GODIYMODULES Mod-MAX98357-002

GODIYMODULES MAX98357A I2S 3W Class D Amplifier Breakout Module User Manual

Model: Mod-MAX98357-002

1. Introduction

The GODIYMODULES MAX98357A I2S Class D Amplifier Breakout Module is designed to convert standard I2S digital audio input into an amplified analog signal, directly driving a speaker. This module integrates both a Digital-to-Analog Converter (DAC) and an amplifier into a single compact unit, making it suitable for projects requiring amplified sound output from I2S-compatible microcontrollers and microcomputers.
It is compatible with various platforms, including Raspberry Pi, Arduino Zero, and ESP32, offering a straightforward solution for audio output in embedded systems.

2. Features

- Integrated I2S DAC and Class D Amplifier for direct speaker drive.
- Operates from a wide voltage range of 2.7V to 5.5V DC, ideal for portable applications.
- Built-in thermal and over-current protection for enhanced reliability.
- Supports I2S standard digital audio input with 3.3V or 5V logic data.
- Bridge-Tied Load (BTL) output configuration for direct speaker connection.
- Adjustable gain settings: 3dB, 6dB, 9dB (default), 12dB, or 15dB via the GAIN pin.
- Shutdown/Mode pin for chip shutdown and I2S audio channel selection (Left, Right, or (L+R)/2 mono mix).
- Compatible with Raspberry Pi, Arduino Zero, ESP32, and other microcontrollers with I2S audio outputs.

3. Specifications

Chip	MAX98357
Amplifier Type	Class D
Output Power (5V supply)	3.2W at 4Ω (10% THD), 1.8W at 8Ω (10% THD)
PSRR (Power Supply Rejection Ratio)	77 dB typical, 1KHz

I2S Sampling Rate	8-96kHz
MCLK Requirement	No MCLK required
Selectable Pin Gains	3dB, 6dB, 9dB, 12dB, 15dB
Minimum Supply Voltage	2.7 Volts (DC)
Maximum Supply Voltage	5.5 Volts (DC)
Mounting Type	Surface Mount
Weight	Approximately 5g per module

4. Setup and Connections

This section details the pinout and connection procedures for integrating the MAX98357A amplifier module into your project.

4.1 Module Overview

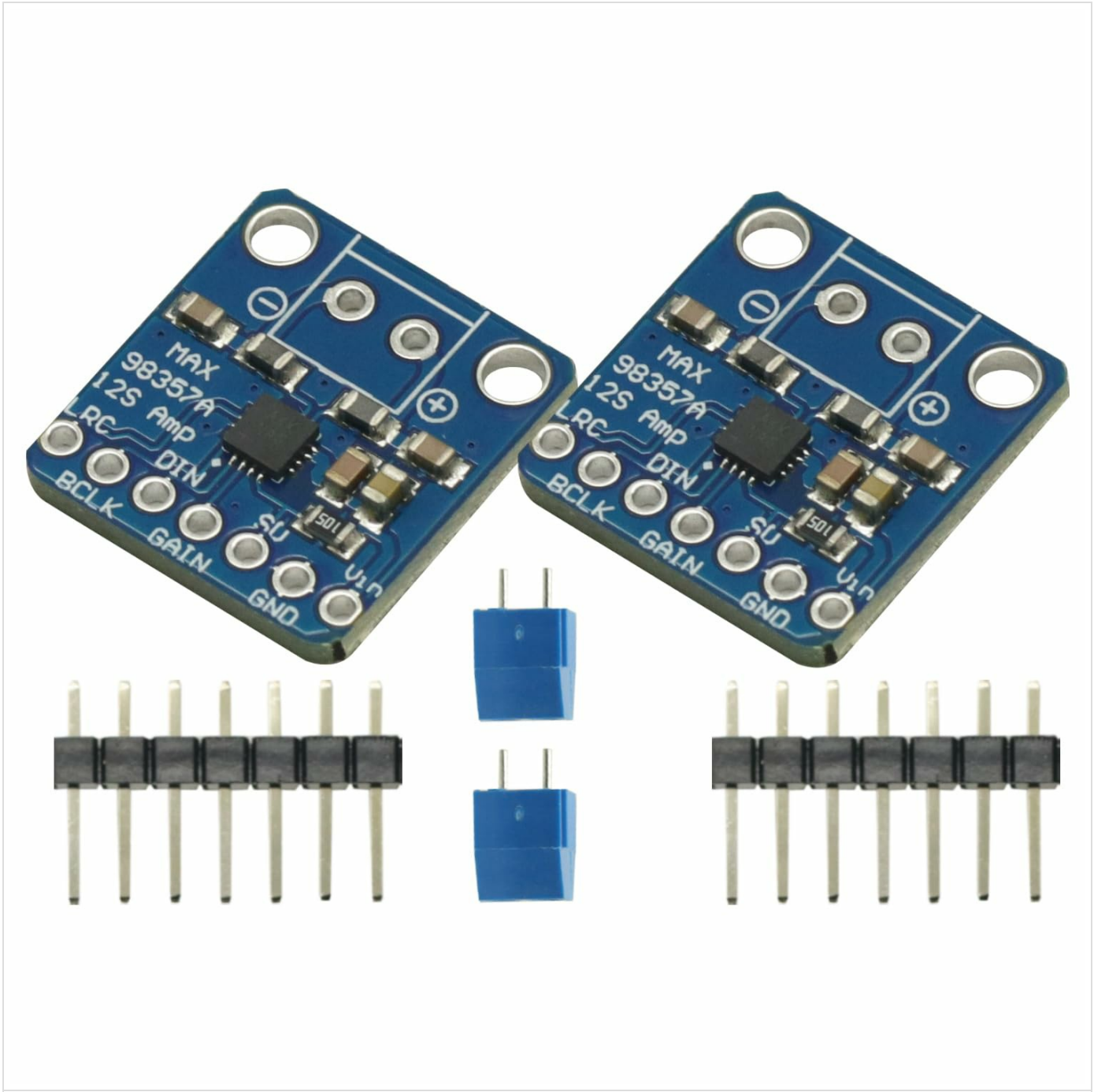

Figure 4.1: Two MAX98357A I2S amplifier modules, showing the top view with components and included pin headers and screw terminals.

The module comes with pin headers for digital connections and screw terminals for speaker output. Ensure proper soldering of the pin headers if they are not pre-attached.

4.2 Pinout Description

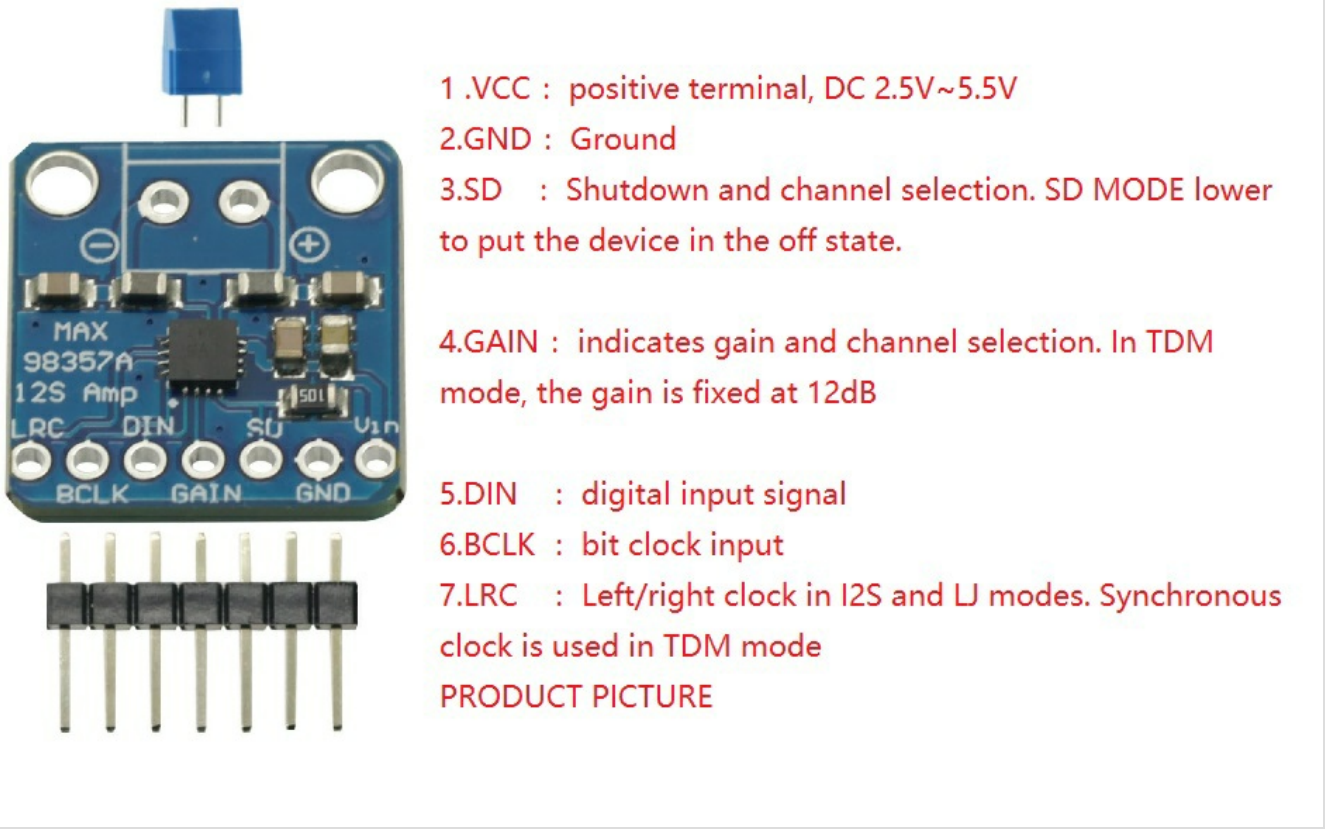

Figure 4.2: Pinout diagram of the MAX98357A module, illustrating the function of each pin for connection.

Refer to the following table for a detailed description of each pin:

Pin	Label	Description
1	VCC	Positive power supply terminal. Connect to DC 2.5V to 5.5V.
2	GND	Ground connection.
3	SD	Shutdown/Mode pin. Pulling this pin low puts the device in shutdown mode. This pin also controls channel selection.
4	GAIN	Gain selection pin. Connect to VCC, GND, or specific resistor values to set gain (3dB, 6dB, 9dB, 12dB, 15dB). Default is 9dB. In TDM mode, gain is fixed at 12dB.
5	DIN	Digital audio input signal (I2S Data In).
6	BCLK	Bit Clock input for I2S communication.
7	LRC	Left/Right Clock (Word Select) for I2S and LJ modes. Synchronous clock is used in TDM mode.

4.3 Wiring Instructions

1. **Power Connection:** Connect the VCC pin to your power supply (2.7V-5.5V DC) and GND to the system ground.
2. **I2S Audio Input:**
    - Connect DIN to the I2S Data Out pin of your microcontroller (e.g., Raspberry Pi, ESP32).
    - Connect BCLK to the I2S Bit Clock pin.
    - Connect LRC to the I2S Left/Right Clock (Word Select) pin.
3. **Speaker Output:** Connect your 4-8Ω speaker directly to the two speaker output terminals (labeled with '+' and '-' or simply the screw terminals). The outputs are "Bridge Tied" and should not be connected to ground or another

amplifier.

4. **Gain Setting (Optional):** The default gain is 9dB. To change the gain, manipulate the GAIN pin:
    - Connect GAIN to GND for 3dB.
    - Connect GAIN to VCC for 15dB.
    - Other gain settings (6dB, 12dB) can be achieved by connecting specific pull-up or pull-down resistors. Refer to the MAX98357 datasheet for exact resistor values.
5. **Shutdown/Mode Control (Optional):**
    - Pull the SD pin low to put the amplifier into shutdown mode, conserving power.
    - By default, the amplifier outputs an (L+R)/2 stereo mix into mono. By adding a resistor to the SD pin, you can configure it to output only the left or right channel. Refer to the MAX98357 datasheet for resistor configurations.

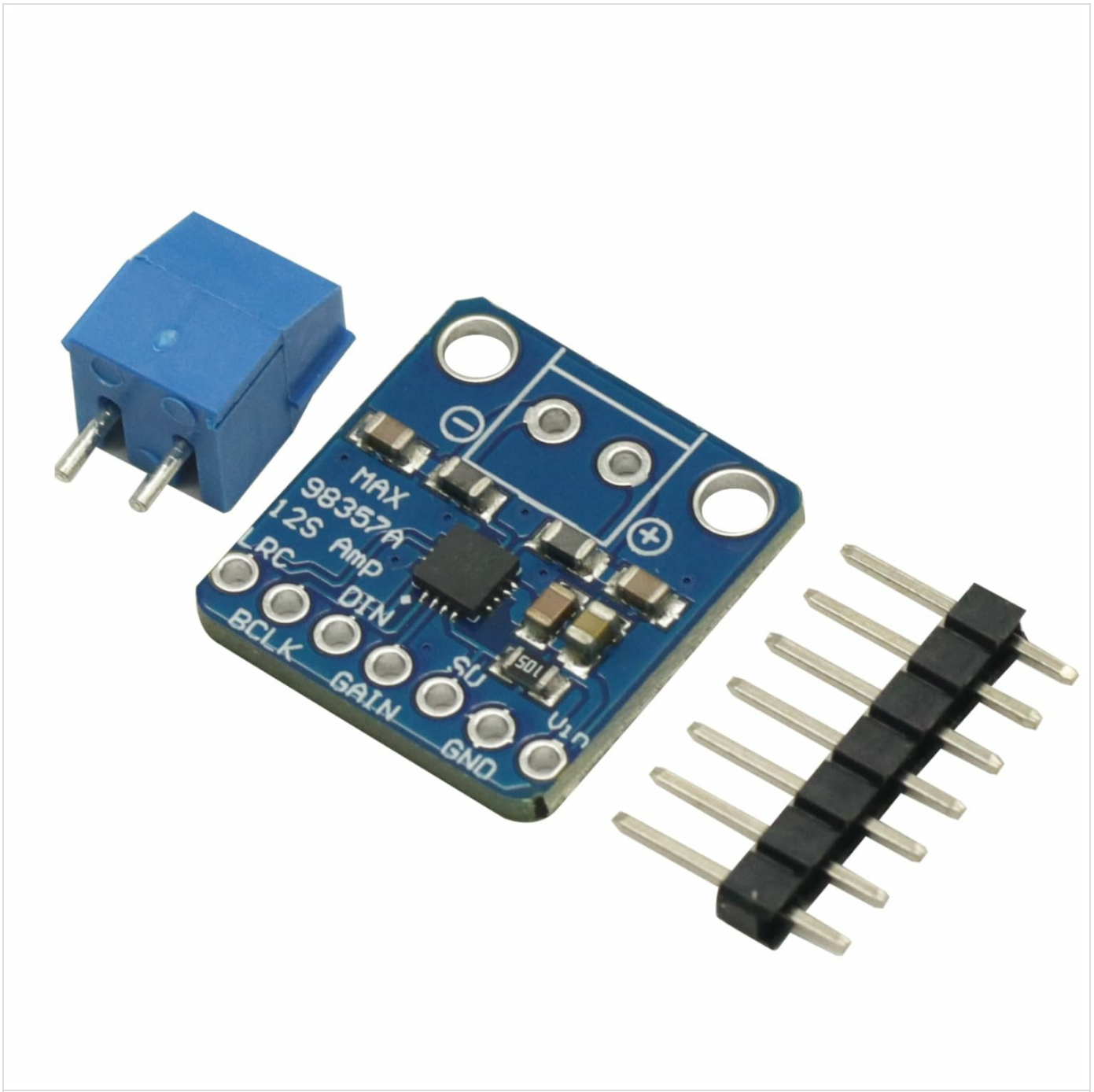

Figure 4.3: A single MAX98357A module, illustrating its compact size and connection points.

5. Operation

Once the MAX98357A module is correctly wired to your microcontroller and speaker, its operation is primarily controlled by the I2S audio data stream and the configuration of the GAIN and SD pins.

1. **Power On:** Apply power within the 2.7V-5.5V DC range to the VCC and GND pins. The amplifier will initialize.
2. **Audio Playback:** Begin sending I2S digital audio data from your microcontroller to the DIN, BCLK, and LRC pins. The module will automatically decode and amplify the audio, outputting it to the connected speaker.
3. **Volume Control:** The overall volume can be adjusted by changing the digital audio signal level from your microcontroller or by modifying the hardware gain setting via the GAIN pin as described in Section 4.3.
4. **Shutdown:** To conserve power, pull the SD pin low. This will put the amplifier into a low-power shutdown state. To resume operation, release the SD pin (allow it to float or pull it high, depending on your configuration).

For stereo output, two MAX98357A modules can be used, with one configured for the left channel and the other for the right channel via the SD pin, and both receiving the same BCLK and LRC signals but different DIN signals (left data for one, right data for the other).

6. Maintenance

The MAX98357A I2S Class D Amplifier Breakout Module is a robust electronic component designed for long-term operation with minimal maintenance.

- **Cleaning:** If necessary, gently clean the module with a dry, soft brush or compressed air to remove dust. Avoid using liquids or solvents.
- **Environmental Conditions:** Operate the module within typical indoor environmental conditions. Avoid exposure to extreme temperatures, high humidity, or corrosive environments.
- **Physical Inspection:** Periodically inspect connections for any signs of corrosion or loose wiring, especially for speaker terminals in high-vibration environments.

No user-serviceable parts are present on the module. Any repairs should be performed by qualified personnel.

7. Troubleshooting

Problem	Possible Cause	Solution
No audio output	◦ Incorrect wiring (power, I2S, or speaker). ◦ Insufficient power supply. ◦ SD pin is low (shutdown mode). ◦ No I2S data being sent or incorrect I2S configuration. ◦ Faulty speaker.	◦ Verify all connections according to Section 4.3. ◦ Ensure power supply is within 2.7V-5.5V and can provide sufficient current. ◦ Check the state of the SD pin; ensure it is not pulled low unless intended for shutdown. ◦ Confirm I2S data is being transmitted correctly from your microcontroller and that its I2S settings match the module's requirements. ◦ Test with a known working speaker.

Distorted or noisy audio	◦ Power supply noise. ◦ Speaker impedance mismatch. ◦ Gain setting too high. ◦ Poor quality I2S signal. ◦ Speaker output connected to ground or another amplifier.	◦ Use a stable, clean power supply. Add decoupling capacitors if necessary. ◦ Ensure speaker impedance is 4-8Ω. ◦ Adjust the GAIN pin to a lower setting. ◦ Verify the integrity of your I2S signal lines. ◦ Ensure speaker outputs are connected directly to the speaker only.
Low volume	◦ Gain setting too low. ◦ Low input audio signal level.	◦ Adjust the GAIN pin to a higher setting (up to 15dB). ◦ Increase the digital audio signal level from your microcontroller.

8. Warranty and Support

Information regarding product warranty and customer support for the GODIYMODULES MAX98357A I2S 3W Class D Amplifier Breakout Module was not provided in the available product data. Please refer to the retailer or manufacturer's website for specific warranty terms and support contact information.