

## Description

The BT AUDIO-5112 Class 1 Bluetooth Hi Power Audio Module is a highly tuned and completely integrated wireless audio transceiver subsystem ready for installation in audio devices. The BT AUDIO-5112 is a pre-engineered subsystem integrating a wireless radio, digital audio system, and programmed firmware profiles that define features, configurations, and user interface. All firmware offered by KC Wirefree can be customized for OEM clients. In many cases a few changes can produce great value by differentiating and improving your product. Firmware can be updated via USB.

### kcAudioGateway Firmware Edition

The kcAudioGateway firmware is a transmitter system, offering A2DP source profile or AGHFP gateway profile (default), but not both simultaneously. A2DP mode provides stereo transmission to Headset/Speaker devices. Stereo audio is sampled from the MIC\_L+, MIC\_L-, MIC\_R+, and MIC\_R- pins at 44.1kHz, and will automatically transmit to a Headset device. AGHFP mode (default) provides two-way voice communications, sampled at 8kHz, to a standard Bluetooth cell phone headset. Additionally, the Headset Voice Command prompt will toggle a PTT pin on kcAudioGateway, which enables standard Bluetooth cell phone headsets to provide a PTT function.

Please refer to our *kcAudioGateway User Guide* for details.

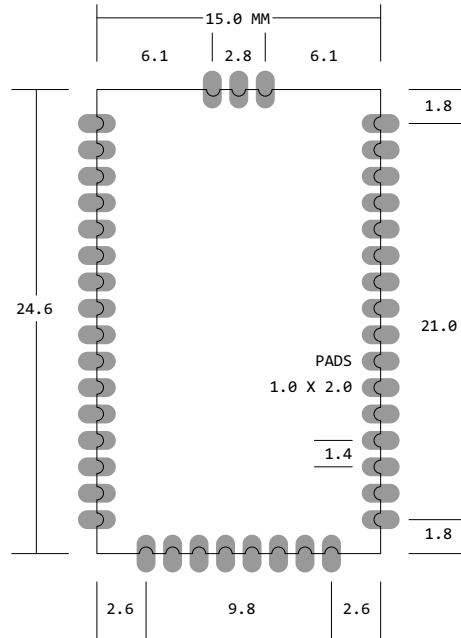
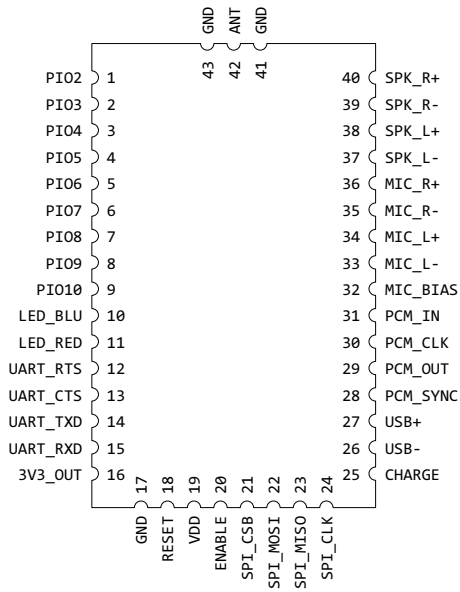
### kcAudioHeadset Firmware Edition

The kcAudioHeadset firmware is a receiver system, offering A2DP sink profile, and HFP profile. It can receive an A2DP wireless stereo signal, decompress, and convert to analog audio available on the SPK\_L+, SPK\_L-, SPK\_R+, and SPK\_R- pins. Additionally, it can “answer” phone calls, which will pause any A2DP stream, and switch modes, now providing two way mono communication channel.

Please refer to our *kcAudioHeadset User Guide* for details.

## Dimensions & Layout

BT AUDIO-5112  
Top View



## Pin Assignments

Pin	Function	Type	Description
1	PIO2	I/O	Programmable I/O
2	PIO3	I/O	Programmable I/O
3	PIO4	I/O	Programmable I/O
4	PIO5	I/O	Programmable I/O
5	PIO6	I/O	Programmable I/O [I <sup>2</sup> C]
6	PIO7	I/O	Programmable I/O [I <sup>2</sup> C]
7	PIO8	I/O	Programmable I/O [I <sup>2</sup> C]
8	PIO9	I/O	Programmable I/O
9	PIO10	I/O	Programmable I/O
10	LED_BLU	Input	Blue LED Drain
11	LED_RED	Input	Red LED Drain
12	UART_RTS	Output	UART Request To Send
13	UART_CTS	Input	UART Clear To Send
14	UART_TXD	Output	UART Data Transmit
15	UART_RXD	Input	UART Data Receive
16	3V3_OUT	Output	Onboard 3.3V Regulator Output
17	GND	--	Ground
18	RESET	Input	Reset (Active Low >5ms)
19	VDD	Input	VDD/Battery Input (2.9V – 4.4V)
20	ENABLE	Input	System Enable (with internal latch)
21	SPI_CSB	Input	SPI Chip Select
22	SPI_MOSI	Input	SPI Master Out
23	SPI_MISO	Output	SPI Master In
24	SPI_CLK	Input	SPI Clock
25	CHARGE	Input	Battery Charging Supply (only use when VDD is battery powered)
26	USB-	I/O	USB Data Negative
27	USB+	I/O	USB Data Positive
28	PCM_SYNC	I/O	PCM Sync [I <sup>2</sup> S WS]
29	PCM_OUT	Output	PCM Out [I <sup>2</sup> S Out] [SPDIF Out]
30	PCM_CLK	I/O	PCM Clock [I <sup>2</sup> S CLK]
31	PCM_IN	Input	PCM In [I <sup>2</sup> S In] [SPDIF In]
32	MIC_BIAS	Output	Microphone Bias
33	MIC_L-	Input	Audio Input Left Negative
34	MIC_L+	Input	Audio Input Left Positive
35	MIC_R-	Input	Audio Input Right Negative
36	MIC_R+	Input	Audio Input Right Positive
37	SPK_L-	Output	Audio Output Left Negative
38	SPK_L+	Output	Audio Output Left Positive
39	SPK_R-	Output	Audio Output Right Negative
40	SPK_R+	Output	Audio Output Right Negative
41	GND	--	Ground
42	ANT	I/O	50 Ohm 2.4GHz Antenna Port
43	GND	--	Ground

[Option features in brackets]

## Interface Pins

### PIO Pins [1-9]

PIO pins are LOW by default, and button presses used for device operation are HIGH signals. PIO inputs are debounced to 20ms.

Several PIO pins are assigned functions in default versions of firmware. Custom programmed functions are available. Inputs can be configured for weak pull-up, weak pull-down, strong pull-up, strong pull-down. Voltage input tolerance and output level is directly related to the VDD level.

Specific functions are enabled on designated PIO pins depending on firmware version. Please refer to the specific firmware **Audio User Guides** for complete information regarding PIO features and assignments.

### LED Pins [10-11]

Two open-drain LED output pins are available. The LED's need a positive 3.3V (maximum) supply, and a current limiting resistor.

### UART Pins [12-15]

The UART is compatible with the 16450 industry standard. Upcoming kcAudio firmware will implement an AT Command set for configuration and operation.

### 3V3\_OUT Pin [16]

The module has several onboard regulators. The onboard 3V3 regulator supplies the PIO, PCM, SPI, UART, and USB Pins. The class 2 module has up to 100mA available from this pin. The class 1 module also uses the onboard 3V3 regulator to supply the RF Power Amp, and has less than 30mA available from this pin.

### GND Pin [17]

VSS ground plane.

### RESET Pin [18]

The module will reset when pulled LOW >5ms.

### VDD Pin [19]

Minimum VDD is 2.9V.

Supplies several onboard regulators, and is also the designated Battery P terminal if powering directly from a Lithium Ion battery. The VDD pin may receive a recharge current supply when the voltage reading from this pin measures below 4.0V, the CHARGE Pin is connected to a power supply, and firmware has enabled battery monitoring and charging (default behavior). This VDD pin supplies the onboard Seiko S-1112 LDO 3V3 regulator. Note: the Seiko S-1112 has a 200mV dropout, so if VDD is < 3.5V, then the 3V3 supply rail will have a 0.2V dropout. The 3V3 rail supplies PIO, PCM, SPI, UART, and USB Pins. Power supply to module should have less than 10mVrms noise between 0-10MHz, and spikes should be minimal.

### **ENABLE Pin [20]**

Enables internal voltage regulators. The ENABLE pin can be utilized in two different ways. Our current default firmware uses the ENABLE pin in Switch Power Mode, where it should be tied to the VDD pin, and used with an external power switch. In Switched Power Mode, our BTB functions are typically assigned to PIO 4. Please see specific firmware User Guides for details regarding PIO function assignments.

Alternatively, firmware can utilize the ENABLE pin in Battery Power Mode, which uses a momentary ON/OFF button to power up. Once powered up, the internal voltage regulators will latch on, and then the ENABLE pin is used for BTB assigned functions. This is typically intended for a battery powered headset application with minimal buttons. Separate firmware must be used that assigns this behavior to the ENABLE pin.

### **SPI Pins [21-24]**

We highly recommend including test points for the four SPI signals, used for firmware loading and diagnostics. The SPI interface is unavailable for general usage, and only interfaces with chip manufacturer diagnostic applications.

### **CHARGE Pin [25]**

Provide power supply for battery charging, when a battery is connected to VDD, and firmware enables battery monitoring and charging function (enabled by default). Do not connect without a Lithium Ion battery connected to VDD Pin.

### **USB Pins [26-27]**

These interfaces are available with custom configuration. USB can be programmed for plug-n-play operation using standard USB Audio drivers available on PC, Mac, and Linux.

### **PCM Pins [28-31]**

Pins are generally 3.3V level logic (dependent upon VDD).

### **MIC\_BIAS Pin [32]**

Provides a DC bias intended for electret microphones. Configurable 1.8V – 3.3V (default = 2.69V) with a current of 200uA – 1.229mA (default = 0.672mA).

### **MIC Pins [33-36]**

Microphone or line level analog audio input. Impedance is 6.0k $\Omega$  - 30k $\Omega$  depending on volume setting. ADC operates at 8, 11.025, 16, 22.05, 32, and 44.1kHz. Input signal should be 4mVrms – 800mVrms. Input gain is adjustable from

### **SPK Pins [37-40]**

Output gain is adjustable from -45dB to +3.5dB.

### **RF Port [41-43]**

The module already contains a balun-filter onboard, so the antenna port only requires a standard 2.4 GHz RF transmission line with a 50 ohm load. Design the antenna circuit according to the antenna manufacturer guidelines. Some designs may use a simple chip antenna without additional circuitry. Microstrip design is not critical if the antenna is less than 3mm from the RF pin. A few recommended chip antennas: Johanson 2450AT18B100E, Johanson 2450AT43A100E, or Antenova Rufa A5839. For PCB transmission line design, we recommend the following online calculator: [http://www.emclabinfo.com/emc\\_calc/microstrip.htm](http://www.emclabinfo.com/emc_calc/microstrip.htm)

## Electrical Characteristics

(Conditions VDD = 3.3V and 25 °C)

Absolute Maximum Ratings	Min	Max	Unit
Storage temperature range	-40	+105	°C
Supply voltage VDD	-0.4	4.4	Volts
Supply voltage CHARGE	4.5	6.5	Volts
Supply voltage ENABLE	-0.4	4.9	Volts

Recommended Operating Conditions	Min	Typical	Max	Unit
Temperature range	-40	20	+85	°C
Supply voltage VDD	2.9	3.3	4.4	Volts
Supply voltage CHARGE	4.5	--	6.5	Volts
Supply voltage ENABLE	2.5	--	4.4	Volts

Current Consumption	Avg	Unit
Stereo	66	mA
Mono Headset	36	mA
No Connection	2	mA
Peak current	190	mA

RF Characteristics	Min	Max	Unit
Carrier Frequency	2400	2483.5	MHz
Transmission Line	50	50	Ω
Transmission Power	0	+20	dBm
Receive Sensitivity	-20	-98	dBm

Audio DAC Characteristics	Min	Typical	Max	Unit
Output voltage full-scale swing (differential)	--	750	--	mV rms
Resolution	--	--	16	Bits
Sample Rate	8	--	48	kHz
SNR (@ 8KHz sampling)	--	95	--	dB
Digital Gain	-24	--	21.5	dB
Analog Gain	0	--	-21	dB
THD+N (@ 100kΩ load)	--	0.04	0.01	%

Audio ADC Characteristics	Min	Typical	Max	Unit
Input full scale at maximum gain (differential)	--	0.004	--	V <sub>rms</sub>
Input full scale at minimum gain (differential)	--	0.800	--	V <sub>rms</sub>
Resolution	--	--	16	Bits
Sample Rate (8, 11.025, 16, 22.050, 32, 44.1kHz)	8	--	44.1	kHz
SNR (@ 8KHz sampling)	--	79	--	dB
Digital Gain	-24	--	21.5	dB
Analog Gain	--	--	42	dB
3dB bandwidth	--	20	--	kHz
Input impedance	--	6.0	30	Ω
THD+N (microphone input) @30mV rms input	--	0.04	--	%

Programmable I/O Pins Operating Characteristics	Min	Typical	Max	Unit
Input Voltage Low Logic	-0.3	--	VDD <sub>LDO</sub> × 0.25	Volts
Input Voltage High Logic	VDD <sub>LDO</sub> × 0.625	--	VDD <sub>LDO</sub> + 0.3	Volts
Output Voltage Low Logic	0	--	0.125	Volts
Output Voltage High Logic	VDD <sub>LDO</sub> × 0.75	--	VDD <sub>LDO</sub>	Volts
Output Current Low Logic	--	4.0	--	mA
Output Current High Logic	--	-4.0	--	mA
Input Leakage Current	-100	0	100	nA
Input Schmitt voltage	VDD <sub>LDO</sub> × 0.25	--	VDD <sub>LDO</sub> × 0.625	Volts
Input Capacitance	1.0	--	5.0	pF
Weak pull up	500K	--	2M	Ω
Weak pull down	500K	--	2M	Ω
Strong pull up	10K	--	50K	Ω
Strong pull down	10K	--	50K	Ω

## **FCC Statement:**

This equipment has been tested and found to comply with the limits for 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 to an outlet on a circuit different from that to which the receiver is connected.

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.

**Note: Modifications to this product will void the user's authority to operate this equipment.**

## **RF Radiation Exposure Statement:**

- 1.This Transmitter must not be co - located or operating in conjunction with any other antenna or transmitter.
- 2.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.

## **FCC Information to 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.

- 1.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, except in accordance with FCC multi - transmitter product procedures.
2. Only those antennas with same type and lesser gain filed under this FCC ID number can be used with this device.
3. The regulatory label on the final system must include the statement: "Contains FCC ID:S22-BTAUDIO or using electronic labeling method as documented in KDB 784748.
4. The final system integrator must ensure there is no instruction provided in the user manual or customer documentation indicating how to install or remove the transmitter module except such device has implemented two - ways authentication between module and the host system