# LM387,LM387A

***LM387 LM387A Low Noise Dual Preamplifier***




Literature Number: SNOSBT7A

National Semiconductor

March 1987

# LM387/LM387A Low Noise Dual Preamplifier

## General Description

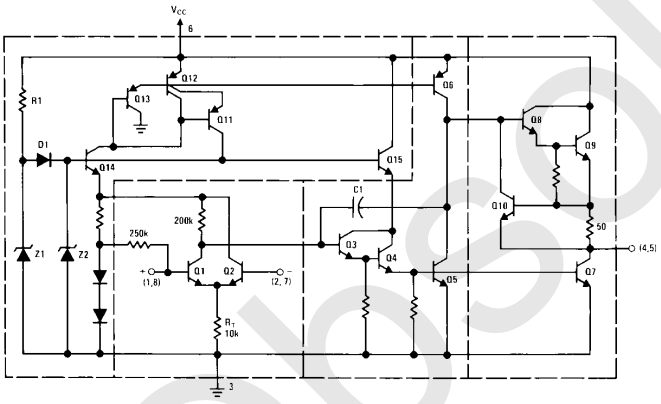
The LM387 is a dual preamplifier for the amplification of low level signals in applications requiring optimum noise performance. Each of the two amplifiers is completely independent, with an internal power supply decoupler-regulator, providing 110 dB supply rejection and 60 dB channel separation. Other 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

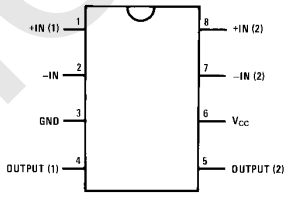
- Low noise 1.0 $\mu$V total input noise
- High gain 104 dB open loop
- Single supply operation
- Wide supply range LM387 9 to 30V
  LM387A 9 to 40V
- Power supply rejection 110 dB
- Large output voltage swing ($V_{CC}$ − 2V)p-p
- Wide bandwidth 15 MHz unity gain
- Power bandwidth 75 kHz, 20 Vp-p
- Internally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

## Schematic and Connection Diagrams




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**Dual-In-Line Package**

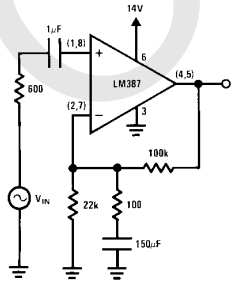



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**Top View**

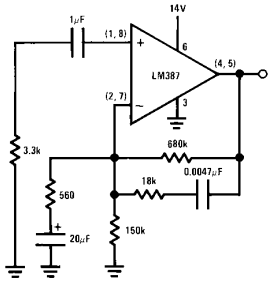
**Order Number LM387N or LM387AN**
**See NS Package Number N08E**

## Typical Applications




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**FIGURE 1. Flat Gain Circuit ($A_V$ = 1000)**




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**FIGURE 2. NAB Tape Circuit**

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RRD-B30M115/Printed in U. S. A.

## 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 |

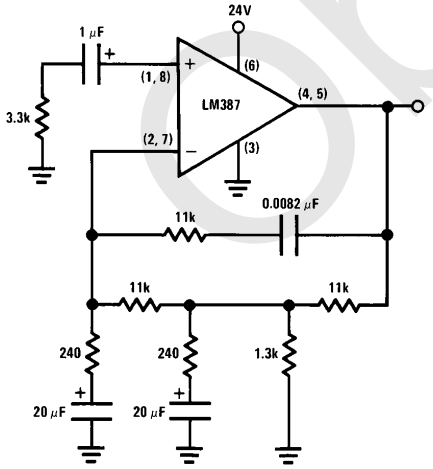
## Electrical Characteristics $T_A = 25°C$, $V_{CC} = 14V$, unless otherwise stated

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

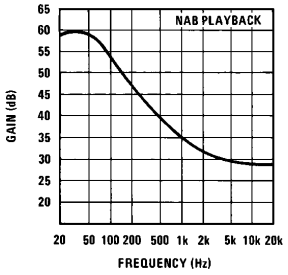
## Typical Applications (Continued)

**Two-Pole Fast Turn-ON NAB Tape Preamplifier**




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**Frequency Response of NAB Circuit of Figure 2**

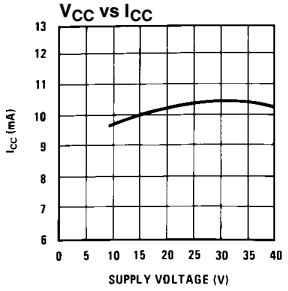



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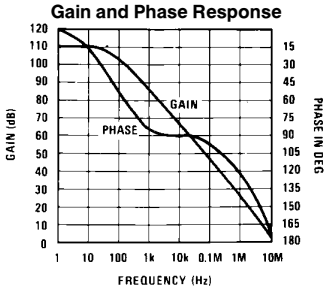
Obsolete

## Typical Performance Characteristics

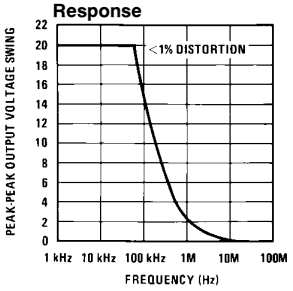
**$V_{CC}$ vs $I_{CC}$**



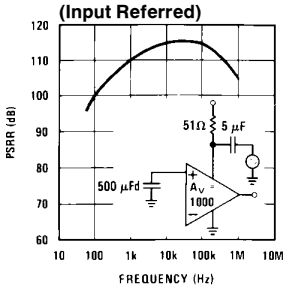

**Gain and Phase Response**



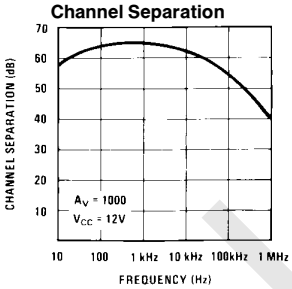

**Large Signal Frequency Response**



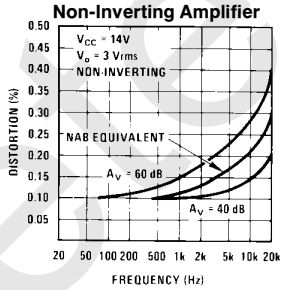

**PSRR vs Frequency (Input Referred)**



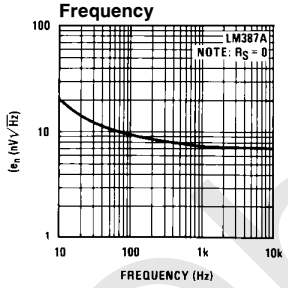

**Channel Separation**



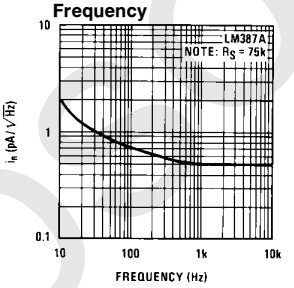

**Distortion vs Frequency Non-Inverting Amplifier**



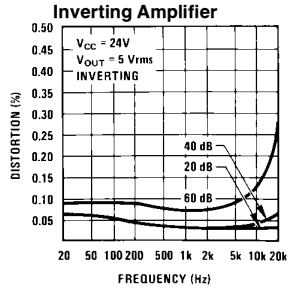

**Noise Voltage vs Frequency**




**Noise Current vs Frequency**




**Distortion vs Frequency Inverting Amplifier**

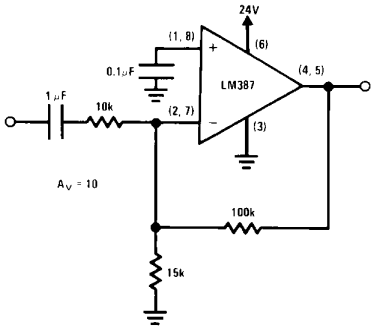



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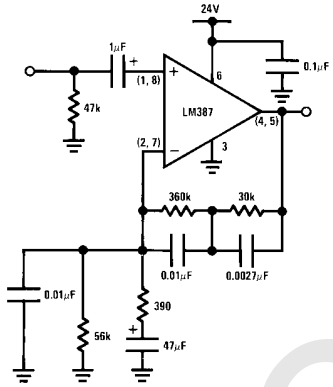
## Typical Applications (Continued)

**Inverting Amplifier Ultra-Low Distortion**




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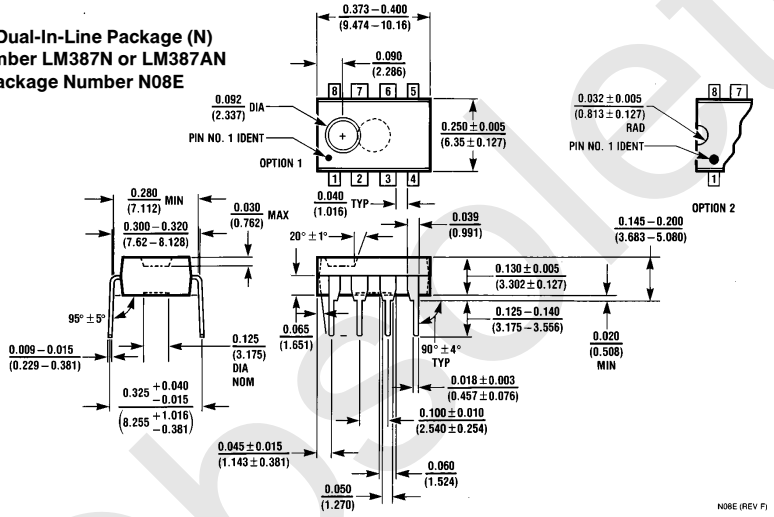
**Typical Magnetic Phono Preamplifier**




TL/H/7845–9

## Physical Dimensions inches (millimeters)

**Molded Dual-In-Line Package (N)**
**Order Number LM387N or LM387AN**
**NS Package Number N08E**




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Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

**National Semiconductor Europe**
Fax: (+49) 0-180-530 85 86
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