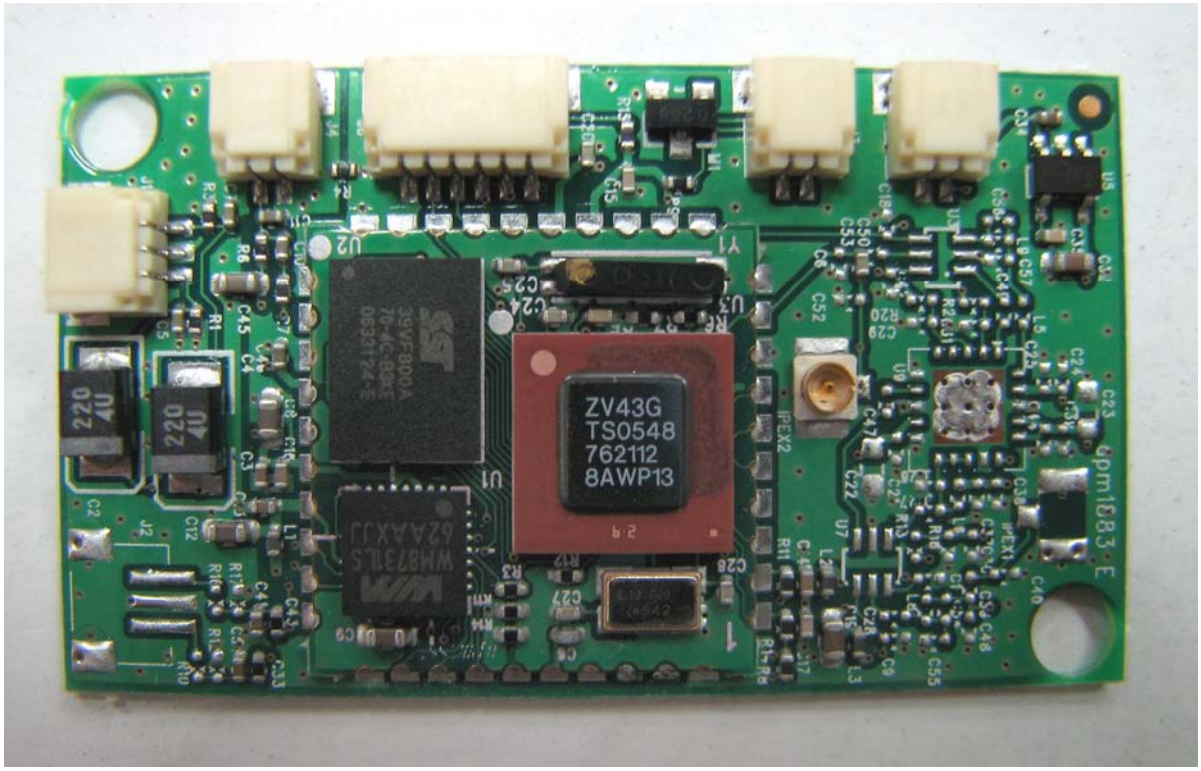
USER MANUAL

Bluetooth Module / APM1883



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FCC Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Notice: Any changes or modification not expressly approved by the party responsible could void the user's authority to operate the device.

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 undersired operation.

The Bluetooth Module allows a speakers with a communicate with other Bluetooth-enabled devices. When used with the Bluetooth application software, it can perform wireless network application such as information exchange, file transfer, network access, dial-up networking, headset audio gateway, and so on.

General Description

The apm1883 Bluetooth audio transceiver provides off-the-shelf wireless function for class1 and class2 stereo audio application. It consists of apm1882 Bluetooth audio module, PA/LNA, RF switch and LPF with a compact size of 45mm by 26mm for class1 solution. The apm1882 integrates Broadcom's ZV4301 Bluetooth chip, Wolfson's WM8731 CODEC, crystal and Flash memory on a single module. It could be easily embedded into audio system for Bluetooth wireless communication.

The specified profiles and firmware are pre-loaded into the built-in flash memory of apm1882 module for Bluetooth audio transmission and receiving. The user could update the firmware version by using the UART interface test point connect to host PC.

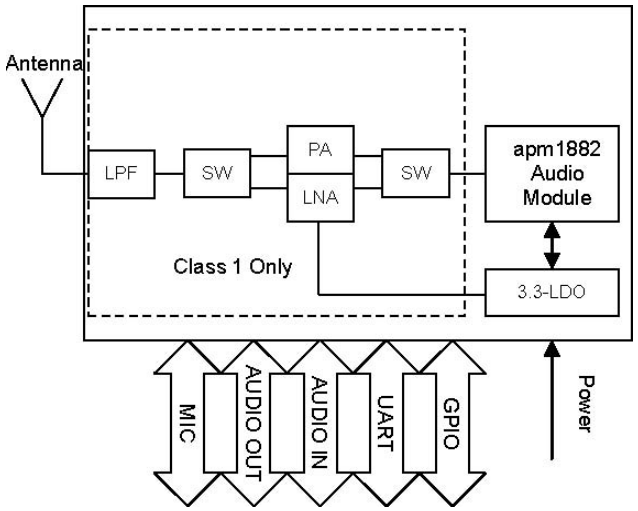
Features

- Compact size class1 and class2 Bluetooth audio transceiver: 45×26mm.
- Integrate apm1882 Bluetooth audio module, PA/LNA, RF switch and LPF into one board for class1 solution.
- Compliant with Bluetooth specification V1.2.
- Low power modes available
- Easy to embed in Bluetooth audio System
- Class1 performance (with PA/LNA) RF output power: < +20 dBm Receiver sensitivity: 85dBm @0.1%BER
- Class2 performance (without PA/LNA) RF output power: < +4 dBm Receiver sensitivity: 80dBm @0.1%BER

Applications

- AV equipments
- Bluetooth stereo headphone or speaker which supports audio source switch between stereo music and cellular phone call
- Bluetooth audio adaptor to transmit music from an analog source

Functional Block Diagram



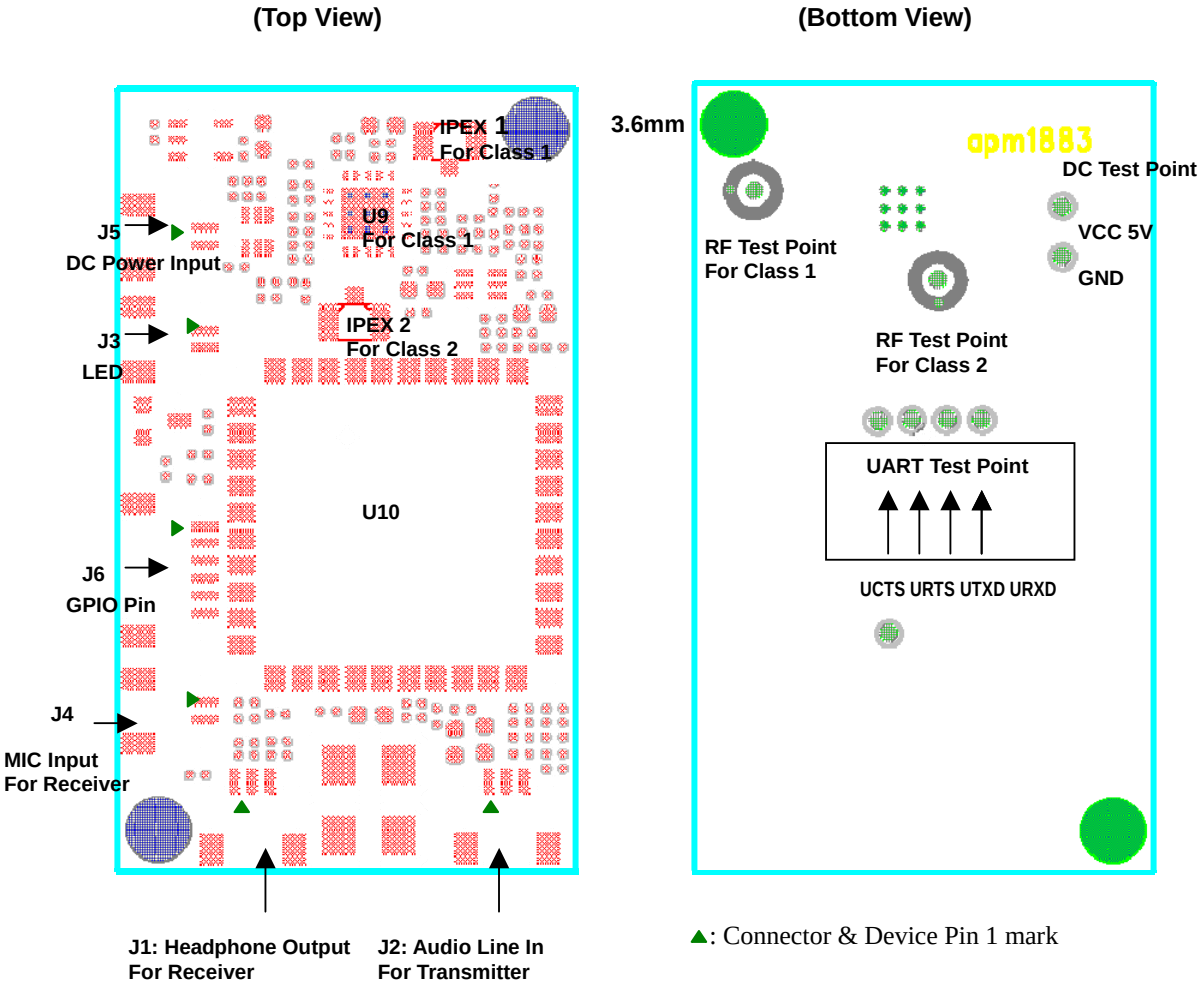
Revision History

Date	Release	Author	Description
29Jun06	1.0	Yushin/Baron	Initial release

3. Setup Steps

- Providing 5V to DC power J5
- For LED indication please connect to J3
- For remote control please using J6
- For microphone input please connecting J4
- For speaker use please connecting audio out to J1(BDB88312A1RX, BDB88322A1RX only)
- For audio transmit please connecting audio in to J2 (BDB88312A1TX, BDB88322A1TX only)
- IPEX1 is RF cable connector and is used for BDB88312A1TX, BDB88312A1RX
- IPEX2 is RF cable connector and is used for BDB88322A1TX, BDB88322A1RX

4. Pin Assignment



4.1 Pin Definition

(J1): Headphone Output Connector

Pin #	Pin Name	Type	Description
1	LHPOUT	Analogue Output	Left Channel Headphone Output
2	AGND	Ground	Analogue GND

Pin #	Pin Name	Type	Description
3	RHPOUT	Analogue Output	n Right Channel Headphoe Output

(J2): Audio Line IN Connector

Pin #	Pin Name	Type	Description
1	LLINEIN	Analogue Output	Left Channel Line Input
2	AGND	Ground	Analogue GND
3	RLINEIN	Analogue Output	Right Channel Line Input

(J3):LED Connector

Pin #	Pin Name	Type	Description
1	LED-	Supply	LED cathode
2	LED+	Supply	LED anode

(J4):Microphone Connector

Pin #	Pin Name	Type	Description
1	GND	Ground	Analogue GND
2	MIC	Analogue Input	Microphone input

(J5):VCC5V Connector

Pin #	Pin Name	Type	Description
1	VCC5	Supply	+5V input power
2	GND	Ground	Analogue GND

(J6):GPIO Pin

Pin #	Pin Name	Type	Description

Pin #	Pin Name	Type	Description
1	BACK(GPIO9)	Digital I/O	Internal pull-high to 3.3V through 10K resistor, active low
2	FORWARD(GPIO10)	Digital I/O	Internal pull-high to 3.3V through 10K resistor, active low
3	PLAY/PAUSE(GPIO6)	Digital I/O	Need to external pull-high to 3.3V through 10K resistor, active low
4	ACC/REJ(GPIO14)	Digital I/O	Internal pull-high to 3.3V through 10K resistor, active low.
4	GPIO15	Digital I/O	For other application, need to external pull-high to 3.3V through 10K resistor..
6	GND	Ground	Digital GND

(J2): Audio Line IN Connector

Pin #	Pin Name	Type	Description
1	LLINEIN	Analogue Output	Left Channel Line Input
2	AGND	Ground	Analogue GND
3	RLINEIN	Analogue Output	Right Channel Line Input

(J3): LED Connector

Pin #	Pin Name	Type	Description
1	LED	Supply	LED cathode
2	LED+	Supply	LED anode

(J4): Microphone Connector

Pin #	Pin Name	Type	Description
1	GND	Ground	Analogue GND
2	MIC	Analogue Input	Microphone input

(J5): VCC5V Connector

Pin #	Pin Name	Type	Description
1	VCC5	Supply	+5V input power
2	GND	Ground	Analogue GND

(J6): GPIO Pin

Pin #	Pin Name	Type	Description
1	BACK(GPIO9)	Digital I/O	Internal pullhigh to 3.3V through 10K resistor, active low
2	FORWARD(GPIO10)	Digital I/O	Internal pullhigh to 3.3V through 10K resistor, active low
3	PLAY/PAUSE(GPIO6)	Digital I/O	Need to external pullhigh to 3.3V through 10K resistor, active low
4	ACC/REJ(GPIO14)	Digital I/O	Internal pullhigh to 3.3V through 10K resistor, active low.
4	GPIO15	Digital I/O	For other application, need to external pullhigh to 3.3V through 10K resistor..
6	GND	Ground	Digital GND

*Based on customer's different demand, the GPIO could be modified for different function.

4.2 Major Component List

(U9): Atmel Front End IC

Pin #	Pin Name	Type	Description

1	LNA_OUT	Analogue Output	Low noise amplifier output
2	RX_ON	I/O	RX active high
3	PU	I/O	Powerup active high
4	R_SWITCH	I/O	Resistor to GND sets the PIN diode
5	SWITCH_OUT	Analogue Output	Switched current output for PIN diode
6	GND	Ground	Analogue ground
7	LNA_IN	Analogue Input	Low noise amplifier input
8	GND	Ground	Digital GND
9	VS_LNA	Supply	Supply voltage for LNA
10	GND	Ground	Analogue ground
11	V3_PA_OUT	Analogue output	Inductor to power supply for power amplifier output
12	V3_PA_OUT	Analogue output	Inductor to power supply for power amplifier output
13	V3_PA_OUT	Analogue output	Inductor to power supply for power amplifier output
14	GND	Ground	Analogue Ground
15	RAMP	I/O	Power ramping control input
16	V2_PA	Supply	Inductor to power supply for power amplifier
17	V2_PA	Supply	Inductor to power supply for power amplifier
18	GND	Ground	Analogue ground
19	V1_PA	Supply	Supply voltage for power amplifier
20	PA_IN	Analogue input	Power amplifier input

(U10): apm1882 Audio Module

Pin #	Pin Name	Type	Description
1	GPIO10	Digital I/O	General Purpose I/O
2	GPIO9	Digital I/O	General Purpose I/O
3	UART_RTS	Digital Output	Request to Send (active low)
4	UART_CTS	Digital Input	Clear to Send (active low)
5	PA_CTRL	Digital Output	PA Control for Class1 Application
6	UART_TXD	Digital Output	Transmit Data
7	UART_RXD	Digital Input	Receive Data
8	GND	Ground	Digital GND

9	ANT	RF I/O	50 Ohm Rx/Tx Connection to Antenna
10	GND	Ground	Digital GND

Pin #	Pin Name	Type	Description
11	GPIO11	Digital I/O	General Purpose I/O
12	GPIO12	Digital I/O	General Purpose I/O
13	INT_0	Digital Input	External interrupt [0]
14	VDD_USB	Supply	USB VDD
15	VDD_ DIG	Supply	Bluetooth Digital VDD
16	GPIO13	Digital I/O	General Purpose I/O
17	GPIO14	Digital I/O	General Purpose I/O
18	GPIO15	Digital I/O	General Purpose I/O
19	GND	Ground	Digital GND
20	GND	Ground	Digital GND
21	GND	Ground	Digital GND
22	MODE	Digital Input	Mode Selection (16Mbit Flash Memory A19 Selection)
23	GND	Ground	Digital GND
24	VCC	Supply	Flash Memory VCC
25	GPIO0	Digital I/O	General Purpose I/O (12MHz test point)
26	DVDD	Supply	CODEC Digital Core VDD
27	AVDD	Supply	CODEC Analogue VDD
28	LHPOUT	Analogue Output	Left Channel Headphone Output
29	RHPOUT	Analogue Output	Right Channel Headphone Output
30	MICBIAS	Analogue Output	Electric Microphone Bias
31	AGND	Ground	Analogue GND
32	MICIN	Analogue Input	Microphone Input (AC Coupled)
33	RLINEIN	Analogue Input	Right Channel Line Input (AC Coupled)
34	LLINEIN	Analogue Input	Left Channel Line Input (AC Coupled)
35	VDD_ANG	Supply	Bluetooth Analog VDD
36	VDD_VCO	Supply	Bluetooth VCO VDD
37	VDD_RF	Supply	Bluetooth RF VDD
38	RESET	Digital Input	Reset Input (Active Low for 5 ms); Schmitt Triggered

39	GPIO6	Digital I/O	General Purpose I/O
40	GND	Ground	Digital GND

5 System Specification

5.1 Absolute Maximum Rating

Symbol	Description	Min.	Typ.	Max.	Units
	Storage temperature	40		+105	°C
VCC5	apm1883 DC Power Input	3.6		8.0	Volts
AVDD	CODEC analogue VDD	0.3		3.63	Volts

*Absolute maximum ratings indicate limits beyond which damage to the device may occur.

5.2 Recommended Operating Condition

Symbol	Description	Min.	Typ.	Max.	Units
	Operating temperature	25		+85	°C
VCC5	apm1883 DC Power Input	3.6	5	8.0	Volts

6 Electrical Characteristics

6.1 I/O Specification (Operation Temp.=25°C, VCC=3.3V)

Symbol	Description/	Test Conditions	Min.	Typ.	Max.	Units
V_{IL}	Input low voltage				0.8	Volts
V_{IH}	Input high voltage		2.0		5.5	Volts
V_{OL}	Output low voltage	I_{OL} =2mA			0.4	Volts
V_{OH}	Output high voltage	I_{OH} =2mA	2.4			Volts

I_{OL}	Output low current	V_{OL} =0.4V			2.2	mA
I_{OH}	Output high current	V_{OH} =2.4V			3.1	mA
I_I	Input leakage current	V_I=3.3V or 0V	1		+1	Volts
R_{INLINE}	Line in input resistance	0dB gain	20k	30k		Ohms
		12dB gain	10k	15k		Ohms
C_{INLINE}	Line in input capacitance			10		pF
R_{INMIC}	Microphone input resistance			10k		Ohms
C_{INMIC}	Microphone input capacitance			10		pF
P_O	Headphone output power	R_L=32 Ohms		30		mW
		R_L=16 Ohms		50		mW

62 RF Specification Test Summary (Operation Temp.=25°C, VCC=3.3V)

Parameter		Min	Typ	Max	Bluetooth Spec.	Unit	Results
Maximum RF transmit power	Class 1		+18		0 to +20	dBm	Pass
	Class 2		+2		6 to +4	dBm	Pass
Modulation index: $\Delta f1avg$		140	165	175	140 < $\Delta f1avg$ < 175	kHz	Pass
Modulation index: $\Delta f2max$		115	172		> 115	kHz	Pass
Modulation index: $\Delta f2avg$ / $\Delta f1avg$		0.8	1.04		> 0.8	NA	Pass
Initial carrier frequency accuracy			20		+ 75	kHz	Pass
Carrier frequency drift rate			11	20	< 20	kHz/50us	Pass
Carrier frequency drift: one slot packet			16	21	+ 25	kHz	Pass
Carrier frequency drift: three slot packet			11	25	+ 40	kHz	Pass
Carrier frequency drift: five slot packet			18	25	+ 40	kHz	Pass

Sensitivity – single slot packets	Class 1		85		< 70	dBm	Pass
	Class 2		80		< 70	dBm	Pass
Sensitivity – multi slot packets	Class 1		85		< 70	dBm	Pass
	Class 2		80		< 70	dBm	Pass
Maximum usable signal		20	0		> 20	dBm	Pass

6.3 Current Consumption test (Operation Temp.=25°C, VCC=3.3V)

Transmitter Application Mode		Average	Maximum	Units
Inquiry state	Class 1	105		mA
	Class 2	17		mA
Transmit DH(1,3,5) packets with PRBS9 payload (Transmitter)	Class 1	220	300	mA
	Class 2	86	120	mA

Headphone Application Mode		Average	Maximum	Units
Inquiry scan	Class 1	17		mA
	Class 2	17		mA
Tester sends DH1 packets with PRBS9 payload to EUT	Class 1	98	150	mA
	Class 2	90	120	mA

6.4 Audio specification

Parameter	Min	Typ	Max	Unit

Sample rate		48		kHz
Noise level		60		dBA
DC input level	3.3	5	7	V
Input signal level		1		Vrms
Frequency response	20	1k	20k	Hz
S/N ratio		90		dB
Separation		90		dB
Hum & Noise level		0.8		mV

7 LED Status

Operating State	LED Blink Frequency	
Inquiry scan	Fast mode	10 Hz
Data throughput	Slow mode	1.5 Hz

8. Connection (Inquiry/Pairing) Time

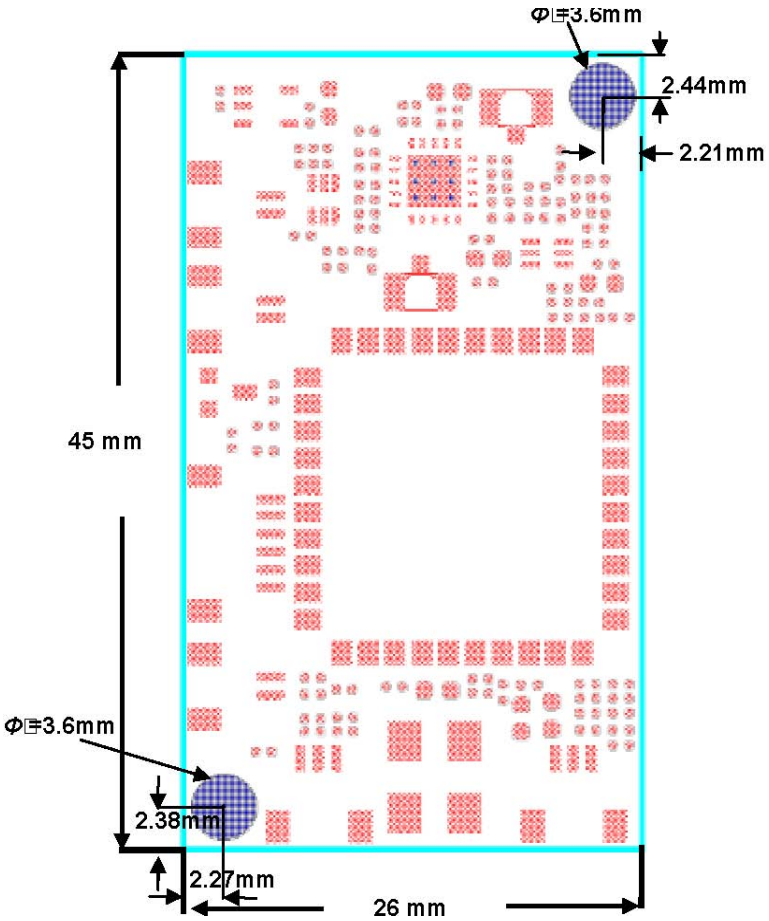
Operating State	Typical	Maximum	Units
To connect a headset in first time	3	120	Sec.
To connect original headset after disconnection	3	8	Sec.
To connect different headset after disconnection	3	120	Sec.

9 Ordering Information

Part Number	Description
BDB88312A1TX	Transmitter for class 1 application
BDB88312A1RX	Receiver for class 1 application
BDB88322A1TX	Transmitter for class 2 application
BDB88322A1RX	Receiver for class 2 application

10 Outline Drawing

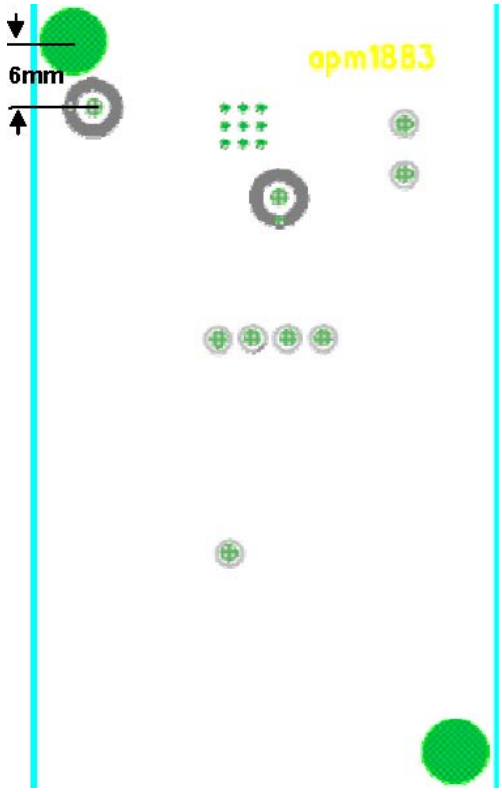
10.1 Main Board (Front Side)



*Physical dimension unit in mm

10.2 Main Board (Backside)

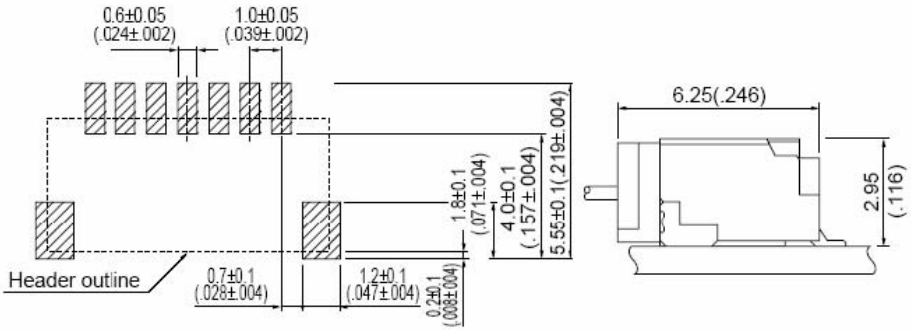
3.6mm



*Physical dimension unit in mm

10.3 Connector Drawing

Side entry type



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of 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. If not installed and used in accordance with the instructions, 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 tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

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

Information for OEM integrator 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 manual of the end product. The user manual which is provided by OEM integrators for end users must include the following information in a prominent location. “To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.” Label for end product must include “ Contains FCC ID: SETAPM1883 ” or “ A RF transmitter inside, FCC ID: SETAPM1883 ”.

TO OEM installer:

1. FCC ID label on the final system must be labeled with “Contains FCC ID:

SETAPM1883”
2. In the user manual, final system integrator must be ensure that there is no instruction provided in the user manual to install or remove the speakers.
3. Audio module must be installed and used in strict accordance with the manufacturer’s instruction as described in the user documentation that comes with the product.
This device complies with the following radio frequency and safety standards.

The user manual of the final host system must contain the following statements:

USA-Federal Communications Commission (FCC)

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

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

Caution: Exposure to Radio Frequency Radiation.

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

12. Label

FCC IDENTIFIER： SETAPM1883 **Name of Grantee： Juster Co., Ltd.** **Equipment Class： Part 15** **Bluetooth Module**