

## CENS402 Dual Channel DSP Board

Technical Data Sheet

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### Features:

- Enables Noise Reduction of corrupted microphone signals
- Enables Full duplex echo cancelling
- Contains 16-Bit D/A and A/D Converter

### Applications:

- Noise cancelling microphone for operation in noisy environments
- Noise & echo cancelling in hands-free telephony

### Technical data:

Item	Symbol	Value	Remarks
Processor		Texas Instruments TMS320VC5402a or ~5410a	
On board memory		128 kByte	
Supply voltage:	$U_b$	6 V (5.0 ... 9.0 V)	
Power consumption:	$I$	80 mA	During operation of dual Channel noise cancellation program.
Audio channels		5 input / 3 output	
Sampling rate		8 ... 26 kHz	
Audio Band width:	$f$	100 Hz ... 7.5 kHz	at 16 kHz sampling rate
Signal to Noise ratio:	SNR	> 65 dB	20 Hz ... 20 kHz; max. amplitude
Total harmonic distortion:	$k$	< 0,5 %	Measured at 70 % of max. amplitude



Noise reduction:		up to 20 dB	For details see applicable Software Datasheets
Echo Cancelling		20 dB typical	
Power Supply Rejection Ratio		> 70 dB	At $U_b = 5\text{ V}$ ; $1\text{ V}_{SS}$ ; 20 Hz ... 20 kHz
Dimensions		60 x 70 mm	PCB Board

**Input:**

5 symmetric inputs,

- Normal input level: 900 mV
- Input impedance: 10 k $\Omega$

**Output:**

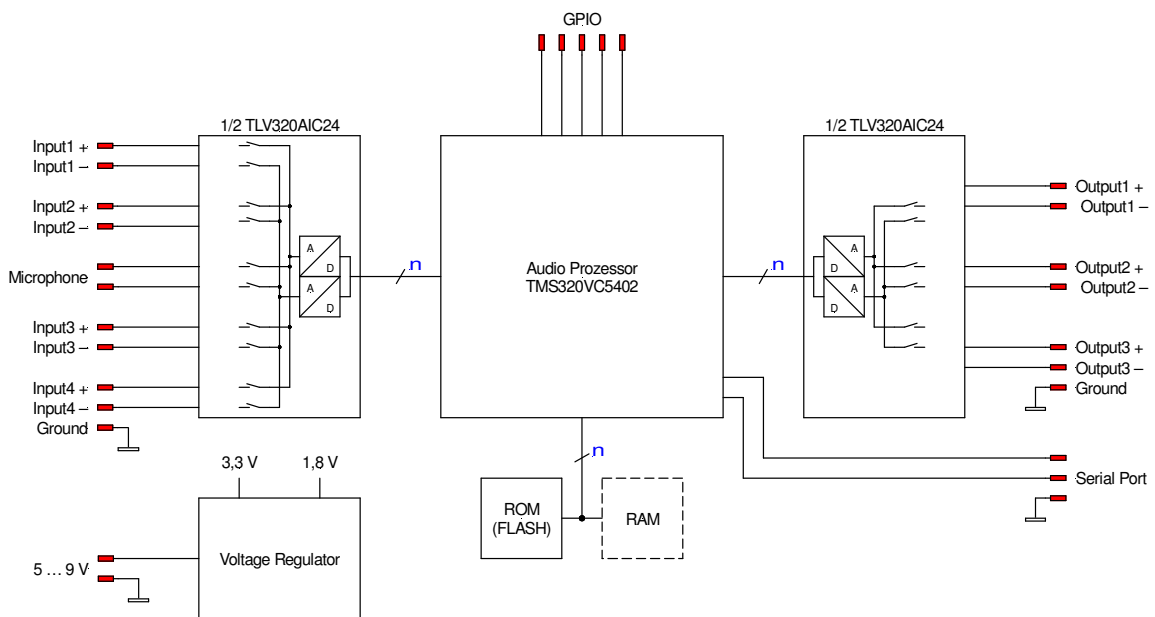
3 Symmetric outputs, software selection, adjustable attenuation

- 2 Outputs with 150  $\Omega$  output load impedance
- 1 Output with 600  $\Omega$  output load impedance
- Normal output level: 900 mV

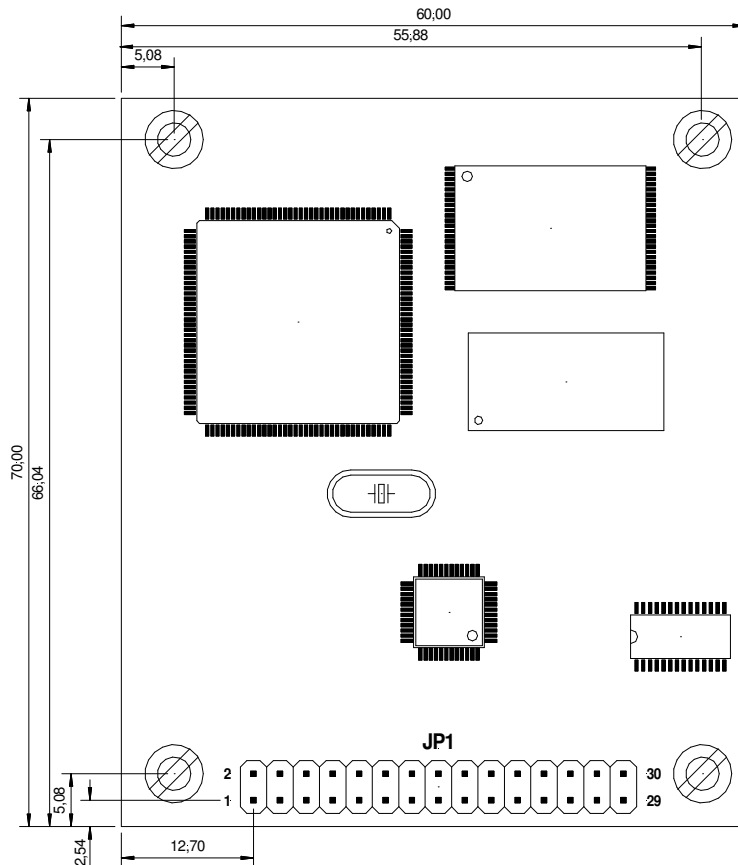
**Control IO:**

5 general purpose IO on Board, 3.3 V Logic

**Block diagram:**



**PCB Outline:**



**Pin assignment of JP1:**

	Signal	Connector Name:	Description	Value
1	Serial in	SER_IN	Serial input for programming with PC. Use level converter for connection to PC.	3.3 V
2	Input 4 -		Symmetrical codec input, minus.	
3	Serial out	SER_OUT	Serial output to PC. Level converter for PC-connection required.	3.3 V
4	Input 4 +		Symmetrical codec input, plus.	
5	Programming	PROG	System goes into programming mode when pin is low during power-on.	Connect to GND for programming



6	Microphone Input –		Symmetrical codec input, minus.	
7	CONF1	HD2	DSP GPIO	3.3 V
8	Microphone Input +		Symmetrical codec input, plus.	
9	CONF2	HD3	DSP GPIO.	3.3 V
10	Input 2 –		Symmetrical codec input, minus.	
11	CONF3	HD4	DSP GPIO.	3.3 V
12	Input 2 +		Symmetrical codec input, plus.	
13	CONF4	HD5	DSP GPIO.	3.3 V
14	Input 1 +		Symmetrical codec input, plus.	
15	CONF5	HD6	DSP GPIO.	3.3 V
16	Input 1 –		Symmetrical codec input, minus.	
17	Ground	GND		
18	Input 3 –		Symmetrical codec input, minus.	
19	Output 2 –		Symmetrical codec Output, minus.	
20	Input 3 +		Symmetrical codec input, plus.	
21	Output 2 +		Symmetrical codec Output, plus.	
22	Ground	GND		
23	Output 1 –		Symmetrical codec Output, minus.	
24	Ground	GND		
25	Output 1 +		Symmetrical codec input, plus.	
26	Reset			
27	Output 3 –		Symmetrical codec Output, minus.	
28	Power Supply			5 ... 9 V
29	Output 3 +		Symmetrical codec input, plus.	
30	Ground	GND		

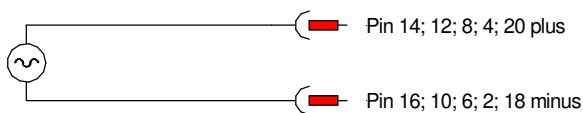
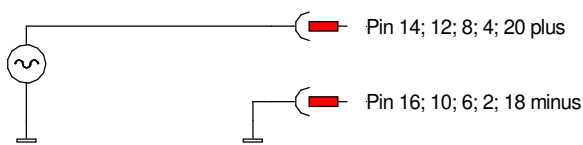
Ser\_in; Ser\_out; Prog; HD2; HD3; HD4; HD5; HD6 are internally pulled up to 3.3 V.

## Analog Input/Output

For ideal common-mode rejection of unwanted signals, all analog I/Os are differential. The signal source driving the analog inputs should have low impedance for optimal SNR.

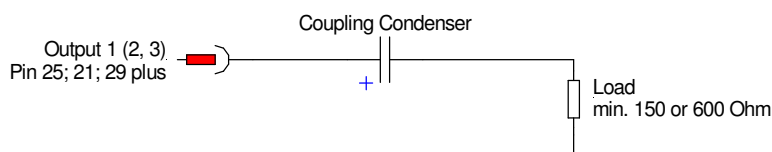
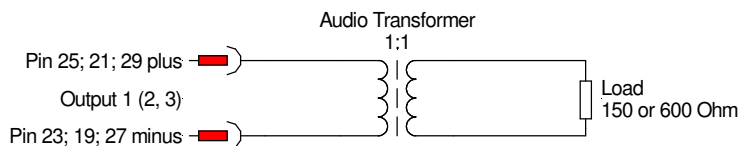
### Input Connection:

The 5 symmetrical inputs can be connected as single ended or as a symmetrical input. All inputs are AC coupled. A 100 k $\Omega$  resistor is connected between any input and ground.



### Output Connection:

Outputs of built-in codec are capable of driving a load of 600  $\Omega$  at output 1; outputs 2 and 3 can drive a load of 150  $\Omega$ . The maximum output level is 900 mV. There are several ways of connecting the outputs of the DSP Board with an external circuit. The output can be connected as single ended or as a symmetrical output. Since the outputs are DC-coupled, coupling condensers or transformers coupling are required.





If a single ended connection is used, either plus or minus output can drive the subsequent circuit. The other output shall be left open. A bridge power amplifier can be driven using both plus and minus outputs with two linear amplifiers. The value of the coupling condenser depends on the lower cut-off frequency; the capacity reads as

$C = \frac{1}{2\pi R_{Load} f}$ . All outputs carry a DC Offset of approx. 1.8 V. If the DC-Level of the

subsequent circuit is higher, connect the plus pin of an electrolytic condenser to the subsequent circuit. If the voltage of the subsequent circuit is lower or there is no DC-Level, then connect the plus pin of the electrolytic condenser to the DSP Board.