

## DCN24

### Digital Crossover with 2 inputs and 4 outputs

#### Features

- High performance Burr-Brown converters
- 24bit resolution
- 96kHz sampling frequency
- XOverWizard II standard
- XOverWizard II advanced
- Optical isolated USB interface
- 180 IIR filters
- 60mS total delay option
- 76bit processor precision
- Latency 1ms
- 4 layer high performance PCB
- Decoupling at all active components

#### Applications

- Active Amplification Systems
- High End Stereo setup
- Supreme Surround Sound Systems

#### Description

DCN24 is a high performance digital crossover filter with equalization and delay. It features 2 balanced analogue inputs and 4 single-ended analogue outputs. High performance converters give DCN24 crystal clear sound and very low noise floor. DCN24 has an optical isolated USB interface to avoid hum and noise from the PC. The circuit board is a high quality 4 layer type which prevents noise and hum. The XOverWizard II program is a graphical tool to change inputs, outputs, gain, crossover frequencies, crossover slopes, equalization and delay. The XOverWizard II has a very significant feature: the ability to import a text file containing measured driver data of frequency, sound pressure level and phase. With these data the XOverWizard are able to display frequency response and more, while design is in progress. Compared to this method, the “old” trial and error method seems obsolete. The loading of parameters to filter are updated within about 1 second

#### DCN24 Module



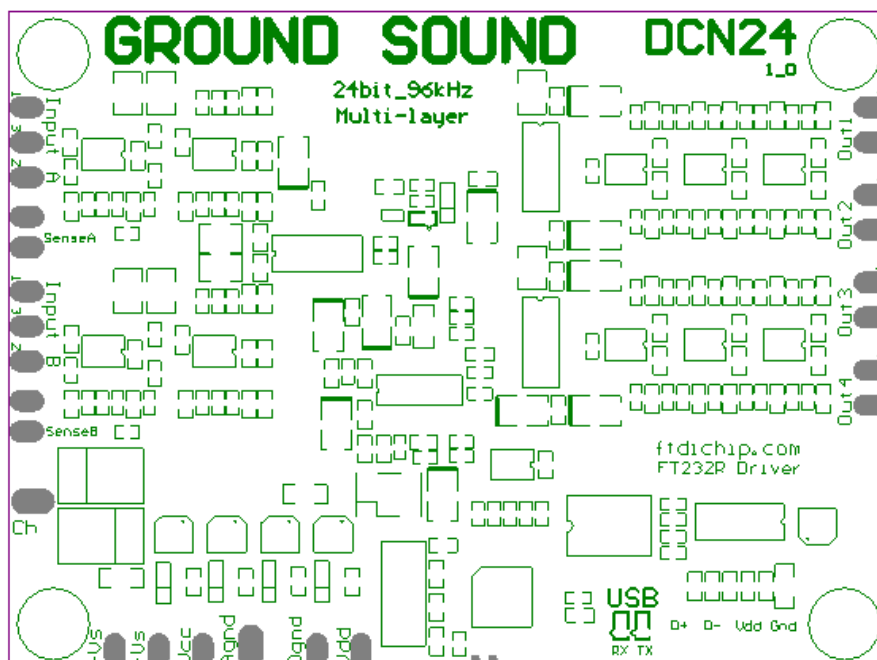
### Operating Conditions

| Regulated voltage supplies                    | Min | Typ | Max  | Units |
|---|-----|-----|------|-------|
| Vdd, voltage digital circuit                  | 3,1 | 3,3 | 3,5  | V     |
| Idd, current consumption digital circuit      | 125 | 130 | 135  | mA    |
| Vcc, voltage converters, analogue             | 4,8 | 5   | 5,2  | V     |
| Icc, current consumption converters, analogue | 95  | 100 | 105  | mA    |
| Vs, voltage op-amps - dual supply             | ±8  | ±9  | ±15  | V     |
| Vs, current consumption op-amps – dual supply | ±60 | ±70 | ±100 | mA    |
| USB interface, PC voltage                     |     | 5   |      | V     |

Note: To ensure perfect booting every time, the Vdd and Vcc have to power on simultaneously or in sequence of Vcc then Vdd. The supply has to be glitch and spike free for perfect performance and it is easily obtained with a classical regulated supply and normal transformer. A switch mode supply can also be used if desired, but care should be taken to avoid EMC problems and switch disturbance on the supply outputs. It can degrade the performance heavily, which is less desired.

### Technical Specifications

|                                   | Min | Typ   | Max  | Units |
|-----------------------------------|-----|-------|------|-------|
| Converter resolution              |     | 24    |      | bit   |
| Sampling rate                     |     | 96    |      | kHz   |
| Signal to Noise Ratio             | 108 | 110   |      | dB    |
| Frequency response, -3dB          |     | 5-48k |      | Hz    |
| THD, 20Hz – 20kHz                 |     |       | <0,1 | %     |
| Input voltage, peak to peak, 0dB  |     | 4     |      | V     |
| Output voltage, peak to peak, 0dB |     | 12    |      | V     |
| Processor resolution, internal    |     | 76    |      | bit   |
| Latency input to output           |     | 1     |      | ms    |
| Input impedance, balanced         |     | 10    |      | kΩ    |
| Output impedance                  |     | <50   |      | Ω     |
| Weight                            |     | 35    |      | g     |



## Connection pads

| Label  | Type   | Description   |
|--------|--------|---|
| Vdd    | Supply | Digital circuit supply  |
| DGND   | Supply | Digital supply ground   |
| Vcc    | Supply | AD/DA converter analogue supply   |
| -Vs    | Supply | OP-AMP negative supply  |
| +Vs    | Supply | OP-AMP positive supply  |
| AGND   | Supply | Analogue supply ground  |
| D+     | USB    | Data +  |
| D-     | USB    | Data -  |
| Vdd    | USB    | PC supplied voltage supply, standard 5V                                   |
| Gnd    | USB    | PC ground (don't connect cable shield)                                    |
| CH     | Supply | Ground lift from AGND, connect to Chassis metal near input connector      |
| A_1    | Input  | Channel <b>A ground</b> (AGND), 1 refers to XLR connector pin1, female    |
| A_2    | Input  | Channel <b>A positive</b> , 2 refers to XLR connector pin2, female        |
| A_3    | Input  | Channel <b>A negative</b> , 3 refers to XLR connector pin3, female        |
| SENSE1 | Output | Sense signal of Input A, (unconnected pad beside for mechanical strength) |
| B_1    | Input  | Channel <b>B ground</b> (AGND), 1 refers to XLR connector pin1, female    |
| B_2    | Input  | Channel <b>B positive</b> , 2 refers to XLR connector pin2, female        |
| B_3    | Input  | Channel <b>B negative</b> , 3 refers to XLR connector pin3, female        |
| SENSE2 | Output | Sense signal of Input B, (unconnected pad beside for mechanical strength) |
| Out1   | Output | Channel 1, single ended output (ex. Tweeter)                              |
| Out2   | Output | Channel 2, single ended output (ex. Mid)                                  |
| Out3   | Output | Channel 3, single ended output (ex. Bass)                                 |
| Out4   | Output | Channel 4, single ended output (ex. Sub)                                  |

## Construction

DCN24 has dual high performance AD and DA converters from Burr-Brown (TI). It features 2 balanced analogue inputs and 4 single-ended outputs. DCN24 has a sampling rate of 96kHz and a resolution of 24bits, which surpasses the CD standard 44,1kHz and 16bit. The processing is based upon IIR filters (Infinite Impulse Response) giving low latency and good audio qualities. The internal processing operates with 76bit resolution to avoid processing overflow and maximize the linear range in the digital domain. A microprocessor takes care of the “household” like boot, mute, and PC communication. DCN24 will normally boot from an internal program without a PC connection. The PC only has to be connected during initial setup and future update of parameters.

The filter is designed for high integration with high end amplifier modules and dedicated power supply.

## USB interface

DCN24 communicates through an on board USB interface circuit which requires installation of a driver on the connected PC. The driver can be downloaded from the chip manufacture's homepage: [www.ftdichip.com](http://www.ftdichip.com) Download the FT232R driver for the operation system installed on the PC. The onboard USB interface acts as a COM port and will be specified as com 1-12 in the XOverWizardII. USB communication LEDs indicates transmitting TX and receiving RX.

## LED indicators

Apart from the LEDs for the USB interface, DCN24 has two additional LEDs. A green LED indicating power good and a red LED indicating programming (flashing) and setup program error (constant).

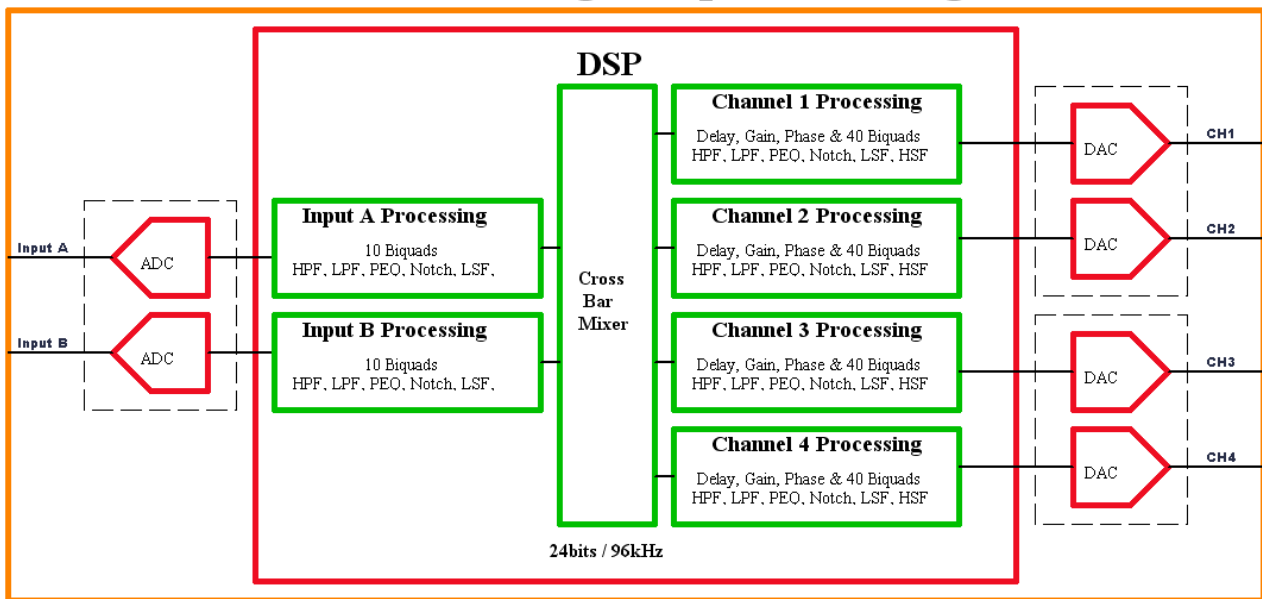
If the red LED is constant you have to update the setup.

## Setup possibilities

DCN24 features 2 input channels and 4 outputs which makes it possible to configure some different setups: Mono 2-way, mono 3-way, mono 4-way, stereo 2-way and 2 channel EQ / room correction.

The most likely setup is mono 4-way or stereo 2-way. The DCN24 is designed to perform a 4-way mono setup as an internal amplifier system in combination with our PA1CC/PA3CC/ PA6CC and PSU4SA/ PSU12SA like in our Coolback concepts.

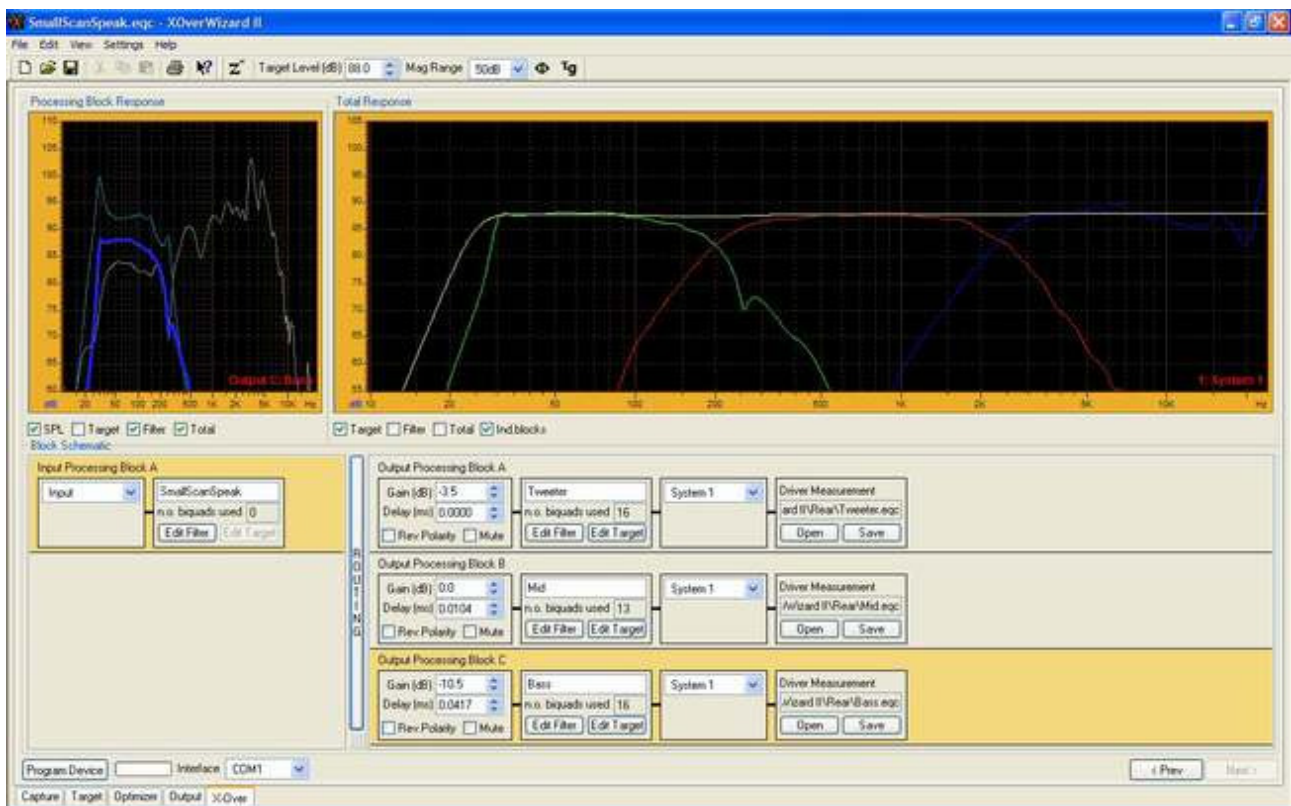
# DCN24 signal processing



The above figure shows how the DSP of DCN24 is setup in software processing blocks

## XOverWizard II

The software for controlling DCN24 is called XOverWizard II. It a very powerful tool and it is best described by downloading the XOverWizard II demo from the Ground Sound web page. This way it can be evaluated directly. Here are two examples:



## Wiring

The **input** wiring depends upon the connector and the distance. If the distance is very short from connector to DCN24 input pads it should be sufficient to use ordinary 0,2mm<sup>2</sup> wire or else shielded cable. The shielded cable will have to have one inner core for unbalanced RCA connector and two inner cores for balanced female XLR. When the unbalanced RCA is used remember to short inverted input (pad3) to AGND (pad1) and the RCA has to be an isolated type to avoid ground loops. If only one input channel is used it's recommended to short both pad 2 and 3 to AGND (pad1) of the unused input.

The **outputs** should be wired with a good shielded cable. It doesn't have to be large square as the signal is line level and low current. Remember to solder inner core to pad labelled Out and shield to AGND pad ⊥.

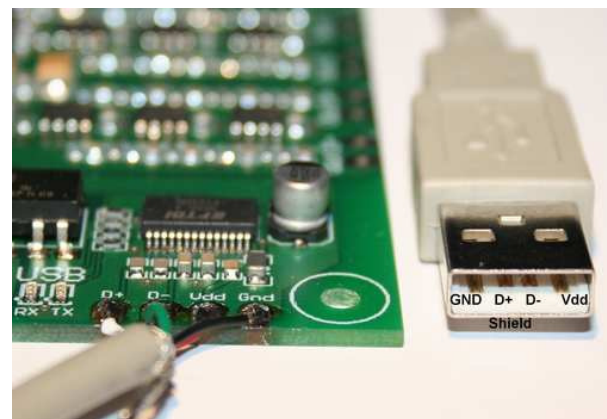
The **CH** pad is actually the lifted ground connection which should be wired to chassis metal very near (RCA) or on the input connector (the XLR connector often has a soldering tag for this purpose).

The **sense** output should be wired with the same shielded cable as the Out for amplifier modules. Solder the core for the pad marked sense and shield for unmarked pad. The pad is actually unconnected and its purpose is only mechanical strength, again to avoid ground loop.

The **supply** for DCN24 should be wired with 0,2mm<sup>2</sup>, which is sufficient except the AGND. The AGND should be wired with 0,75mm<sup>2</sup>. It's recommended to twist wire pair +Vs/-Vs and if there is a dedicated digital ground (DGND) then wire pair Vdd/DGND. If there isn't a separate dedicated digital ground, only wire the AGND from the supply star ground.

The **USB** connection has four pads labelled D+, D-, Vdd and GND. This part of the circuitry is isolated from the rest of the board. An opto-coupler transfer data from the PC powered part to the  $\mu$ C. The board is designed with pads instead of a USB B connector for flexibility and mounting options. The chassis connector could be a Neutrik NAUSB or NAUSB-B or a USB B connector on a small printed PCB or simply a wire with a USB A connector. The shield isn't connected on the DCN24 board, there is no need. **Don't** relay on the colours of D- and D+ at the picture! (The Neutrik NAUSB connector actually switches D- and D+).

Wiring a USB A connector looks like this:



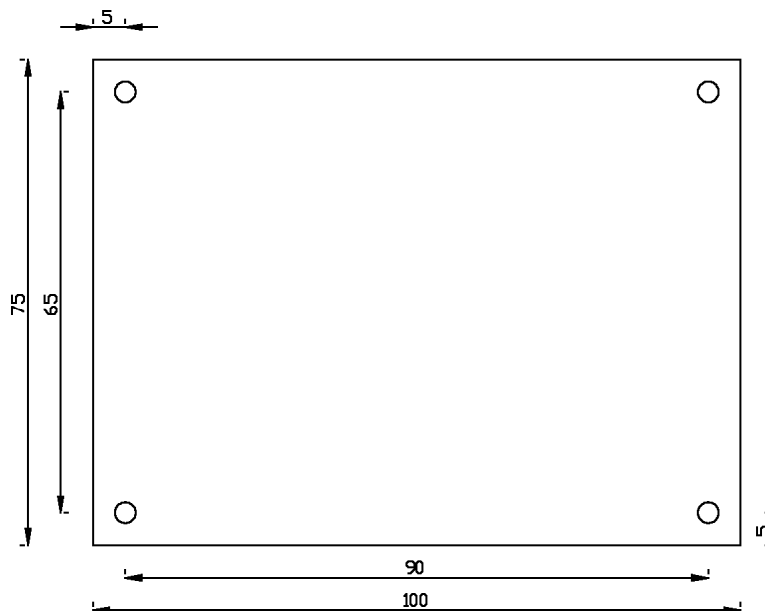
## Mechanical dimensions

The mounting of DCN24 requires:

4 pcs M3 x 16mm screws

4 pcs M3 x 3-10mm distances

4 pcs 3mm spring washers



Ground Sound reserves the rights to make alterations without prior notice.

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