



# Digigram ESnet

## Network Core for Audio Devices

FOR RAPID DEVELOPMENT OF NETWORKED AUDIO PRODUCTS

### EtherSound Overview

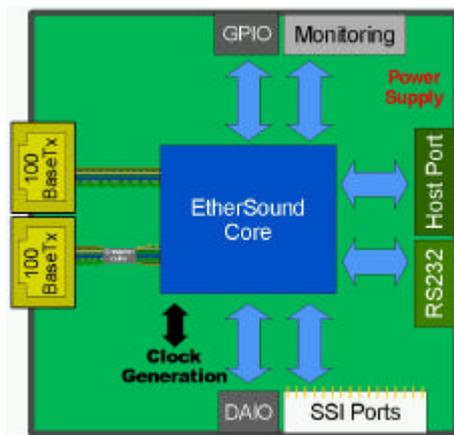
EtherSound™ enhances established technologies to provide easy-to-implement, high-quality audio networks. The patent-pending EtherSound protocol provides fully deterministic, very low-latency transmission of synchronized audio channels over standard Ethernet. EtherSound maintains in a cost effective way, a fully digital path between networked audio devices. Up to 64 channels of 24-bit digital audio, plus bi-directional status and control data, may be transported among a virtually infinite number of connected devices. Off-the-shelf Ethernet components can be used to extend the number of audio devices, as well as the distance between the devices, on the network.



### ESnet Description

ESnet modules, manufactured by Digigram, serve as the network core for manufacturers to integrate EtherSound into their own audio equipment. Cost and size were considerably reduced by connecting directly to Ethernet links, by simplifying clock recovery management and by removing all complex processing (no DSP or µController is required).

Each ESnet module has two RJ45 Ethernet links used for the EtherSound stream.



ESnet module schematic

Connection to the audio source or the audio destination is via an industry standard 24-bit, I2S compatible Synchronous Serial Interface (SSI).

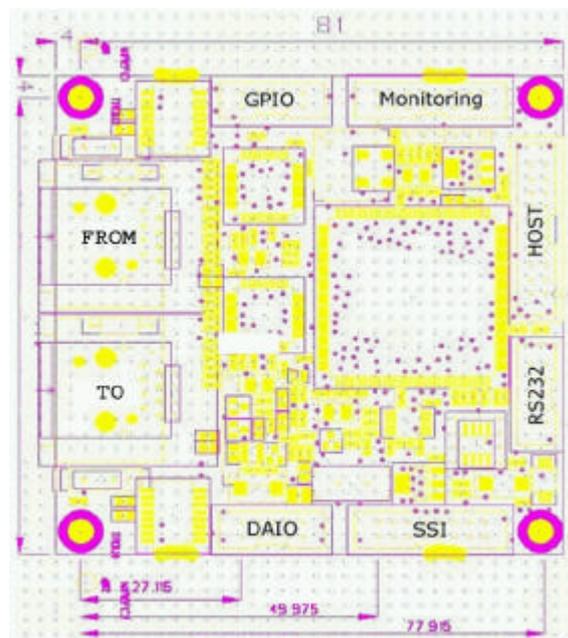
By default, each ESnet module manages up to eight Input and/or eight Output channels of digital audio. Customized versions may transmit and/or receive up to 64 channels of any combination of inputs and outputs.

Examples of audio sources may be Microphones or Signal Processors. Loudspeakers are typical audio destinations. Analog and digital filters ensure clock recovery and reduce jitter to minimum.

An RS232 port is available for peripheral devices or for remote control of the network from the Primary Master via a host computer. DSP or µController management may be performed using the Host Port. Eight fully configurable General Purpose Input/Outputs (GPIOs) on each ESnet device allow simple external controls, managed by the Primary Master. Ten Dedicated Application Input/Outputs (DAIOs) are available for specific product development such as control of digital-to-analog and analog-to-digital converters (DACs/ADCs) or extension of the number of channels available on the SSI Audio Port.

### Mechanical Specifications

ESnet module is an 85 mm square circuit board. Connectivity is via two RJ45 and six HE10 connectors. The ESnet may be used as a daughterboard or otherwise embedded in a product design by using the four mounting holes and the required ribbon cables.

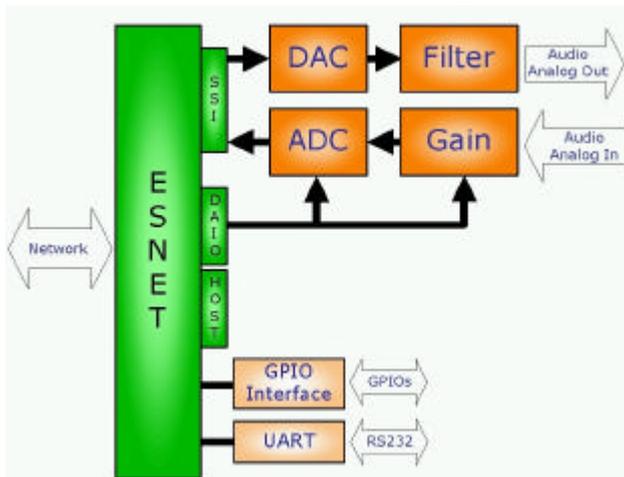


ESnet Printed Circuit Board (PCB).

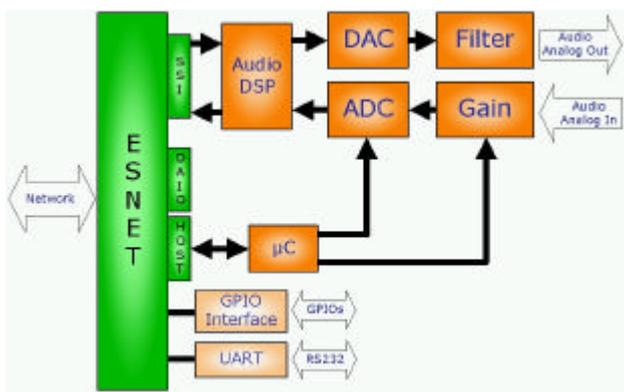
## Applications

Compact and cost-effective, ESnet simplifies product design considerably and can be easily embedded in a variety of professional audio products.

ESnet modules are designed to operate in Master, Slave or Master/Slave modes. The following examples illustrate some basic product designs using ESnet modules. Both Master and Slave implementations are shown:



A simple product design with digital-to-analog and analog-to-digital converters directly wired to the ESnet module and controlled via the Dedicated Application Inputs/Outputs (DAIO) port.



A more sophisticated solution implementing µController and DSP intelligence for powerful control and features

### Typical applications:

- Loudspeakers
- Amplifiers
- Signal processors
- Public Address equipment
- Residential entertainment systems

## Features

### 100BaseTX Ethernet Interface

- 100Mbps, full duplex Ethernet Interface
- Fully compliant with IEEE 802.3 standard
- Star, Daisy-Chain or combined architectures

### Synchronous Audio Port

- Provides 8Inputs and/or 8Outputs in a default configuration
- Up to 64 audio channels in case of specific development
- From 44.1 to 48 kHz, 24-bit resolution

### Host Port Interface

- 25 MHz Interface
- Generic and compatible with a wide range of µCs and DSPs

### Asynchronous Serial Port

- RS232 remote control of the configuration

### GPIOs

- 8 General Purpose IOs fully configurable
- TTL electrical Interface

### DAIOs

- 10 Dedicated Application IOs fully configurable
- Optional: alternatively may be specified to provide up to 32 additional digital audio channels (16 In / 16 Out)
- TTL electrical Interface

### Connectivity

- One connector per basic function
- Low cost HE10 connectors
- RJ45 connectors

### Latency

- Fully deterministic low latency transmission
- Typical end-to-end transit time < 6 samples
- 1.22 µs latency per ESnet module at 48 KHz

### Synchronization

- Slave and Master modules are synchronized on Primary Master module
- < 1 ns of jitter

## Electrical Specifications

### Network

Signals	Signal Description	M / S / MS *
RX1+ / RX1-	FROM RX	In
TX1+ / TX1-	FROM TX	Out
FRPOW +/-	FROM POWER	(In/Out) *
RX2+ / RX2-	TO RX	In
TX2+ / TX2-	TO TX	Out
TOPOW +/-	TO POWER	(Out/In) *
PLED (3:0)	Network status	Out

- ♦ Power supply connector pins routed and available on ESnet board.  
May be used by other boards or applications.

### Audio Port: Synchronous Serial I/F (SSI)

Signals	Signal Description	M / S / MS *
SSI(3:0)	SSI Data	In
SSI(7:4)	SSI Data	Out
FS IN	Sample Clock In	In/Unused/In
FS OUT	Sample Clock Out	Out
SSICLK	SSI bit CLK (64xfs)	Out
M_CLK_IN	256xfs In	In/Unused/In
M_CLK_OUT	256xfs Out	Out
MUTE	Mute Out for DAC	Out

### Host port

Signals	Signal Description	M / S / MS *
D(7:0)	Data Bus	Bidir
A(3:0)	Address Bus	In
R/W / WR	Read/Write / Write	In
DS / RD	Data Strobe / Read	In
CS	Chip Select	In
IT	Interruption	Out
DTACK / RDY	Data Transfer ACK	Out
CLK_25	Host Port Clock	Out
HPM(1:0)	Host Port Mode	In

### Power Consumption:

0.5 A max.

### Storage: Temp/Humidity (non-condensing):

-5°C to 70°C / 0% to 95%

### Operating: Temp/Humidity (non-condensing):

0°C to 50°C / 5% to 90%

ESnet module ordering numbers:

**ESnet-S8:** 8 channel Slave module  
**ESnet-M8:** 8 channel Master module  
**ESnet-MS8:** 8 channel Master/Slave module (to be announced soon)

### RS232 Asynchronous serial port

Signals	Signal Description	M / S / MS *
TXD1	TX Host	Out
RXD1	RX Host	In
CTS1	CTS Host	In
RTS1	RTS Host	Out
SPM	Serial Port Mode	In

### IO ports

Signals	Signal Description	M / S / MS *
GPIO(7:0)	General Purpose IO	Bidir
DAIO(9:0) / SSI(15:8)	Dedicated App IO / SSI Data Bus Extension	Bidir

### System monitoring port

Signals	Signal Description	M / S / MS *
RSI	Reset In	In
RSO	Reset Out	Out
PDM	Power Down Mode	Out

### Local settings

Signals	Signal Description	M / S / MS *
LOC_CONF (5:0)	Local Configuration (input positioning for Masters or channel routing for Slaves)	In
CONF_H/S	Hard/Soft config select	In
MACPROG	MAC @ program	In

### Power

Signals	Signal Description	M / S / MS *
VDD	+5.0V +/- 5 %	In
GND	Ground	In

\* M = Master, S = Slave, MS = Master/Slave

For further information on EtherSound™ products and licensing, please contact:

**Digigram Europe**

Parc de Pré Milliet 38330 Montbonnot-FRANCE  
Tel: +33 (0)4 76 52 55 01 • Fax: +33 (0)4 76 52 53 07  
E-mail: europe@digigram.com

**Digigram Inc.**

2101 Wilson Boulevard, Suite 1004,  
Arlington, VA 22201-USA  
Tel: +1 703 875 9100 • Fax: +1 703 875 9161  
E-mail: input@digigram.com

**Digigram Asia Pte Ltd.**

350 Orchard Road - #19-07 Shaw House Singapore  
238868-SINGAPORE  
Tel: +65 291 2234 • Fax: +65 291 3433  
E-mail: info\_asia@digigram.com

**Digigram América Latina**

Plaza Teopanzolco, oficina 210  
Av. Teopanzolco Esq. Cuahulote, Col. Cantarranas  
62448 Cuernavaca, Morelos-MEXICO  
Tel: +52 777 318 4718 • Fax: +52 777 318 3762  
E-mail: infolatin@digigram.com



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**Digigram Powered** are installed in thousands of radio and television stations; corporate and commercial sound installations; and audio recording and video postproduction facilities around the globe.

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