

LM386 - Low Voltage Audio Power Amplifier

Features

- Battery operation
- Minimum external parts
- Wide supply voltage range: 4V-12V or 5V-18V
- Low quiescent current drain: 4mA
- Voltage gains from 20 to 200
- Ground referenced input
- Self-centering output quiescent voltage
- Low distortion: 0.2% ($A_v = 20$, $V_s = 6V$, $R_L = 8\Omega$, $P_o = 125mW$, $f = 1kHz$)
- Available in 8 pin MSOP package

Typical Application

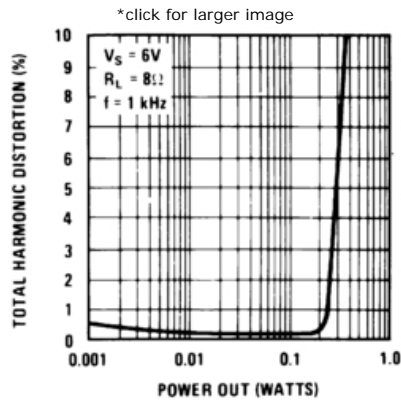
Parametric Table

Channels	1 Channels
User Supply	6 Volt
Supply Range	+4 - +18 V
Power@ 8Ohms, 1% THD	0.25 Watt
Power@ 8Ohms, 10% THD	0.325 Watt
PSRR	50 dB
THD	0.25 %
THD Conditions	$P_o=0.125W$ @ $V_s=6V$, $R_L=8\Omega$
Temperature Min	0 deg C
Temperature Max	70 deg C

Typical Performance

Applications

- AM-FM radio amplifiers
- Portable tape player amplifiers
- Intercoms
- TV sound systems
- Line drivers
- Ultrasonic drivers
- Small servo drivers
- Power converters





RoHS Compliance Information

LM386 Low Voltage Audio Power Amplifier
LM386 Low Voltage Audio Power Amplifier (Japanese)

Package Availability, Models

Part Number	Package						Factory Lead Time		Models	Std Pack Size	Package Marking Format	
	Type	Pins	Spec.	MSL Rating	Peak Reflow	RoHS Report	CAD Symbols	Weeks				Qty
LM386M-1	SOIC NARROW	8	STD	1	235	RoHS	N/A	Full production		N/A	rail of 95	NSZXTT LM386 M-1
			NOPB	1	260			6 weeks	2500			
LM386MX-1	SOIC NARROW	8	STD	1	235	RoHS	N/A	Full production		N/A	reel of 2500	NSZXTT LM386 M-1
			NOPB	1	260			6 weeks	15000			
LM386MMX-1	MINI SOIC	8	NOPB	1	260	RoHS	N/A	Full production		N/A	reel of 3500	ZXTT Z86
								6 weeks	7500			
LM386N-1	MDIP	8	STD	1	NA	RoHS	N/A	Full production		N/A	rail of 40	NSUZXYTT LM 386N-1
			NOPB	1	NA			6 weeks	2000			
LM386N-3	MDIP	8	STD	1	NA	RoHS	N/A	Full production		N/A	rail of 40	NSUZXYTT LM 386N-3
			NOPB	1	NA			6 weeks	2000			
LM386N-4	MDIP	8	STD	1	NA	RoHS	N/A	Full production		N/A	rail of 40	NSUZXYTT LM 386N-4
			NOPB	1	NA			6 weeks	2500			

Obsolete Versions

Obsolete Part	Alternate Part or Supplier	Source	Last Time Buy Date
LM386MM-1	MOTOROLA	LM386MM-1	12/01/2004

General Description

The LM386 is a power amplifier designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200.

The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 milliwatts when operating from a 6 volt supply, making the LM386 ideal for battery operation.

Reliability Metrics

Part Number	Process	EFR Reject	EFR Sample Size	PPM *	LTA Rejects	LTA Device Hours	FITS	MTTF (Hours)
LM386M-1	SLM	0	42786	0	0	3352500	2	951281028
LM386MMX-1	SLM	0	42786	0	0	3352500	2	951281028
LM386MX-1	SLM	0	42786	0	0	3352500	2	951281028
LM386N-1	SLM	0	42786	0	0	3352500	2	951281028
LM386N-3	SLM	0	42786	0	0	3352500	2	951281028
LM386N-4	SLM	0	42786	0	0	3352500	2	951281028

Note: The Early Failure Rates were calculated as point estimates. The Long Term Failure Rates were calculated at 60% confidence using the Arrhenius equation at 0.7eV activation energy and derating the assumed stress temperature of 150°C to an application temperature of 55°C.

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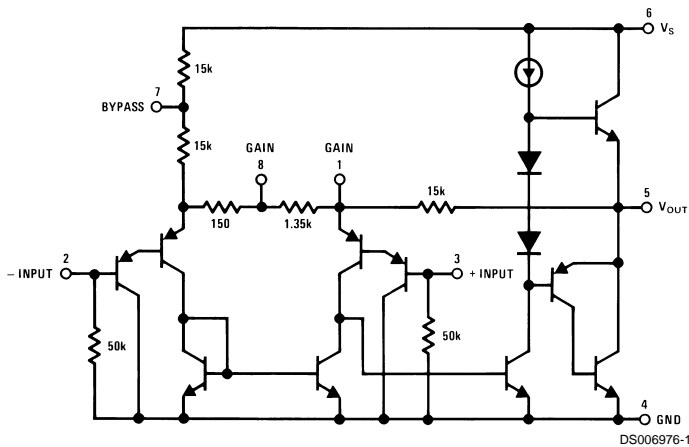
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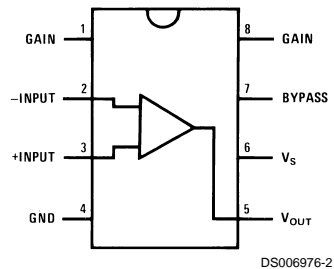
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Equivalent Schematic and Connection Diagrams



**Small Outline,
Molded Mini Small Outline,
and Dual-In-Line Packages**



Top View
Order Number LM386M-1,
LM386MM-1, LM386N-1,
LM386N-3 or LM386N-4
See NS Package Number
M08A, MUA08A or N08E

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (LM386N-1, -3, LM386M-1)	15V
Supply Voltage (LM386N-4)	22V
Package Dissipation (Note 3) (LM386N)	1.25W
(LM386M)	0.73W
(LM386MM-1)	0.595W
Input Voltage	±0.4V
Storage Temperature	-65°C to +150°C
Operating Temperature	0°C to +70°C
Junction Temperature	+150°C
Soldering Information	

Dual-In-Line Package

Soldering (10 sec) +260°C

Small Outline Package
(SOIC and MSOP)

Vapor Phase (60 sec) +215°C

Infrared (15 sec) +220°C

See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Thermal Resistance

 θ_{JC} (DIP) 37°C/W θ_{JA} (DIP) 107°C/W θ_{JC} (SO Package) 35°C/W θ_{JA} (SO Package) 172°C/W θ_{JA} (MSOP) 210°C/W θ_{JC} (MSOP) 56°C/W**Electrical Characteristics** (Notes 1, 2) $T_A = 25^\circ\text{C}$

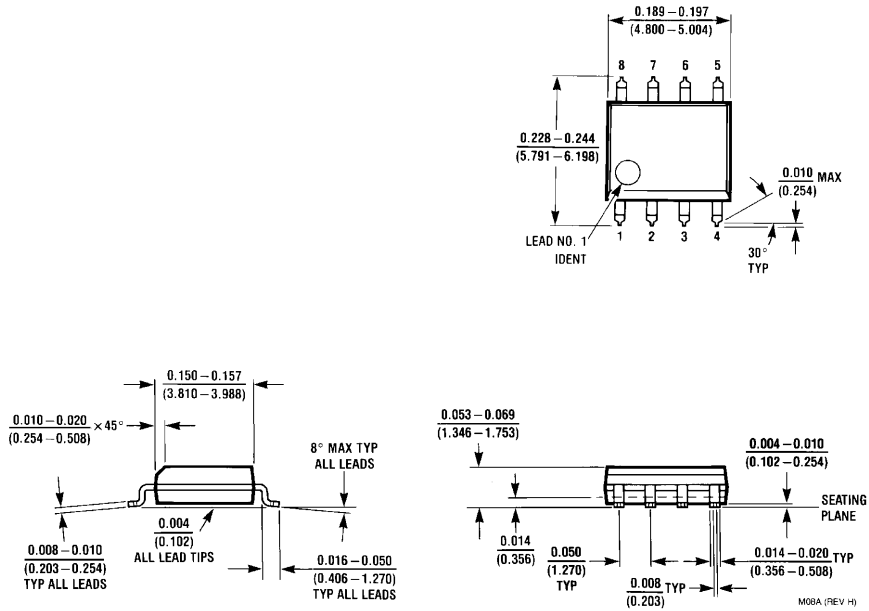
Parameter	Conditions	Min	Typ	Max	Units
Operating Supply Voltage (V_S) LM386N-1, -3, LM386M-1, LM386MM-1 LM386N-4		4 5		12 18	V
Quiescent Current (I_Q)	$V_S = 6V, V_{IN} = 0$		4	8	mA
Output Power (P_{OUT}) LM386N-1, LM386M-1, LM386MM-1 LM386N-3 LM386N-4	$V_S = 6V, R_L = 8\Omega, THD = 10\%$ $V_S = 9V, R_L = 8\Omega, THD = 10\%$ $V_S = 16V, R_L = 32\Omega, THD = 10\%$	250 500 700	325 700 1000		mW
Voltage Gain (A_V)	$V_S = 6V, f = 1\text{ kHz}$ 10 μF from Pin 1 to 8		26 46		dB
Bandwidth (BW)	$V_S = 6V, \text{ Pins 1 and 8 Open}$		300		kHz
Total Harmonic Distortion (THD)	$V_S = 6V, R_L = 8\Omega, P_{OUT} = 125\text{ mW}$ $f = 1\text{ kHz, Pins 1 and 8 Open}$		0.2		%
Power Supply Rejection Ratio (PSRR)	$V_S = 6V, f = 1\text{ kHz, } C_{BYPASS} = 10\ \mu\text{F}$ Pins 1 and 8 Open, Referred to Output		50		dB
Input Resistance (R_{IN})			50		k Ω
Input Bias Current (I_{BIAS})	$V_S = 6V, \text{ Pins 2 and 3 Open}$		250		nA

Note 1: All voltages are measured with respect to the ground pin, unless otherwise specified.

Note 2: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 3: For operation in ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and 1) a thermal resistance of 107°C/W junction to ambient for the dual-in-line package and 2) a thermal resistance of 170°C/W for the small outline package.

Physical Dimensions inches (millimeters) unless otherwise noted



SO Package (M)
Order Number LM386M-1
NS Package Number M08A