

Preliminary Module Brief

Point-to-point AVMD6210-SWA12TX/RX modules for Stereo and Mono Wireless Audio Systems, based on Avnera's AV6210 IC

General Description

Every consumer wants to be free from wires, but it has been challenging to find a low-cost, high-quality, easy-to-use wireless audio solution for the wireless subwoofer market.

Avnera's proprietary wireless system takes a new approach to wireless audio. The wireless protocol was designed from the ground up and delivers uncompressed mono or stereo audio, with fixed latency and variable over the air data rate support to eliminate interference problems at the best possible audio quality.

Avnera's wireless modules offer a low-touch, easy-to-integrate wireless audio solution and enable fast time to market by already solving the problem associated with FCC certification, antenna tuning and board optimization.

Modules based on Avnera's AV6210 silicon provide breakthrough wireless audio functionality with fixed low-latency point-to-point transport of uncompressed mono PCM audio data at up to 48KHz, 16-bit resolution using digital (I2S) interfaces.

Applications

- ✓ Wireless Subwoofers
- ✓ Stereo audio channel transmission

Ordering Options

AVMD6210 -SWA12 TXD: Transmit module with digital audio input and integrated printed PCB antennas

AVMD6210 -SWA12 RXD: Receive module with digital audio output and integrated printed PCB antennas

Features

- ✓ Audio Interfaces
 - ✓ I2S Digital Input Interface with 93dB end-to-end digital audio path
- ✓ Support for >15m range
- ✓ Frequency range: 2.4 GHz ISM band, continuous dynamic frequency selection
- ✓ Forward error correction coding, error detection, and audio-specific error concealment
- ✓ Custom Dual onboard printed PCB antennas for multipath and fading mitigation
- ✓ Auto-search/synch and dynamic channel selection
- ✓ Low, fixed latency of 16ms, suitable for video lip-synch
- ✓ Connector: 24 position 0.5mm flex cable connector for maximum mounting flexibility in the system.
- ✓ Sample rate converter: Support for 16, 20, 24, and 32 bit PCM words at 8,16, 22.05, 24, 32, 44.1, and 48 kHz
- ✓ General purpose over-the-air (OTA) serial interface:
 - ✓ 2 kbps, bi-directional, full duplex
 - ✓ Support for meta-data and remote control commands

4 AVMD6210-SWA12- Connector Information

Table 1 shows the module connector pin out for the SWA12. A goal of the design is to have the exact same pin out for both the Tx and Rx modules. The module function is completely determined by firmware.

The module pins provide the capability to use either SPI slave or I2C slave interfaces – these are mutually exclusive. If an I2C slave host interface is used GPIOs 2 and 3 can be used for general purpose I/O. In addition, the SPI master port is brought out to the connector to facilitate direct programming of the module flash memory if required. A single I2S port is brought to the connector and can be configured to be either a slave or master port. The MCLK pin can be an input or output to offer optimal flexibility. Likewise the I2S audio pin can be an input or output to implement either audio Tx or Rx.

In addition, there are 5 other GPIOs that can be used exclusively for system features such as pair button, interrupt, LEDs etc. The reset pin allows for an external device to reset the module but must be driven from an open drain device to avoid timing issues with the module reset.

Note: the connector pin out is subject to change throughout the development process to optimize the PCB routing.

SWA12 Pin-Out				
No	Pin Name	I/O	AV6200	Pin Description
1	VDD	-		+5V +/- 10%
2	VDD	-		+5V +/- 10%
3	GPIO	I/O	GPIO13 pin 28	Function defined by firmware application.
4	GPIO	I/O	GPIO18 pin 43	Function defined by firmware application.
5	GPIO	I/O	GPIO19 pin 37	Function defined by firmware application.
6	Reset	I	Pin 24	Driven from open drain external source. Can be left open.
7	I2C_SCL_S / S_MISO	I/O	GPIO5 pin 44	I2C slave or SPI slave port
8	I2C_SDA_S / S_MOSI	I/O	GPIO4 pin 45	I2C slave or SPI slave port
9	I2C_SCL_M	O	GPIO22 pin 41	I2C master port or GPIO
10	I2C_SDA_M	I/O	GPIO21 pin 42	I2C master port or GPIO
11	S_SCLK	I	GPIO3 pin 46	SPI slave port or GPIO
12	GND	-		Ground
13	BCK1	I/O	GPIO15 pin 26	I2S port
14	WCLK1	I/O	GPIO16 pin 25	I2S port
15	S_SSB	I	GPIO2 pin 47	SPI slave port or GPIO
16	MCLK	I/O	GPIO10 pin 31	I2S port or GPIO
17	ADOUT/ADIN1	I/O	GPIO14 pin 27	I2S port
18	M_SSB	O	GPIO6 pin 36	SPI master port
19	M_SCLK	O	GPIO7 pin 35	SPI master port
20	M_MOSI	O	GPIO8 pin 34	SPI master port
21	M_MISO	I	GPIO9 pin 33	SPI master port
22	GPIO	I/O	GPIO11 pin 30	Function defined by firmware application.
23	GPIO	I/O	GPIO12 pin 29	Function defined by firmware application.
24	GND	-		Ground

Table 1 – Rx and Tx SWA12 Module Pin-Out

5 AVMD6210-SWA12 Mechanical Dimensions

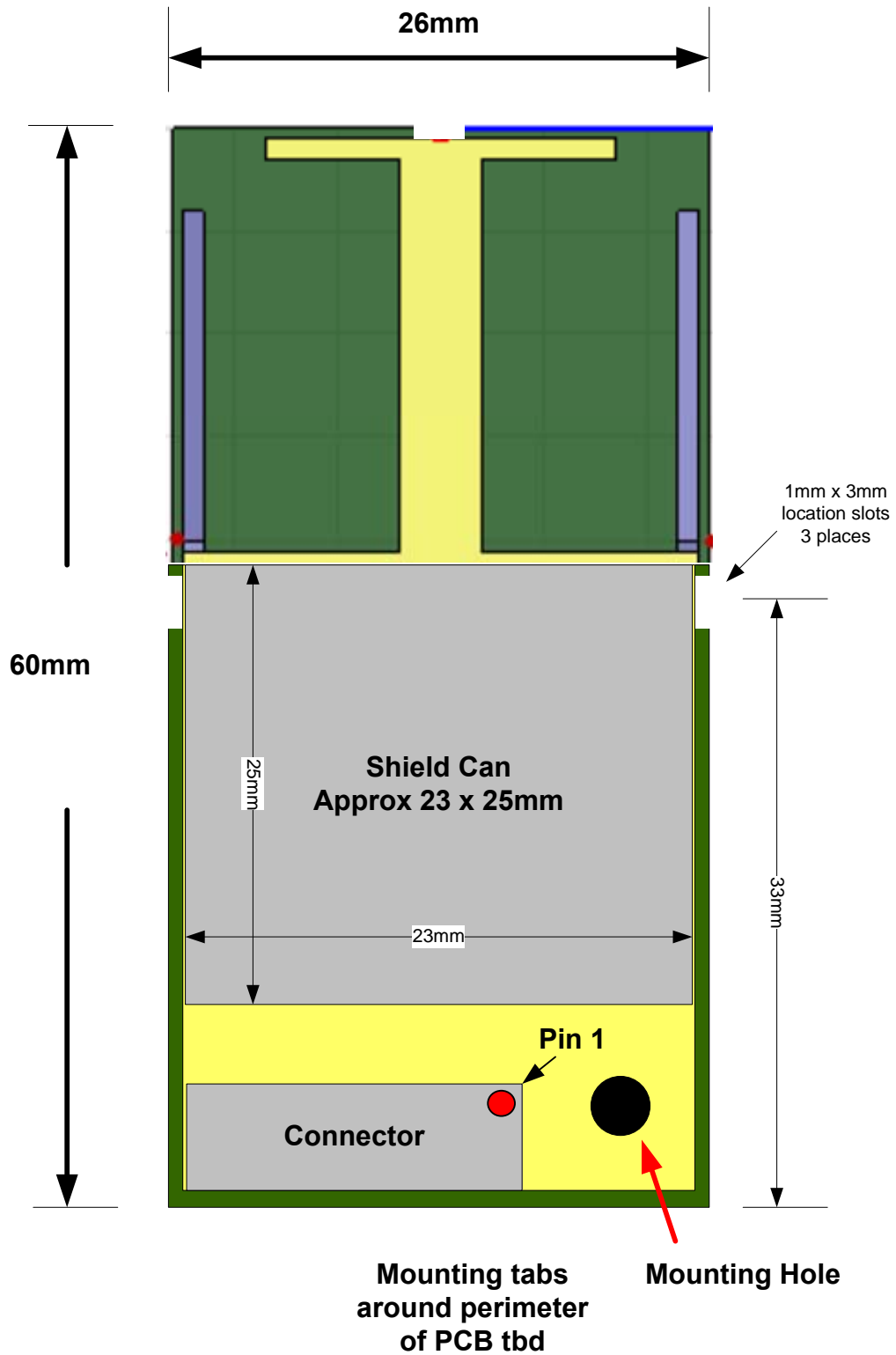


Figure 3 - AVMD6210-SWA12 mechanical dimensions

6 Electrical Specifications

6.1 Absolute Maximum Ratings

Absolute Maximum Ratings (AMR) are stress ratings only. AMR corresponds to the maximum value that can be applied without leading to instantaneous or very short-term unrecoverable hard failure (destructive breakdown). Stresses beyond those listed under AMR may cause permanent damage to the device.

Functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Range" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may adversely affect device reliability.

Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

CONDITION MIN		MAX
VDD Supply Voltage Input	-0.3V	6.0V
Input Voltage Range – Digital Inputs ¹	-0.3V	3.6V
Operating Temperature	-20°C	+80°C
Storage Temperature	-40°C	+100°C
Assembly Temperature		TBD
Static Discharge Voltage – HBM ²	TBD	
Static Discharge Voltage – MM ³	TBD	

Notes:

Note 1: Digital GPIO Pins are 5V Tolerant when programmed as Inputs.

Note 2: Terminology: HBM => ESD human body model

Note 3: Terminology: MM => Machine model

6.2 Recommended Operating Range

PARAMETER MIN		TYP	MAX	UNIT
VDD Supply pin voltage	4.5		5.5	V
Ambient Temperature (T _A)	0		70	°C

6.3 Electrical Characteristics

Test Conditions: T_A=+25°C, VDC=+5.0V

Table 2 - AVMD6210-SWA12 Electrical Characteristics

PARAMETER CO	NDITIONS	MIN	TYP	MAX	UNIT
RF Frequency Range		2402		2478	MHz
RF Transmit power		-3	0		dBm
RF Receiver sensitivity ¹		-86	-89		dBm
Range (LOS)			>15		m
Audio SNR I2S Input/Output ²	I2S end to end 16bit mode	90	93		dB
Audio SNR I2S Input/Output ²	I2S end to end 12bit mode	70	72		dB
Analog Audio THD+N ³			tbd		dB
Audio Bandwidth (end to end I2S)	0.1dB point 20KHz mode		20		KHz
Audio Bandwidth (end to end I2S)	0.1 dB point 5KHz mode		5		KHz
Current consumption	V _{DC} (Active Audio mode)		50		mA

Note 1: AV6200 IC specification, measure by conducted u.fl connection at IC

Note 2: AVMD6200-SWA12-TX/RX

Note 3: Measured at -3dbFS input, A weighting. Output is taken, using external DAC on Avnera development board.

7 Firmware Architecture

7.1 Standard Firmware Options

Avnera provides standard firmware images that implement basic wireless link operation. Each of these images uses 1 GPIO as a link status indicator and another GPIO is an input used to get the module into pairing mode as illustrated in Figure 4.

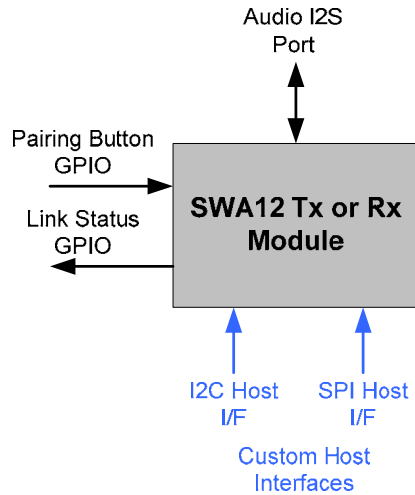


Figure 4 – Standard Module Firmware Topology

The basic firmware image options supported are:

Tx Module	Over-the-Air Audio Format	I2S Configuration
SWA12TX-44/16-Slave	44KSps @ 16bit Stereo	I2S Slave
SWA12TX-44/16-Master	44KSps @ 16bit Stereo	I2S Master
SWA12TX-11/16-Slave	11KSps @ 16bit Mono	I2S Slave
SWA12TX-11/16-Master	11KSps @ 16bit Mono	I2S Master
Rx Module	Over-the-Air Audio Format	I2S Configuration
SWA12RX-44/16-Slave	44KSps @ 16bit Stereo	I2S Slave
SWA12RX-44/16-Master	44KSps @ 16bit Stereo	I2S Master
SWA12RX-11/16-Slave	11KSps @ 16bit Mono	I2S Slave
SWA12RX-11/16-Master	11KSps @ 16bit Mono	I2S Master

Table 3 – Standard Firmware Image Support

7.2 Custom Firmware Options

Beyond the basic audio, link status and pairing functionality, it is possible for Avnera to customize the firmware functionality to support advanced system features such as over-the-air communication by means of either an I2C or SPI host interface.

Customization may consist of features such as:

- Defined command and control API through I2C/SPI host interface
- Data transfer between the Tx and Rx modules
- Custom apps running on the module MCU to implement I2C master port or specific GPIO input/output functions

7.3 Firm ware Upgrades

The possible interfaces that can be used for upgrades of the flash memory device are shown in Figure 5.

With the standard firmware implementation, firmware upgrades are achieved by using the module SPI master port to directly program the module flash device. Avnera provides a GUI application that runs on a PC to facilitate direct SPI programming.

By means of additional custom firmware, programming of the module flash device can be achieved via the slave I2C or SPI host interfaces.

It is also possible to implement over-the-air programming of the Rx module so all elements of a system can be upgraded through a single host interface. This requires working with customer to define the functionality and architecture required as well as the customer host interface and API to the Tx module.

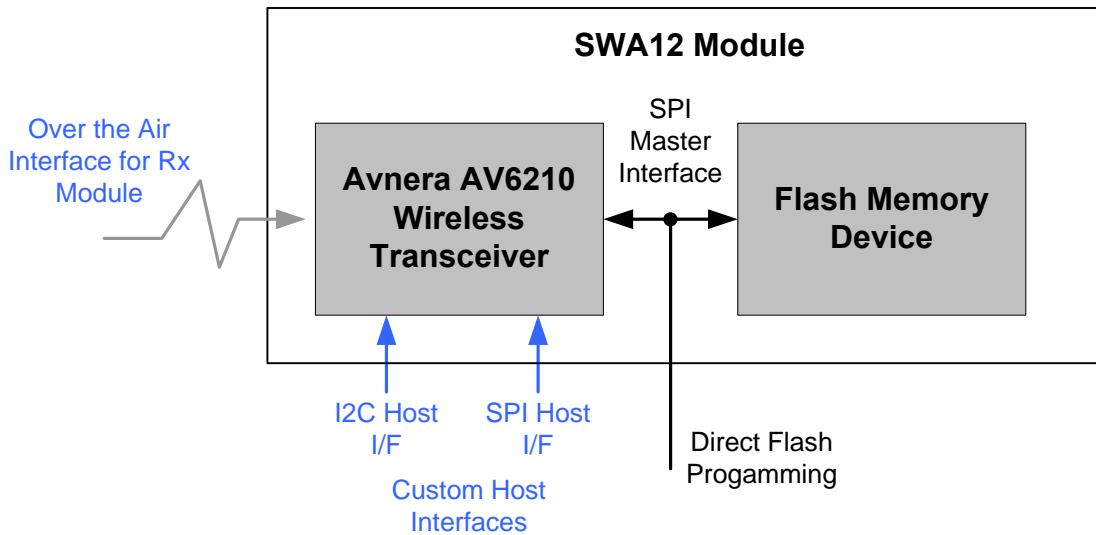


Figure 5 – Flash Programming Interface Options

FCC Statement:

Federal Communication Commission Interference Statement

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 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.

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

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

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " **Contains TX FCC ID: NKR-SWA12**". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

IC Statement:

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the IC RSS-102 radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. IC statement is required to be available in the users manual: This Class B digital apparatus complies with Canadian ICES-003. 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " **Contains TX IC : 4441A-SWA12** ".