



SAM-200-TR



i2i® Streaming Audio Module

DESCRIPTION

The SAM-200 is an RF module for digital streaming of CD-quality audio (48KHz, 16-bit stereo) from simple analog inputs and outputs. It is fully self-contained with easy-to-use interface signals and options, to minimize time-to-market for wireless audio applications.

Stereo line inputs and line or headphone outputs are available. Inputs have ALC level matching and level/impedance selection for line, instrument, and microphone signals. Audio outputs have mute and volume level control.

Internal voltage regulation provides flexible management of power for embedding in existing or new products.

Channel selection is available through direct addressing or sequential toggling with a single button/input. Output volume is controllable with simple switches.

FEATURES

- 2.4GHz Digital CD-Quality Digital Audio
- Range 60+ Feet
- 8 Consumer Channels + 8 Professional
- Coexists with WiFi and Bluetooth
- Simple Analog Audio I/O
- Simple Control Pins
- On-Board Voltage Regulation
- ALC Audio Inputs
- Headphone or Line Outputs
- Microphone and Musical Instrument Inputs
- Compatible with i2i Stream® Consumer Products

WIRELESS APPLICATIONS

- Headphones
- Remote Speakers
- Musical Instruments
- Microphone
- Audio for Electronic Gaming
- PC Audio Streaming

PRODUCT VARIANTS

Product	Variant
SAM-200-TR	Transceiver with Tx/Rx control line, audio input and output
SAM-200-TX	Transmitter without Tx/Rx or vol ctrl, audio input only
SAM-200-RX	Receiver without Tx/Rx or input level sel, audio output only

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Typ	Max	Unit
Supply Voltage, V_{IN}	-0.3	--	+13.5	V
Voltage range at control pin	-0.3	--	$V_{IN} + 0.3$	V
Voltage range at audio pin	-0.3	--	$V_{IN} + 0.3$	V
ESD Contact Discharge	-2	--	+2	kV
Storage temperature range	-40	--	+85	°C
Operating temperature range	-10	--	+60	°C

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
V_{IN}	Supply Voltage	3.8	5.0	9.5	V
V_{IH}	Input Logic Voltage High	2.0	--	3.6	V
V_{IL}	Input Logic Voltage Low	--	--	0.8	V
I_{TX}	Current Consumption, Tx	--	77	--	mA
I_{RX}	Current Consumption, Rx	--	50	--	mA
BW	Occupied Bandwidth	2400	--	2483.5	MHz
P_{TX}	Transmission Power	14	16	18	dBm
S_{RX}	Rx Sensitivity	--	-83	--	dBm

AUDIO CHARACTERISTICS

Parameter	Value
Sample Rate	48Ksps
Bit Depth (stereo)	16bits
Frequency Response	20Hz – 20KHz +/-3dB
Signal-to-Noise Ratio (SNR)	>90dB
Total Harmonic Distortion (THD)	0.007% @ 1KHz
Stereo Separation	>75dB
Latency (source to destination, constant)	18ms
Headphone power output, 32-ohm load (16-ohm load)	15mW (30mW)
Line Output Level	Selectable over I2C

QUICK-CONNECT PINOUT

The Quick-Connect port is a row of 2mm-spaced holes (0.75mm dia) suitable for soldered wires or header for quick-and-easy connections for dedicated boards. Input and output pins' mode and format are customizable on board with solder jumpers, and can be factory-configured.

No.	Name	Tx Rx Xcvr	I/O	Description
1	VCC	T R X	PWR	+4 to 9V power supply input
2	GND	T R X	PWR	Ground connection
3	AUDIO_LP	T X	I O	Audio In/Out, Left, Headphone or Bal +
4	AUDIO_LM	T X	I O	Audio In/Out, Left, Headphone Gnd or Bal -
5	AUDIO_RP	T X	I O	Audio In/Out, Right, Headphone or Bal +
6	AUDIO_RM	T X	I O	Audio In/Out, Right, Headphone Gnd or Bal -
7	CHSEQ	T R X	I	Sequence the channel sel. on each negative transition
8	VOLUP (I2C_CLK)	R X	I	Volume up on each negative transition or I2C Clock
9	VOLDN (I2C_DAT)	R X	I	Volume down on each negative transition or I2C Data
10	RESET	T R X	I	Reserved, leave open or tie to VCC
11	TEST	T R X	I	Reserved, leave open or tie to VCC
12	GND	T R X	PWR	Ground Connection

MAIN CONNECTOR PINOUT

The module's main connector is a dual-row pin header located on the bottom of the board, with two rows of 17 pins spaced on a 0.050" grid.

No.	Name	Tx Rx Xcvr	I/O	Description
1	VCC	T R X	PWR	+4 to 9V power supply input
2	GND	T R X	PWR	Ground connection
3	L_IN	T X	I	Audio input, headphone-level left
4	R_IN	T X	I	Audio input, headphone-level, right
5	LINE_L_IN	T X	I	Audio input, line-level, left (balanced + L)
6	LINE_L_GND	T X	I	Audio input, line-level gnd, left, (balanced – L)
7	LINE_R_IN	T X	I	Audio Input, line-level, right (balanced + R)
8	LINE_R_GND	T X	I	Audio input, line-level gnd, right (balanced – R)
9	GND	T R X	PWR	Ground connection
10	GND	T R X	PWR	Ground connection
11	L_OUT	R	O	Audio output, headphone, left
12	R_OUT	R	O	Audio output, headphone, right
13	LINE_L_OUT	R	O	Audio output, line-level, left (balanced + L)
14	LINE_L_GND	R	O	Audio output, line-level, left, gnd (balanced – L)
15	LINE_R_OUT	R	O	Audio output, line-level, right (balanced + R)
16	LINE_R_OUT	R	O	Audio output, line-level, right, gnd (balanced - R)
17	GND	T R X	PWR	Ground connection
18	GND	T R X	PWR	Ground connection
19	IN_SEL	T R X	I	Audio input select line (0 = headphone, 1 = line/bal)
20	OUT_SEL	T R X	I	Audio output select line (0 = headphone, 1 = line/bal)
21	TX_RX	X	I	Tx/Rx select: 1 = Rx, 0 = Tx (N/U on Tx and Rx models)
22	CH0	T R X	I	Channel select bit 0
23	CH1	T R X	I	Channel select bit 1
24	CH2	T R X	I	Channel select bit 2
25	CHSEQ	T R X	I	Sequence the channel sel. on each negative transition
26	CHSEL	R X	I	Select channel range: 1 = Consumer, 0 = Professional
27	VOLUP	R X	I	Volume up: inc. volume one step each negative transition
28	VOLDN	R X	I	Volume dn: dec. volume one step each negative transition
29	MUTE	R X	I	Mute the output volume when grounded
30	GND	T R X	PWR	Ground connection
31	I2C_CLK	T R X	I	I2C serial interface clock line (extended interface)
32	I2C_DATA	T R X	I/O	I2C serial interface data line (extended interface)
33	TEST	T R X	I	Reserved.
34	RESET	T R X	I	Reserved

APPLICATION INFORMATION

1. Power Supply

The power supply inputs are designed to run off of a variety of batteries. The level must remain above 4.0V at the rated currents or unstable operation will result. Suggested battery types:

- 3.8V – 4.2V in one LiIon cell
- 4.8V – 7.2V in 4 – 6 NiCd or NiMH cells
- 4V – 9V in 4 – 6 Alkaline cells (0.8 – 1.0V end-of-life cell voltage assumption)

2. Audio Inputs

The module is designed for three different types of audio inputs.

- Headphone-level audio from personal audio players
- Line-level audio from standard audio components
- Balanced audio from microphones (pre-amplified) or musical/PA equipment

The module has two sets of inputs on its main connector. These can be solder-jumper-configured for headphone and line level (default), or headphone and balanced. The quick-connect port can host only one type of input or one type of output, selected by solder jumpers. Headphone, line, and balanced inputs are available on the quick-connect port.

On the main connector, the IN_SEL line selects between the two sets of inputs on that connector.

Audio Input Selection

IN_SEL	Audio Input Setting
0	Headphone-level input
1	Line-level or balanced input

3. Audio Outputs

Like the inputs, the module is designed for three different types of audio outputs.

- Headphone-level audio to earbuds or standard headphones
- Line-level audio to standard audio components
- Balanced audio to musical/PA equipment

The module has two sets of outputs on its main connector. These can be solder-jumper-configured for headphone and line level (default), or headphone and balanced. The quick-connect port can host only one type of input or one type of output, selected by solder jumpers. Headphone, line, and balanced outputs are available at the quick-connect port.

On the main connector, the OUT_SEL line selects between the two sets of outputs on that connector.

Audio Input Selection

OUT_SEL	Audio Output Setting
0	Headphone-level output
1	Line-level or balanced output

4. I2C Communication

The module acts as an I2C slave to support extended functionality when embedded in a product that has microprocessor control. The module maps a number of different registers accessible through the I2C communication. These registers allow setting of parameters that include but go beyond the functions available directly on the pins. Current settings and immediate status may be read back through the registers.

Please contact Aerielle for further information.

5. Tx/Rx Selection

The Tx/Rx selection pin (TX_RX) is available only on the transceiver version of the module. This pin selects whether the module plays the role of transmitter or receiver. With no connection, the pin is pulled high internally and the unit functions as a receiver. When this pin is pulled to ground, the module functions as a transmitter.

On dedicated transmitter or receiver versions of the module, this pin has no function.

TX/RX SELECTION

TX_RX	Module Function
1	Receiver (default)
0	Transmitter

6. Channel Selection

The module supports 8 “consumer” channels and 8 “professional” channels, intended for use in musical instruments and other professional audio applications. The division of channel types is primarily to prevent interference with professional audio applications by users of consumer-class devices (wireless headphones, music-sharing platforms) at a public venue.

The **CHSEL** line controls the selection of the class of channels. This line is pulled up internally, and by default (high) selects the consumer class of channels. Strap this line to ground (low) to select the professional class of channels.

The **CHSEQ** line allows simple sequential selection of channels. A very simple product could use this line to select channels by stepping through them (albeit blindly) with a single pushbutton. This type of channel selection is very similar to cordless phones. When you encounter interference on one channel, you push the button once to step to the next channel. When you have a pair of devices (one transmitter, one receiver) and you change the channel on one to avoid interference, you would simply sequence the channel button on the other device until you hear the audio link re-established. (This requires that you

know what the audio source is playing so you can identify it on the receiver.) This line is pulled up internally, and the channel advances each time it transitions to ground. The input is debounced internally to allow the use of a simple electromechanical pushbutton switch.

The **CH0**, **CH1**, and **CH2** lines provide for direct selection of the channel. Use these lines to select the channel from a microcontroller or when you want to hard-wire a particular channel other than the default. These lines are pulled up internally so they must be pulled down to select. See the following table that shows active-low binary selection. In this way, Channel 0 (all lines high) is the default.

Channel Selection

Class	Channel Address			Channel	Color*
CHSEL	CH0	CH1	CH2		
X	1	1	1	Channel 1 (default)	Red
X	1	1	0	Channel 2	Orange
X	1	0	1	Channel 3	Yellow
X	1	0	0	Channel 4	Green
X	0	1	1	Channel 5	Blue
X	0	1	0	Channel 6	Violet
X	0	0	1	Channel 7	White
X	0	0	0	Channel 8	undef.
1	X	X	X	Consumer Class	
0	X	X	X	Professional Class	

*The channel colors refer to those used on the i2i Stream[®] consumer device.

7. Volume Control/Mute

On the transceiver or dedicated receiver version of the module, there are simple function pins for volume control and mute. These control the output volume in the headphone-drive mode.

- **VOLUP** Transition to ground increases volume at headphone outputs by one step.
- **VOLDN** Transition to ground decreases volume at headphone outputs by one step.
- **MUTE** Ground mutes headphone output and floating or high-level input un-mutes it.

8. Regulatory Information

This module has been certified to meet the requirements of US FCC Part 15 regulations. This certification applies only to the RKV-SAM200TR module itself, and not to any circuitry in a host device. If you embed this module into your product, it is your responsibility to meet the regulatory requirements of any markets in which your product will be sold. It is also a requirement that the phrase "Contains FCC ID: RKV-SAM200TR" appear on either your product's exterior FCC label (if required), or on an exterior product label if no FCC label is required.

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