The Well-Tempered Computer

An introduction to computer audio

search

Connecting audio
Audio PC
Media player
Music server
NAS
Audio bridge
Remote control
Sound card
USB Audio
 • USB to SPDIF converters
 • USB DAC
  • Asynchronous USB 2
  • Asynchronous USB 1
  • 24 bit Adaptive USB
  • 16 bit USB DAC
 • USB Amplifiers
 • USB Interface
 • USB Trouble shooting
FireWire DAC
Vinyl rippers
Active crossover
Active speakers
Headphone

Asynchronous USB 2 DACs

USB Audio class 1 is limited to 24 bits/ 96 kHz maximum.
This is what fits into USB Full Speed mode so 12 MHz (USB 1).
To play higher sample rates the High Speed mode (USB 2, 480 MHz) is needed.

From mid-2010 on both OSX and Linux supports USB audio class 2 natively.
If the DAC is USB audio class 2 compliant it will play up to 32/384 on these systems without the need to install additional drivers.
Microsoft doesn't have a native mode USB Audio class 2 driver. You need to install a third party Class 2 Audio driver at the PC side.

All DACs listed in this section requires USB 2 (High Speed).
The fact that they do need USB 2 (High Speed) does not necessarily imply they are also USB audio class 2 compliant.

> Using High Speed might have an unexpected consequence.
> Some audiophile USB cables are of such a low build quality that they will fail you the moment you switch to high speed mode.
> The higher band width simply requires a digital cable build to close tolerances.
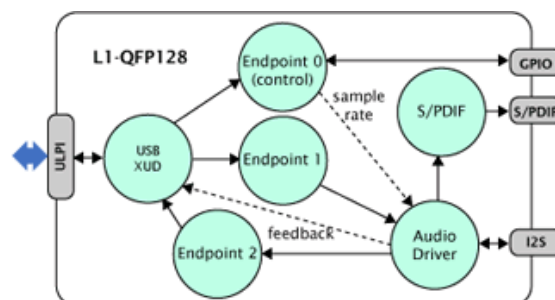
A lot of USB audio class 2 compliant DACs use the XMOS chipset.
Sagittarius has compiled an overview.

The information below is as supplied by the manufacturers website.

XMOS XS1-L1 USB Audio 2.0 US$ 149.00

 • USB endpoints use the asynchronous synchronization
 • 500 MIPS, 8 threads, XS1-L1 processor
 • 2 Channel analog input
 • 2 Channel analog output
 • USB 2.0 high speed interface - supports multiple 24 bit, 192kHz channels with extremely low latency (3ms round trip)
 • Plug-and-play with Audio Class 2.0 enabled computers (native Mac OSX support, Thesycon Windows drivers available)
 • Audio Class 1.0 compliant - native Mac OSX and Windows support
 • Asynchronous clocking - complete control of the audio master clock

Basically a USB to I2S converter. Optional support for SPDIF/ADAT/MIDI

Abbingdon Music Research - Digital Processor-777 €3.600

24/192kHz Asynchronous USB Audio Class 2.0 (XMOS)

Thermionic Electron Valves amplification stage:	2 x 6H1n-EV / 1 x 6H11P fitted ECC88, E88CC, 7308, Cca, 6DJ8, 6922, 6H23n-EV optional
Total Harmonic Dist. + Noise (THD+N):	<0.3%
Dynamic range:	>90 dB
Digital Audio Inputs:	2 x XLR/BNC with HD Valve Digital Input technology 2 x RCA/Toslink SPDIF Interface 1 x 24/192 Asynchronous USB

Aesthetix Pandora DAC USD 5,000.-

- Card-based DAC with three digital input slots.
- AES/EBU, RCA Coax, Toslink standard on digital input 1 slot.
- USB standard on digital input 2 slot.
- *USB capable of class 1 audio (96KHz, 24bit) and class 2 audio (192KHz, 24bit).*
- 2nd USB input optional.
- Asynchronous USB, (Streamlength ™)
- DSP based digital section using Motorola DSP56362 for digital filters.
- DAC section based on Burr-Brown PCM1792A.
- Analog section featuring four vacuum tubes in differential configuration.
- Zero global feedback.
- Balanced and single-ended outputs.
- Volume control optional, allows DAC to drive a power amplifier directly. Switched resistor design.
- Remote control of all functions.
- Multiple stainless steel faraday cages isolate critical digital, analog and power supply sections.
- Two transformers, one for digital circuits and one for analog circuits.
- All aluminum chassis construction.
- RS232 control.
- 12v trigger.
- Unit Weight: 35 Lbs
- Dimensions: 18" width x 4 3/8" height x 18" depth

April Music Eximus DP1 US$ 2,295

DAC/Pre/Headphone amp

Digital Input:
1 USB 2.0 + driver for Win
USB receiver: XMOS
1 I2S 100 Ohms TTL Level,
2 SPDIF coax 75 Ohms,
1 AES/EBU, 110 Ohms,
1 Toslink

Analog Input: 1 RCA, 1 MINI JACK
Analog Output: 1 RCA, 1 XLR, 1 Headphone

Receiver: Cirris Logic C58416
ASRC: TI SRC4192 (can be bypassed)
DAC: TI PCM1794A

Ayre QB-9 USD 2750.-

- **Asynchronous** USB (Streamlength ™)
- 16/24 bit/192 kHz.
- *TheSycon USB Audio class 2 driver for Windows*
- XMOS USB audio class 2 converter
- Minimum phase digital filter.
- Single-pass 16x oversampling.
- zero-feedback, fully-balanced discrete circuitry.
- Equilock circuitry for active gain devices.
- Ayre Conditioner (patent pending) power-line RFI filter.
- AyreLink communication system.

Frequency Response: DC - 20 kHz, ± 0.25 dB
Signal/Noise: 110 dB (unweighted)
Output Level: 4 volts balanced, 2 volts single-ended

The USB receiver section is isolated from the
rest of the audio circuitry with high-speed opto-isolators. This means that the RFI generated by the multitude of clocks operating inside the PC and its noise-generating switching power supply is completely kept out of one's music system.
Ayre White paper

Bladelius USB DAC

- Accepts data up to 24 bit/192 kHz
- USB powered
- Asynchronous USB transfer, re-clocking with a fixed low jitter crystal clock
- Galvanic isolation between USB and the analog circuits,
- Super low noise power supply with multistage regulation and filtering
- For low out of band noise we use low order modulator
- Digital filter with minimum phase
- The analog output stage is a high performance stage with high drive capability
- Distortion < 0.001%
- Thd Noise -126db
- Output Level 2.5v @0db

B.M.C. DAC1 Pre HiRes USBII - € 3.248

DAC with preamp.
Asynchronous USB (24/192) with driver for Win.

Cambridge Audio DacMagic Plus £349.95

Twin Wolfson WM8740 24bit DACs used in dual differential configuration
New Anagram Technologies ATF2™ 24-bit/384kHz audio up-sampling / jitter reduction
Optional Digital Preamp mode allowing connection directly to power amp or active speakers
24-bit/96kHz driverless USB Audio 1.0
24-bit/192kHz USB Audio 2.0 with ASIO or kernel streaming modes.
USB class 2 driver for Win

Asynchronous USB transfer
Selectable digital filters - linear phase, minimum phase and steep
Balanced XLR audio output and RCA phono output
Two 24 bit digital inputs (with optical or coaxial for each)
External input for optional BT100 Bluetooth receiver - allows audio to be streamed and up-sampled from any paired Bluetooth device

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CYP AU-D160 £150.00

USB DAC with analogue out (RCA), headphone out and Toslink.

- Supports standard sampling rates - 44.1kHz, 48kHz, 88.2kHz, 96kHz, 192kHz
- Supports Bits : 16 Bits / 24Bits
- Power supplied by USB BUS Power
- The Headphone, R/L and Optical ports will simultaneously support audio output
- ASIO driver supported
- USB Audio Class 2.0 with asynchronus mode and driver for Win
- 500 MIPS, 8 threads, XS1-L1 processor (XMOS)

Digital & Analog Calyx DAC 24/192 - 1500.00 USD

D/A Converter IC ESS Technology ES9018 Sabre Reference 32-bit DAC

THD+N 0.0005% @ 1KHz, 0dBFS
SNR 125 dB, A-weighted, 2.2 Vrms
Channel Separation 140 dB @ 1KHz, 130 dB @ 20KHz

Digital Input Resolution and Sample Rate
USB : 24 bits / 44.1K, 48K, 88.2K, 96K, 176.4K, 192KHz
COAX : 32 bits / 44.1K, 48K, 88.2K, 96K, 176.4K, 192KHz

Line Output
Unbalanced stereo, RCA jacks with gold-plated contacts
Balanced stereo, XLR jacks with gold-plated contacts
Output Level 2.2 Vrms (unbalanced), 6.8 Vrms(balanced)
Output Offset 2 mV max

Comes with a ASIO driver for Win
It claims to do 24/192 on OSX without a driver so probably USB class 2 audio.
XMOS USB audio class 2 converter

Reviews

http://www.digitalaudioblog.com/2011/02/review-calyx-dac-24192.html
http://www.digital-highend.de/start/wp-content/bildupload/EN111_S.64-67.pdf

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ExaSound E18 $2000

DAC with volume control and headphone out.
- ES9018 SABRE32 Reference DAC
- 8 channels at up to 32bit/384kHz (USB only)
- Asynchronous USB interface
- Ultra low jitter
- Galvanic isolation
- Bit-perfect ASIO Driver Reference-class specifications
- Automatic sampling rate switching
- Plays DXD 352.8 kHz

Firestone ILoveTW 299,00 EUR

DAC supporting both adaptive and asynchronous mode

Amplifier Structure : Low pass filter with 2Vrms output
Power Structure : High frequency switching DC-DC
regulator
USB Support Format :
16/24 Bit : 44.1kHz / 48kHz / 88.2kHz / 96kHz / 176.4kHz /
192kHz
Digital Interface : Direct I2S data format transmission (MAX
support up to 192kHz-24bit over 1 meter CAT-5E cable)
Operation Mode : Support Adaptive and Asynchronous
mode for audio stream transmission
DAC Chip : WOLFSON - WM8740
USB Chip : TENOR - TE8802
LPF OP : NS - LM4562
dB-Weighed Frequency response (From 40Hz to 15kHz) :
40Hz +0.02dB, 15kHz -0.12dB
Noise level (1kHz, A-Weighted) : -106.7dB
Dynamic range (1kHz, A-Weighted) : 106.7dB
THD% : 0.012%
Stereo crosstalk : -102.7dB
Housing dimensions : 117 x 80 x 50 mm (D x W x H).
Housing only without parts 'sticking out' like connector
parts, swithes, etc.
Weight : 286 gram (without the external power supply)

Grace Design m903 € 1.545

Headphone amplifier, DAC, monitor controller
 • Balanced and unbalanced analog inputs

 • 24bit/192kHz digital stereo inputs- AES3, S/PDIF,
   TOSLINK and USB

 • High speed asynchronous USB interface

 • Driverless operation on Windows & Mac up to 96kHz/24bit

 • Supports USB Class 2 audio specification for 192kHz/24bit operation on Windows & Mac
   (drivers needed for 192kHz operation under Windows)

Lindemann USB-DAC 24/192 € 690,-

 • Asynchronous USB interface (USB audio class 2
   compatible) based on an XMOS-DSP with 500 Mips.
   Resolution up to 24 bits and 192 kHz. Three
   separate clocks for USB, 44.1 kHz (and multiples)
   and 48 kHz (and multiples).
 • USB class 2 driver for Windows
 • Digital interface controller (WM8805WM8805
   with efficient jitter reduction due to buffer storage and adaptive PLL. Guaranteed jitter
   level < 50 ps.
 • High-precision master clock with < 2.5 ps timing jitter.
 • DAC WM8742WM8742
 • Minimum phase digital filter with apodizing behaviour.
 • Fully-balanced, analog output stage (ADA4927ADA4927

Linnenberg udc 1 €1260.-

USB 2.0 compatible input
- Jitter free asynchronous data transfer (udc1 as master)
- Bit transparent drivers for Mac and PC operating systems
- Precision master 3ps crystal oscillator
- 24bit/192kHz Burr Brown digital - to - analogue converter
- True class A, fully discrete analogue circuits with zero negative feedback
- Ultra short signal path
- Balanced analogue outputs with PCB-mounted gold-plated Neutrik XLR sockets
- High current output stage

Specifications:
Frequency response 1Hz - 24kHz +0.1dB -0.5dB
Distortion and noise <0.01% 10Hz - 20kHz at -10dB
Output level 4V rms balanced
Output impedance 150 Ohms
Mains voltage 115V, 230V factory set
Dimensions (H x W x D) 55 x 165 x 224 mm

[Meitner Audio](#) MA-1 DAC $7,000

- XMOS USB 2.0 High Speed Interface: 16, 24 bit
  sampling rate up to 192kHz
  Thesycon USB audio class 2 driver for Win
- Available Digital Inputs:
  - 1x USB
  - 1x AES/EBU (XLR)
  - 2x SPDIF (RCA)
  - 2x TOSLINK (Optical)
- Word lengths up to 24bit, and sample frequencies up to 192kHz are
  supported on all digital inputs.
- Analog Outputs:
  - Balanced (XLR)
  Output Line Level (0dBfs signal on AES/EBU input): 4.6Vrms
  Output Impedance: 300Ω
  - Un-Balanced (RCA)
  Output Line Level (0dBfs signal on AES/EBU input): 2.3Vrms
  Output Impedance: 150Ω

Musiland MD30 DAC/Headphone amp

- USB 2.0 High Speed Interface: 16, 24, 32Bit sampling rate up to 192kHz
- Coaxial RCA, BNC coaxial, fiber optic, AES: 16, 24Bit sampling depth up to 192kHz. Support MMDI instruction
- MULINK high-definition digital interface (proprietary i2s): 16, 24, 32Bit sampling depth up to 192kHz. Support MMDI instruction.
- Clock jitter (44.1kHz): S/PDIF less than 30PS, USB, MULINK less than 20PS

M2Tech Young DAC $1,999.00

High-speed asynchronous USB D/A converter

Inputs:
1x USB (USB female Type B)
16, 24, 32 bits
44.1, 48, 88.2, 96, 176.4, 192, 352.8, 384 kHz

2 x S/PDIF (RCA and 75 Ohms BNC)
1x AES/EBU (XLR)
16 and 24 bits, 44.1, 48, 88.2, 96, 176.4, 192

1x optical (Toslink)
16 and 24 bits, 44.1, 48, 88.2, 96

SNR: 121dB (A weighted, 192kHz, 24 bits, 20kHz bandwidth)
THD+N: 0.0003% (192kHz, 24 bits)

Mytek Stereo192-DSD-DAC USD $1,695.00

- Asynchronous USB2 with driver (Rigisystems)up to 192 kHz
- Asynchronous Firewire 400/800 (TC Electronics)
- Conversion: 32bit, PCM up to 192k, 64xDSD, 128xDSD.
- Dynamic Range: 128dB (ESS Sabre chipset in 8 mono to 2 stereo config.) THD DAC: -110dB.
- Digital Audio Inputs: SPDIF, AES/EBU, Toslink all up to 192k single wire. (64xDSD and 128XDSD SDIF DSD interface on Mastering Version).
- Clock: Internal Clock Generator (10ps jitter), Wordclock In and Out, or sync to incoming digital audio input with low jitter JET (tm) PLL.
- Internal Async Hardware Upsampling- 16bit 44.1k etc. can be optionally upsampled prior to conversion to 192k/24bit with clock jitter eliminated.
- Transparent, 1dB stepped programmable analog attenuator, separate for main out and headphones.

Various models including one with headphone and pre-amp function.
A tread on a forum including Michal from Mytek.

Onkyo DAC-1000 £599.00

At the moment (January 2011) only available in Japan.

Frequency	2Hz-48kHz ±0.5dB 2Hz-48kHz ±0.5dB
Total harmonic distortion	0.003%
DAC	PCM1795 - 32bit/192kHz
SN ratio	116dB(USB→LINE OUT IHF-A) 116dB

input	24 bit /96kHz Optical
	24 bit / 192kHz AES/EBU - SPDIF
	24 bit / 192kHz asynchronous USB
	Unclear if USB is class 2 compliant
Digital output	24 bit /96kHz optical)
	2ch PCM formats
Analog out	XLR + RCA

Peachtree Audio Grand Pre control center US$2995

DAC/preamp/headphone amp with volume control and defeatable tubed output.

Manufacturers description:
- Reference ESS Sabre32 DAC knocks jitter down to <1 picosecond for accurate sound reproduction
- Galvanic Isolation eliminates noise generated by switching power supplies in source components
- New asynchronous I2S 24/192 USB input provides the best connection between computer and DAC
- VCA gain control for minimal noise and cross talk replaces the commonly used potentiometer
- New Bascom King tube buffer rejuvenates poor recordings and compressed audio
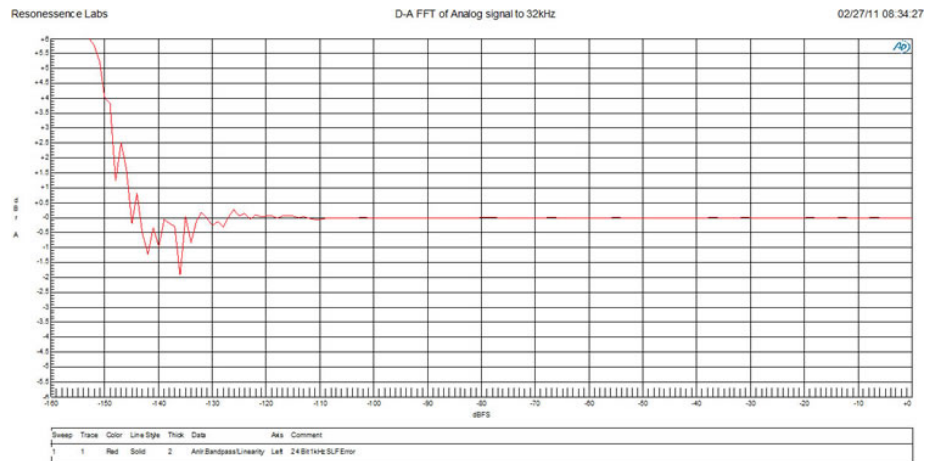

Resonessence Labs Invicta $3.995 USD

- ESS SABRE32 24/192kHz DAC chip
- Digital filtering DSP and controls via Xilinx MicroBlaze FPGA soft processor cores
- Ultra-low phase noise oscillator master clock
- 1 x Toslink input and 1 x Toslink output
- 2 x BNC digital input
- 1 x AES/EBU input
- USB - asynchronous mode, high speed so probably USB audio class 2 compliant but no drivers for Windows available. USB firmware by Cypres Semiconductor.
- All digital inputs are transformer coupled, galvanically isolated
- 2 x headphone outputs on front panel, simultaneous drive and levels can be independently set
- SD card (WAV format only, up to 24/192)
- Low noise OLED screen
- Firmware upgradeable (FPGA)
- High quality AD797 J-FET operational amplifier output stage

The manual contains a lot of measurements.
Each measurement is accompanied by a short explanation, very instructive.

This DAC is linear up to 130 dB. An excellent values allowing for minimal full 22 bits resolution.

Teac UD-H01 DAC £299.00

Main Features
- USB Audio Class2 High-speed Input from PC/MAC (Tenor 8802)
- 32-bit/192kHz Dual D/A Convertors (BurrBrown 1795 x 2)
- Up-conversion to 32bit/192kHz
- Supports Asynchronous Transfer Mode
- Toroidal-core-Power Transformer
- Detachable AC Socket
- Headphone Out with Volume Control
- Aluminium Front Panel

General Specifications:
- USB Input: x 1 (USB2.0)
- Digital Audio Inputs: x 2 (Coaxial, Optical)
- Balanced Audio Output: x 1 (XLR, 1-GND, 2=Hot, 3=Cold)
- Audio Output: x 1 (RCA)
- Headphone Out: x 1 (6.3mm)
- Input Signal Sampling Rate: 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz
- Operation:230V AC, 50kHz
- Dimensions (W x H x D): 215mm x 55mm x 215mm

Wyred 4 Sound - DAC2 $1,499.00

- ESS Reference audio (ES9018) 32 bit DAC
- Automatic oversampling for precise output filtering
- Fully balanced design with balanced and unbalanced outputs
- Upgradable Digital, Output, and USB boards (designed for future improvements)
- VFD display for input, sample rate, volume control, and configuration viewing
- Remote control

- Defeatable - 32 bit volume control
- 2x Coax inputs
- 2x Toslink inputs
- 1x AES/EBU input
- 1x Balanced I2S input via HDMI cable (not standard HDMI cable format)
- 24-bit 192kHz **Asynchronous** USB input
- *Proprietary drivers* for 32/64 bit Windows XP, Vista, 7 and Mac OS 10.4, 10.5 ,10.6

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