National Semiconductor

LM387/LM387A Low Noise Dual Preamplifier

General Description

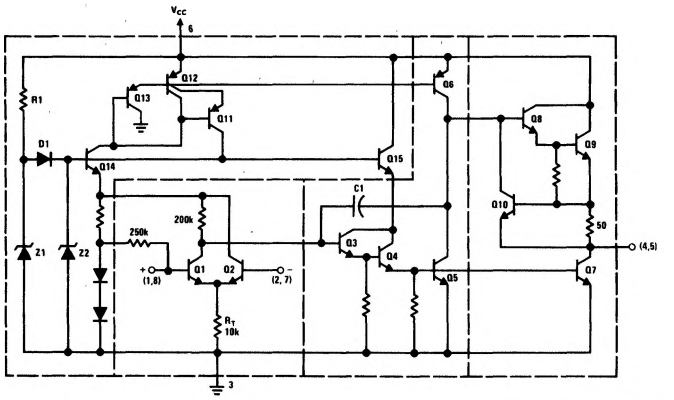
The LM387 is a dual preamplifier for the amplification of low level signals in applications requiring optimum noise performance. Each of the two amplifiers is completely independent, with an internal power supply decoupler-regulator, providing 110 dB supply rejection and 60 dB channel separation. Other outstanding features include high gain (104 dB), large output voltage swing (V_{CC} − 2V)p-p, and wide power bandwidth (75 kHz, 20 Vp-p). The LM387A is a selected version of the LM387 that has lower noise in a NAB tape circuit, and can operate on a larger supply voltage. The LM387 operates from a single supply across the wide range of 9V to 30V, the LM387A operates on a supply of 9V to 40V.

The amplifiers are internally compensated for gains greater than 10. The LN387, LM387A is available in an 8-lead dual-in-line package. The LM387, LM387A is biased like the LM381. See AN-64 and AN-104.

Features

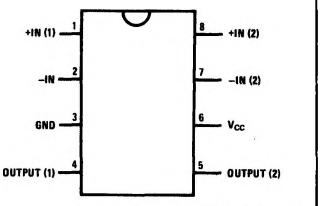
- Low noise — 1.0 μV total input noise
- High gain — 104 dB open loop
- Single supply operation
- Wide supply range LM387 — 9 to 30V
  LM387A — 9 to 40V
- Power supply rejection — 110 dB
- Large output voltage swing (V_{CC} − 2V)p-p
- Wide bandwidth 15 MHz unity gain
- Power bandwidth 75 kHz, 20 Vp-p
- Internally compensated
- Short circuit protected
- Performance similar to LM381

Schematic and Connection Diagrams



TL/H/7845–1

Dual-In-Line Package

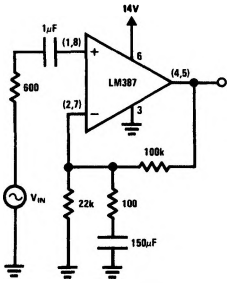


TL/H/7845–2

Top View

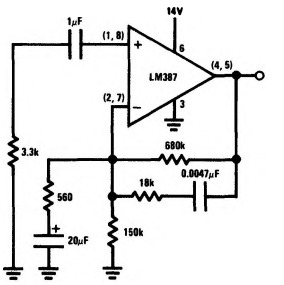
Order Number LM387N or LM387AN
See NS Package Number N08E

Typical Applications



TL/H/7845–3

FIGURE 1. Flat Gain Circuit (A_V = 1000)



TL/H/7845–4

FIGURE 2. NAB Tape Circuit

Absolute Maximum Ratings

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

Supply Voltage
- LM387 +30V
- LM387A +40V

Power Dissipation (Note 1)	1.5W
Operating Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

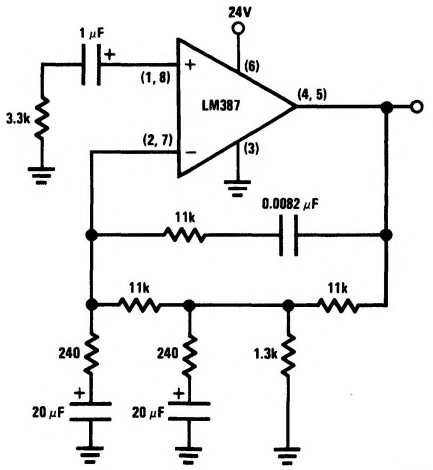
Electrical Characteristics T_A = 25°C, V_{CC} = 14V, unless otherwise stated

Parameter	Conditions	Min	Typ	Max	Units
Voltage Gain	Open Loop, f = 100 Hz		160,000		V/V
Supply Current	LM387, V_{CC} 9V–30V, R_L = ∞ LM387A, V_{CC} 9V–40V, R_L = ∞		10 10		mA mA
Input Resistance Positive Input Negative Input		50	 100 200		 kΩ kΩ
Input Current Negative Input			0.5	3.1	μA
Output Resistance	Open Loop		150		Ω
Output Current	Source Sink		8 2		mA mA
Output Voltage Swing	Peak-to-Peak		V_{CC}−2		V
Unity Gain Bandwidth			15		MHz
Large Signal Frequency Response	20 Vp-p (V_{CC} > 24V), THD ≤ 1%		75		kHz
Maximum Input Voltage	Linear Operation			300	mVrms
Supply Rejection Ratio Input Referred	f = 1 kHz		110		dB
Channel Separation	f = 1 kHz	40	60		dB
Total Harmonic Distortion	60 dB Gain, f = 1 kHz		0.1	0.5	%
Total Equivalent Input Noise (Flat Gain Cricuit)	10 Hz–10,000 Hz LM387 *Figure 1*		1.0	1.2	μVrms
Output Noise NAB Tape Playback Circuit Gain of 37 dB	Unweighted LM387A *Figure 2*		400	700	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.

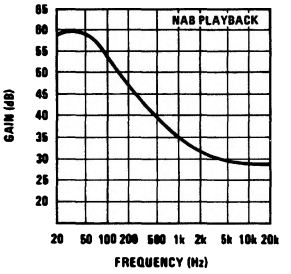
Typical Applications (Continued)

Two-Pole Fast Turn-ON NAB Tape Preamplifier



TL/H/7845–5

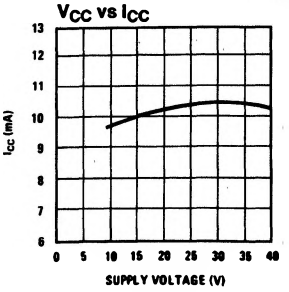
Frequency Response of NAB Circuit of Figure 2



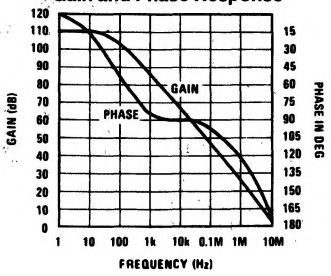
TL/H/7845–6

Typical Performance Characteristics

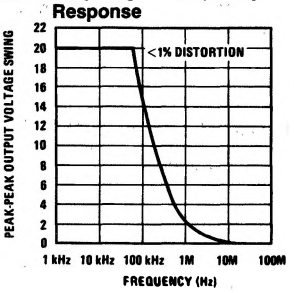
V_{CC} vs I_{CC}



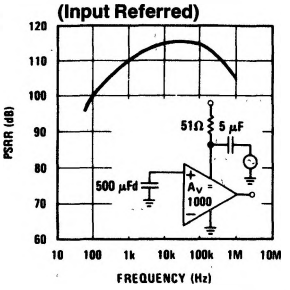
Gain and Phase Response



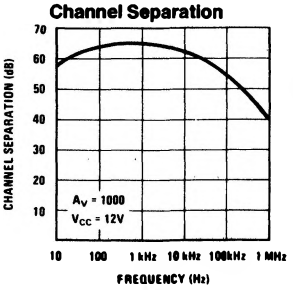
Large Signal Frequency Response



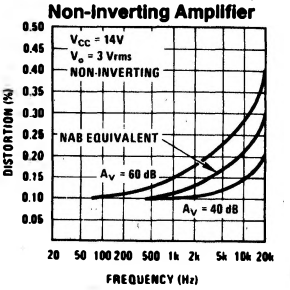
PSRR vs Frequency (Input Referred)



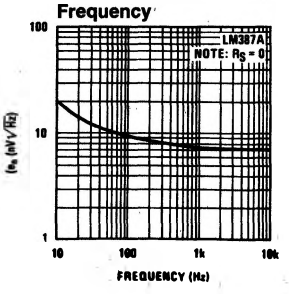
Channel Separation



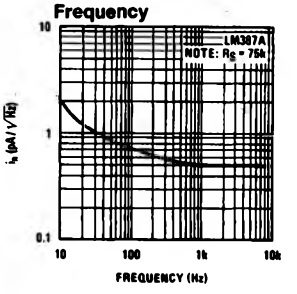
Distortion vs Frequency Non-Inverting Amplifier



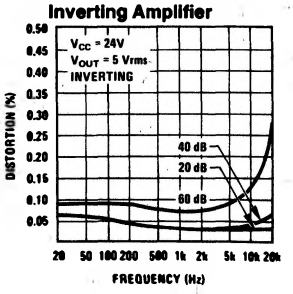
Noise Voltage vs Frequency



Noise Current vs Frequency



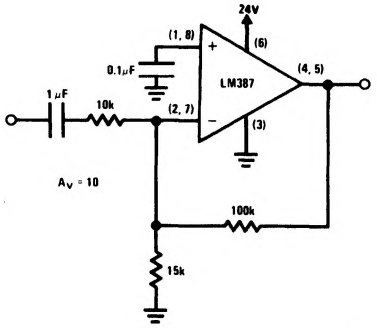
Distortion vs Frequency Inverting Amplifier



TL/H/7845–7

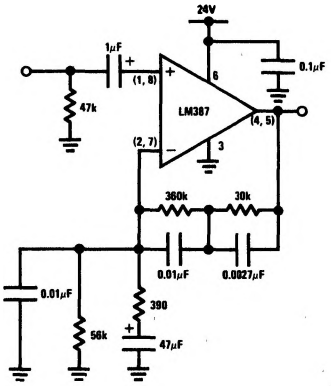
Typical Applications (Continued)

Inverting Amplifier Ultra-Low Distortion



TL/H/7845–8

Typical Magnetic Phono Preamplifier



TL/H/7845–9