

LM837

Low Noise Quad Operational Amplifier

General Description

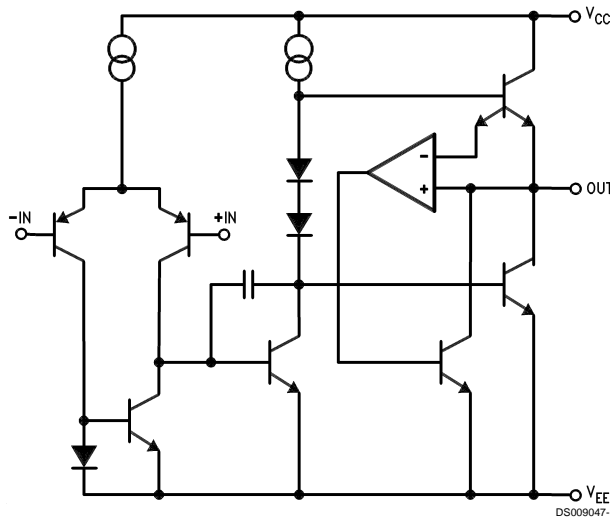
The LM837 is a quad operational amplifier designed for low noise, high speed and wide bandwidth performance. It has a new type of output stage which can drive a 600Ω load, making it ideal for almost all digital audio, graphic equalizer, preamplifiers, and professional audio applications. Its high performance characteristics also make it suitable for instrumentation applications where low noise is the key consideration.

The LM837 is internally compensated for unity gain operation. It is pin compatible with most other standard quad op amps and can therefore be used to upgrade existing systems with little or no change.

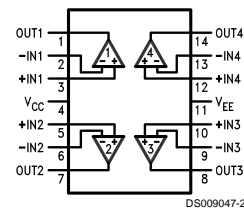
Features

- High slew rate 10 V/μs (typ); 8 V/μs (min)
- Wide gain bandwidth product 25 MHz (typ); 15 MHz (min)
- Power bandwidth 200 kHz (typ)
- High output current ±40 mA
- Excellent output drive performance >600Ω
- Low input noise voltage 4.5 nV/√Hz
- Low total harmonic distortion 0.0015%
- Low offset voltage 0.3 mV

Schematic and Connection Diagrams



Dual-In-Line Package



Top View
Order Number LM837M
or LM837N
See NS Package Number
M14A or N14A

Absolute Maximum Ratings (Note 1)

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

| | |
|---|----------------------------------|
| Supply Voltage, V_{CC}/V_{EE} | $\pm 18V$ |
| Differential Input Voltage, V_{ID} (Note 2) | $\pm 30V$ |
| Common Mode Input Voltage, V_{IC} (Note 2) | $\pm 15V$ |
| Power Dissipation, P_D (Note 3) | 1.2W (N) 830 mW (M) |
| Operating Temperature Range, T_{OPR} | $-40^{\circ}C$ to $+85^{\circ}C$ |

Storage Temperature Range, T_{STG} $-60^{\circ}C$ to $+150^{\circ}C$

| | |
|--------------------------|----------------|
| Soldering Information | |
| Dual-In-Line Package | |
| Soldering (10 seconds) | $260^{\circ}C$ |
| Small Outline Package | |
| Vapor Phase (60 seconds) | $215^{\circ}C$ |
| Infrared (15 seconds) | $220^{\circ}C$ |

ESD rating to be determined.

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

DC Electrical Characteristics

$T_A = 25^{\circ}C$, $V_S = \pm 15V$

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|----------|------------------------------|--|----------|------------|------|-------|
| V_{OS} | Input Offset Voltage | $R_S = 500\Omega$ | | 0.3 | 5 | mV |
| I_{OS} | Input Offset Current | | | 10 | 200 | nA |
| I_B | Input Bias Current | | | 500 | 1000 | nA |
| A_V | Large Signal Voltage Gain | $R_L = 2\text{ k}\Omega$, $V_{OUT} = \pm 10V$ | 90 | 110 | | dB |
| V_{OM} | Output Voltage Swing | $R_L = 2\text{ k}\Omega$ | ± 12 | ± 13.5 | | V |
| | | $R_L = 600\Omega$ | ± 10 | ± 12.5 | | V |
| V_{CM} | Common Mode Input Voltage | | ± 12 | ± 14.0 | | V |
| CMRR | Common Mode Rejection Ratio | $V_{IN} = \pm 12V$ | 80 | 100 | | dB |
| PSRR | Power Supply Rejection Ratio | $V_S = 15 \sim 5, -15 \sim -5$ | 80 | 100 | | dB |
| I_S | Power Supply Current | $R_L = \infty$, Four Amps | | 10 | 15 | mA |

AC Electrical Characteristics

$T_A = 25^{\circ}C$, $V_S = \pm 15V$

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|------------------------|--|-----|-----|-----|------------|
| SR | Slew Rate | $R_L = 600\Omega$ | 8 | 10 | | V/ μs |
| GBW | Gain Bandwidth Product | $f = 100\text{ kHz}$, $R_L = 600\Omega$ | 15 | 25 | | MHz |

Design Electrical Characteristics

$T_A = 25^{\circ}C$, $V_S = \pm 15V$ (Note 4)

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------------------------|------------------------------------|---|-----|--------|-----|-------------------|
| PBW | Power Bandwidth | $V_O = 25\text{ V}_{P-P}$, $R_L = 600\Omega$, THD < 1% | | 200 | | kHz |
| e_{n1} | Equivalent Input Noise Voltage | JIS A, $R_S = 100\Omega$ | | 0.5 | | μV |
| e_{n2} | Equivalent Input Noise Voltage | $f = 1\text{ kHz}$ | | 4.5 | | nV/\sqrt{Hz} |
| i_n | Equivalent Input Noise Current | $f = 1\text{ kHz}$ | | 0.7 | | pA/\sqrt{Hz} |
| THD | Total Harmonic Distortion | $A_V = 1$, $V_{OUT} = 3\text{ V}_{rms}$, $f = 20 \sim 20\text{ kHz}$, $R_L = 600\Omega$ | | 0.0015 | | % |
| f_U | Zero Cross Frequency | Open Loop | | 12 | | MHz |
| ϕ_m | Phase Margin | Open Loop | | 45 | | deg |
| | Input-Referred Crosstalk | $f = 20 \sim 20\text{ kHz}$ | | -120 | | dB |
| $\Delta V_{OS}/\Delta T$ | Average TC of Input Offset Voltage | | | 2 | | $\mu V/^{\circ}C$ |

Note 1: 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.

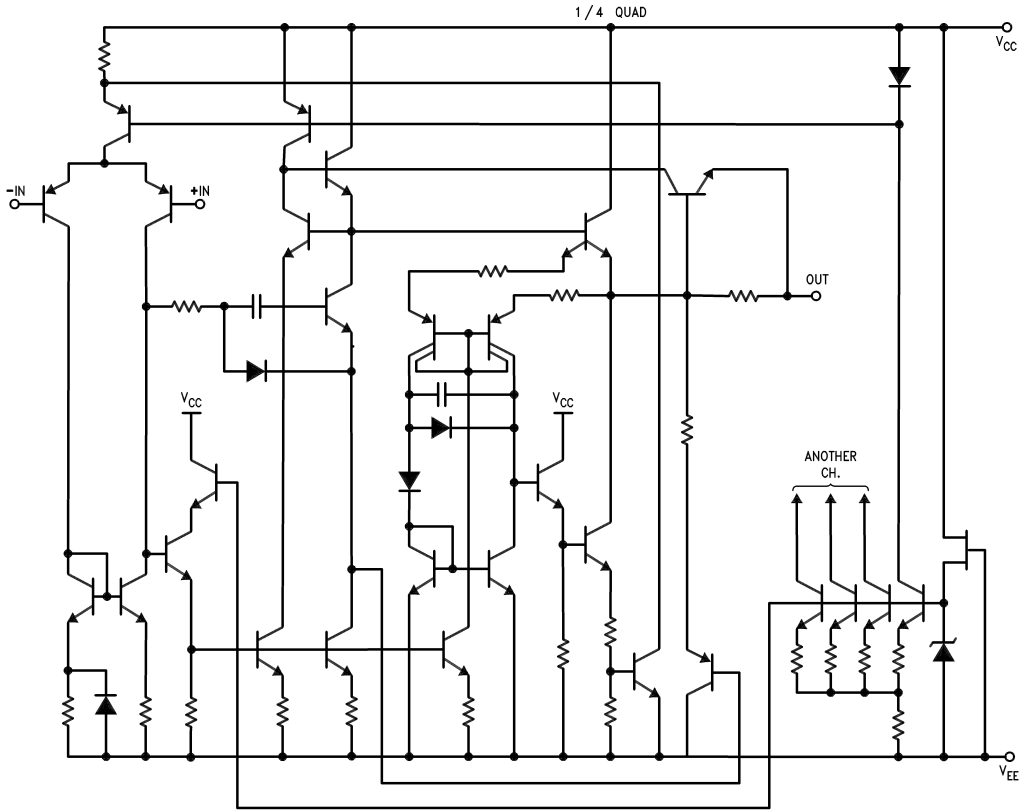
Note 2: Unless otherwise specified the absolute maximum input voltage is equal to the power supply voltage.

Design Electrical Characteristics (Continued)

Note 3: For operation at ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance, junction to ambient, as follows: LM837N, 90°C/W; LM837M, 150°C/W.

Note 4: The following parameters are not tested or guaranteed.

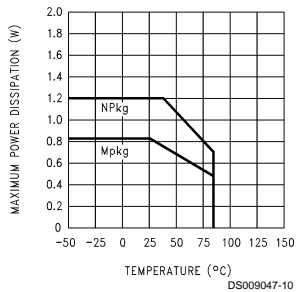
Detailed Schematic



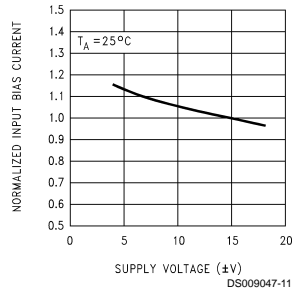
DS009047-3

Typical Performance Characteristics

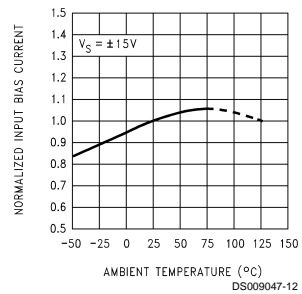
Maximum Power Dissipation vs Ambient Temperature



Normalized Input Bias Current vs Supply Voltage

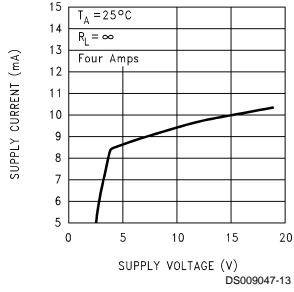


Normalized Input Bias Current vs Ambient Temperature

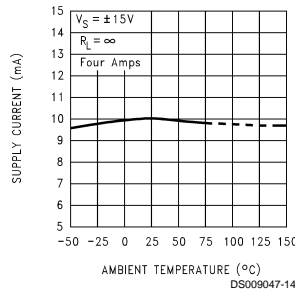


Typical Performance Characteristics (Continued)

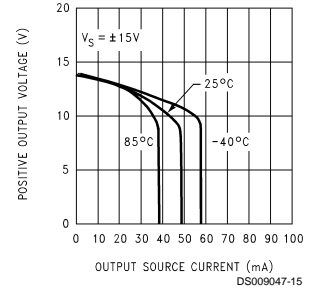
Supply Current vs Supply Voltage



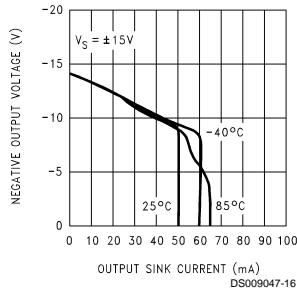
Supply Current vs Ambient Temperature



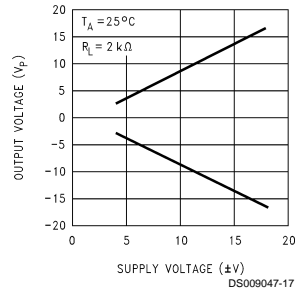
Positive Current Limit



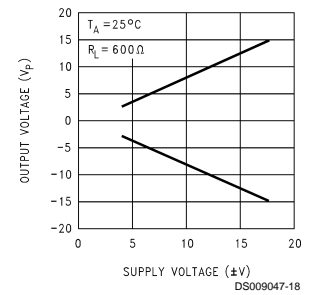
Negative Current Limit



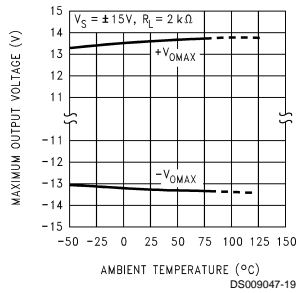
Maximum Output Voltage vs Supply Voltage



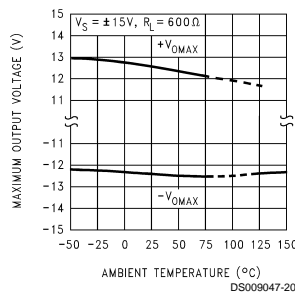
Maximum Output Voltage vs Supply Voltage



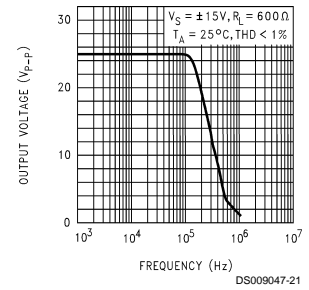
Maximum Output Voltage vs Ambient Temperature



Maximum Output Voltage vs Ambient Temperature

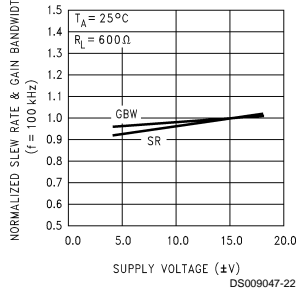


Power Bandwidth

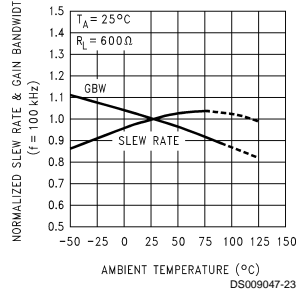


Typical Performance Characteristics (Continued)

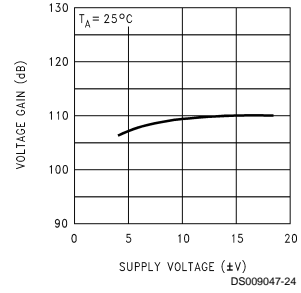
Normalized Slew Rate & Gain Bandwidth vs Supply Voltage (f = 100 kHz)



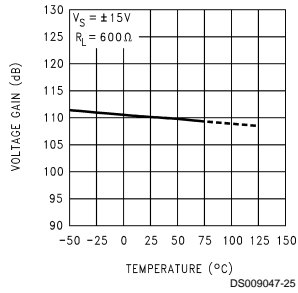
Normalized Slew Rate & Gain Bandwidth (f = 100 kHz) vs Ambient Temperature



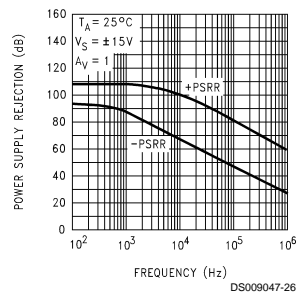
Voltage Gain vs Supply Voltage



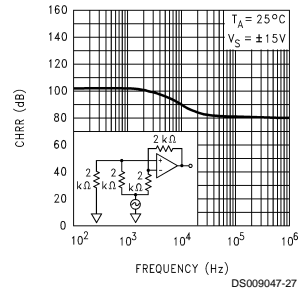
Voltage Gain vs Ambient Temperature



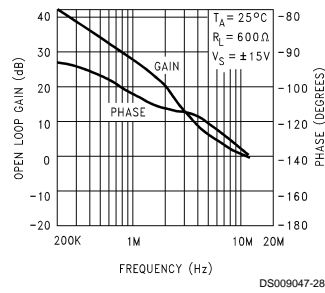
Power Supply Rejection vs Frequency



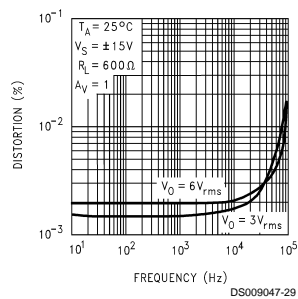
CMRR vs Frequency



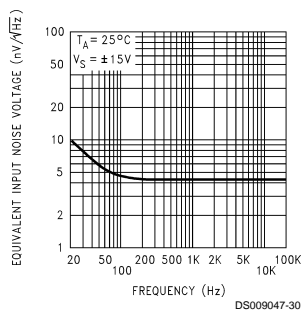
Open Loop Gain & Phase vs Frequency



Total Harmonic Distortion vs Frequency

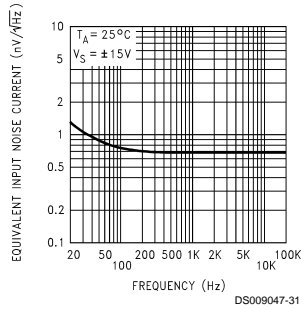


Equivalent Input Noise Voltage vs Frequency



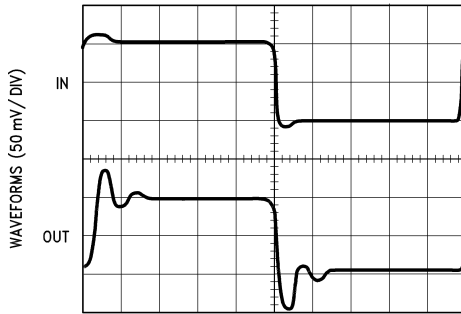
Typical Performance Characteristics (Continued)

Equivalent Input Noise Current vs Frequency



Small Signal, Non-Inverting

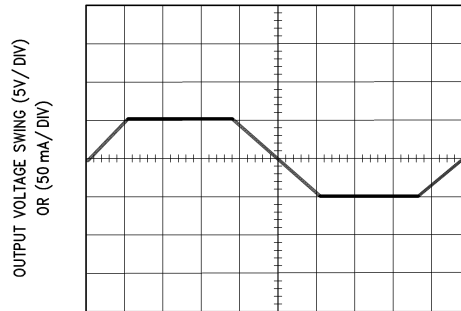
$T_A = 25^\circ\text{C}$, $A_V = 1$, $R_L = 600\Omega$, $V_S = \pm 15\text{V}$



TIME (0.1 μs / DIV)

Current Limit

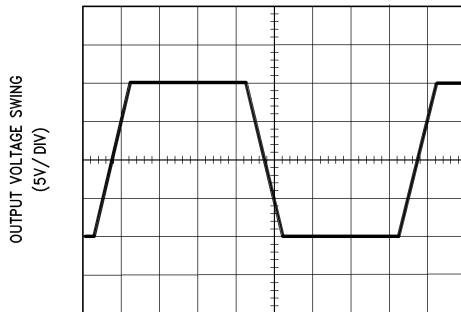
$T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{V}$, $R_L = 100\Omega$, $A_V = 1$



TIME (0.1 ms / DIV)

Large Signal Non-Inverting

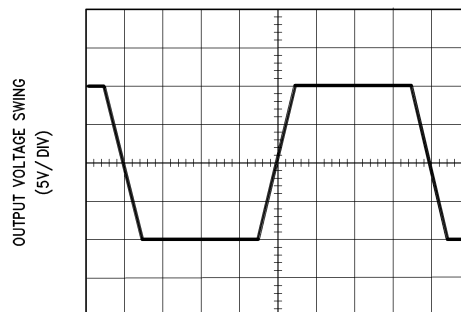
$T_A = 25^\circ\text{C}$, $R_L = 600\Omega$, $V_S = \pm 15\text{V}$



TIME (1 μs / DIV)

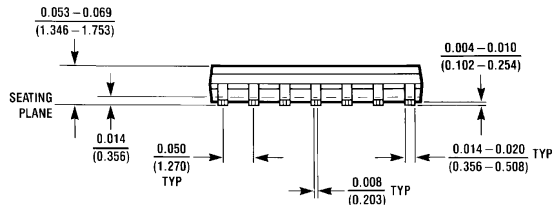
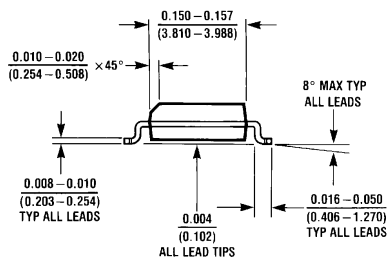
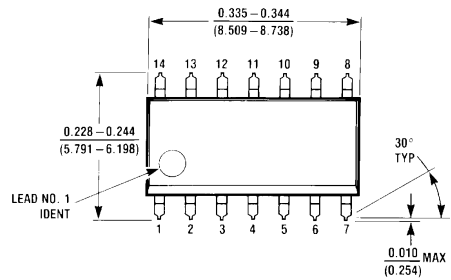
Large Signal Inverting

$T_A = 25^\circ\text{C}$, $R_L = 600\Omega$, $V_S = \pm 15\text{V}$



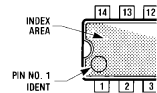
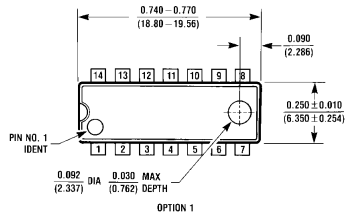
TIME (1 μs / DIV)

Physical Dimensions inches (millimeters) unless otherwise noted

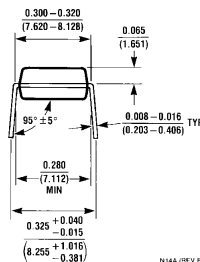
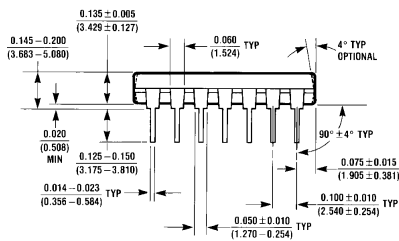


M14A (REV H)

Molded Package (SO)
Order Number LM837M
NS Package Number M14A



OPTION 02



N14A (REV F)

Lit. #107255
Molded Dual-In-Line Package
Order Number LM837N
NS Package Number N14A

Notes

LIFE SUPPORT POLICY

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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