



# IP AUDIO MODULE

## 100

### DEVELOPMENT SPECIFICATION

**Advanced multiformat audio decoder module with network, USB and serial interface, adding IP based streaming and controlling capabilities to OEM products**

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## Introduction

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The Barix IP AUDIO MODULE 100 allows manufacturers of traditional audio devices to add network capabilities to their products.

### Hardware features

The Barix IP AUDIO MODULE 100 features:

- High quality, multi standard audio encoding and decoding in formats: G.711, WAV, MP3 Layer 1 and 2
- Stereo Line in and outputs
- Microphone input (coil, powered or passive capacitive)
- I<sup>2</sup>S bus (Inter-IC Sound)
- S/P DIF input and output
- Integrated CPU / MAC / IO controller
- Dual 100Mbit Ethernet ports (1 with PHY, 1 without), suitable for bridging / daisy chaining
- 2 KB EEprom for configuration store
- 1 MB Flash memory for application and web server content
- 2 TTL level UARTs
- CAN bus interface
- USB1.1 interface,
- Dallas 1-wire interface for Real Time Clock
- 4 GPIOs
- Small form factor
- Low Power consumption, runs off a single +5Volt DC power source

### Related products

The Barix IP AUDIO MODULE 100 is built into the following Barix products:

- Annunicom 100 (with a built-in relays and 2 inputs)
- Annunicom 1000 (with 9 built-in relays and 8 inputs)
- Exstreamer 1000 (with 4 built-in relays and 4 inputs)
- Instreamer 100 (no external inputs/outputs besides the standard RS-232 I/Os)
- IPAM Carrier PCB

Barix recommends the IPAM Carrier PCB for evaluation purposes prior to development of an own carrier board. The IPAM Carrier PCB can be powered by 8 to 30 VDC and features LAN, RS-232 and USB interfaces, microphone and audio in/outputs, a socket for DS1904 iButton Real Time Clock, 4 GPIOs, a reset input and two status LEDs.

### Applications

The Barix IP AUDIO MODULE 100 is suitable in the following application fields:

- Interfacing of digital or analog audio signals to TCP/IP, web, Intranet and Internet
- Intercom systems
- Paging systems
- Broadcast equipment
- Audio monitoring
- Audio distribution
- Updatable, standalone player
- Alarm systems
- Audio recording (Live audio transmission)

### Available Firmware

The Barix IP AUDIO MODULE 100 comes preloaded with a bootloader and can be loaded with different firmware packages featuring:

- Embedded and robust operating system with fully routable IP stack
- IP standard based protocols (TCP/IP, UDP, HTTP, ICMP, SNMP)
- Supports BootP, DHCP and Auto IP
- Integrated web server for configuration, control, update and streaming functions
- Fully documented Application Programming Interface (API)
- Highly customizable User Interface (HTML) with development kit
- Special software features in OEM versions on request

## Hardware

### Mechanical drawing

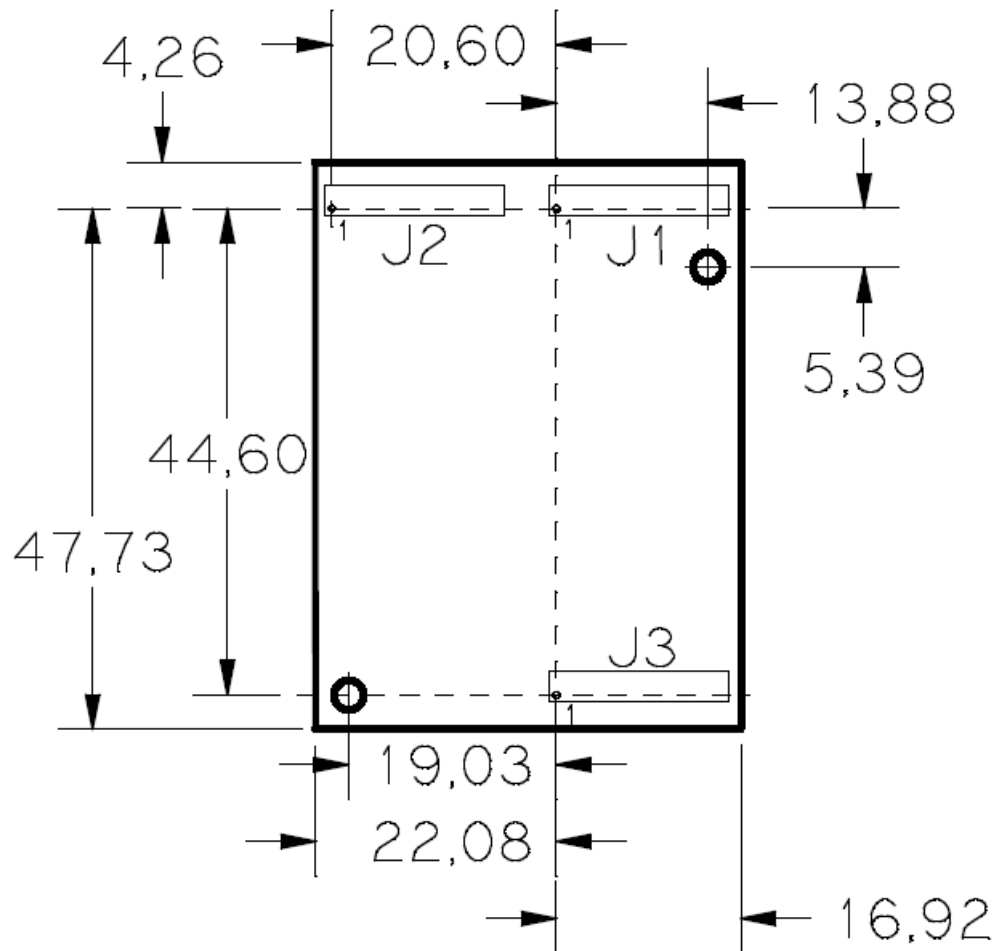
The Barix IP Audio Module can be plugged onto the target connector or motherboard using three, high density, 0.8mm spacing, SMT connectors.

The corresponding counterparts (for connectors J1, J2 and J3) to be placed on motherboard are SAMTEC FTE-series header (Part No. FTE-I20-02-G-DV).

For mechanical fixation, the board provides two 2.7mm mounting holes for 2.5mm screws.

The total size is 53.0mm +/-0.2 by 39.0mm +/-0.2.

Maximum component height is 6mm. Using standard distance bolts a total height of 8mm can be achieved when mounted on a carrier board.



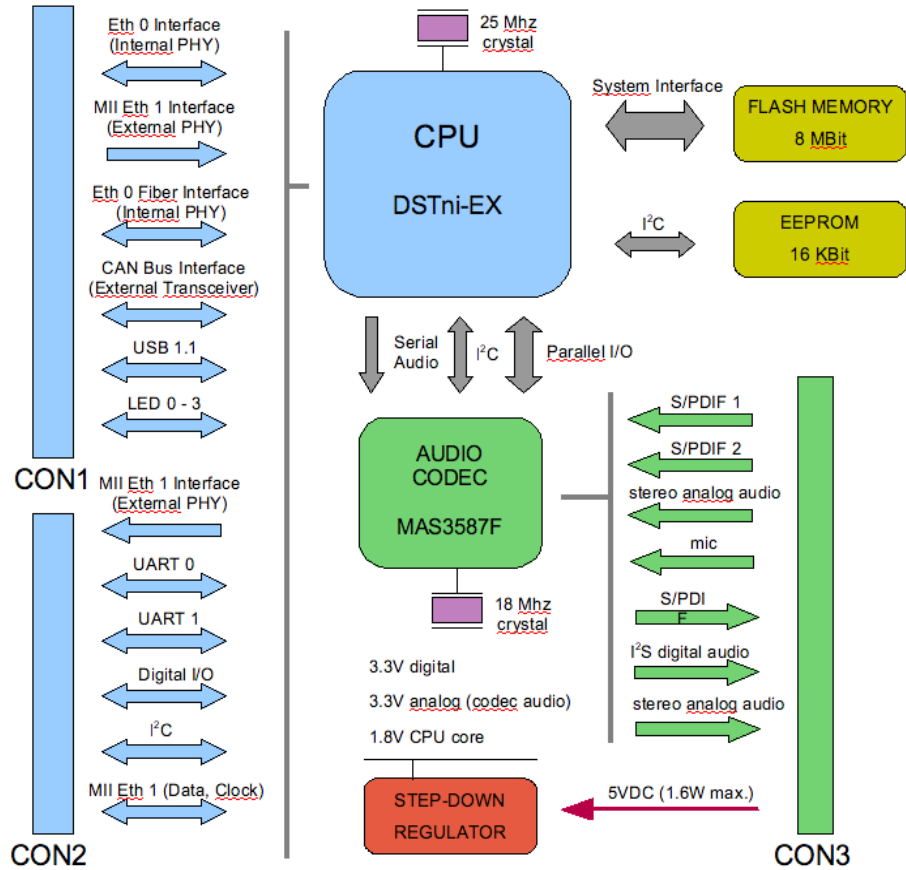
Drawing shows component side.

Dimension is metric (mm)

Drawing is not to scale

Tolerance of PCB dimension is +/-0.2mm, others 0.1mm

**Block diagram**



**Network Interfaces**

**1 x PHY (TP or FO), 1 x MII**

The Barix IP Audio Module is equipped with one on-chip physical layer (PHY) Ethernet interface (10/100MBit, full / half duplex, auto negotiation) which supports either a twisted pair port or a fiber optic link. A second Ethernet port can be used by adding a standard PHY chip to the OEM carrier board connected to the MII interface of the Barix IP Audio Module.

**Serial Interfaces**

**2 x UART (TTL level, TX, RX, RTS, CTS), 1 x CAN-Bus, 1 x USB 1.1**

Two separate serial ports can be used to build serial standard interfaces like RS-232 or RS-485 by attaching external driver chips. Special serial framing (9bit protocols, bi-phase encoding etc) or speeds (up to 1MBit) can be implemented for OEM versions. One CAN-Bus and one USB 1.1 standard interface are provided on connector J1 and can be supported in OEM versions.

**Digital Audio**

**1 x S/P DIF In, 1 x S/P DIF Out, 1 x I<sup>2</sup>S**

Three digital audio interfaces are provided on the Barix IP Audio Module. The S/P DIF input allows connecting of a coaxial or optical receiver circuit, the S/P DIF output can be used to connect to coaxial or optical driver the I<sup>2</sup>S interface can be used to connect to I<sup>2</sup>S capable devices.

**Analog Audio**

**1 x Stereo Input (L&R), 1 x Stereo Output (L&R), 1 x Microphone Input (Bias powered),**

Three analog audio interfaces are provided on the Barix IP Audio Module. The stereo input allows the connection of analog audio sources, the stereo output can be used to connect to analog amplifiers and the microphone input (with Bias output to power integrated preamp) allows the use of a wide selection of microphones (dynamic, capacitive, FET amplified).

**Peripheral I/O**

**11 x PIO**

Of the eleven 3.3VDC digital I/Os available on the IP AUDIO MODULE 100 eight can be used freely by OEM software as either input or output as three are reserved for designated functions (see below). The inputs tolerate 5VDC Logic Level and outputs supply 3.3VDC.

Reservations:

- One I/O pin is used as a hardware input for the Reset button
- Two I/O pins serve as a user interface for driving status LEDs (green and red)
- During initialization PIO#17 is pulled down for 500 µsec in order to detect I-wire devices

**Power supply**

**4 x VIN, 4 x SGND**

Eight connector pins are provided to power the Barix IP Audio Module from a single +5 Volt DC power source. The maximum power consumption is 1.6 Watt.

## Connectors

### Connector placement

For connector placement (and type) please refer to the mechanical drawing in chapter Hardware.

### Connector Pin out J1

N.	Name	T	Description	N.	Name	T	Description
1	TX+	O	PHY level positive Transmit	2	DGND	P	Digital Ground
3	TXCT	R	Trans. Transformer center Tap	4	LED.3	O	see DSTni EX manual
5	TX-	O	PHY level negative Transmit	6	LED.2	O	see DSTni EX manual
7	DGND	P	Digital Ground	8	DGND	P	Digital Ground
9	RX+	I	PHY level positive Receive	10	DGND	P	Digital Ground
11	RXCT	R	Rec. Transformer center Tap	12	LED.1	O	see DSTni EX manual
13	RX-	I	PHY level negative Receive	14	LED.0	O	see DSTni EX manual
15	DGND	P	Digital Ground	16	DGND	P	Digital Ground
17	RXD0	I	2 <sup>nd</sup> MAC receive data 0 (LSB)	18	RXCRS	I	2 <sup>nd</sup> MAC receive carrier sense
19	RXD1	I	2 <sup>nd</sup> MAC receive data 1	20	RXCOL	I	2 <sup>nd</sup> MAC receive collision
21	RXD2	I	2 <sup>nd</sup> MAC receive data 2	22	RXCLK	I	2 <sup>nd</sup> MAC receive clock
23	RXD3	I	2 <sup>nd</sup> MAC receive data 3 (MSB)	24	RXERR	I	2 <sup>nd</sup> MAC receive error
25	FOUT+	O	Fiber optic Interface TX positive	26	FOUT-	O	Fiber optic Interface TX negative
27	FIN+	I	Fiber optic Interface RX positive	28	FIN-	I	Fiber optic Interface RX negative
29	DGND	P	Digital Ground	30	DGND	P	Digital Ground
31	CANTX	O	CAN-Bus Interface Transmit	32	FSD	I	Fiber optic Interface input detect
33	CANRX	I	CAN-Bus Interface Receive	34	RESV	R	Fiber optic current resistor
35	DGND	P	Digital Ground	36	VREF	R	Fiber optic Interface Voltage ref.
37	DGND	P	Digital Ground	38	DGND	P	Digital Ground
39	USB+	U	USB 1.1 Host Interface positive	40	USB-	U	USB 1.1 Host Interface negative

In the column Name T the T stands for Type:  
O=Output, I=Input, P=Power, U=USB bus, R=Special function

### Connector Pin out J2

N.	Name	T	Description (Usage)	N.	Name	T	Description (Usage)
1	PIO20	C	DSTni PIO #20 (GPIO)	2	CTS.0	I	UART 0 flow control input
3	PIO8	C	DSTni PIO #8 (Soft Reset)	4	RTS.0	O	UART 0 flow control output
5	PIO22	C	DSTni PIO #22 (GPIO)	6	RXD.0	I	UART 0 receive data
7	PIO23	C	DSTni PIO #23 (GPIO)	8	TXD.0	O	UART 0 transmit data
9	DGND	P	Digital Ground	10	DGND	P	Digital Ground
11	PIO16	C	DSTni PIO #16 (GPIO)	12	CTS.1	I	UART 1 flow control input
13	PIO17	C	DSTni PIO #17 (GPIO/I-wire*)	14	RTS.1	O	UART 1 flow control output
15	PIO24	C	DSTni PIO #24 (Green LED)	16	TXD.1	O	UART 1 transmit data
17	PIO25	C	DSTni PIO #25 (Red LED)	18	RXD.1	I	UART 0 receive data
19	DVCC	P	LED return (DVCC)	20	DGND	P	Digital Ground
21	PIO29	C	DSTni PIO #29 (GPIO)	22	I <sup>2</sup> CCLK	C	I <sup>2</sup> C Clock (internally used)
23	PIO30	C	DSTni PIO #30 (GPIO)	24	I <sup>2</sup> CDAT	C	I <sup>2</sup> C Data (internally used)
25	TMR.0	C	Timer0 inp./PIO #11 (GPIO)	26	-RST	D	Low active Reset I/O
27	MDC	O	MII Management IF Clock	28	MDIO	B	MII Management IF Data
29	DGND	P	Digital Ground	30	DGND	P	Digital Ground
31	TXD0	O	2 <sup>nd</sup> MAC transmit data 0 (LSB)	32	TXCLK	I	2 <sup>nd</sup> MAC transmit clock
33	TXD1	O	2 <sup>nd</sup> MAC transmit data 1	34	TXERR	O	2 <sup>nd</sup> MAC transmit error
35	TXD2	O	2 <sup>nd</sup> MAC transmit data 2	36	TXEN	O	F 2 <sup>nd</sup> MAC transmit enable
37	TXD3	O	2 <sup>nd</sup> MAC transmit data 3 (MSB)	38	RXDV	I	2 <sup>nd</sup> MAC receive data valid
39	DGND	P	Digital Ground	40	DGND	P	Digital Ground

In the column Name T the T stands for Type:  
O=Output, I=Input, B=Bidirectional, P=Power, C=configurable as input or output,  
D=Open Drain (pull-up resistor on module)  
\* During initialization PIO#17 is pulled down (to GND) for 500 µsec in order to detect attached I-wire devices ! Nevertheless it can be used as a push button input (to GND), as a logic input (needs a current limiting resistor) or as an active high logic output (needs a 2K7 pull down resistor).

**Connector  
Pin out J3**

N.	Name	T	Description	N.	Name	T	Description
1	AGND	P	Audio Ground	2	OUTL	A	Left channel audio output
3	-	-	reserved	4	AGND	P	Audio Ground
5	AGND	P	Audio Ground	6	OUTR	A	Right channel audio output
7	-	-	reserved	8	AGND	P	Audio Ground
9	AGND	P	Audio Ground	10	INL	a	Left channel audio input
11	-	-	reserved	12	AGND	P	Audio Ground
13	-	-	reserved	14	INR	a	Right channel audio input
15	AGND	P	Audio Ground	16	AGND	P	Audio Ground
17	AGND	P	Audio Ground	18	MICBI	A	Microphone Bias output
19	AGND	P	Audio Ground	20	MICIN	a	Microphone input
21	AGND	P	Audio Ground	22	AGND	P	Audio Ground
23	DGND	P	Digital Ground	24	DGND	P	Digital Ground
25	SPDO	O	S/P DIF output	26	SOC	B	I <sup>2</sup> S serial clock in/output
27	SPDIR	R	S/P DIF reference	28	SOD	O	I <sup>2</sup> S serial data output
29	SPDI2	I	S/P DIF input 2	30	SOI	O	I <sup>2</sup> S frame indication
31	SPDI1	I	S/P DIF input 1	32	DGND	P	Digital Ground
33	SGND	P	Supply input Ground	34	SGND	P	Supply input Ground
35	SGND	P	Supply input Ground	36	SGND	P	Supply input Ground
37	VIN	P	Audio module input Voltage	38	VIN	P	Audio module input Voltage
39	VIN	P	Audio module input Voltage	40	VIN	P	Audio module input Voltage

In the column Name T the T stands for Type:

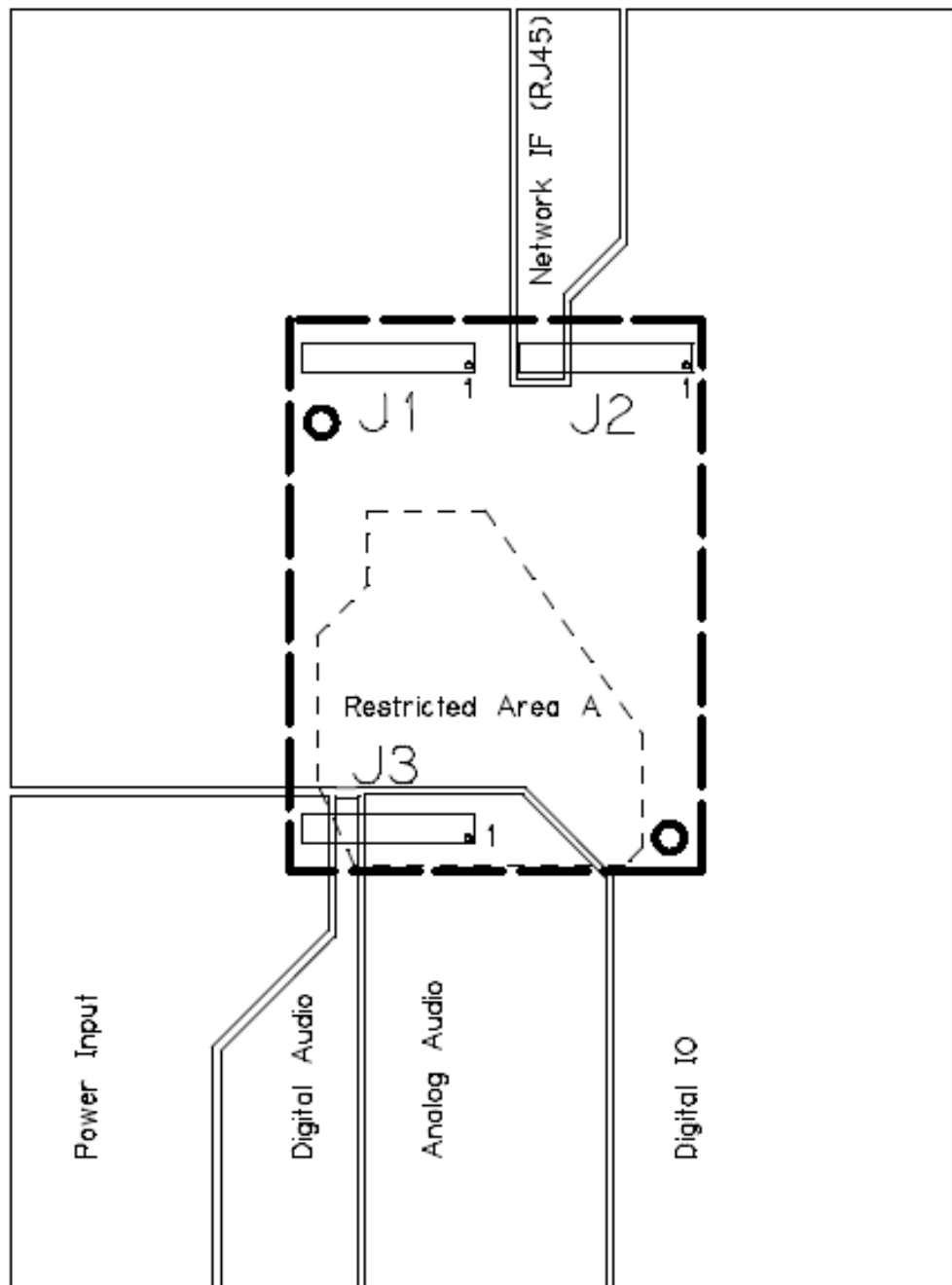
O=Output, I=Input, B=Bidirectional, P=Power, A=Audio Output, a=Audio Input

## Layout guidelines

### General rules

- A low ESR Capacitor of 10uF to 47uF in parallel to a low loss ceramic 100nF capacitor is recommended as power supply bypass close to the Barix Audio Module's power supply pins.
- All available ground pins of the Barix Audio Module should be attached to their respective ground domain.
- Avoid any connection of ground domains on the Carrier PCB as the ground interconnection is made on the Barix Audio Module already.
- Avoid signal trace routing crossing domain borders.
- Restricted Area A must not contain any high current switching circuitry nor any components creating magnetic flux.
- Flood unused PCB areas with copper and connect those planes to it's respective ground.
- The corresponding counterparts (for connectors J1, J2 and J3) to be placed on motherboard are SAMTEC FTE-series header (Part No. FTE-120-02-G-DV).

### Carrier PCB view



## Technical data

**CPU's, speed, memory** Lantronix DSTni-EX, 12-125MHz clock software selectable, 256 KB zero wait state static RAM

**Audio processor** Micronas MAS3587F Encoder/Decoder, Encoding fetures:

- G.711 ( $\mu$ Law / aLaw 8 to 48 kHz sampling rate)
- WAV (16bit PCM uncompressed 8 to 48 kHz)
- MP3 MPEG1 Layer 3 (32, 44.1 and 48 kHz) VBR (variable bit rate) only
- MP3 MPEG2 Layer 3 (16, 22.05 and 24 kHz) VBR (variable bit rate) only

Parameter	Value	Unit
Analog line input clipping level (at input gain -3 dB)	3,2	V <sub>pp</sub>
Analog line input resistance (at input gain -3 dB)	97	k $\Omega$
(at input gain +19.5 dB)	20	k $\Omega$
Analog line input signal-to-noise ratio	74	dB
Microphone input clipping level (at input gain +21 dB)	282	mV <sub>pp</sub>
Microphone input resistance (at input gain +21 dB)	94	k $\Omega$
(at input gain +43.5 dB)	8	k $\Omega$
Microphone input signal-to-noise ratio	73	dB
Bias voltage for microphone	2,62	V
Bias source resistance	180	$\Omega$
Bias current maximum	300	$\mu$ A
Input Total Harmonic Distortion	0,02	%
Interchannel Isolation (Cross Talk)	80	dB

Decoding features:

- G.711 ( $\mu$ Law / aLaw 8 to 48 kHz sampling rate)
- WAV (16bit PCM uncompressed 8 to 48 kHz)
- MP3 MPEG 1/2 layer 2 and 3, CBR +VBR (constant and variable bit rate)

Parameter	Value	Unit
Full Scale Output Voltage (Peak-to-peak)	3	V <sub>pp</sub>
Output Total Harmonic Distortion	0,03	%
Output S/N Ratio (full scale signal)	94	dB
Interchannel Isolation (Cross Talk)	80	dB
Analog Output Load Resistance	16	$\Omega$
Analog Output Load Capacitance	100	PF

**Non-volatile storage** 1MB Flash ROM (approximately 700KB available for user data)  
2KB EEprom for configuration

**Serial Interfaces** 2 x UART (TTL level, TX, RX, RTS, CTS) 300 Baud to 230 kBaud, CAN-Bus,<sup>2</sup>S-Bus, USB 1.1

**Network Interfaces** 1 x 10/100 Base (integrated PHY for twisted pair or fiber optic link)  
1x 10/100 Base Mill port (needs PHY chip on OEM carrier board to connect to RJ45 socket)

**Peripheral I/O** 11 x inputs/outputs (inputs 5VDC tolerant, outputs 3.3VDC), 8 GPIOs for OEM use (1 GPIO selectable as hardware timer input, 1 GPIO shared with I-wire bus), 1 GPIO reserved for reset button, 2 GPIOs pins serve as a user interface driving green and red status LEDs

**Required connectors** The corresponding counterparts (for connectors J1, J2 and J3) to be placed on motherboard are SAMTEC FTE-series header (Part No. FTE-120-02-G-DV).

**Input Power** 5VDC nominal (min. 4VDC / max. 5.5VDC), max. 1.6 Watt

**Dimensions** 53.0mm +/-0.2 by 39.0mm +/-0.2.  
2 mounting holes for 2.5mm screws (drill size 2.7mm).  
Maximum component height 6mm. (total 8mm when mounted on carrier board)

**Weight** approx. 10g

**Environmental conditions** 32 ~ 131° F / 0 ~ 55° C,  
< 85% relative humidity (non-condensing)

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We explicitly reserve the right to change and improve the product without notice.

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