RF Hardened, Ultralow Noise Microphone with Bottom Port and Analog Output

Data Sheet

ADMP510

FEATURES

- Tiny, 3.35 mm × 2.5 mm × 0.98 mm surface-mount package
- Noninverted signal output
- Omnidirectional response
- High SNR of 65 dBA
- Sensitivity of −38 dBV
- Sensitivity tolerance of ±2 dB
- Extended frequency response from 60 Hz to 20 kHz
- Enhanced radio frequency (RF) performance
- Acoustic overload point of 124 dB SPL
- Low current consumption of 180 µA
- Single-ended analog output
- High PSR of −78 dBV
- Compatible with Sn/Pb and Pb-free solder processes
- RoHS/WEEE compliant

APPLICATIONS

- Smartphones and feature phones
- Tablet computers
- Teleconferencing systems
- Digital still and video cameras
- Bluetooth headsets
- Notebook PCs
- Security and surveillance

FUNCTIONAL BLOCK DIAGRAM

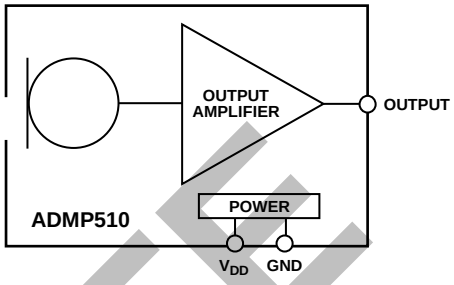

Figure 1.

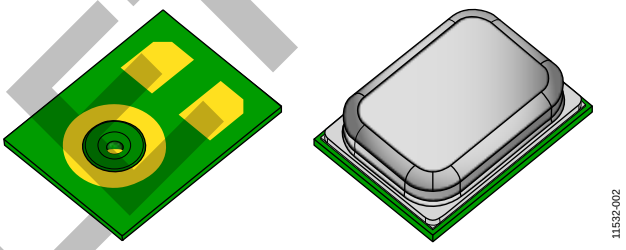

Figure 2. Isometric Views of the Microphone Package

GENERAL DESCRIPTION

The ADMP510[1] is an RF hardened, analog output, bottom-ported, omnidirectional MEMS microphone with high performance, ultralow noise, and low power. The ADMP510 consists of a MEMS microphone element, an impedance converter, and an output amplifier. The ADMP510 sensitivity specification makes it an excellent choice for both near-field and far-field applications. The ADMP510 is pin compatible with the ADMP504 microphone.

The ADMP510 has a very high signal-to-noise ratio (SNR) and extended wideband frequency response, resulting in natural sound with high intelligibility. Low current consumption enables long battery life for portable applications.

The ADMP510 is available in an ultraminiature 3.35 mm × 2.5 mm × 0.98 mm surface-mount package. It is reflow solder compatible with no sensitivity degradation.

[1] Protected by U.S. Patents 7,449,356; 7,825,484; 7,885,423; and 7,961,897. Other patents are pending.

Rev. A
Document Feedback

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TABLE OF CONTENTS

REVISION HISTORY

10/13—Rev. 0 to Rev. A

Change to Figure 5 6

7/13—Revision 0: Initial Version

SPECIFICATIONS

T_A = 25°C, V_{DD} = 1.8 V, unless otherwise noted. All minimum and maximum specifications are guaranteed. Typical specifications are not guaranteed.

Table 1.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
PERFORMANCE						
Directionality				Omni		
Output Polarity				Noninverted		
Sensitivity		1 kHz, 94 dB sound pressure level (SPL)	−40	−38	−36	dBV
Signal-to-Noise Ratio	SNR	20 Hz to 20 kHz, A-weighted		65		dBA
Equivalent Input Noise	EIN	20 Hz to 20 kHz, A-weighted		29		dBA SPL
Dynamic Range		Derived from EIN and maximum acoustic input		91		dB
Frequency Response[1]		Low frequency −3 dB point		60		Hz
		High frequency −3 dB point		>20		kHz
Total Harmonic Distortion	THD	105 dB SPL		0.2	1	%
Power Supply Rejection	PSR	217 Hz, 100 mV p-p square wave superimposed on V_{DD} = 1.8 V (A-weighted)		−78		dBV
Power Supply Rejection Ratio	PSRR	1 kHz, 100 mV p-p sine wave superimposed on V_{DD} = 1.8 V		−55		dB
Acoustic Overload Point		10% THD		124		dB SPL
POWER SUPPLY						
Supply Voltage	V_{DD}		1.5		3.63	V
Supply Current	I_S	V_{DD} = 1.8 V		180	220	µA
		V_{DD} = 3.3 V		210	250	µA
OUTPUT CHARACTERISTICS						
Output Impedance	Z_{OUT}			350		Ω
Output DC Offset				0.7		V
Maximum Output Voltage		124 dB SPL input		0.398		V rms
Noise Floor		20 Hz to 20 kHz, A-weighted, rms		−103		dBV

[1] See Figure 5 and Figure 6.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	−0.3 V to +3.63 V
Sound Pressure Level (SPL)	160 dB
Mechanical Shock	10,000 *g*
Vibration	Per MIL-STD-883 Method 2007, Test Condition B
Temperature Range	−40°C to +85°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

SOLDERING PROFILE

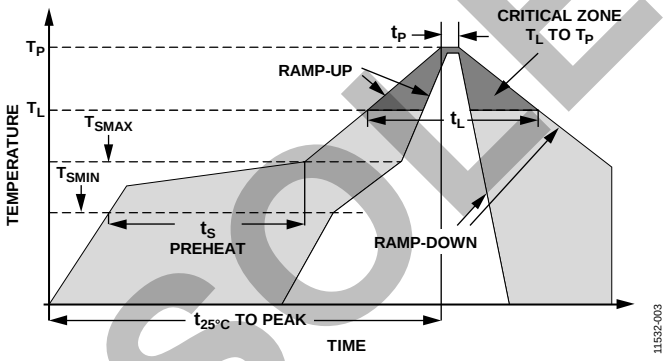

Figure 3. Recommended Soldering Profile Limits

Table 3. Recommended Soldering Profile Limits

Profile Feature	Sn63/Pb37	Pb-Free
Average Ramp Rate (T_L to T_P)	1.25°C/sec maximum	1.25°C/sec maximum
Preheat		
Minimum Temperature (T_{SMIN})	100°C	150°C
Maximum Temperature (T_{SMAX})	150°C	200°C
Time, T_{SMIN} to T_{SMAX} (t_S)	60 sec to 75 sec	60 sec to 75 sec
Ramp-Up Rate (T_{SMAX} to T_L)	1.25°C/sec	1.25°C/sec
Time Maintained Above Liquidous (t_L)	45 sec to 75 sec	~50 sec
Liquidous Temperature (T_L)	183°C	217°C
Peak Temperature (T_P)	215°C +3°C/−3°C	260°C +0°C/−5°C
Time Within 5°C of Actual Peak Temperature (t_P)	20 sec to 30 sec	20 sec to 30 sec
Ramp-Down Rate	3°C/sec maximum	3°C/sec maximum
Time 25°C ($t_{25°C}$) to Peak Temperature	5 minutes maximum	5 minutes maximum

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

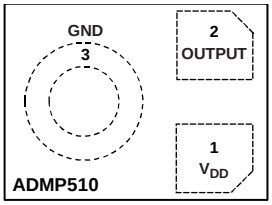

Figure 4. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	V_{DD}	Power Supply
2	OUTPUT	Analog Output Signal
3	GND	Ground

TYPICAL PERFORMANCE CHARACTERISTICS

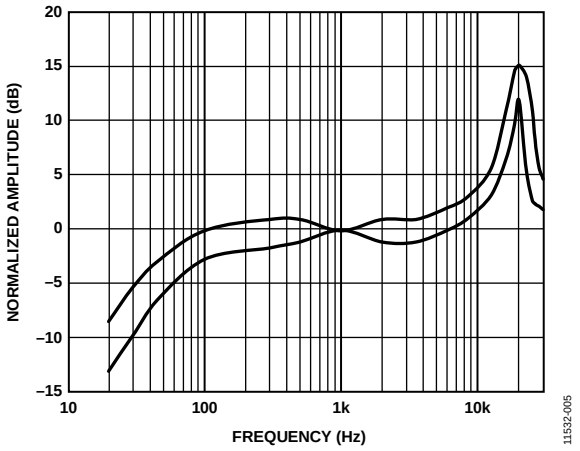

Figure 5. Frequency Response Mask

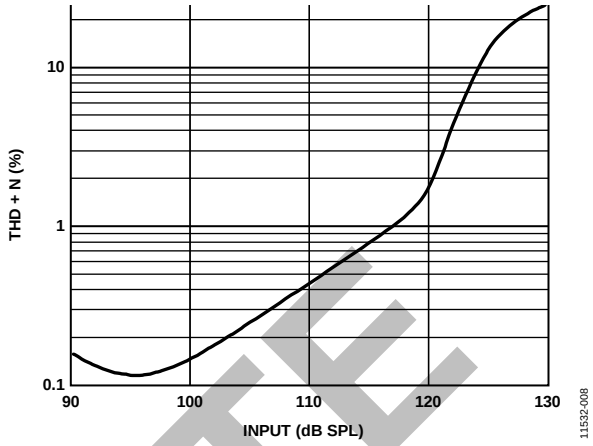

Figure 8. THD + N vs. Input SPL

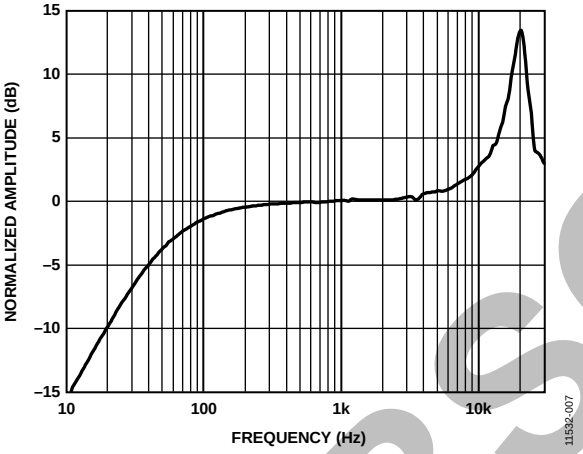

Figure 6. Typical Frequency Response (Measured)

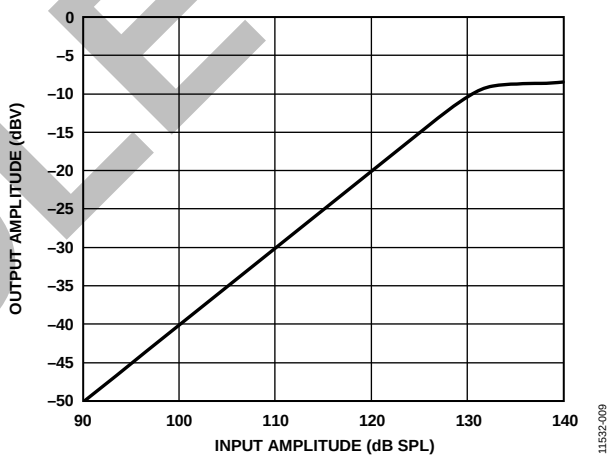

Figure 9. Linearity

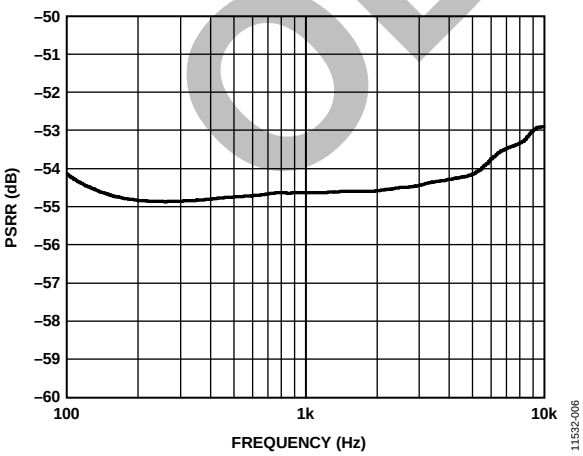

Figure 7. Typical Power Supply Rejection Ratio vs. Frequency

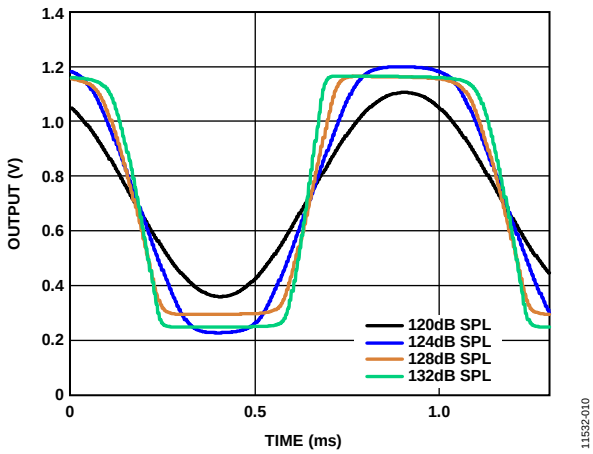

Figure 10. Clipping Characteristics

APPLICATIONS INFORMATION

INTERFACING WITH ANALOG DEVICES CODECS

The output of the ADMP510 can be connected to a dedicated codec microphone input (see Figure 11) or to a high input impedance gain stage (see Figure 12). A 0.1 µF ceramic capacitor placed close to the ADMP510 supply pin is used for testing and is recommended to adequately decouple the microphone from noise on the power supply. A dc blocking capacitor is required at the output of the microphone. This capacitor creates a high-pass filter with a corner frequency at

$$f_C = 1/(2\pi \times C \times R)$$

where R is the input impedance of the codec.

A minimum value of 2.2 µF is recommended in Figure 11 because the input impedance of the ADAU1761/ADAU1361 can be as low as 2 kΩ at its highest PGA gain setting, which results in a high-pass filter corner frequency at about 37 Hz.

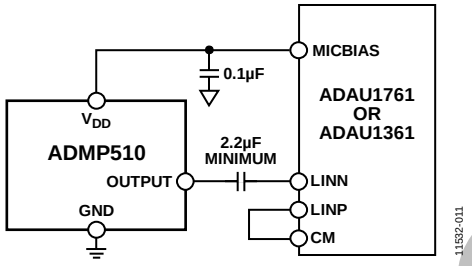

Figure 11. ADMP510 Connected to the ADAU1761 or ADAU1361 Codec

Figure 12 shows the ADMP510 connected to an ADA4075-2 op amp configured as a noninverting preamplifier.

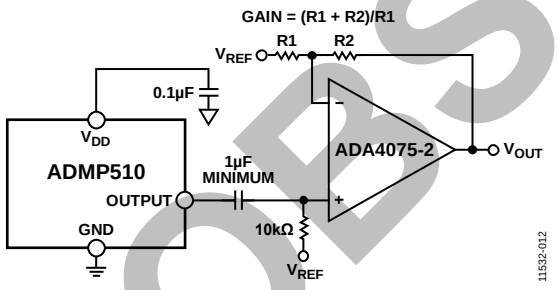

Figure 12. ADMP510 Connected to the ADA4075-2 Op Amp

SUPPORTING DOCUMENTS

For additional information, see the following documents.

Evaluation Board User Guide

UG-325, *Analog Output MEMS Microphone Flex Evaluation Board*

Circuit Note

CN-0207, *High Performance Analog MEMS Microphone's Simple Interface to SigmaDSP Audio Codec*

Application Notes

AN-1003, *Recommendations for Mounting and Connecting the Analog Devices, Inc., Bottom-Ported MEMS Microphones*

AN-1068, *Reflow Soldering of the MEMS Microphone*

AN-1112, *Microphone Specifications Explained*

AN-1124, *Recommendations for Sealing Analog Devices, Inc., Bottom-Port MEMS Microphones from Dust and Liquid Ingress*

AN-1140, *Microphone Array Beamforming*

AN-1165, *Op Amps for MEMS Microphone Preamp Circuits*

AN-1181, *Using a MEMS Microphone in a 2-Wire Microphone Circuit*

PCB DESIGN AND LAND PATTERN LAYOUT

Lay out the PCB land pattern for the ADMP510 at a 1:1 ratio to the solder pads on the microphone package (see Figure 13). Take care to avoid applying solder paste to the sound hole in the PCB. Figure 14 shows a suggested solder paste stencil pattern layout.

The diameter of the sound hole in the PCB should be larger than the diameter of the sound port of the microphone. A minimum diameter of 0.5 mm is recommended.

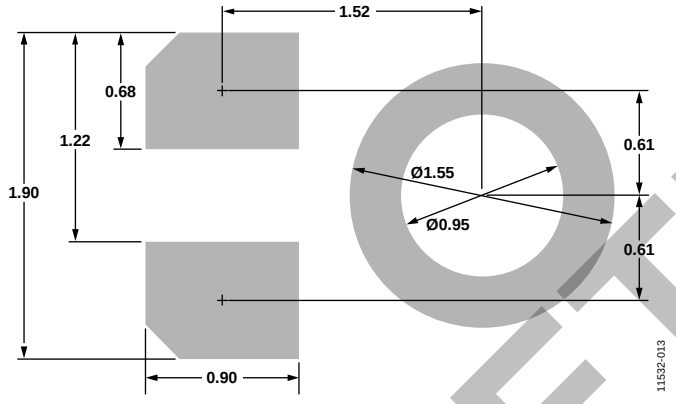

Figure 13. Suggested PCB Land Pattern Layout

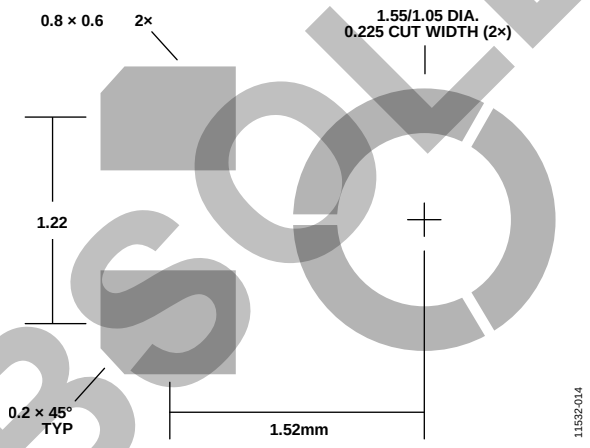

Figure 14. Suggested Solder Paste Stencil Pattern Layout

HANDLING INSTRUCTIONS

PICK-AND-PLACE EQUIPMENT

The MEMS microphone can be handled using standard pick-and-place and chip shooting equipment. Take care to avoid damage to the MEMS microphone structure as follows:

- Use a standard pickup tool to handle the microphone. Because the microphone hole is located on the bottom surface of the package (see Figure 2), the pickup tool can make contact with any part of the top lid surface.
- Do not pick up the microphone with a vacuum tool that makes contact with the bottom side of the microphone.
- Do not use excessive force to place the microphone on the PCB.

REFLOW SOLDER

For best results, the soldering profile should be in accordance with the recommendations of the manufacturer of the solder paste used to attach the MEMS microphone to the PCB. It is recommended that the solder reflow profile not exceed the limit conditions specified in Figure 3 and Table 3.

BOARD WASH

When washing the PCB, ensure that water does not make contact with the microphone port. Do not use blow-off procedures or ultrasonic cleaning.

OUTLINE DIMENSIONS

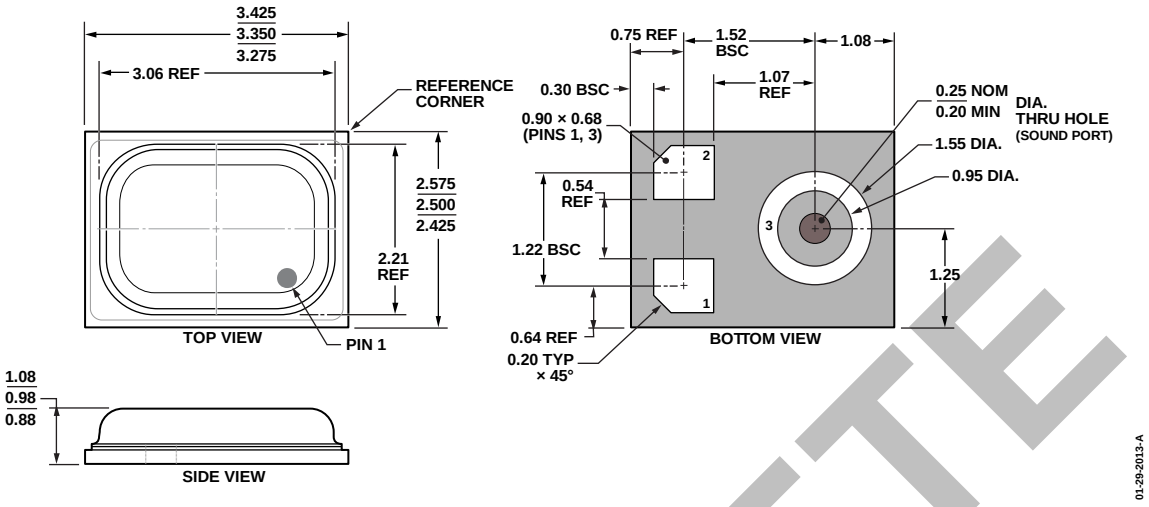

Figure 15. 3-Terminal Chip Array Small Outline No Lead Cavity [LGA_CAV]
3.35 mm × 2.5 mm Body
(CE-3-5)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option[2]	Ordering Quantity
ADMP510ACEZ-RL	−40°C to +85°C	3-Terminal LGA_CAV, 13"Tape and Reel	CE-3-5	10,000
ADMP510ACEZ-RL7	−40°C to +85°C	3-Terminal LGA_CAV, 7"Tape and Reel	CE-3-5	1,000
EVAL-ADMP510Z-FLEX		Flexible Evaluation Board		

[1] Z = RoHS Compliant Part.
[2] This package option is halide free.

NOTES

NOTES

D11532-0-10/13(A)