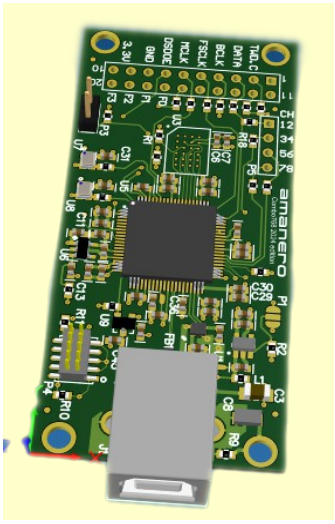
COMBO768 USB TO I2S DSD CONVERTER

Datasheet
version 06/03/2024

FEATURES



- **Core**
  ARM® Cortex®-M7 IMXRT1011
  Arm and Cortex are registered trademarks of Arm Limited

- **OSCILLATORS**
  XO 49.1520 MHz Low phase noise
  XO 45.1584 MHz Low phase noise
  Crystal 24 MHz

- **USB**
  USB 2.0 High Speed Class 2 compatible
  No drivers for Mac OSX® 10.6+
  Mac OSX are trademarks of Apple Inc
  No drivers for Linux UAC2 Kernel compliant
  No Kernel Drivers for MS Windows®
  ASIO® for Windows
  ASIO is a registered trademark of Steinberg Media Technologies GmbH
  Windows is a registered trademarks of Microsoft Corporation

- **AUDIO**

  PCM sample rates 44.1kHz 48kHz, 88,2kHz,96kHz,192kHz,
  352.8kHz, 384kHz,
  705,6kHz,768kHz,
  1411,2kHz,1536kHz I2S output

  DoP sample rates DSD64 - DSD512
  PCM token FA05

  Native DSD Linux/Windows DSD64 - DSD1024
  Native DSD on Windows requires ASIO driver

- **OUTPUT**
  LVCMOS33

  Powered by USB 5V bus or from external 3.3V power supply.
  Power Consumption is TBD at max speed.
  The module mounts an ultra low noise LDO ADP-151-3.3V ADP-151-1.2V

- **ROHS**

DESCRIPTION

The Combo768 is an USB audio device adapter designed for OEM applications. USB PCM audio data (2 channels) accepted as input are converted into an I2S stream or a native DSD stream. Supported PCM sampling frequencies range from 44.1kHz to 1536kHz. The maximum sample rate can be limited to 192kHz, 384kHz, or 768kHz.

The DSD format is decoded both in DoP format (FA05 token) and in native format. In DoP format, the maximum sample rate is DSD512, while in native DSD format, the maximum sample rate is DSD1024.

On Windows, no kernel mode drivers are required, as system USB drivers are used, ensuring they are always up to date. Additionally, a ASIO driver is provided to support native DSD from DSD64 to DSD1024.

On Linux, with a kernel supporting native DSD, you can achieve up to DSD1024.
Native DSD support in Linux is constrained by the USB VID/PID. The Combo768 base board uses VID=0x16d0 and PID=0x0A23, values already included in many Linux distributions as enabled for native DSD.

Clock signals can be generated by two low phase noise oscillators at 45.1584MHz/49.152MHz or directly from the 24MHz XTAL that powers the CPU.

The CPU is a Cortex-M7 NXP IMXRT1011 and the external flash is W25Q32. The power supply requires 3.3V and 1.2V.
An incoming DSD stream is indicated by an asserted signal in a specific DSD ON pin of the output comb connector and the I2S DATA and I2S FSCLK pins become the DSD Left/Right output pins.

The module works in Master Mode Only.

Output connector

header 10x2 raw 2.54 pitch

1	Cable Plugged	-	It's "1" When the usb cable is plugged
2	Reserved	-	
3	I2S DATA/DSD1	Out	Data stream LVCMOS 3.3V 47ohm
4	I2S CLK/DSD CLK	Out	Clock LVCMOS 3.3V 47ohm
5	I2S FSCLK/DSD2	Out	Frame sync LVCMOS 3.3V 47ohm
6	MCLK	Out	Actual Master Clock 24.576MHz or 22.5792MHz
7	DSD ON	Out	This line is "1" when a DSD stream is detected. (FA05 in the PCM envelope MSB) LVCMOS 3.3V
8	GND	Power	Ground Terminal
9	3.3V output (max 50mA)	Power Out	This output can be used to power an isolator or it can be used to detect when the usb is connected to the PC.
10			
11	MUTE	Out	This line is "1" during a sample rate change or when the DSD mode is changing.
12	Reserved	-	
13	GND	Power	Ground Terminal
14	GND	Power	Ground Terminal
15	GND	Power	Ground Terminal
16	DSD64_128	Out	0=DSD64 1=DSD128 -open drain-
17	F0	Out	Sample rate indicator see table below
18	F1	Out	Sample rate indicator see table below
19	F2	Out	Sample rate indicator see table below
20	F3	Out	Sample rate indicator see table below

Output Connector pinout

[11] **Mute**	[12] **SDA**	[13]**GND**	[14]**GND**	[15]**GND**	[16]**DSD**	[17]**F0**	[18]**F1**	[19]**F2**	[20]**F3**
[1] **Plug**	[2] **SCL**	[3] **DATA**	[4] **CLK**	[5]**FSCLK**	[6] **MCLK**	[7]**DSDON**	[8]**GND**	[9]**3.3V**	[10]**3.3V**

Windows ASIO Drivers can be downloaded on request at support@amanero.com

ELECTRICAL CHARACTERISTICS
ABSOLUTE RATINGS*
Storage Temperature.....-40°C to + 85°C
Maximum Operating Voltage .....5.5V USB supply
***NOTICE: Stresses beyond those listed under "Absolute Maximum**
Ratings" may cause permanent damage to the device.
This is a stress rating only and functional operation of the
device at these or other conditions beyond those indicated
in the operational sections of this specification is
not implied. **Exposure to absolute maximum rating conditions for extended periods may affect device reliability**

Sample Rate Indicators

DSDOE=0 PCM
0 (F3), 0 (F2), 0(F1), 0(F0) -> 32kHz
0 (F3), 0 (F2), 0(F1), 1(F0) -> 44.1kHz
0 (F3), 0 (F2), 1(F1), 0(F0) -> 48kHz
0 (F3), 0 (F2), 1(F1), 1(F0) -> 88.2kHz
0 (F3), 1 (F2), 0(F1), 0(F0) -> 96kHz
0 (F3), 1 (F2), 0(F1), 1(F0) -> 176.4kHz
0 (F3), 1 (F2), 1(F1), 0(F0) -> 192kHz
0 (F3), 1 (F2), 1(F1), 1(F0) -> 352.8kHz
1 (F3), 0 (F2), 0(F1), 0(F0) -> 384kHz
1 (F3), 0 (F2), 0(F1), 1(F0) →> 705,6kHz
1 (F3), 0 (F2), 1(F1), 0(F0) →> 768kHz
1 (F3), 0 (F2), 0(F1), 1(F0) →> 1411,2kHz
1 (F3), 1 (F2), 0(F1), 0(F0) →> 1536kHz

DSDOE=1 DSD
1 (F3), 0(F2), 1(F1), 0(F0) →> DSD64
1 (F3), 0(F2), 1(F1), 1(F0) →> DSD128
1 (F3), 0(F2), 1(F1), 1(F0) →> DSD256
1 (F3), 1(F2), 0(F1), 0(F0) →> DSD512
1 (F3), 1(F2), 0(F1), 1(F0) →> DSD1024

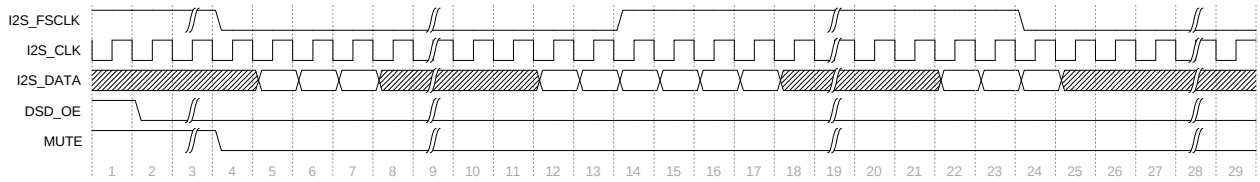
DC Characteristics

VCCIO 3.3V

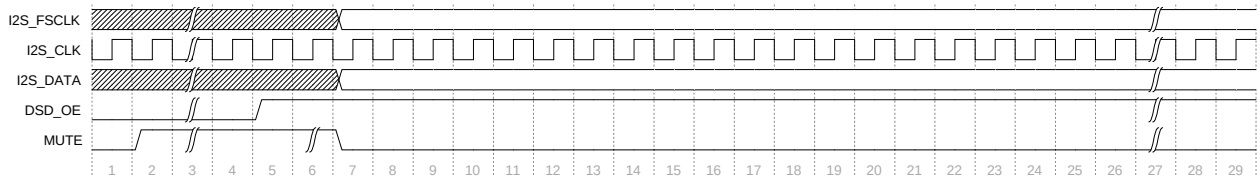
Symbol	Parameter	Min	Max
VOH	High level output voltage	VCCIO – 0.4V (Ioh=-8mA)	-
VOL	Low level output voltage	_	0.4 V (Iol=8mA)
Pdc	Power consumption at 32/1536kHz		TBD

Timing Diagrams

I2S Mode



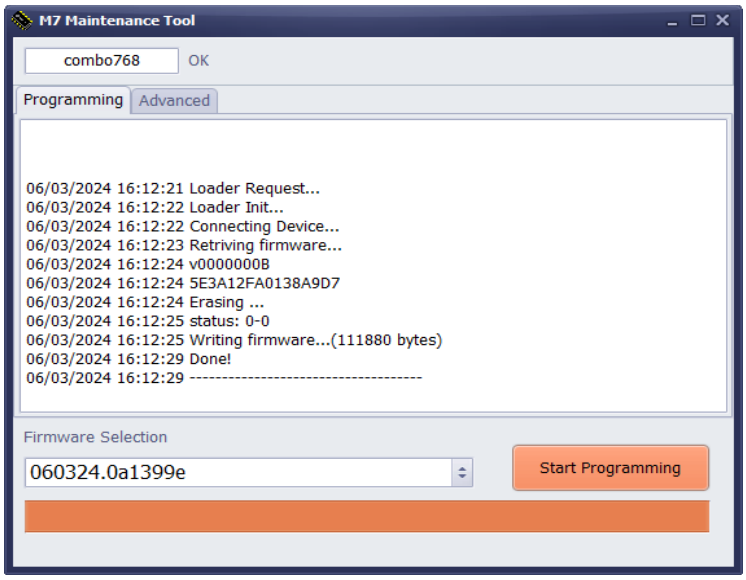
DSD Mode

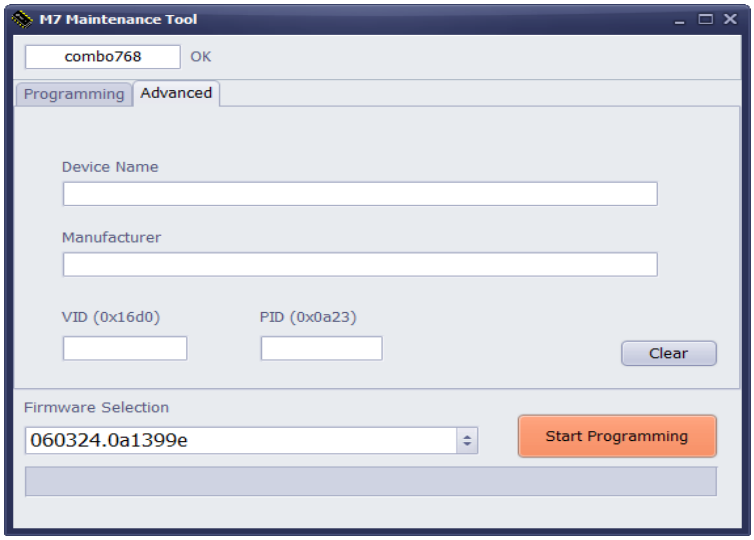


In DSD Mode the **I2S_CLK** becomes the DSD clock signal, the **I2S_Data** becomes the output data line DSD1 (LEFT) and **I2S_FSCLK** becomes the DSD2 (RIGHT) Line.

Maintenance and programming

The firmware update is performed through a maintenance program in Windows, which also allows customization of the Device Name, Manufacturer, and USB VID/PID. The maintenance program automatically handles the reprogramming of the board, and the flash memory is erased via software.





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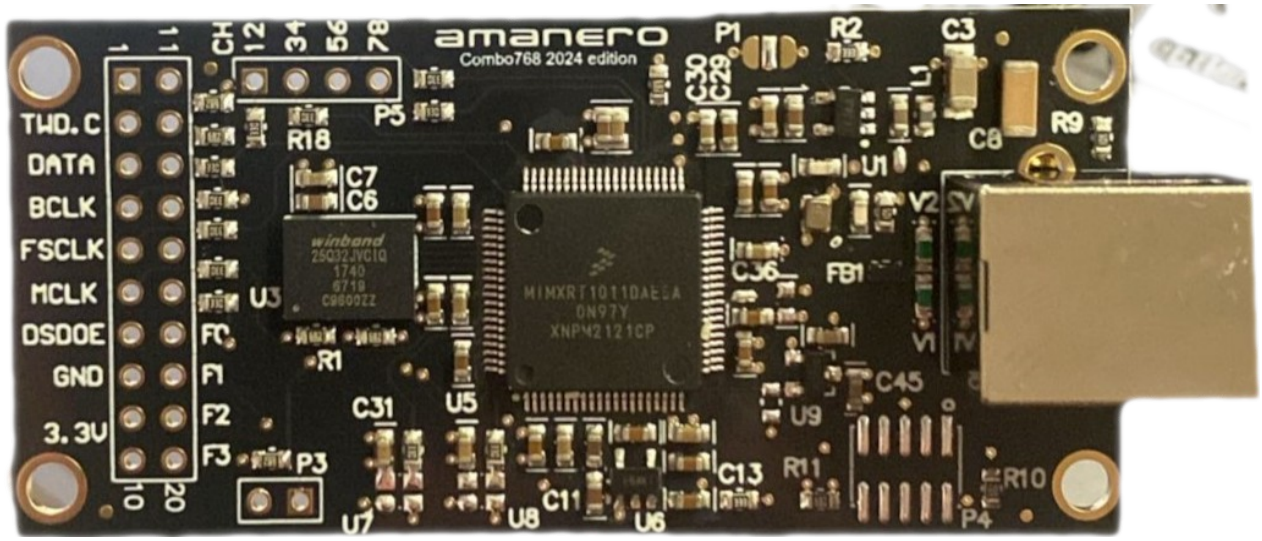
Evaluation module

When the jumper **P1** is soldered, the LDO 3.3V regulator is disabled, and it is possible to supply external power at 3.3V from the main output connector of the board.

When jumper **P3** is closed while powering the board or plugging in the USB cable, it forces the programming mode. This operation is not required for firmware updates and is only intended in the case of a total reset.

P4 reserved for test

P5 is an auxiliary connector for using the board with specific firmware in multichannel mode or as an input.



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This is a preliminary datasheet and is not complete.