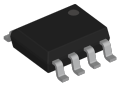
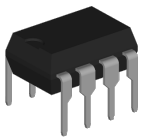
Low Power Audio Amplifier MC34119

FEATURES

- Wide Operating Supply Voltage Range (2.0V to 16V), Allows Telephone Line Powered Applications
- Low Quiescent Supply Current for Battery Powered Applications
- Chip Disable Input to Power Down the IC
- Low Power-Down Quiescent Current
- Drives a Wide Range of Speaker Loads (8.0Ω to 100Ω)
- Output Power Exceeds 250mW with 32Ω Speaker
- Low Total Harmonic Distortion
- Gain Adjustable from below 0dB to over 46dB for Voice Band
- Requires Few External Components



SOP-8



DIP-8

DESCRIPTION

The MC34119 is a low power audio amplifier integrated circuit intended (primarily) for telephone applications, such as in speakerphones. It provides differential speaker outputs to maximize output swing at low supply voltages (2.0V minimum). Coupling capacitors to the speaker are not required. Open loop gain is 80dB, and the closed loop gain is set with two external resistors. A Chip Disable pin permits powering down and/or muting the input signal. The MC34119 is available in standard 8 pin DIP and SOP package.

ORDERING INFORMATION

Device	Package
MC34119D	SOP-8
MC34119N	DIP-8

ABSOLUTE MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
Supply Voltage	V_{CC}	1.0	18	V
Maximum Output Current at VO1, VO2	I_{OUT}	-	±250	mA
Maximum Input Voltage (FC1, FC2, CD, VIN)	V_{IN}	−1.0	VCC + 1.0	V
Applied Output Voltage to VO1, VO2 when disabled	V_{VO}	−1.0	VCC + 1.0	V
Storage Temperature Range	T_{STG}	−65	150	°C

Note 1. Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Ratings* are not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING RATINGS (Note 2)

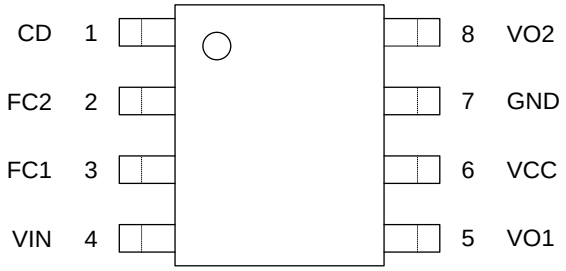
CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
Supply Voltage	V_{CC}	2.0	16	V
Load Impedance	R_L	8.0	100	Ω
Peak Load Current	I_L	-	200	mA
Differential Gain (5.0kHz Bandwidth)	AVD	0	46	dB
Voltage at CD (Pin 1)	VCD	0	V_{CC}	V
Operating Ambient Temperature Range	T_A	−10	70	°C

Note 2. The device is not guaranteed to function outside its operating ratings.

ORDERING INFORMATION

Package	Order No.	Description	Supplied As	Status
SOP-8	MC34119D	Low Power Audio Amplifier	Tape & Reel	Active
DIP-8	MC34119N	Low Power Audio Amplifier	Tube	Active

PIN CONFIGURATION

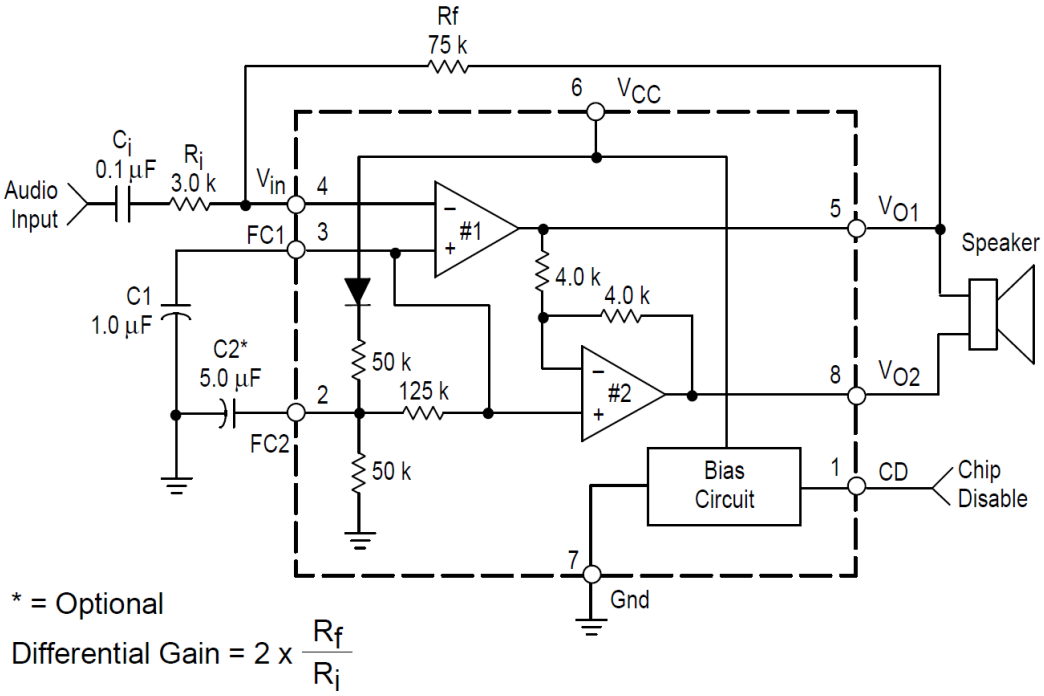


SOP-8 / DIP-8

PIN DESCRIPTION

Pin No.	Pin Name	Pin Function
1	CD	Chip Disable. Digital Input. A Logic level low (< 0.8V) sets normal operation. A logic level high (≥ 2.0V) sets power down mode. Input impedance is nominally 90kΩ.
2	FC2	A capacitor at this pin increases power supply rejection, and affects turn-on time. This pin can be left open if the capacitor at FC1 is sufficient.
3	FC1	Analog ground for the amplifiers. A 1.0μF capacitor at this pin (with 5.0μF capacitor at Pin 2) provides (typically) 52dB of power supply rejection. Turn-on time of the circuit is affected by the capacitor on this pin. This pin can be used as an alternate input.
4	VIN	Amplifier Input. The input capacitor and resistor set low frequency rolloff and input impedance. The feedback resistor is connected to this pin and VO1.
5	VO1	Amplifier Output #1. The DC level is ≈ (V_{CC} − 0.7V) / 2.
6	VCC	DC supply voltage (2.0V to 16V) is applied to this pin.
7	GND	Ground pin for the entire circuit.
8	VO2	Amplifier Output #2. This signal is equal in amplitude, but 180° out-of-phase with that at VO1. The DC level is ≈ (V_{CC} − 0.7V) / 2.

BLOCK DIAGRAM AND SIMPLIFIED APPLICATION CIRCUIT



ELECTRICAL CHARACTERISTICS

Specifications are for T_A = −10°C to 70°C, V_{CD} = 0V, unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
AMPLIFIERS (AC CHARACTERISTICS)					
AC Input Resistance (V_{IN})	r_i		22.5	-	MΩ
Open Loop Gain (Amplifier #1)	A_{VOL1}	f = 100Hz, V_{CC} = 6.0V, V_{FC2} = 2.65V	60	-	dB
Closed Loop Gain (Amplifier #2)	A_{V2}	f = 1.0kHz, V_{CC} = 6.0V, R_L = 32Ω	−0.35	0.35	dB
Gain Bandwidth Product	GBW		1.125	-	MHz
Output Power	P_{OUT3}	V_{CC} = 3.0V, R_L = 16Ω, THD ≤ 10%, V_{FC2} = 1.15V	55	-	mW
	P_{OUT12} (Note 3)	V_{CC} = 12V, R_L = 100Ω, THD ≤ 10%, V_{FC2} = 12V	400	-	mW
Total Harmonic Distortion	THD	V_{CC} = 6.0V, R_L = 32Ω, f = 1.0kHz, P_{OUT} = 125mW	-	5.0	%
Power Supply Rejection	PSRR	V_{CC} = 6.0V, ΔV_{CC} = 3.0V, C1 = ∞, C2 = 0.01μF	35	-	dB
Differential Muting	GMT	V_{CC} = 6.0V, f = 1.0kHz, V_{CD} = 2.0V	50	-	dB
AMPLIFIERS (DC CHARACTERISTICS)					
Output DC Level (VO1, VO2)	V_O	V_{CC} = 3.0V, R_L = 16Ω, R_f = 75kΩ	0.75	1.75	V
Output Level - High	V_{OH}	I_{OUT} = −75mA, V_{CC} = 2.0V	0.5	-	V
Output Level - Low	V_{OL}	I_{OUT} = 75mA, 2.0V ≤ V_{CC} ≤ 16V	-	0.55	V
Output DC Offset Voltage (VO1 − VO2)	ΔV_O	V_{CC} = 6.0V, R_L = 32Ω, R_f = 75kΩ	−200	200	mV
Input Bias Current @ VIN	I_{IB}	V_{CC} = 6.0V	-	1600	nA
Equivalent Resistance @ FC1	R_{FC1}	V_{CC} = 6.0V	100	220	kΩ
Equivalent Resistance @ FC2	R_{FC2}	V_{CC} = 6.0V	18	40	kΩ
CHIP DISABLE (Pin 1)					
Input Voltage - High Level	V_{IH}		2.0	-	V
Input Voltage - Low Level	V_{IL}		-	0.8	V
Input Resistance (Note 3)	R_{CD}	V_{CC} = V_{CD} = 16V	50	175	kΩ
POWER SUPPLY					
Power Supply Current	I_{CC1}	V_{CC} = 3.0V, R_L = ∞, V_{CD} = 0.8V	-	5.0	mA
	I_{CC2}	V_{CC} = 3.0V, R_L = ∞, V_{CD} = 2.0V	-	125	μA

Note 3. Specifications are for T_A = 25°C.
Note 4. All currents into a device pin are positive, those out of a pin are negative.

APPLICATION INFORMATION

The MC34119 is a low power audio amplifier capable of low voltage operation (V_{CC} = 2.0V minimum) such as that encountered in line-powered speakerphones. The circuit provides a differential output (VO1 − VO2) to the speaker to maximize the available voltage swing at low voltages. The differential gain is set by two external resistors. Pins FC1 and FC2 allow controlling the amount of power supply and noise rejection, as well as providing alternate inputs to the amplifiers. The CD pin permits powering down the IC for muting purposes and to conserve power.

Amplifiers

Referring to the block diagram, the internal configuration consists of two identical operational amplifiers. Amplifier #1 has an open loop gain of ≥80dB (at f ≤ 100Hz), and the closed loop gain is set by external resistor R_f and R_i. The amplifier is unity gain stable, and has a unity gain frequency of approximately 1.5MHz. In order to adequately cover the telephone voice band (300Hz to 3.4kHz), a maximum closed loop gain of 46 is recommended. Amplifier #2 is internally set to a gain of −1.0 (0dB).

The outputs of both amplifiers are capable of sourcing and sinking a peak current of 200mA. The outputs can typically swing to within ≈0.4V above ground, and to within ≈1.3V below V_{CC}, at the maximum current.

The output DC offset voltage (VO1 − VO2) is primarily a function of the feedback resistor (R_f), and secondarily due to the amplifiers' input offset voltages. The input offset voltages of the two amplifiers will generally be similar for a particular IC, and therefore nearly cancel each other at the outputs. Amplifier #1's bias current, however, flows out of VIN (Pin 4) and through R_f, forcing VO1 to shift negative by an amount equal to [$R_f \times I_{IB}$]. VO2 is shifted positive an equal amount. The output offset voltage, specified in the Electrical Characteristics, is measured with the feedback resistor shown in the Typical Application Circuit, and therefore takes into account the bias current as well as internal offset voltages of the amplifiers. The bias current is constant with respect to VCC.

FC1 and FC2

Power supply rejection is provided by the capacitors (C1 and C2 in the Typical Application Circuit) at FC1 and FC2. C2 is somewhat dominant at low frequencies, while C1 is dominant at high frequencies. The required values of C1 and C2 depend on the conditions of each application. A line powered speakerphone, for example, will require more filtering than a circuit powered by a well regulated power supply. The amount of rejection is a function of the capacitors, and the equivalent impedance looking into FC1 and FC2 (listed in the Electrical Characteristics as R_{FC1} and R_{FC2}).

In addition to providing filtering, C1 and C2 also affect the turn-on time of the circuit at power-up, since the two capacitors must charge up through the internal 50kΩ and 125kΩ resistors.

Chip Disable

The Chip Disable (Pin 1) can be used to power down the IC to conserve power, or for muting, or both. When at a Logic low (0V to 0.8V), the MC34119 is enabled for normal operation. When Pin 1 is at a Logic high (2.0V to VCC), the IC is disabled. If Pin1 is open, that is equivalent to a Logic low, although good design, practice dictates that an input should never be left open. Input impedance at Pin 1 is a nominal 90kΩ.

Muting, defined as the change in differential gain from normal operation to muted operation, is in excess of 70dB. The turn-off time of the audio output, from the application of the CD signal, is < 2.0µs, and turn-on time is 12ms to 15ms. Both times are independent of C1, C2, and VCC.

When the MC34119 is disabled, the voltages at FC1 and FC2 do not change as they are powered from VCC. The outputs, VO1 and VO2, change to a high impedance condition, removing the signal from the speaker. If signals from other sources are to be applied to the outputs (while disabled), they must be within the range of VCC and

ground.

Layout Considerations

Normally a snubber is not needed at the output of the MC34119, unlike many other audio amplifiers. However, the PC board layout, stray capacitances, and the manner in which the speaker wires are configured, may dictate otherwise. Generally, the speaker wires should be twisted tightly, and not more than a few inches in length.

TYPICAL OPERATING CHARACTERISTICS

T.B.D.

REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.