

Microphone Amplifier

Features

- Microsoft PC99 & PC2001 compliant
- Differential and Single-ended Microphone Inputs
- Internally frequency compensated for unity gain
- 20dB DC voltage gain (maximum)
- Buffered DC bias voltage for external microphone
- Very low supply current (< 3.0 mA)
- 20K Ω minimum input impedance
- Low Total Harmonic Distortion (0.03% at 1 KHz typical)
- Small MSOP package
- Lead-free version available

Applications

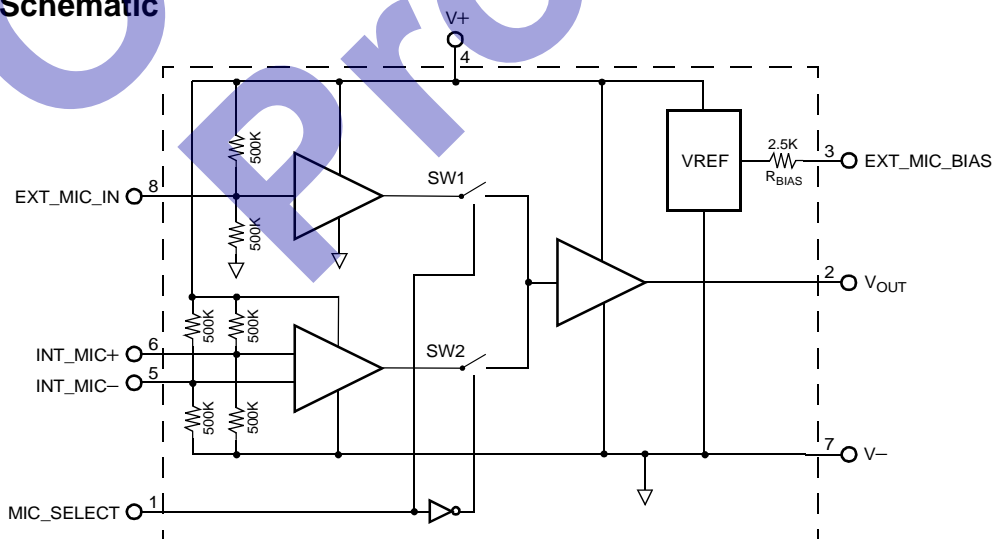
- Computers
- Mobile Phones
- PDA's
- MP3 Players
- Digital Cameras
- Video Tape Recorders

Product Description

The CMAMP110 Microphone Amplifier selects (via MIC_SELECT) between and amplifies Internal and External Microphone input signals. The device is designed to be compliant with Microsoft PC99 and PC2001 specifications. The CMAMP110 contains the equivalent of 7 operational amplifiers and 19 precision resistors, and is intended for use in PC audio applications. The Internal Microphone input is differential, but it can also be used single-ended by simply grounding one of the inputs through a capacitor. The External Microphone input is single-ended. A logic high level on the MIC_SELECT pin selects the external microphone input. Since the chip supplies the DC bias for the external microphone (EXT_MIC_BIAS), both dynamic and electret type microphones may be used. The output amplifier is unity gain stable and is capable of driving a resistive load in excess of 10K Ω .

The CMAMP110 Microphone Amplifier is housed in a space saving MSOP-8 package and is optionally available with lead-free finishing.

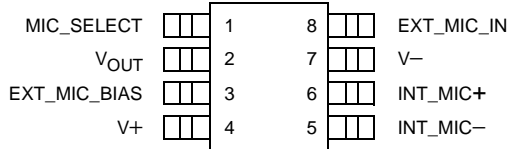
Electrical Schematic





PACKAGE / PINOUT DIAGRAM

Top View



Note: This drawing is not to scale.

8-pin MSOP

PIN DESCRIPTIONS

| PIN | NAME | DESCRIPTION |
|-----|------------------|---|
| 1 | MIC_SELECT | Microphone Select logic input control. The external microphone input is selected when the MIC_SELECT signal (pin 1) is at Logic "1" (> 3.5 volts), and the internal microphone inputs are selected by applying Logic "0" to the pin (< 1.5V). |
| 2 | V _{OUT} | Amplifier output pin. |
| 3 | EXT_MIC_BIAS | External microphone bias output. |
| 4 | V+ | Positive supply pin. |
| 5 | INT_MIC- | Inverting internal microphone differential input. Can be operated as a single-ended input by connecting a 0.22µF (or greater) capacitor between pin 6 and V-. |
| 6 | INT_MIC+ | Non-inverting internal microphone differential input. Can be operated as a single-ended input by connecting a 0.22µF (or greater) capacitor between pin 5 and V-. |
| 7 | V- | Negative supply pin. |
| 8 | EXT_MIC_IN | External microphone signal input. |

Ordering Information

PART NUMBERING INFORMATION

| Pins | Package | Standard Finish | | Lead-free Finish | |
|------|---------|-----------------------------------|--------------|-----------------------------------|--------------|
| | | Ordering Part Number ¹ | Part Marking | Ordering Part Number ¹ | Part Marking |
| 8 | MSOP-8 | CMAMP110M | A110 | CMAMP110MR | R110 |

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.



Specifications

| ABSOLUTE MAXIMUM RATINGS ^(SEE NOTE 1) | | |
|--|------------------------------|-------|
| PARAMETER | RATING | UNITS |
| ESD Protection (HBM, Note 2) | ±2000 | V |
| Differential Input Voltage | +/- Supply Voltage | V |
| Voltage at any Input/Output Pin | [(V-) - 0.3] to [(V+) + 0.3] | V |
| Storage Temperature Range | -40 to +150 | °C |
| Junction Operating Temperature | +125 | °C |
| Lead Soldering Temperature (10 seconds) | +260 | °C |
| Supply Voltage [(V+) - (V-)] | 7.5 | V |
| Current at Input Pin | 5 | mA |
| Current at Output Pin (Note 3) | 15 | mA |
| Current at Power Supply Pin | 15 | mA |

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. For guaranteed specifications and the test conditions, see the Electrical Operating Characteristics.

Note 2: Human Body Model, 1.5KΩ in series with 100pF (MIL-STD-883, Method 3015).

Note 3: Continuous short circuit operation at elevated ambient temperatures can result in exceeding the maximum allowed junction temperature of 150°C.

| STANDARD OPERATING CONDITIONS ^(SEE NOTE 1) | | |
|---|------------|-------|
| PARAMETER | RATING | UNITS |
| Maximum Power Dissipation | 200 | mW |
| Ambient Operating Temperature Range | 0 to +70 | °C |
| Supply Voltage | 3.3 to 5.5 | V |

Note 1: Operating conditions indicate ratings for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Operating Characteristics.

Specifications (cont'd)

| ELECTRICAL OPERATING CHARACTERISTICS(SEE NOTE 1) | | | | | | |
|---|-------------------------------------|--|------------|------------|------------|-----------------|
| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
| R_{IN} | Input Impedance | All Inputs | 20 | 40 | | $K\Omega$ |
| A_V | AC Voltage Gain | $V_{IN} = 100\text{ mV rms}$, $R_L = 10K\Omega$ | | 18 | 20 | dB |
| V_{MIC_IN} | Microphone Input Signal Level | | | | 110 | mV rms |
| V_{OUT} | Output Signal Level | $R_L = 10K\Omega$ | | | 1 | V rms |
| $V_{EXT_MIC_BIAS}$ | External Microphone Bias Voltage | No Load $I_{SOURCE} = 0.8\text{mA}$ | 2.0 | 4.6 2.6 | | V V |
| R_{BIAS} | Microphone Bias Resistor | | 2.0 | 2.5 | | $K\Omega$ |
| GBW | Gain Bandwidth Product | $R_L = 10K\Omega$ | | 2.0 | | MHz |
| SR | Slew Rate | $R_L = 10K\Omega$ | | 1.3 | | $V/\mu\text{s}$ |
| T.H.D. | Total Harmonic Distortion | $f = 1\text{KHz}$, $V_{IN} = 100\text{mV rms}$, $R_L = 10K\Omega$ | | 0.03 | | % |
| V_{IH} | MIC_SELECT Logic High Voltage | | 3.5 | | | V |
| V_{IL} | MIC_SELECT Logic Low Voltage | | | | 1.5 | V |
| t_{SW} | Microphone Switching Time | | | 2 | | μs |
| I_{SUP} | Supply Current | | | 1.5 | 3.0 | mA |
| I_{SC} | Output Short Circuit Current | $V_{OUT} = 0V$ | | 15 | | mA |
| R_L | Load Impedance Applied to V_{OUT} | | 10 | | | $K\Omega$ |

Note 1: All tests at 25°C, $V_+ = +5V$, $V_- = 0V$ unless otherwise noted.



Application Information

CMAMP110 Design Considerations

1. General Overview

The CMAMP110 is very straightforward to apply, but a few precautions are worth noting. It is recommended that the power supply pin, V+ (pin 4), be bypassed with a parallel combination of a 4.7μF and a 0.1μF capacitor to minimize noise and hum pickup. In addition, a 100Ω resistor may be inserted in series to form a RC filter between the the power supply feed and the V+ pin to the CMAMP110. Also, in that regard, lead dress for the microphone inputs on the PCB should either be shielded from or spaced from noise sources. The V- input on the device (pin 7) should be connected to the "clean analog ground".

2. Passive Component Selection

Selection of the microphone input coupling capacitors can be made using the following equation:

$$C = \frac{1}{2\pi \cdot R_{IN} \cdot f_{MIN}}$$

Where:

R_{IN} = Microphone Input Impedance (40KΩ typical)

f_{MIN} = Minimum Input Frequency

For example, for $f_{MIN} = 20\text{Hz}$, C should be selected for 0.22μF (or greater). The above equation may also be used to select the output coupling capacitor.

3. Microphone Bias

The CMAMP110 provides a nominal 4.6 volt stable reference and 2.5KΩ resistor to bias the microphone. For a bias current of 800μA, a 2.6 volt bias voltage results. However, if other voltages are desired, a resistor can be inserted in series with the microphone bias output (pin 3) whose value, R_{EXT} , can be chosen using the following equation:

$$R_{EXT} = \frac{V_{BMIC} - (I_B \cdot R_{BIAS}) - V_B}{I_B}$$

Where:

$V_{BMIC} = 4.6$ volts

$R_{BIAS} = 2.5$ KΩ

V_B = Desired Microphone Bias Voltage

I_B = Microphone Bias Current

For example, an electret condenser microphone that operates on 1.5V and 0.5mA, R_{EXT} should be selected to be 3.9KΩ (nearest standard value).

4. Microphone Select

The CMAMP110 has provisions for the selection of either the internal microphone and external microphone inputs. The external microphone is selected when the MIC_SELECT signal (pin 1) is at Logic "1" (> 3.5 volts), and the internal microphone is selected by applying Logic "0" to the pin (< 1.5V). The switching time is approximately 2 ms. For static applications where only one input is used, pin 1 can simply be strapped to either V- or V+.

5. Internal Microphone

The CMAMP110 provides for a differential (floating) input for the Internal microphone where INT_MIC+ (pin 6) is the "non-inverting" input and INT_MIC- (pin 5) is the "inverting" input. The CMAMP110 may be operated single-ended by connecting a 0.22μF (or greater) capacitor between either pin 5 or pin 6 and V-.

6. Start Up

Application of the CMAMP110 requires AC coupling the inputs and outputs (see Passive Component Selection). Both the Internal Microphone inputs (INT_MIC+ and INT_MIC-) and the External Microphone input (EXT_MIC_IN) are DC biased at half the supply voltage with an equivalent impedance of about 500KΩ. As a result, a start up transient will occur as the capacitors charge to half of the rail. The time for the amplifier inputs and outputs to settle is given by:

Application Information (cont'd)

$$t = RC_{IN} \cdot \ln\left(\frac{V_{SUP}}{V_{SUP}/2}\right) = 0.69RC_{IN}$$

For an input capacitance of 0.22μF, the turn on transient is about 76ms.

7. Evaluation Board

An evaluation board, part number CMAMP110-20EV, is available to facilitate easy and rapid checkout of the CMAMP110. The board is about the size of a business card, and samples of it may obtained by calling the factory at (800) 325-4966 or (408) 263-3214 or from your local representative. Ask the operator to be connected to Applications Engineering. Otherwise, you may request samples on our website at www.calmicro.com by navigating to the 'Contact Us' page, click on the 'Literature & Samples Request' button and request the above part number.

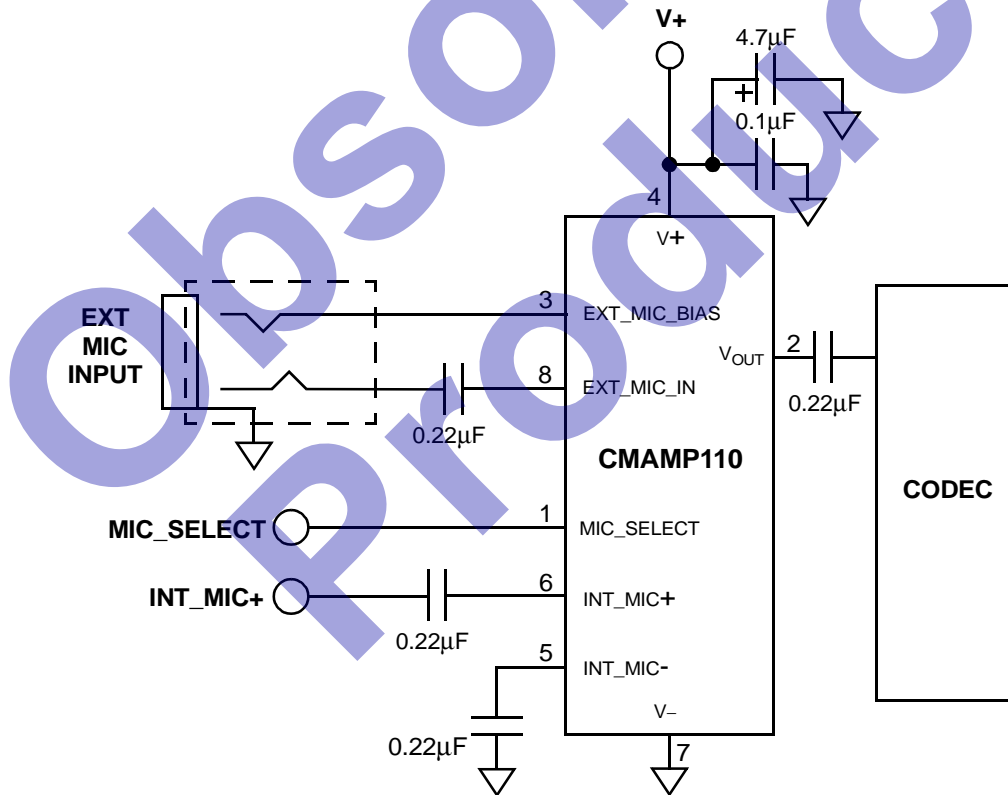


Figure 1. CMAMP110 Typical Application Circuit (single-ended input configuration shown for differential INT_MIC inputs).



Mechanical Details

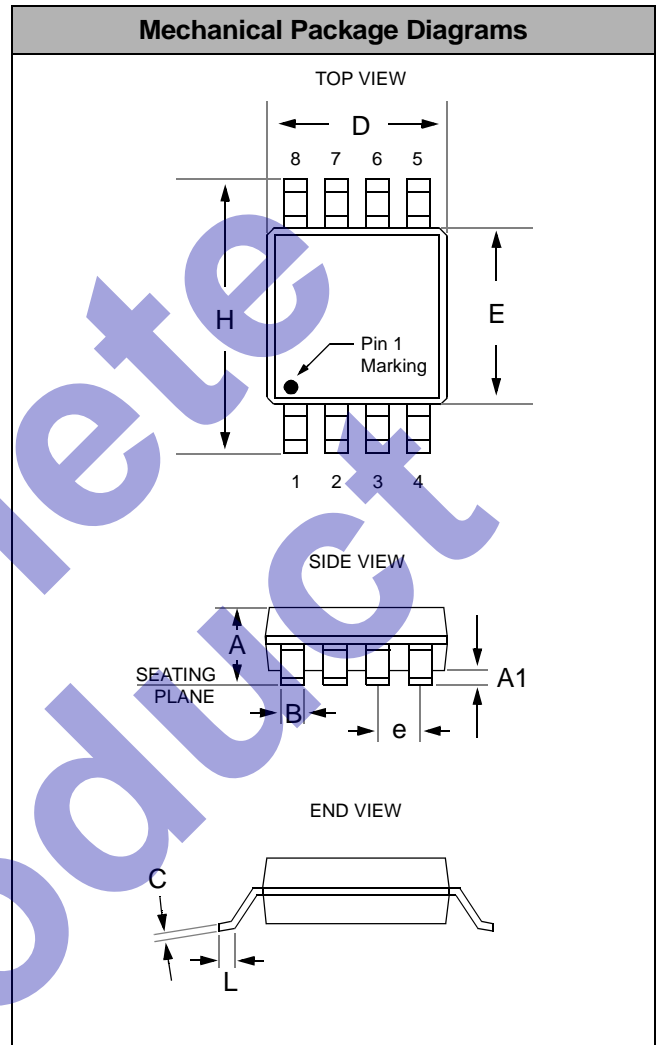
MSOP Mechanical Specifications:

CMAMP110 devices are packaged in 8-pin MSOP packages. Dimensions are presented below.

For complete information on the MSOP-8 package, see the California Micro Devices MSOP Package Information document.

| PACKAGE DIMENSIONS | | | | |
|-------------------------------|-------------|------|-------------|-------|
| Package | MSOP | | | |
| Pins | 8 | | | |
| Dimensions | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.87 | 1.17 | 0.034 | 0.046 |
| A1 | 0.05 | 0.25 | 0.002 | 0.010 |
| B | 0.30 (typ) | | 0.012 (typ) | |
| C | 0.18 | | 0.007 | |
| D | 2.90 | 3.10 | 0.114 | 0.122 |
| E | 2.90 | 3.10 | 0.114 | 0.122 |
| e | 0.65 BSC | | 0.025 BSC | |
| H | 4.78 | 4.98 | 0.188 | 0.196 |
| L | 0.52 | 0.54 | 0.017 | 0.025 |
| # per tube | 80 pieces* | | | |
| # per tape and reel | 4000 pieces | | | |
| Controlling dimension: inches | | | | |

* This is an approximate number which may vary.



Package Dimensions for MSOP-8