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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)
- 20KΩ minimum input impedance
- Low Total Harmonic Distortion (0.03% at 1 KHz typical)
- Small MSOP package
- Lead-free version available

Applications

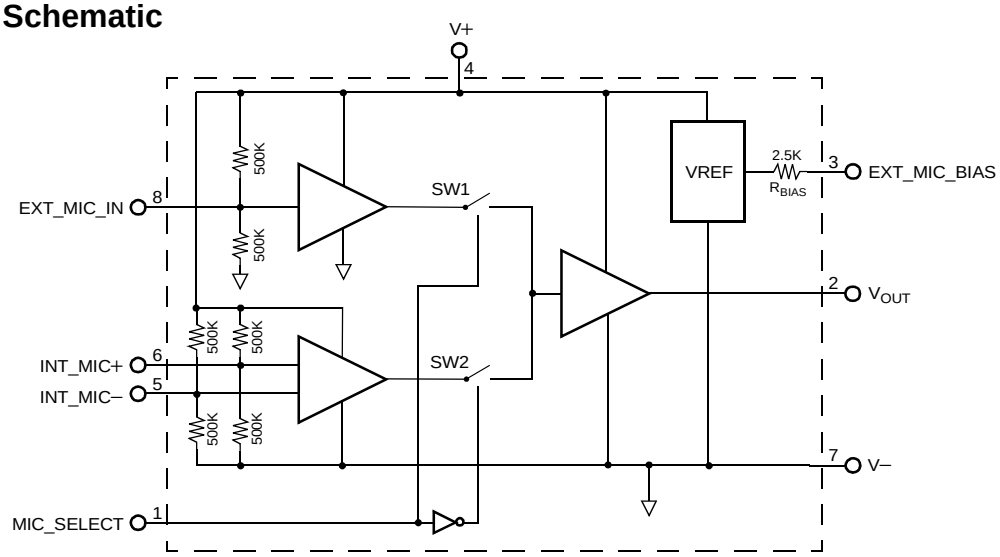
- Computers
- Mobile Phones
- PDA's
- MP3 Players
- Digital Cameras
- Video Tape Recorders

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 10KΩ.

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

Electrical Schematic



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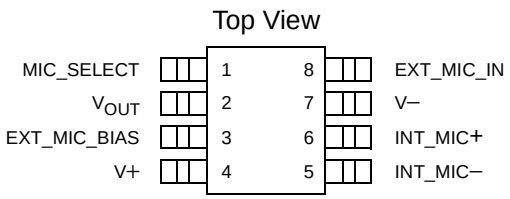
PACKAGE / PINOUT DIAGRAM



Note: This drawing is not to scale.

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.

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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.

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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.

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Specifications (cont'd)

ELECTRICAL OPERATING CHARACTERISTICS(SEE NOTE 1)						
SYMBOL	**PARAMETER**	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNITS**
R_{IN}	Input Impedance	All Inputs	20	40		KΩ
A_V	AC Voltage Gain	V_{IN} = 100 mV rms, R_L=10KΩ		18	20	dB
V_{MIC_IN}	Microphone Input Signal Level				110	mV rms
V_{OUT}	Output Signal Level	R_L=10KΩ			1	V rms
$V_{EXT_MIC_BIAS}$	External Microphone Bias Voltage	No Load I_{SOURCE} = 0.8mA	 2.0	4.6 2.6		V V
R_{BIAS}	Microphone Bias Resistor		2.0	2.5		KΩ
GBW	Gain Bandwidth Product	R_L=10KΩ		2.0		MHz
SR	Slew Rate	R_L=10KΩ		1.3		V/µs
T.H.D.	Total Harmonic Distortion	f = 1KHz, V_{IN} = 100mV rms, R_L=10KΩ		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			KΩ

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

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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} = 20Hz, 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:

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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.

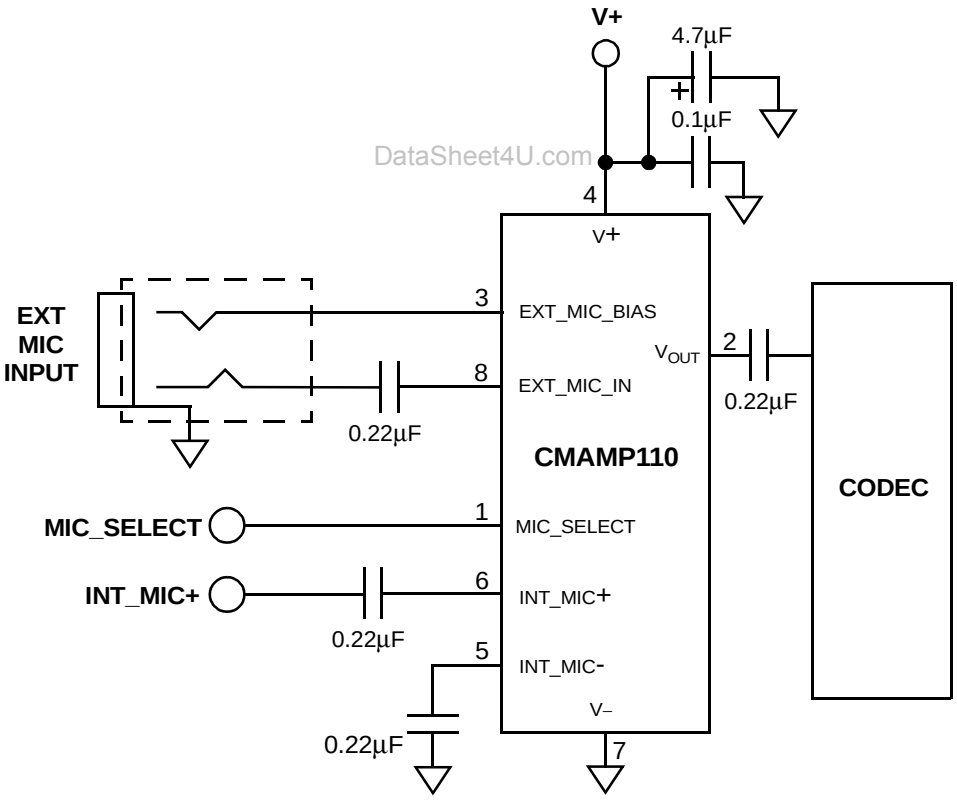

Figure 1. CMAMP110 Typical Application Circuit (single-ended input configuration shown for differential INT_MIC inputs).

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Mechanical Details

MSOP Mechanical Specifications:

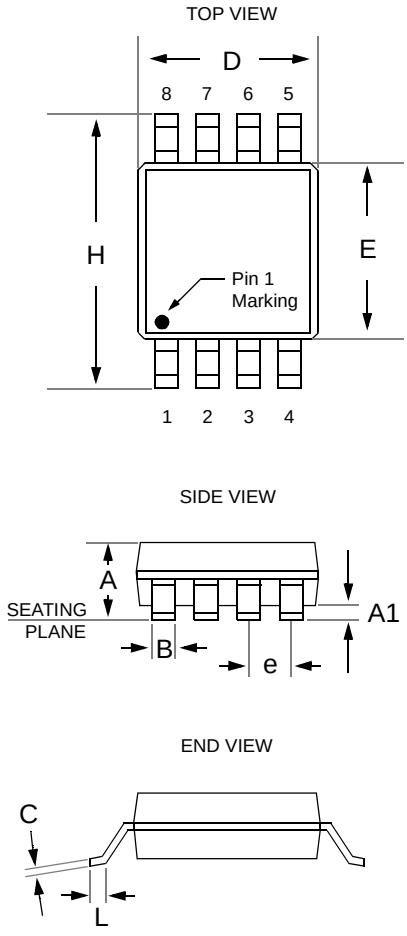
CMAMP110 devices are packaged in 8-pin MSOP packages. Dimensions are presented below.

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.

Mechanical Package Diagrams



Package Dimensions for MSOP-8

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