TX_N	O	PCI Express transmit data-Negative
25	PCIE_TX_P	O	PCI Express transmit data-Positive
27	GND	—	Ground connections
29	GND	—	Ground connections
31	PCIE_RX_N	I	PCI Express receive data-Negative
33	PCIE_RX_P	I	PCI Express receive data-Positive
35	GND	—	Ground connections
37	GND	—	Ground connections
39	VDD_3V3	I	VDD system power supply input
41	VDD_3V3	I	VDD system power supply input
43	GND	—	Ground connections
45	NC	—	No connect
47	NC	—	No connect
49	NC	—	No connect
51	NC	—	No connect
BOTTOM			
2	VDD_3V3	I	VDD system power supply input
4	GND	—	Ground connections
6	1.5V (NC)	—	No connect
8	NC	—	No connect
10	NC	—	No connect
12	NC	—	No connect
14	NC	—	No connect
16	NC	—	No connect
18	GND	—	Ground connections
20	WL_DISABLE	I	Internal regulators power disable
22	PCIE_PERSTn	I	PCIe host indication to reset the device
24	VDD_3V3	I	VDD system power supply input
26	GND	—	Ground connections
28	1.5V (NC)	—	No connect
30	NC	—	No connect
32	NC	—	No connect
34	GND	—	Ground connections
36	USB_DM	I/O	USB serial differential data Negative
38	USB_DP	I/O	USB serial differential data Positive
40	GND	—	Ground connections

42	NC	—	No connect
44	NC	—	No connect
46	NC	—	No connect
48	1.5V (NC)	—	No connect
50	GND	—	Ground connections
52	VDD_3V3	I	VDD system power supply input

6.2 Physical Dimensions



6.3 Sample Picture (Label Diagram)

< TOP VIEW >

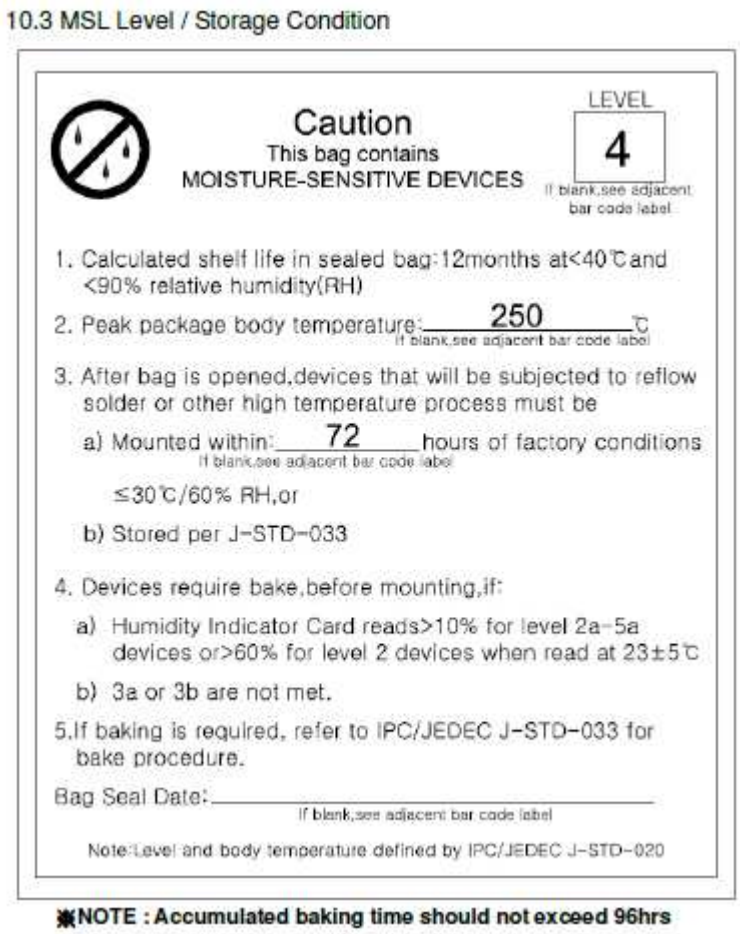
< BOT VIEW >

7. Package Information

7.1 Labe

7.2 Package Manner

8. MSL caution/Storage Condition



9. Operating temperature VS. Performance