

W-DAC S 4493 DA-Converter

Very high performance I2C-controlled audio DA-converter

AUDIO PERFORMANCE

- Up to 768 kHz / 32 bit audio
- 121 dBA dynamic range / SNR
- -115 dB THD+N (-1 dBFS, 1 kHz)
- -121 dB THD (-2 dBFS, 1 kHz)
- -125 dB crosstalk (10 kHz)

Typical values. Measurement BW is 20 kHz
and sample rate 48 kHz.

0 dBFS = 2 Vrms output level.

FEATURES

- Requires I2C software control
(software or code not provided)
- Unbalanced (RCA) output
 - Balanced (XLR) addon available
- I2S input
 - W-DAC is I2S Slave
 - Flexible clocking support
- DSD support (DSD64-DSD512)
- Output mute relay
- Hybrid volume control adds one-step
relay attenuator to digital volume control
- Six digital filter options
- Comprehensive measurement results

APPLICATIONS

- Very high performance DAC or
Preamplifier in Hifi system
- Use in DIY DAC system:
 - In Wee DAC system with
additional baseboards and addons
 - With any compatible I2S source
such as S/PDIF or USB module



W-DAC S 4493 is a very high performance audio DA-converter suitable for most demanding DIY DAC setups. Despite compact size and humble looks, performance figures are impressive reaching 121 dBA dynamic range, -115 dB THD+N, and -121 dB THD.

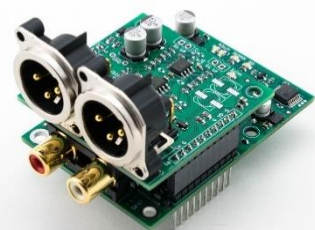
This is an I2C-controlled version of W-DAC 4493 and requires I2C control by host to start up and function.

Input to DAC is I2S, W-DAC being I2S Slave. Alternatively, DSD Master source can be used.

Analog audio output is single-ended RCA but can be expanded with balanced XLR addon board.

W-DAC is part of Wee DAC system. Various baseboards are available as well as W-Input (S) S/PDIF receiver. However, any compatible I2S/DSD source, such as USB to I2S module, can be used.

Below are photos of W-DAC S with W-Output XLR Mute balanced addon, and in more extensive Wee DAC system. See nihtila.com for more information.



Control and extra features

W-DAC S uses AK4493 in SW-mode so all configuration is done via I2C bus (SCL and SDA).

TCA9554 I2C I/O expander is used to power up AK4493 and control relays: output mute relay and attenuation relays.

Output is unmuted (relay and LED on) when Mute signal is low and all supplies are up, and back muted if conditions change. This allows pop-free operation.

Attenuation relays have 8 dB analog attenuation and improve SNR when used with digital volume control in preamplifier application. Two LEDs are on when attenuation relays are on.

Default I2C address for TCA9554 IO-expander is 0x22 and AK4493EQ 0x12. These can be changed to one of four options with 0R resistors. Note that many AKM ICs use the same I2C address space;

thus, for example W-Input S, W-DAC S, and ADC AK5572 all use the same address space and up to four boards can be placed in the same I2C bus.

For very simple board bring-up see pseudo-code examples at nihtila.com. Writing complete control firmware requires good understanding of the circuit and AK4493EQ and TCA9554 datasheets.

Digital audio input J1, all signals inputs. I2S or DSD.

J4 Pin	Description
MC	Master Clock
LR	I2S Word Clock or DSD Right Data
BC	I2S Bit clock or DSD Clock
DA	I2S Data or DSD Left Data

Supplies and pins on edge connector J4.

J4 Pin	Description
G	Ground
VA	Analog supply, not used in this board
VP	Analog positive supply, +15 V
VN	Analog negative supply, -15 V
Rn	Right negative (used by addon boards)
Rp	Right positive (used by addon boards)

Supplies and pins on edge connector J3.

J3 Pin	Description
G	Ground
VD	Digital supply, 5 V
M	Mute signal (controls mute relay)
IRQ	Interrupt (from I2C I/O expander)
SDA	I2C data (pull-up needed)
SCL	I2C clock (pull-up needed)
Ln	Left negative (used by addon boards)
Lp	Left positive (used by addon boards)

HARDWARE DETAILS

- AKM AK4493EQ DAC
- LM4562 opamps
- LT3042 LDOs
- 4-layer PCB
- C0G capacitors and thin film 0.5 % resistors in signal path
- Supply decoupling optimised by measurements
- Design and performance evaluated by comprehensive measurements

SYSTEM REQUIREMENTS

- I2C control (does not work without)
- I2S/DSD source; must be Master
 - Data, Bit clock, Word clock
 - Master clock
 - 3.3 V logic level
- Three supplies:
 - 5 V digital, 75 mA
 - +15 V analog, 79 mA
 - -15 V analog, 32 mA

INFORMATION AND CONTACT

- <http://nihtila.com> for general up to date information and shop
- [Youtube](#) for videos
- Follow [Twitter](#) (@nihtilacom)
- [Contact](http://nihtila.com/contact/) (<http://nihtila.com/contact/>)

DOCUMENT VERSION

v1.0B.0 (12/2020) for board v1.0B

