# PmodAMP3™ Reference Manual

Overview

The Digilent PmodAMP3 features an Analog Devices SSM2518 2 watt Class-D Audio Power Amplifier. The module enables the use of I^2S audio protocol or TDM to produce stereo audio at various sampling frequencies. The module features configurable digital volume and dynamic range control via an I^2C interface. Additionally, you may use the AMP3 in a stand-alone mode that does not require the use of the I^2C interface.
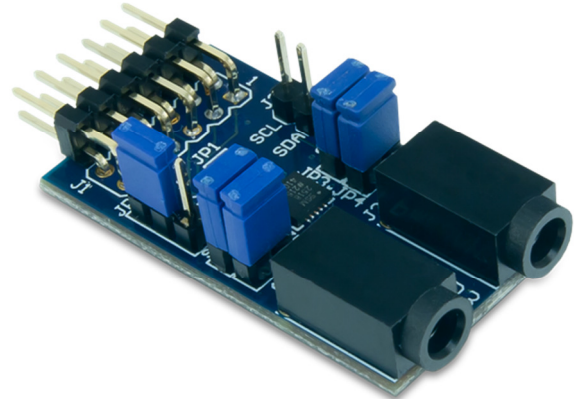
Features Include:

- separate left and right channel 1/8-inch headphone jacks
- 12-pin header Pmod™ interface connector
- supports common I^2S audio formats
- digitally configurable volume control for each channel
- dynamic range control
- standalone mode for systems without I^2C interface
- Operates at 3.3 V

Functional Description

Customers may operate the PmodAMP3 in either an I^2C programmable mode or a simple stand-alone mode. The stand-alone mode is the default setting and can be activated by clearing the jumper JP5. When the stand-alone mode is active, the jumpers JP3, JP4, and JP6 allow a simple hardware configuration of the amplifier. The jumper JP3 configuration determines whether to use Standard or Left Justified I^2S protocol. The jumper JP4 determines if the MCLK input is 256 or 384 times the audio sampling frequency Fs. The jumper JP6 configures the amplifier to output at either 0dB or +12dB gain. (See Table 1 for further information.)
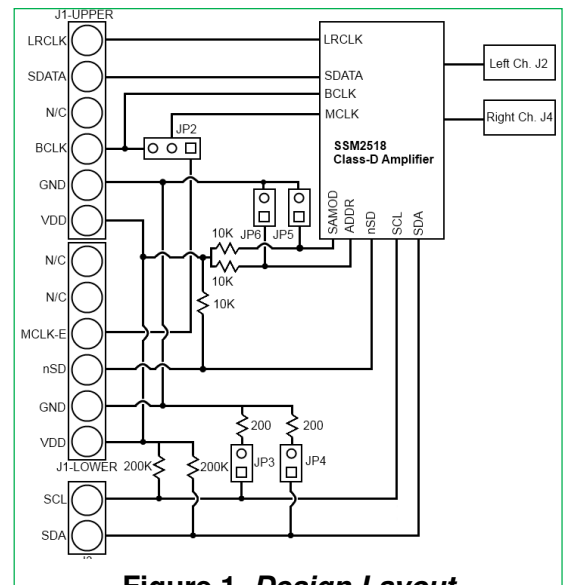

Figure 1. *Design Layout*

	JP5 Loaded (I^2C Programmable Mode)		JP5 Unloaded (Stand-Alone Mode)	
	Loaded	**Unloaded**	**Loaded**	**Unloaded**
JP3	Prohibited	Required	I^2S (Standard)	Left Justified
JP4	Prohibited	Required	256x Fs	384x Fs
JP6	ADDR: 01101**0**0[r/w]	ADDR: 0110**1**10[r/w]	12dB Gain	0dB Gain

Table 1. *Connector Descriptions*

Note: Both the 0dB and +12dB gain modes are very loud. You should take care to protect both yourself and your equipment when operating in stand-alone mode. Digilent recommends that you use the programmable mode and set the gain to -12dB or lower.

Programming Interface

When using the I²C programmable mode, you have to set the jumper JP5 and remove the jumpers JP3 and JP4. You can use Jumper JP6 to configure the 6th bit of the 7-bit I²C address. You can program the SSM2518 via the I²C protocol address [0][1][1][0][1][ADDR][0][R/W]. The 8th bit "R/W" determines the type of I²C transmission and should be set Low for Write and High for Read.

Audio Interface

The PmodAMP3 requires the use of the I²S or TDM audio protocols for operation. The Pmod requires the LRCLK input to indicate the channel of the audio data presented. The sampling frequency Fs of the data presented should be the same as the LRCLK frequency. The SSM2518 supports sampling frequencies from 8 to 96 KHz. The BCLK must present 64 clocks in a single period of the LRCLK, 32 clocks for each phase of the LRCLK. The AMP3 uses the clock to shift data into the SSM2518 in 24-bit words.

The SSM2518 requires the use of an MCLK signal as well, which you can generate internally in the device. However, customers must provide an external reference clock. The PmodAMP3 has a jumper JP2 which allows you to route the BCLK to the MCLK input. This signal may then be processed internally by the SSM2518 to generate an appropriate MCLK signal. In addition, you may generate the MCLK signal externally and provide it to the MCLK-E pin.

Power Supply

The SSM2518 includes an active low Shut Down pin. This pin must be driven high while the device is in use. The device may be powered down by driving a logic low signal to the pin. The PmodAMP3 includes a 10Kohm pull-up resistor on this pin. However, you must configure the parent system board I/O to prevent an unknown voltage settling on the pin.

We have designed the PmodAMP3 to work with either Digilent programmable logic or Digilent embedded control system boards that have 6 or 12-pin header connectors. The AMP3 connects directly into these header connectors. The PmodAMP3 requires a 3.3V supply voltage to power the module. All Digilent system boards have a comparable power supply voltage (3.3V) and provide the necessary power as part of the standard Pmod interface. Digilent system boards that provide Pmod interface connectors allow jumper selection of the Pmod power supply voltage. Ensure that your system board has a jumper to provide 3.3V to the module before applying power to the board.

Note: For more information on the PmodAMP3 see the schematic at: www.digilentinc.com. For a detailed review of the SSM2518, including Input Register data formatting, please refer to the SSM2518 Data Sheet available at www.analog.com.