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, pre-amplifiers, 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: >600 Ω
- Low input noise voltage: 4.5 nV/√Hz
- Low total harmonic distortion: 0.0015%
- Low offset voltage: 0.3 mV

Schematic and Connection Diagrams

Order Number LM837M or LM837N
See NS Package Number M14A or N14A
Absolute Maximum Ratings

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

Supply Voltage $V_{CC/VEE}$: 18V
Differential Input Voltage (Note 1) $V_{ID}$: 30V
Common Mode Input Voltage (Note 1) $V_{IC}$: 15V
Power Dissipation (Note 2) $P_D$: 1.2W (N), 830 mW (M)
Operating Temperature Range $T_{OPR}$: $-40°C$ to $+85°C$
Storage Temperature Range $T_{STG}$: $-60°C$ to $+150°C$

Soldering Information
- Dual-In-Line Package: Soldering (10 seconds) 260°C
- Small Outline Package: Vapor Phase (60 seconds) 215°C, Infrared (15 seconds) 220°C
- ESD rating is 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 $T_A = 25°C, V_S = \pm 15V$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{OS}$</td>
<td>Input Offset Voltage</td>
<td>$R_S = 50\Omega$</td>
<td>0.3</td>
<td>5</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>$I_{OS}$</td>
<td>Input Offset Current</td>
<td></td>
<td>10</td>
<td>200</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>$I_B$</td>
<td>Input Bias Current</td>
<td></td>
<td>500</td>
<td>1000</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>$A_V$</td>
<td>Large Signal Voltage Gain</td>
<td>$R_L = 2k\Omega$, $V_{OUT} = \pm 10V$</td>
<td>90</td>
<td>110</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>$V_{OM}$</td>
<td>Output Voltage Swing</td>
<td>$R_L = 2k\Omega$, $V_{OUT} = \pm 10V$</td>
<td>$\pm 12$</td>
<td>$\pm 13.5$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{CM}$</td>
<td>Common Mode Input Voltage</td>
<td>$R_L = 600\Omega$</td>
<td>$\pm 10$</td>
<td>$\pm 12.5$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>CMRR</td>
<td>Common Mode Rejection Ratio</td>
<td>$V_{IN} = \pm 12V$</td>
<td>80</td>
<td>100</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>PSRR</td>
<td>Power Supply Rejection Ratio</td>
<td>$V_S = 15 \sim 5, \sim 15 \sim 5$</td>
<td>80</td>
<td>100</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>$I_P$</td>
<td>Power Supply Current</td>
<td>$R_L = \infty$, Four Amps</td>
<td>10</td>
<td>15</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

AC Electrical Characteristics $T_A = 25°C, V_S = \pm 15V$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>Slew Rate</td>
<td>$R_L = 600\Omega$</td>
<td>8</td>
<td>10</td>
<td></td>
<td>V/\mu s</td>
</tr>
<tr>
<td>GBW</td>
<td>Gain Bandwidth Product</td>
<td>$f = 100\ kHz$, $R_L = 600\Omega$</td>
<td>15</td>
<td>25</td>
<td></td>
<td>MHz</td>
</tr>
</tbody>
</table>

Design Electrical Characteristics $T_A = 25°C, V_S = \pm 15V$ (Note 3)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBW</td>
<td>Power Bandwidth</td>
<td>$V_O = 25 V_{p-p}$, $R_L = 600\Omega$, THD &lt; 1%</td>
<td>200</td>
<td></td>
<td></td>
<td>kHz</td>
</tr>
<tr>
<td>$\phi_{N1}$</td>
<td>Equivalent Input Noise Voltage</td>
<td>$JIS A, R_S = 100\Omega$</td>
<td>0.5</td>
<td></td>
<td></td>
<td>\mu V</td>
</tr>
<tr>
<td>$\phi_{N2}$</td>
<td>Equivalent Input Noise Voltage</td>
<td>$f = 1 \ kHz$</td>
<td>4.5</td>
<td></td>
<td></td>
<td>nV/\sqrt{Hz}</td>
</tr>
<tr>
<td>$I_N$</td>
<td>Equivalent Input Noise Current</td>
<td>$f = 1 \ kHz$</td>
<td>0.7</td>
<td></td>
<td></td>
<td>pA/\sqrt{Hz}</td>
</tr>
<tr>
<td>THD</td>
<td>Total Harmonic Distortion</td>
<td>$A_V = 1$, $V_{OUT} = 3 \text{ Vrms}$. $f = 20 \sim 20 \text{ kHz}$, $R_L = 600\Omega$</td>
<td>0.0015</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>$f_0$</td>
<td>Zero Cross Frequency</td>
<td>Open Loop</td>
<td>12</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>$\phi_m$</td>
<td>Phase Margin</td>
<td>Open Loop</td>
<td>45</td>
<td></td>
<td></td>
<td>deg</td>
</tr>
<tr>
<td></td>
<td>Input-Reflected Crosstalk</td>
<td>$f = 20 \sim 20 \text{ kHz}$</td>
<td>$-120$</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>$AVOS/\Delta T$</td>
<td>Average TC of Input Offset Voltage</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>\mu V/°C</td>
</tr>
</tbody>
</table>

Note 1: Unless otherwise specified the absolute maximum input voltage is equal to the power supply voltage.

Note 2: 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 3: The following parameters are not tested or guaranteed.
Typical Performance Characteristics

- Maximum Power Dissipation vs Ambient Temperature
- Normalized Input Bias Current vs Supply Voltage
- Normalized Input Bias Current vs Ambient Temperature
- Supply Current vs Supply Voltage
- Supply Current vs Ambient Temperature
- Positive Current Limit
- Negative Current Limit vs Supply Voltage
- Maximum Output Voltage vs Supply Voltage
- Maximum Output Voltage vs Ambient Temperature
- Power Bandwidth
Typical Performance Characteristics (Continued)

- Normalized Slew Rate & Gain Bandwidth vs Supply Voltage (f = 100 kHz)
- 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
- Equivalent Input Noise Current vs Frequency
Typical Performance Characteristics (Continued)

Small Signal, Non-Inverting
\[ T_A = 25^\circ C, A_V = 1, R_L = 600\Omega, V_S = \pm 15V \]

Current Limit
\[ T_A = 25^\circ C, V_S = \pm 15V, R_L = 100\Omega, A_V = 1 \]

Large Signal Non-Inverting
\[ T_A = 25^\circ C, R_L = 600\Omega, V_S = \pm 15V \]

Large Signal Inverting
\[ T_A = 25^\circ C, R_L = 600\Omega, V_S = \pm 15V \]
### Physical Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Inches</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0.160</td>
<td>4.06</td>
</tr>
<tr>
<td>Width</td>
<td>0.850</td>
<td>21.59</td>
</tr>
<tr>
<td>Height</td>
<td>0.060</td>
<td>1.52</td>
</tr>
</tbody>
</table>

**Molded Dual-In-Line Package**

Order Number LM837N  
NS Package Number N14A

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