

BM-3095

**Bluetooth v5.4 APTX LE Audio
RX Module**

Manual

Version: 1.0

Overview

BM-3095 is a highly integrated single-chip Bluetooth v5.4, audio and programmable application module. It includes high-performance, analog, and digital audio codes, advanced power management, Li-ion battery charger, light-emitting diode (LED) drivers, and flexible interfaces including inter-integrated circuit sound (I2S), inter-integrated circuit interface (I2C), universal asynchronous receiver transmitter (UART), and programmable input/output (PIO).

The system-on-chip architecture design of the module makes a much smaller space and minimal cost and simplifies the whole system design.

Features

- Qualified to Bluetooth v5.4 specification
- Qualcomm® aptX™ and aptX HD Audio
- 240 MHz Qualcomm® Kalimba™ audio DSP
- 32/80 MHz Developer Processor for applications
- Firmware Processor for system
- Flexible QSPI flash programmable platform
- High-performance 24-bit stereo
- Digital and analog microphone interfaces
- Flexible LED controller and LED pins with PWM support
- Serial interfaces: UART, Bit Serializer (I2C/SPI), USB 2.0
- Advanced audio algorithms
- aptX Adaptive, enabled using license key
- Integrated PMU: Dual SMPS for system/digital circuits, Integrated Li-ion battery charger

Application subsystem

- Dual-core application subsystem 32/80 MHz operation
- 32-bit Firmware Processor (reserved for system use) executes:
 - Bluetooth upper stack
 - Profiles
 - House-keeping code
- 32-bit Developer Processor executes:
 - Developer applications
- Both cores execute code from external flash memory using QSPI clocked at 32 MHz or 80 MHz

- On-chip caches per core enable optimized performance and power consumption

Bluetooth subsystem

- Qualified to Bluetooth v5.4 specification including 2 Mbps Bluetooth Low Energy and Bluetooth Low Energy Isochronous Channels
- Qualcomm® Bluetooth High Speed Link
- Single ended antenna connection with on-chip balun and Tx/Rx switch
- Bluetooth, Bluetooth Low Energy, and mixed topologies supported
- Class 1 support

Application

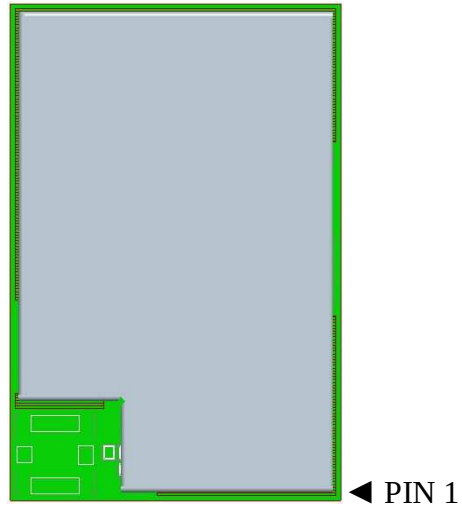
Bluetooth Receiver with multiple audio interfaces (e.g., Line in/ Dual Analog Mic, DigMic, I2S/PCM.....)

General Specification

Model Name	BM-3095
Product Name	Bluetooth V5.4 APTX LE Audio RX Module
Standard	Bluetooth V5.4
Bluetooth Chip	QCC3095 WLCSP
Frequency Band	2402MHz ~ 2480MHz
RF Output Power	EDR(8DPSK) Mode: 9.66dBm
Receiver Sensitivity	< -70dBm
Antenna	External Antenna
Power supply	VDD_PADS_6: 1.8~3.3V; VDD_PADS_134: 1.8~3.3V; VBAT: 2.8~4.3V
Operating Temperature	-30 ~ +70°C ambient temperature
Storage Temperature	-40 ~ +85°C ambient temperature
Humidity	5 to 90 % maximum (non-condensing)
Size	16mm x 11mm x 2.5mm (LxWxT)

Factory options

Pin outs define:



Pin	Pin Name	Pad Type	Description
1	MIC_4_P	Analog	Microphone differential 4 input, positive. Alternative function: ■Differential audio line input 4 , positive
2	MIC_4_N	Analog	Microphone differential 4 input, negative. Alternative function: ■Differential audio line input 4, negative
3	PIO20	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 20. Alternative function: ■PCM_DOUT[1]
4	PIO19	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 19. Alternative function: ■PCM_DIN[0]
5	PIO18	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 18. Alternative function: ■PCM_DOUT[0]
6	PIO17	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 17. Alternative function: ■PCM_SYNC
7	PIO16	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 16. Alternative function: ■PCM_CLK
8	PIO15	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 15. Alternative function: ■MCLK_OUT
9	VBAT_SENSE	Analog	Battery voltage sense input.
10	USB_DN	Digital I/O	USB Full Speed device D- I/O.
11	USB_DP	Digital I/O	USB Full Speed device D+ I/O.
12	VCHG	Supply	Charger input to Bypass regulator.(USB VBUS)
13	VCHG_SENSE	Analog	Charger input sense pin. High impedance. Connect VCHG_SENSE direct to VCHG.
14	CHG_EXT	Analog	External charger transistor current control. Connect to base of external charger transistor as per application schematic.

15	SYS_CTRL	Digital input	Typically connected to an ON/OFF push button. If power is present from the battery and/or charger, and software has placed the device in the OFF or DORMANT state, a button press boots the device. Also usable as a digital input in normal operation. No pull. Additional function: ■ PIO[0] input only
16	VBAT	Supply	Battery voltage input.
17	GND	Ground	
18	AIO0/LED0	Analog or digital input /open drain output.	General-purpose analog/digital input or open drain LED output.
19	AIO1/LED1	Analog or digital input /open drain output.	General-purpose analog/digital input or open drain LED output.
20	AIO2/LED2	Analog or digital input/open drain output.	General-purpose analog/digital input or open drain LED output.
21	AIO3/LED3	Analog or digital input/open drain output.	General-purpose analog/digital input or open drain LED output.
22	3V3_OUT	Supply	3.3V supply output
23	GND	Ground	
24	1V8_OUT	Supply	1.8V supply output
25	VDD_PADS_6	Supply	1.8V/3.3V PIO supply
26	VDD_PADS_134	Supply	1.8V/3.3V PIO supply
27	PIO4	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 4. Alternative function: ■ TBR_MOSI[1]
28	PIO3	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 3. Alternative function: ■ TBR_MISO[2]
29	PIO6	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 6. Alternative function: ■ TBR_MOSI[0]
30	PIO5	Digital: Bidirectional with programmable strength	Programmable I/O line 5. Alternative function:

		internal pull-up/pull-down	■TBR_MISO[1]
31	PIO8	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 8. Alternative function: ■TBR_CLK
32	PIO7	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 7.. Alternative function: ■TBR_MISO[0]
33	PIO2	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 2. Alternative function: ■TBR_MISO[3]
34	PIO1/RST	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Automatically defaults to RESET# mode when the device is unpowered, or in off modes. Reconfigurable as a PIO after boot. Alternative function: ■Programmable I/O line 1
35	PIO21	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 21 Alternative function: ■PCM_DOUT[2]
36	SPK_R_N	Analog	Headphone/speaker differential 2 output, negative. Alternative function: ■Differential 2 line output, negative
37	SPK_R_P	Analog	Headphone/speaker differential 2 output, positive. Alternative function: ■Differential 2 line output, positive
38	SPK_L_N	Analog	Headphone/speaker differential 1 output, negative. Alternative function: ■Differential 1 line output, negative
39	SPK_L_P	Analog	Headphone/speaker differential 1 output, positive. Alternative function: ■Differential 1 line output, positive

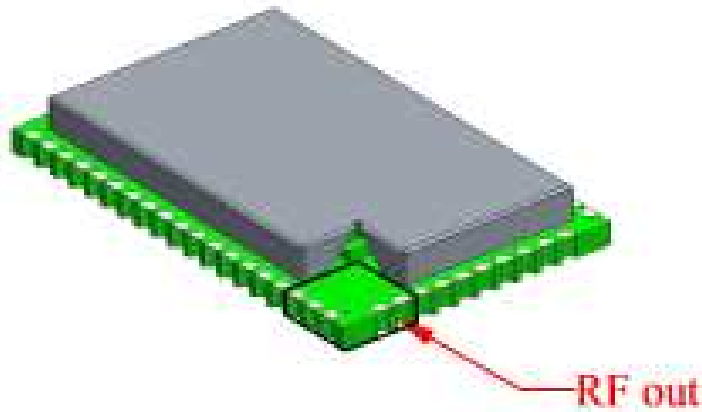
40	GND	Ground	
41	MIC_BIAS	Analog	Mic bias output.
42	MIC_2_N	Analog	Microphone differential 2 input, negative. Alternative function: ■ Differential audio line input 2, negative
43	MIC_2_P	Analog	Microphone differential 2 input, positive. Alternative function: ■ Differential audio line input 2, positive
44	MIC_1_N	Analog	Microphone differential 1 input, negative. Alternative function: ■ Differential audio line input 1, negative
45	MIC_1_P	Analog	Microphone differential 1 input, positive. Alternative function: ■ Differential audio line input 1, positive
46	GND	Ground	
47	MIC_3_N	Analog	Microphone differential 3 input, negative. Alternative function: ■ Differential audio line input 3, negative
48	MIC_3_P	Analog	Microphone differential 3 input, positive. Alternative function: ■ Differential audio line input 3, positive
49	PIO39	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 39. Alternative function: ■ QSPI2_IO[3]
50	PIO38	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 38. Alternative function: ■ QSPI2_CS0#
51	GND	Ground	
52	RF_OUT	RF	Bluetooth transmit/receive.
53	GND	Ground	
54	PIO37	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 37. Alternative function: ■ QSPI2_IO[1]
55	PIO36	Digital: Bidirectional with programmable strength	Programmable I/O line 36. Alternative function:

		internal pull-up/pull-down	■QSPI2_IO[2]
56	PIO35	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 35. Alternative function: ■QSPI2_CLK
57	PIO34	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 34. Alternative function: ■QSPI2_IO[0]
58	XTAL_CLKOUT	Analog	Buffered clock output.

Recommended Operating Conditions	Unit: Voltage		
Operating Condition	Min	Type	Max
Supply voltage: VCHG (pin 12)	4.75	5	5.5
Supply voltage: VBAT (pin 16)	2.8	3.7	4.3
Supply voltage: VDD_PADS_134 (pin 26)	1.7	1.8	3.6
Supply voltage: VDD_PADS_6 (pin 25)	1.7	1.8	3.6
Supply voltage: SYS_CTRL (pin 15)	- 0.4	---	4.6
Supply voltage: AIO(AIO Mode)	0	---	1.95

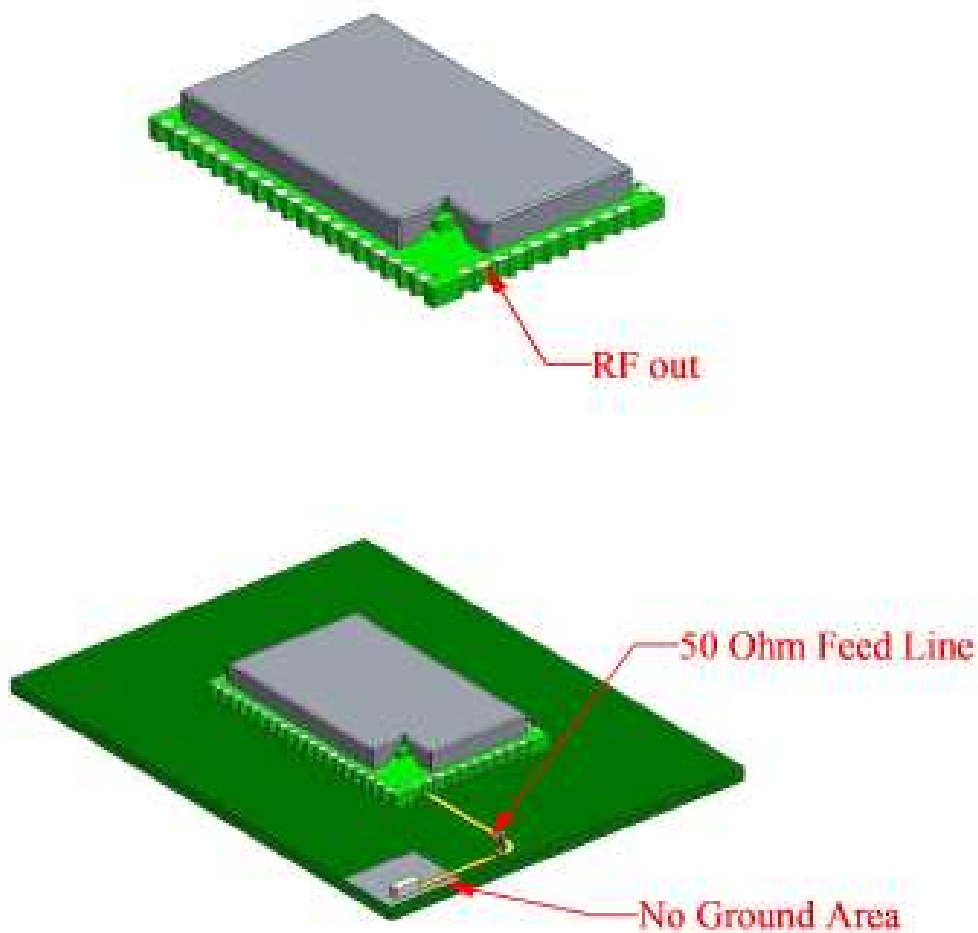
Placement Notice

- In order to get a better RF performance, please don't put any trace or copper plane under Black frame of the module.

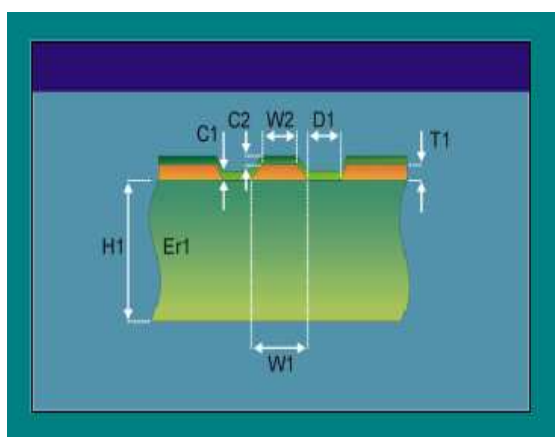


- **RF out**

Please have the impedance of feed lines to be 50 ohms from RF output pin to Antenna.



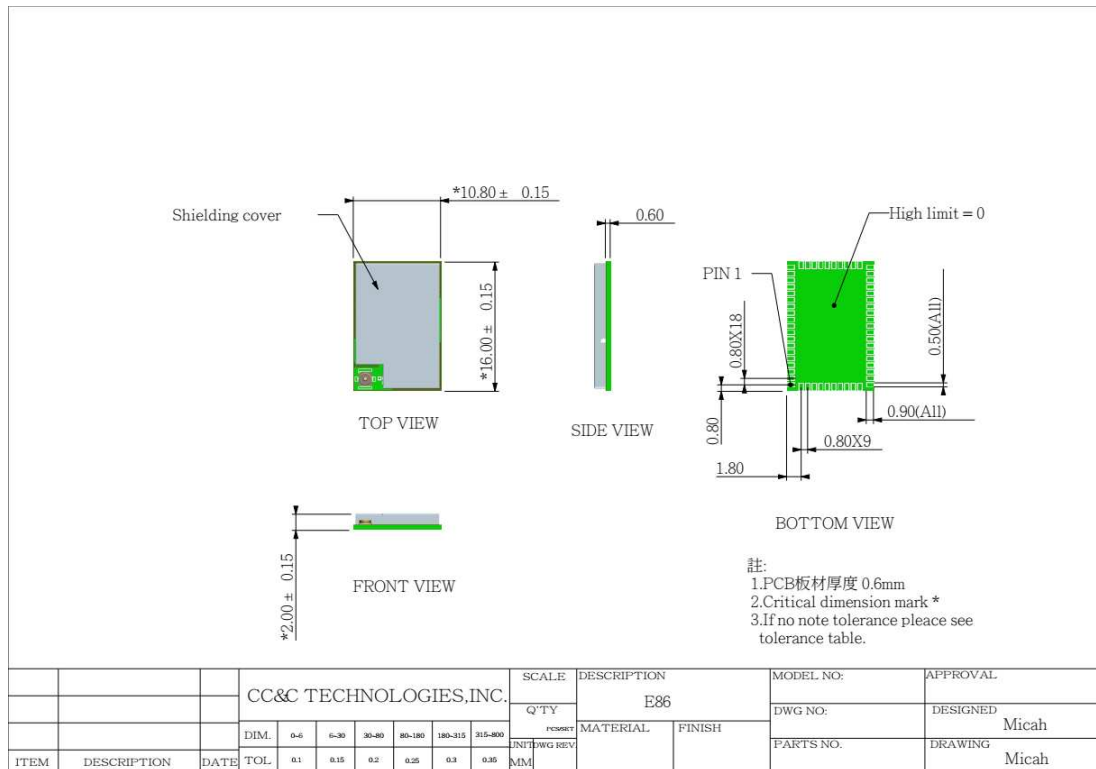
50 Ohm Feed line:



D1: 5 mil
C1: 0.7 mil
C2: 0.7 mil
T1: 1.4 mil (1 oz)
Impedance: 51 ~ 53 O

H1: 20 ~ 60 mil
Er1: 4.2
W1: 20 mil
W2: 20 mil

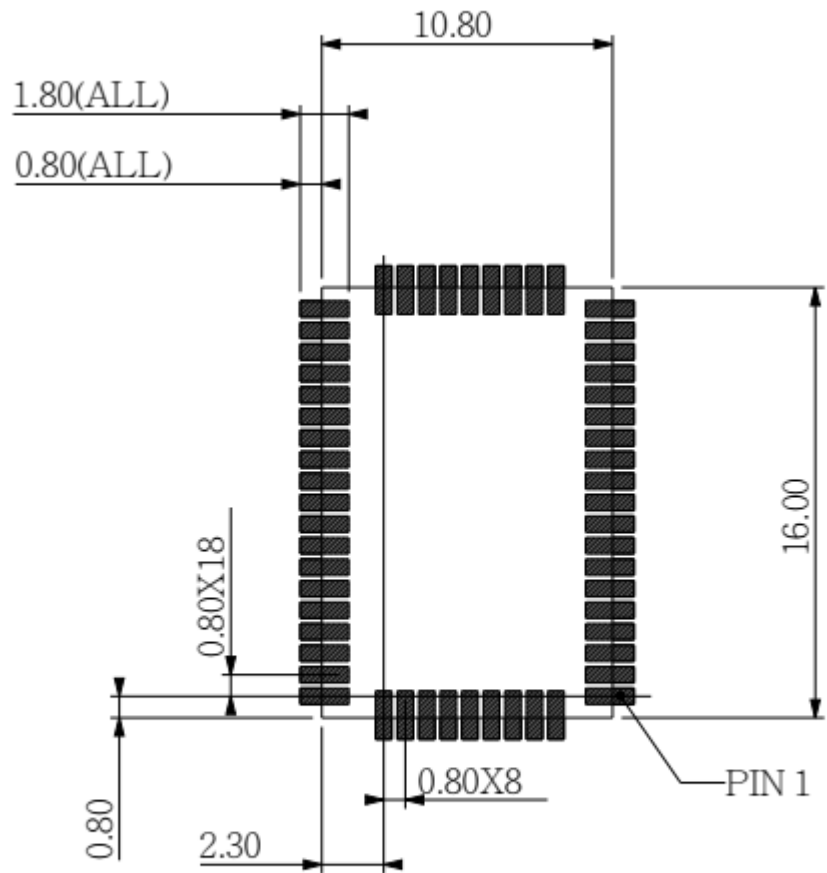
Dimension



Subject to change without notice

PCB Layout footprint

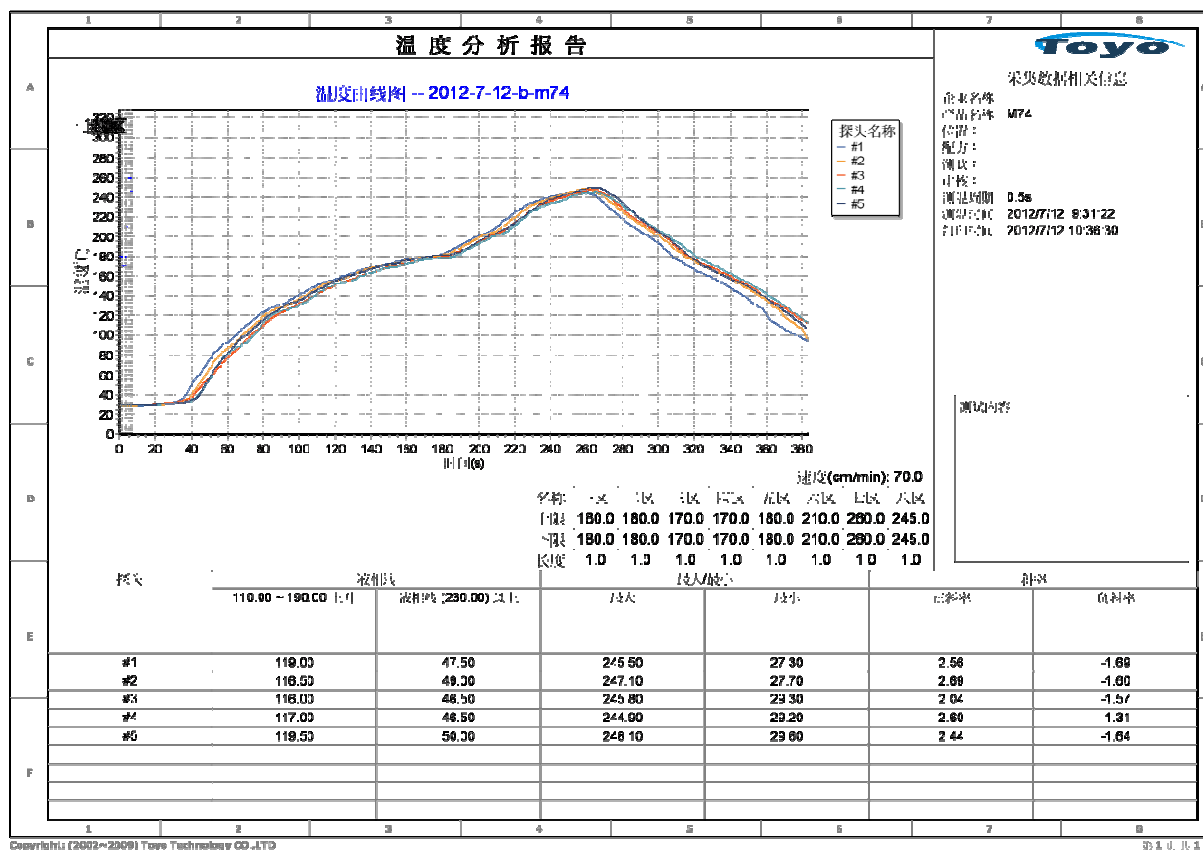
The recommended layout pads for BM-3095 module are shown below.



Recommend layout footprint

All dimensions are in millimeters.

Reference Temperature Reflow Chart



Note:

1. If the system PCBA is double side design please reflow the side without this module first.
2. Don't let the solder machine temperature over 250°C or follow solder paste vender's recommended temperature.
3. The Ramp-up temperature speed is 1~4 °C per second, the Ramp-down temperature speed is 1~4 °C per second.
4. This temperature reflow chart is for reference only, it depends on the manufacturing machine's characters requirement.

This module is surface mount device; please refer below conditions for drying before solder reflow processes.
(extracted from IPC/JEDEC J-STD-033B.1)

Bake @ 125 °C		Bake @ 90 °C		Bake @ 40 °C	
Exceeding floor Life By > 72h	Exceeding floor Life By ≤ 72h	Exceeding floor Life By > 72h	Exceeding floor Life By ≤ 72h	Exceeding floor Life By > 72h	Exceeding floor Life By ≤ 72h
9 hours	7 hours	33 hours	23 hours	13 days	9 days

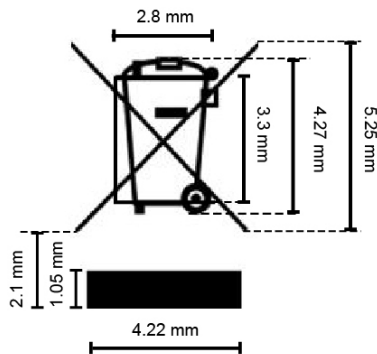


- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
 - (1) this device may not cause harmful interference, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation.

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 or more 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.
- Any changes or modifications not expressly approved by the party responsible for compliance could void the authority to operate equipment.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.



FCC RF Radiation Exposure Statement:

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Requirement of FCC KDB 996369 D03 for module certification:

2.2 List of applicable FCC rules

This module complies with FCC Part 15.247

2.3 Summarize the specific operational use conditions

The module must be installed with an approved antenna type and maximum gain as specified in this manual.

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

Not applicable.

2.5

Trace antenna designs: Not applicable, the antennas for this module are integrated into the module.

Use of external antennas or antennas integrated into the host circuit board are not an option

2.6 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2.7 Antennas:

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module.

Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

The installer should use unique antenna connector and Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

The manufacturer of module will inform installer to meet with the FCC part 15.203 in the warning part.

Antenna Specification list below:

Model Name	BM-3095
Antenna Type	Chip Antenna
Antenna Gain	0.5dBi
Antenna Brand	ACX
Antenna Model	AT3216-B2R7HAAT/LF
Connector	N/A

2.8 Label and compliance information

Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as “Contains FCC ID: PANBM3095”; any similar wording that expresses the same meaning may be used.

2.9

In accordance with FCC guidance it is recommended that the host product manufacturer perform investigative measurements to confirm that the system does not exceed the spurious emissions limits or band edge limits once the module is installed in the host system.

If the host system contains other transmitters additional testing is required to check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to the physical properties of the host product (enclosure). RF exposure assessments to account for transmissions across all transmitters that can operate simultaneously is also required.

For additional information refer to FCC KDB 996369 D04 Module Integration Guide.

2.10

The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

2.11

The host manufacturer is recommended to use FCC KDB 996369 D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12

The module is for specific audio line in like USB, 3.5mm or others. If the end product will involve the different operations, the host manufacture have to consult with the module manufacture for the integration method in end system.