National Semiconductor Corporation

LM381/LM381A Low Noise Dual Preamplifier

General Description

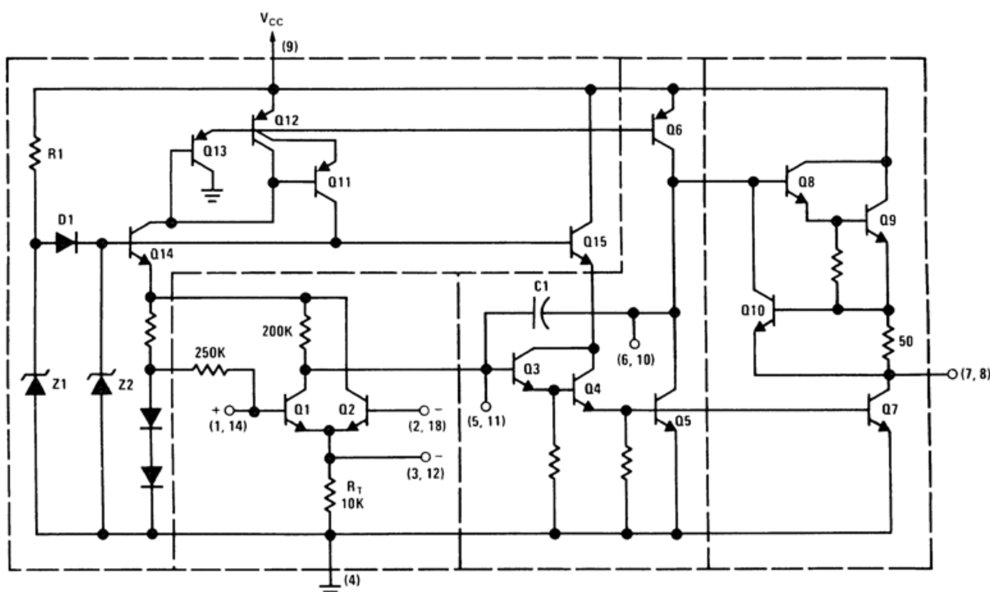
The LM381/LM381A is a dual preamplifier for the amplification of low level signals in applications requiring optimum noise performance. Each of the two amplifiers is completely independent, with individual internal power supply decoupler-regulator, providing 120 dB supply rejection and 60 dB channel separation. Other outstanding features include high gain (112 dB), large output voltage swing (V_{CC} − 2V) p-p, and wide power bandwidth (75 kHz, 20 Vp-p). The LM381/LM381A operates from a single supply across the wide range of 9V to 40V.

Either differential input or single ended input configurations may be selected. The amplifier is internally compensated with the provision for additional external compensation for narrow band applications. For additional information see AN-64, AN-104.

Features

- Low noise — 0.5 μV total input noise
- High gain — 112 dB open loop
- Single supply operation
- Wide supply range 9V–40V
- Power supply rejection — 120 dB
- Large output voltage swing (V_{CC} − 2V)p-p
- Wide bandwidth 15 MHz unity gain
- Power bandwidth 75 kHz, 20 Vp-p
- Internally compensated
- Short circuit protected

Schematic Diagram



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Absolute Maximum Ratings

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

Supply Voltage	+40V
Power Dissipation (Note 1)	1.56 W
Operating Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

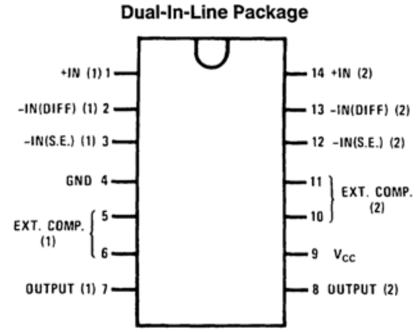
Electrical Characteristics $T_A = 25°C$, $V_{CC} = 14V$, unless otherwise stated.

Parameter	Conditions	Min	Typ	Max	Units
Voltage Gain	Open Loop (Differential Input), f = 100 Hz		160,000		V/V
	Open Loop (Single Ended), f = 100 Hz		320,000		V/V
Supply Current	V_{CC} 9V to 40V, $R_L = \infty$		10		mA
Input Resistance (Positive Input) (Negative Input)			100 200		kΩ kΩ
Input Current (Negative Input)			0.5		μA
Output Resistance	Open Loop		150		Ω
Output Current	Source		8		mA
	Sink		2		mA
Output Voltage Swing	Peak-to-Peak		$V_{CC} - 2$		V
Unity Gain Bandwidth			15		MHz
Power Bandwidth	20 V_{PP} (V_{CC} = 24V)		75		kHz
Maximum Input Voltage	Linear Operation			300	mVrms
Supply Rejection Ratio	f = 1 kHz		120		dB
Channel Separation	f = 1 kHz		60		dB
Total Harmonic Distortion	60 dB Gain, f = 1 kHz		0.1		%
Total Equivalent Input Noise LM381A LM381	$R_S = 60Ω$, 10–10,000 Hz (Single Ended Input, Flat Gain Circuit, $A_V = 1000$)		 0.5 0.5	 0.7 1.0	 μVrms μVrms

Note 1: For operation in ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 80°C/W junction to ambient.

Connection Diagram

Dual-In-Line Package



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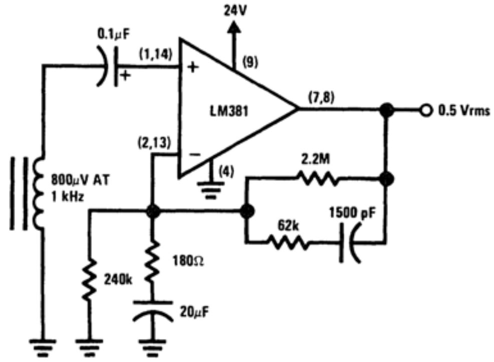
Top View

Order Number LM381N or LM381AN
See NS Package Number N14A

Typical Applications

Typical Tape Playback Amplifier



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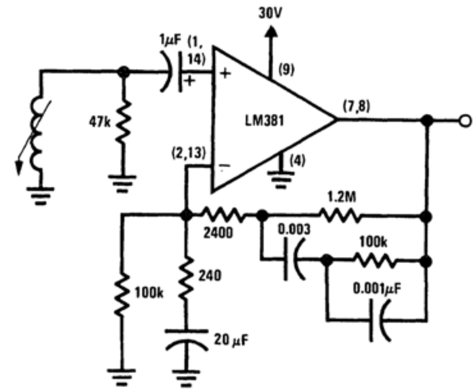
Typical Magnetic Phono Preamp



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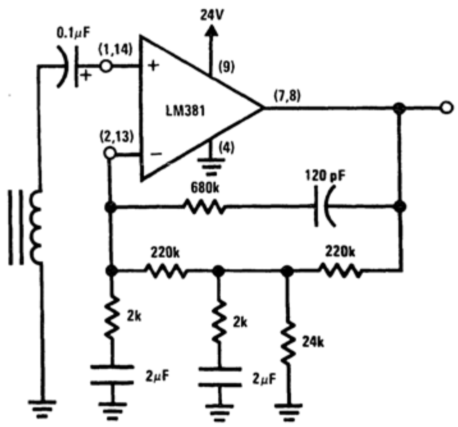
Two-Pole Fast Turn-On NAB Tape Preamp



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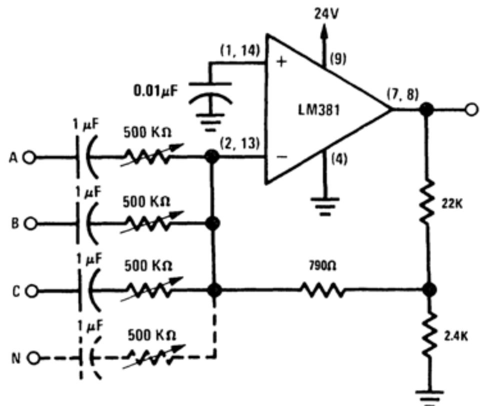
Audio Mixer



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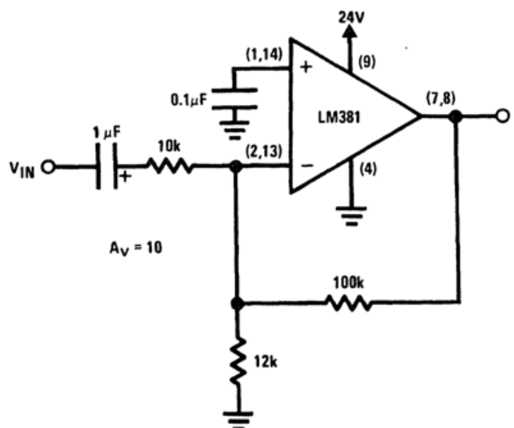
Ultra-Low Distortion Amplifier
(A_V = 10, THD < 0.05%, V_{OUT} = 3 V_{RMS})



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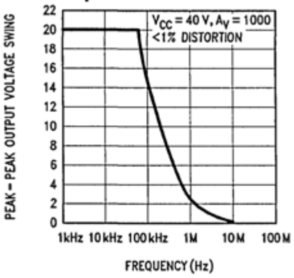
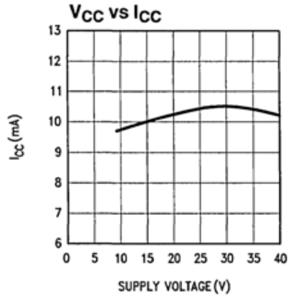
Typical Performance Characteristics

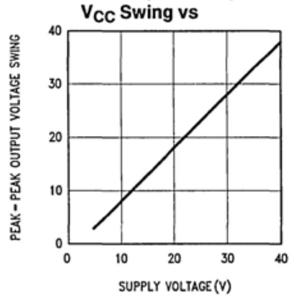
Large Signal Frequency Response



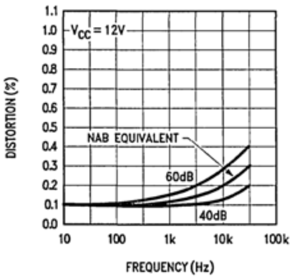
V_{CC} vs I_{CC}



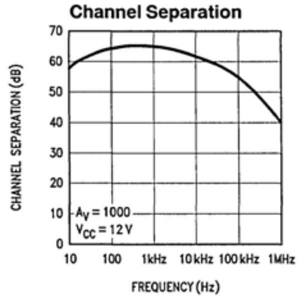
P-P Output Voltage V_{CC} Swing vs



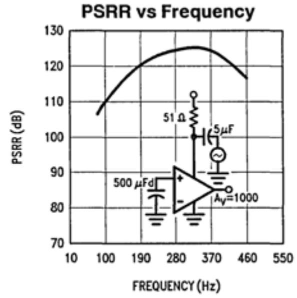
% Distortion



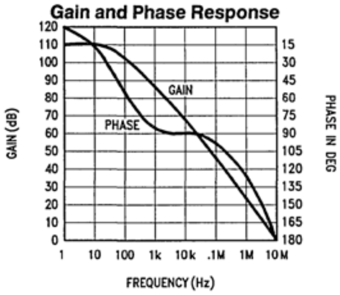
Channel Separation



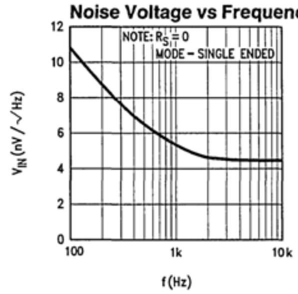
PSRR vs Frequency



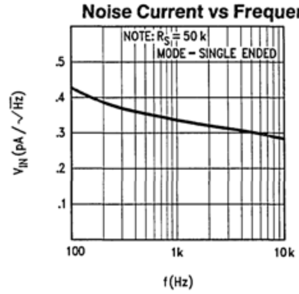
Gain and Phase Response



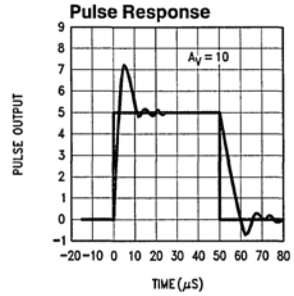
Noise Voltage vs Frequency



Noise Current vs Frequency



Pulse Response



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