

AVB-DG / DGK

Quick Start Guide

Revision	Description	Date
V1.0	Initial revision	01-06-2013

AVB-DG Description

The AVB-DG is an affordable OEM module featuring the latest Audio Video Bridging (AVB) standards. Based on XMOS technology, it can stream up to 8 inputs by 8 outputs audio channels via I2S format. The modular configuration and co-processor architecture gives designers the flexibility required to keep up with ever changing requirements.

To foster creativity, DSP4YOU is opening all avenues for 3rd party product development. Schematics, template pre-compiled binaries and full source code are available for download from DSP4YOU & XMOS GitHub.

Features

- Low cost AVB module
- Low power, small form factor
- OEM friendly

Hardware

- XMOS XS1-L16 128QFN
- Microchip 32bit MCU coprocessor
- JTAG for custom programming

Network

- Complete AVB stack by XMOS
- Additional L3 stack can be added on 32bit MCU as required

Connectivity

- 1 x RJ45 10/100Mbps
- 1 x miniUSB 2.0
- 1 x XMOS JTAG
- 1 x Microchip ICSP
- 1 x GPIO from XMOS
- 1 x I2S in/out + clocks for 8x8

Power

- USB self powered
- Optional +5VDC header
- Power over Ethernet Pin routed to header (requires PoE PD module not included)

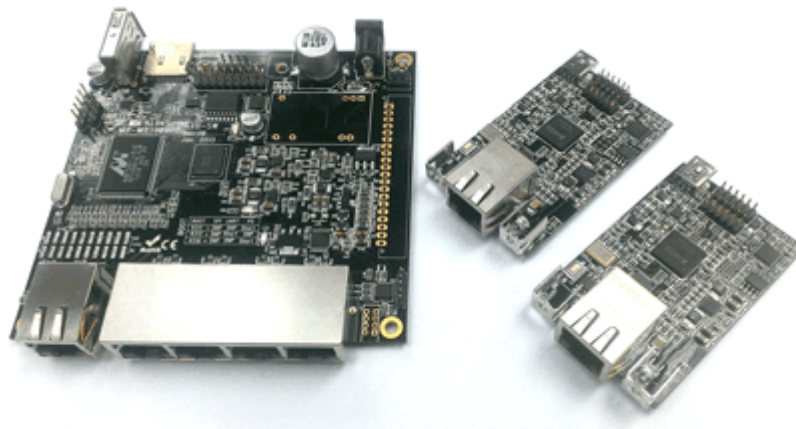


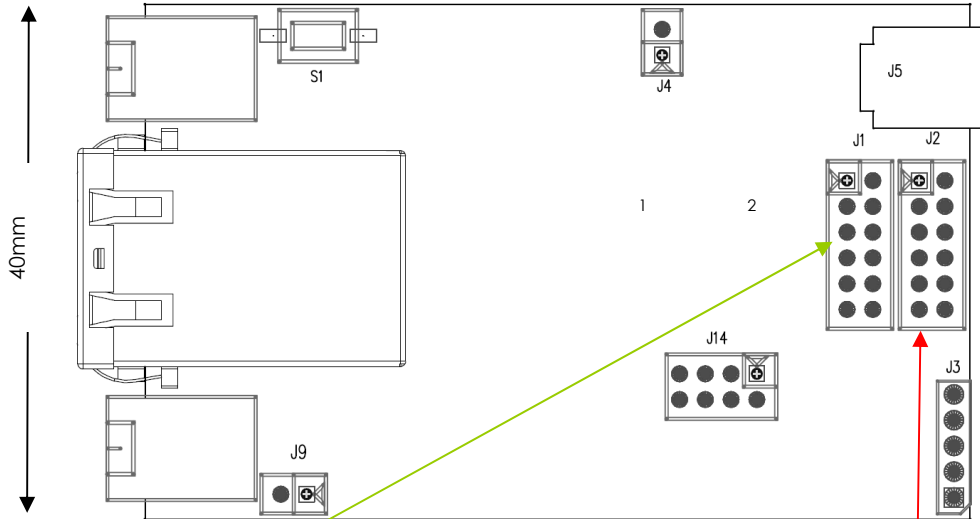
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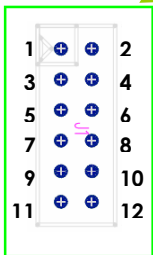
1 Product Overview

1.1 Top View

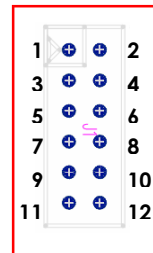
69 mm (2.4")



Item	Description
S1	Reset switch
J5	miniUSB port - Power in
J1	I2S data In/Out + Clocks See below pin out
J2	GPIO pins + Power See below pin out
J14	XMOS JTAG debugger
J3	Microchip MCU ICSP
J4	+5VDC input
J9	PoE power from RJ45
J21	RJ45 with Embedded magnetics

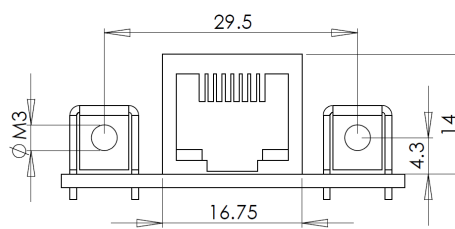


Pin	Description
1	I2S data OUT ch1&2 - Playback
2	I2S data IN ch1&2 - Recording
3	I2S data OUT ch3&4 - Playback
4	I2S data IN ch3&4 - Recording
5	I2S data OUT ch5&6 - Playback
6	I2S data IN ch5&6 - Recording
7	I2S data OUT ch7&8 - Playback
8	I2S data IN ch7&8 - Recording
9	Master Clock out (MCLK OUT)
10	I2S System clock (SCLK)
11	Ground (GND)
12	I2S frame synch (LRCLK)



Pin	Description
1	GND
2	+3.3V
3	GND
4	+3.3V
5	NC
6	GPIO (future)
7	GPIO (future)
8	RST (negative low) (Requires to add 0 ohm on board / See schematic)
9	I2C SDA
10	I2C SCK
11	Ground (GND)
12	5V input for external power Recommended 300mA PSU

1.2 Front view



For complete mechanical drawings, please get in touch with our team.

1.3 Schematics

Schematics for the AVB-DG are available online few days after the purchase of the module. Please navigate to the [User Downloads](#) section once logged in.

1.4 Feature description

1.4.1 Audio Video Bridging

AVB defines a group of network protocols for the distribution of time synchronized and low latency Audio & Video streams over IEEE802 networks. By leveraging a combination of existing 802 network technologies along with standards specifically designed for the purpose, AVB technology lays the ground work for un-paralleled guaranteed media streaming over Ethernet networks. The overall concept of AVB is actually rather simple. Without getting into too much detail, the three core protocols specify:

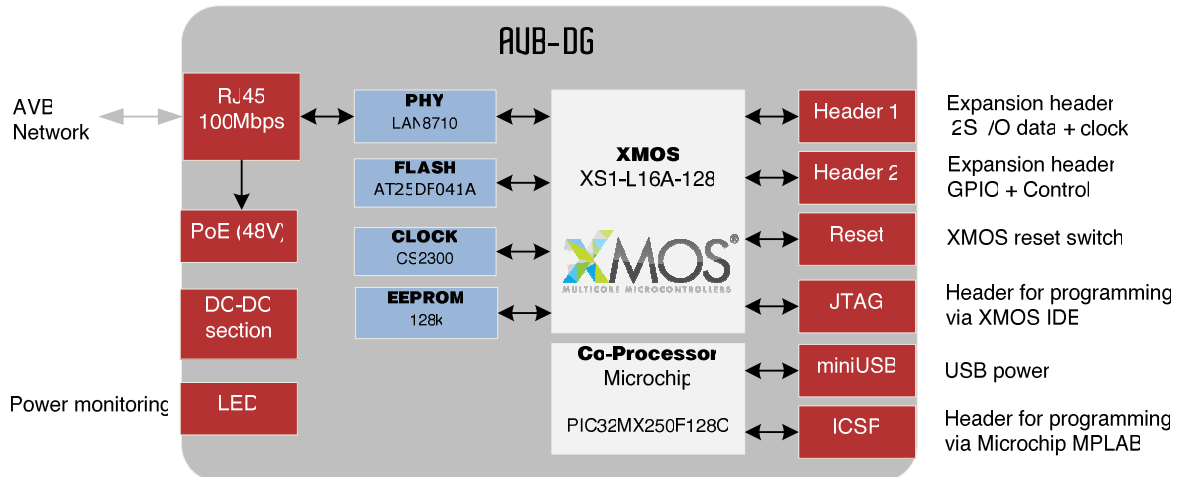
- Timing and synchronization
- Bandwidth allocation through the Stream Reservation Protocol (SRP)
- Traffic shaping to ensure that low priority Ethernet traffic does not interfere with AVB traffic

Engineered from the ground up for media streaming applications, AVB has a definitive edge over legacy Ethernet technology in the sense that it allows bandwidth allocation and priority rules based on timing. Unlike similar audio over IP (AOIP) technology, AVB will dynamically assign and defend bandwidth allocation for AVB streaming thanks to the concept of Stream Reservation Protocol (SRP).

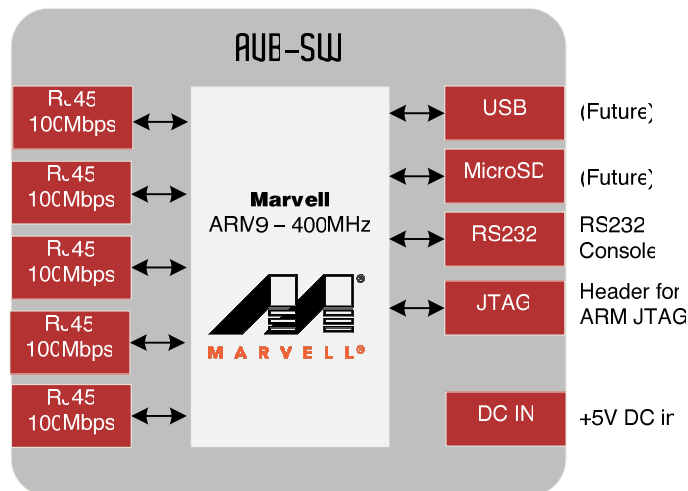
Terminology for AVB streaming goes as follow:

- o **Audio Video Bridging (AVB):** General descriptive for a group of protocols providing audio/ video streaming, timing, synchronization, Quality of service (QoS) , control and discovery.
- o **AVB Endpoint:** AVB powered device, capable of transmitting and/ or receiving audio streams using P1722/ P1733 transport protocol.
- o **Talker:** AVB endpoint transmitting audio to the network. (Source)
- o **Listener:** AVB endpoint receiving audio from the network. (Sink/ Destination)
- o **Talker/Listener:** AVB endpoint that is both transmitting and receiving. AVB-DG modules are by default Talker/Listener devices.
- o **Precision Time Protocol (PTP):** Allows devices on the network to get a notion of global time in the effort to synchronize with each other. PTP component in each AVB module can act as a Grand Master (providing clock) or as a slave (receiving clock). Once a grand master negotiates and is selected as a sync source, all units will synchronize to it.
- o **Streams:** General term describing packetization of one or multiple audio/ video channels over the network.
- o **Stream ID:** Unique 64-bit stream identifier used by AVB transport protocols to identify streams.

1.4.2 System diagram for AVB-DG



1.4.3 System diagram for AVB-SW



2 Setup guide

2.1 AVB-DGK Box content

Box Content:

- 2 or 4 pcs of AVB-DG module
- 1 x AVB-SW (AVB switch)
- CAT6 patch cables
- 1 x 5V PSU for AVB-SW

Required for evaluation:

- External 5V supply for AVB-DG or USB charger. See power section for more info.

2.2 Connectivity

2.2.1 AVB Network

If you purchased the AVB-DG without DSP4YOU's AVB switch ([AVB-SW](#)), you will require an AVB switch to be able to stream audio. Standard switches will not allow audio streaming.

Please consult the wikipedia [AVB page](#) for an up to date list of AVB switch currently available. Current tests by our team was done with Marvell Firefox series, Broadcom eval board and Netgear GS724T with EAV license.

2.2.2 DC power connectivity for AVB-DG

The AVB-DG requires an external DC supply either provided by an external 5VDC SMPS or the USB port.

OPTION A (USB port): Using a simple USB charger/supply/HUB (not provided), the module can be powered with the miniUSB port. This method is the easiest way to start your demo.

OPTION B (External supply): +5VDC power supply (not provided) can be connected directly to the header J4 on the board.

2.2.3 DC power connectivity for AVB-SW

The AVB-SW requires an external +5VDC supply already provided with an AVB-DGK/AVB-SW. Here is a picture of the power supply provided along with the interchangeable plugs.



2.2.4 I2S in/out connectivity for AVB-DG

I2S stands for Inter-IC Sound protocol and is most commonly used to carry audio information between IC's. This protocol is only intended short Inter-IC, board to board connections.

The AVB-DG can only operate as an I2S Master (clock being outputs from the device) by default and runs with a default sample rate of 48kHz.

Customization using the XMOS source code Github can be done to modify sample rate and I2S/TDM port behavior but note that such modifications are outside DSP4YOU's support structure. Please consult the XMOS IDE programming section of this user manual for more info.

Clock lines

- MCLK: Master clock of the device for both playback and recording is a ratio of the sample rate ($F_s = \text{LRCLK}$). This pin is an output only.
- LRCK: The frame synchronization is equal to the sampling frequency (F_s) of the native signal being streamed. This pin is an output only
- SCLK: The system clock which is always equal to $64 \times F_s$. This pin is an output only.

Sample Rate (LRCLK)	Master Clock (MCLK)	System Clock (SCLK)	MCLK/LRCLK	SCLK/LRCLK ratio
48 kHz	24.576 MHz	3.072 MHz	512	64

Data lines

- SDIN: 16/24bit data input to the AVB-DG for audio recording.
- SDOUT: 16/24bit data output from the AVB-DG for audio playback.

The following timing diagram illustrates the expected I2S audio format.

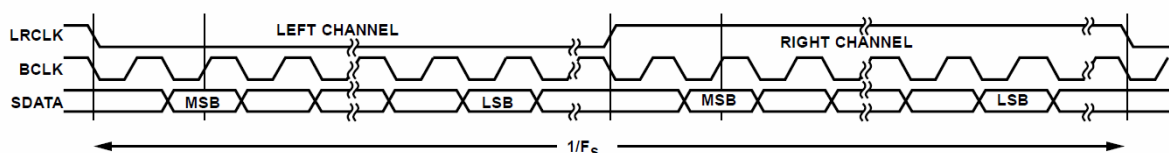


Figure 31. I²S Mode—16 Bits to 24 Bits per Channel

3 Software configuration

3.1 Default pre-loaded AVB demo for AVB-DG

To simplify your evaluation and allow instant results, the AVB-DG is preloaded with a default configuration :

- All AVB-DG are setup with 1 x talker Stream of 8 audio channel + 1 x listener stream of 8 audio channels
- When 2 x AVB-DG are connected to an AVB network (i.e. using an AVB switch), the module are automatically discovered and will mount to the first talker stream discovered. This results in bidirectional 8x8 audio streaming between both AVB-DG
- For configurations with more than 2 x AVB-DG, a 3rd party 1722.1 compliant software is required for configuration of the stream routing. We recommend the very user friendly UNOS vision software from Uman Universal Media Access Networks GmbH.

3.2 UNOS vision demo

Test environment for this demo was as follow:

AVB Switch

- o DSP4YOU AVB-SW
- o Netgear GS724Tv3 with AV license

AVB end points

- o Two or more AVB-DG

Software

- o [UNOS Vision](#) 0.99.136

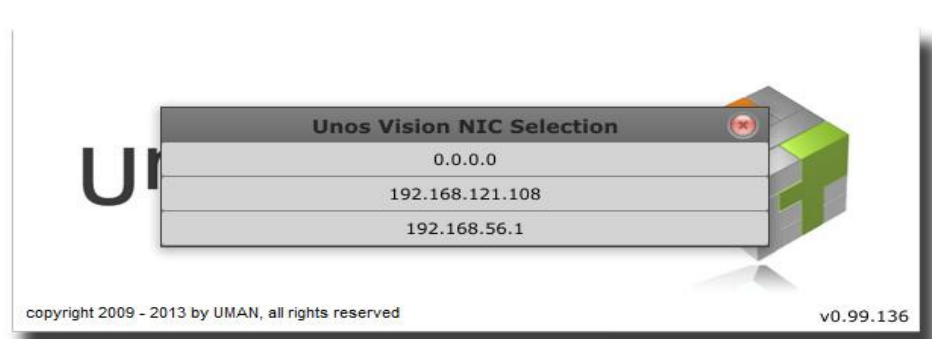
To obtain UNOS Vision please contact directly [UNOS](#) at: info@umannet.com

XMOS firmware

- o The AVB-DG default firmware is based on 14th June, 2013 of <https://github.com/xcore> and able to handle 1 Talker stream with 8 channels plus 1 Listener stream with 8 channels. Also by default the AVB-DG will listen and mount to the first Talker stream it discover.

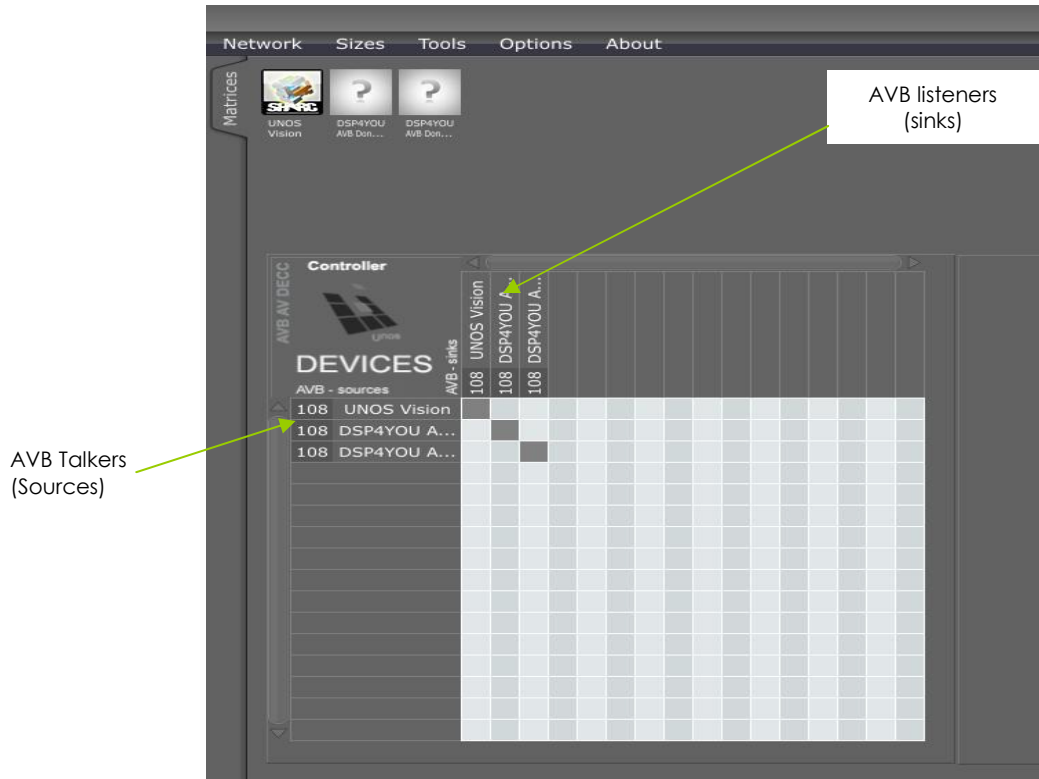
3.2.1 Step by Step routing with UNOS Vision

- 1) On opening of UNOS Vision, you may need to select the correct LAN interface connected to the AVB Network.

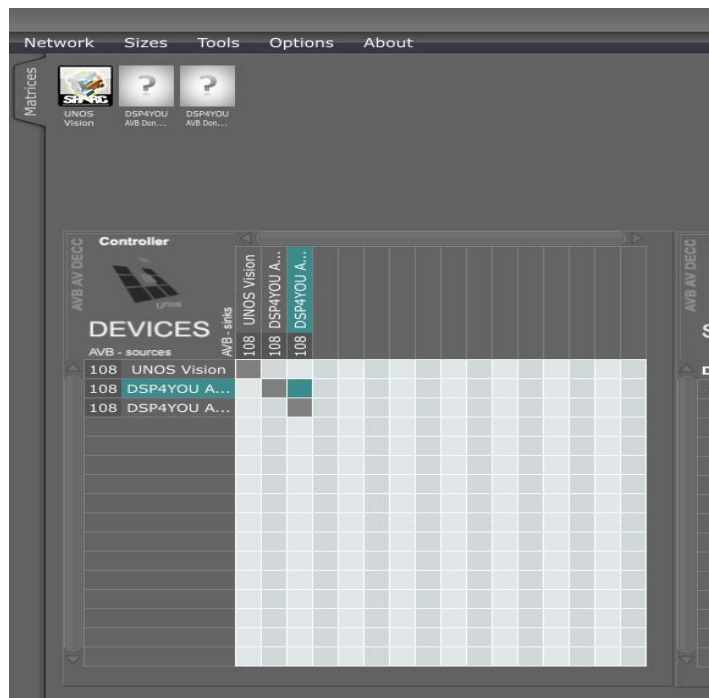


- 2) The main page of UNOS Vision will display the endpoints discovered on the network. If not, double check your connectivity and go to "Network->Rescan"

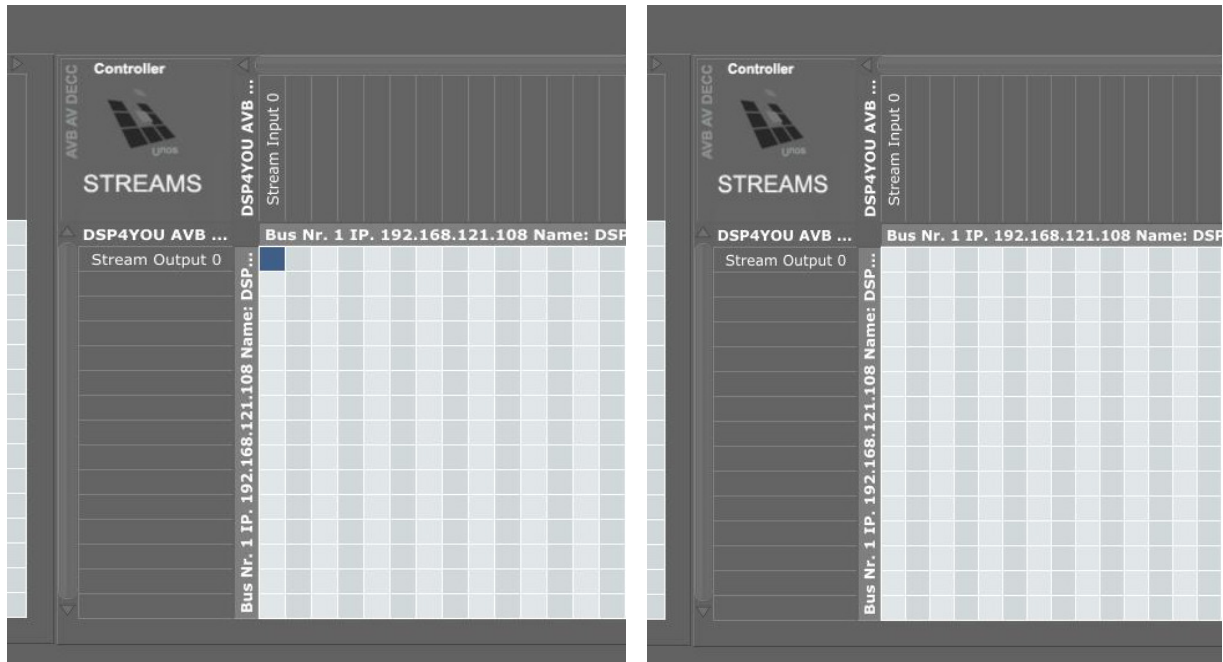
The GUI is very intuitive and similar to any Audio Matrix device. The discovered AVB Sources/talkers (inputs) are on the rows while the AVB sinks/listeners (outputs) are on columns.



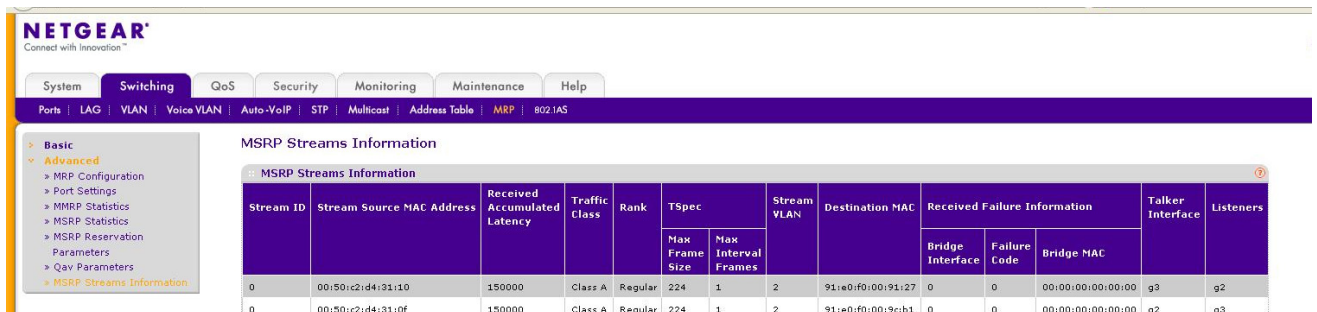
- 3) To control the routing of a source, simply select a crosspoint between a source and a sink the same way you would in a matrix mixer.



- 4) On clicking, a second window will appear to provide additional information and granularity if more than 1 stream is available for routing within a talker. Toggle ON (Blue color), or OFF (grey) to enable/disable the streaming.



- 5) Finally, information of the stream can be obtained from some managed switch if available. Here is a screenshot of the Netgear GS724T (with AVB) web GUI.

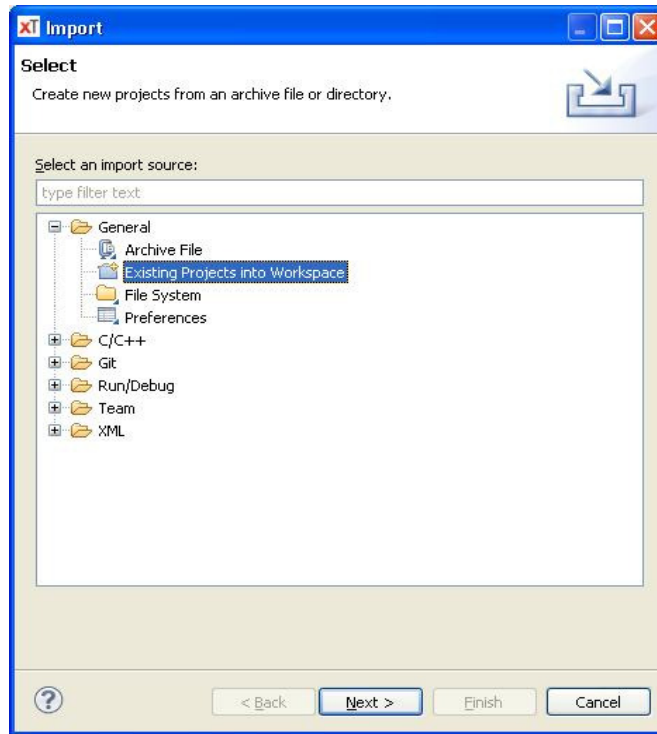


3.3 Customization under XMOS IDE tools

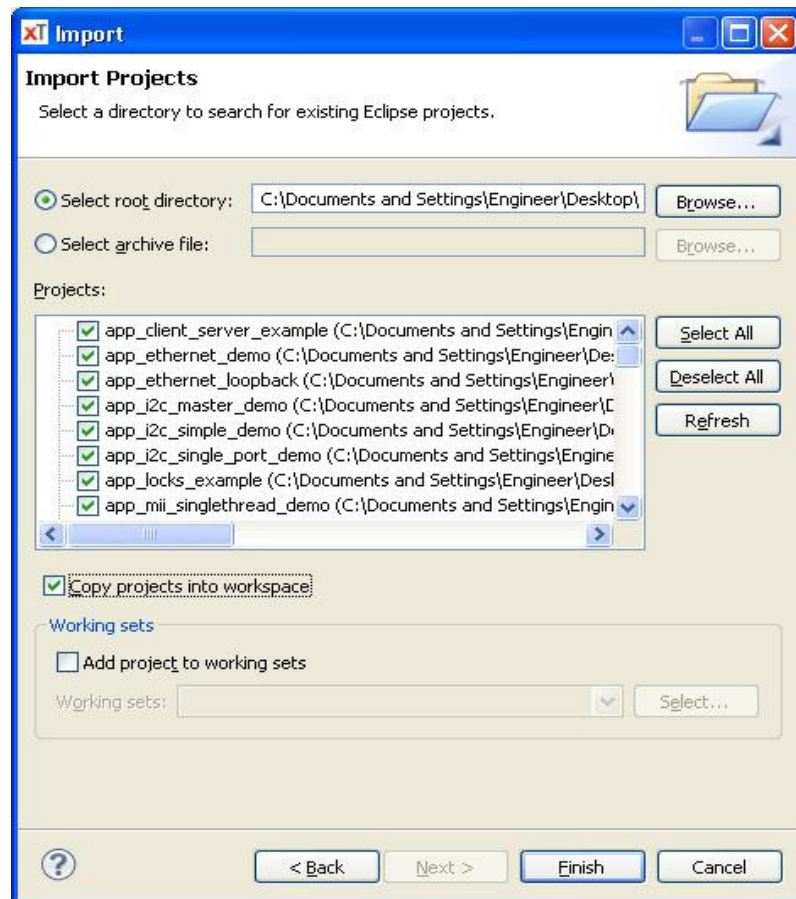
To provide complete flexibility, the AVB-DG is provided with complete source code and fully compliant with the XMOS AVB Github. (<https://github.com/xcore>). The following basic steps are only for reference and to get you started.

Note that custom programming and technical questions related to XMOS coding are outside our support structure. We recommend anybody wanting to learn XMOS programming to start by reading the wealth of application notes and online examples already available on XMOS website.

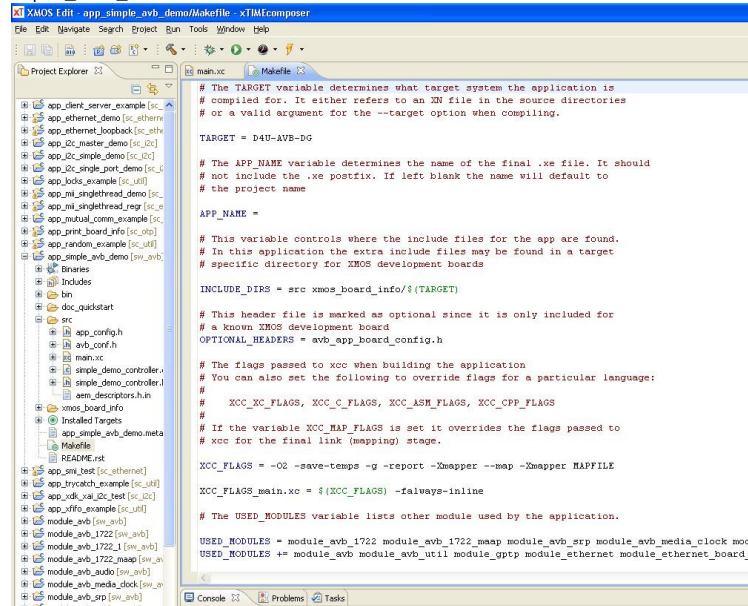
1. Unzip the source code
2. Install and Run xTIME Composer Studio (latest version)
3. Select "File->Import" -> General -> Existing Projects into Workspace



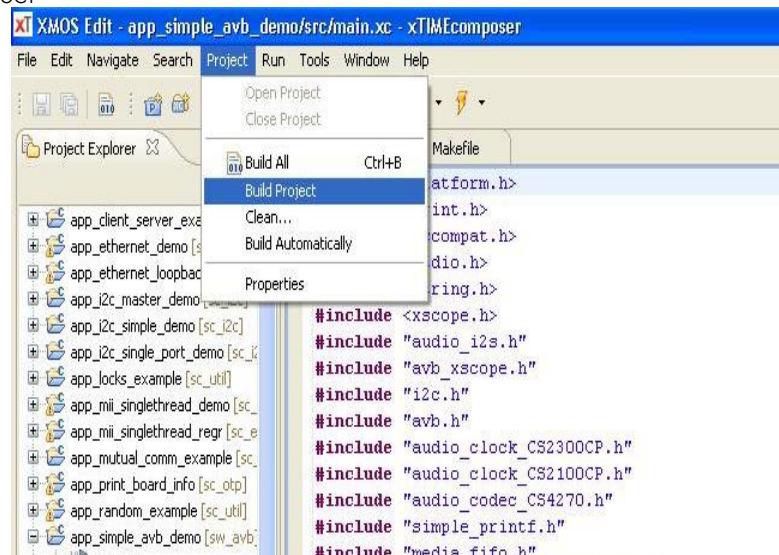
4. Choose the source code folder and select "Copy projects into workspace"



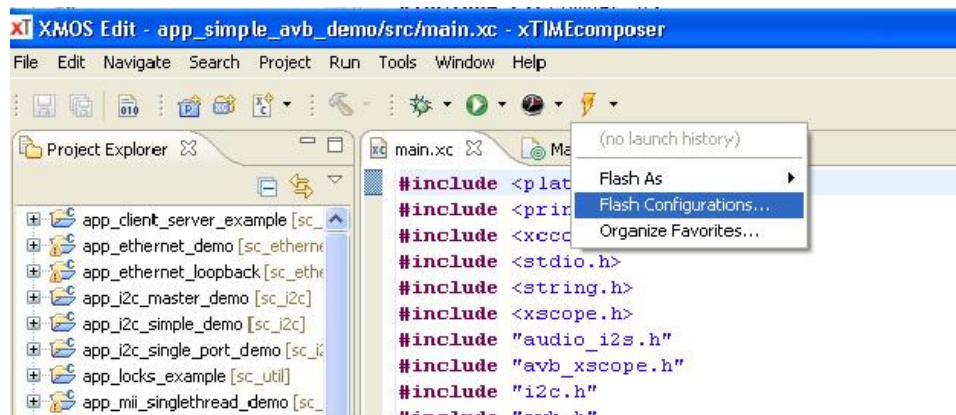
5. Open "app_simple_avb_demo/Makefile" make sure the TARGET is D4U-AVB-DG

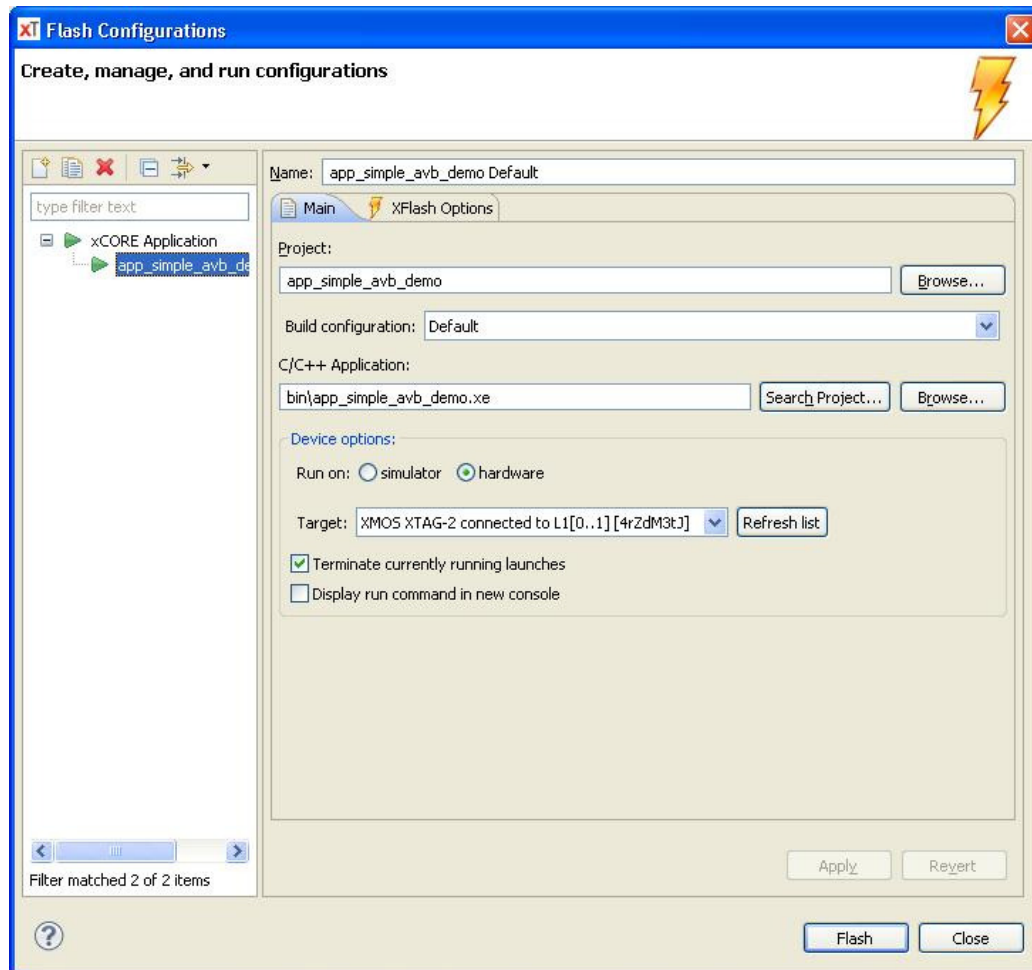


6. Build the Project



7. Connect the XTAGE2 to the AVB-DG
8. Flash the configuration





9. Following a successful flashing, press the reset button on the AVB-DG to reboot the device

Technical specifications

3.4 AVB-DG Technical specifications

Item	Description
Network Processor	XMOS XS1-L16A-128 (16 core processor) - Programmable via JTAG
Co Processor	32bit Microchip PIC32MX250F128C - Programmable via ICSP
Network port	1 x auto speed sensing 10/100 Mbps RJ45 port
Network protocols & IEEE standards	IEEE 802.3i/u for 10/100BaseT IEEE 802.1AS, 802.1Qat, 802.1Qav for Audio Video Bridging standards IEEE 1722.1 for discovery and enumeration
USB slave mode	miniUSB 2.0 for Power / Connected to Microchip MCU
AVB Endpoint interface	2mm pitch connector with I2S input & output streaming AVBTP (IEEE 1722) talker listener mode Up to 8ch bidirectional @ 48kHz Sample rate of 44.1/48/88.2/96/176.4/192kHz (Channel count varies) Sample width up to 24bit Automatic hardware locking to stream's media using the IEEE 1722 presentation time
GPIO	Configurable GPIO routed directly to the XMOS core and available for custom programming by using XMOS IDE tools
Front/Rear connectors	FRONT: 1 x RJ45 with embedded magnetics - PoE pin routed to board for optional PoE REAR: 1 x miniUSB connector, 2 x 2mm headers for GPIO and I2S audio JTAG: 1 x XMOS JTAG connector, 1 x Microchip ICSP connector
Power Supply	USB Self powered Optional +5VDC via 2pin header Power over Ethernet Pin routed to header (requires PoE PD module not included)
Weight	20gm
Dimensions (H x W x D) mm	16 x 40 x 69 mm
Safety / Compliance	CE/LVD, RoHS compliant
Warranty	1 year warranty
Mounting	Removable mounting brackets with keyholes for ceiling, under the desk installation

3.5 AVB-SW Technical specifications

Item	Description
Network Processor	400MHz ARM9 Marvell 88E7251
Network port	5 auto speed sensing 10/100 Mbps RJ45 ports
Network protocols and standards	IEEE 802.3i/u for 10/100BaseT IEEE 802.1AS, 802.1Qat, 802.1Qav for Audio Video Bridging standards
USB 2.0, microSD	USB 2.0 Type A plug (Future) - Host mode microSD card (future)
AVB Endpoint header (Future feature via firmware upgrade)	Internal 20pin 0.1" pitch connector with TDM/I2S input & output streaming AVBTP (IEEE 1722) talker listener mode Up to 8ch per stream Sample rate of 44.1/48/88.2/96/176.4/192kHz Sample width of 20/24bit Automatic hardware locking to stream's media using the IEEE 1722 presentation time
Front/Rear connectors	FRONT: 5 x RJ45 (4 x PoE+ ports in the GWP version) REAR: 1 x 2.1mm DC connector, 1 x MicroSD card, 1 x USB 2.0 connector
Power Supply	External +5VDC AC~DC converter 3W @ 5VDC no USB plugged in / 6W @ 5VDC with USB host
Weight	100gm
Dimensions (H x W x D) mm	31 x 129 x 108mm
Safety	CE Mark, CE/LVD
Warranty	1 year warranty
Mounting	4 x 3mm Diameter plated holes - Board provided on plastic standoffs