DESCRIPTION

The MP8130 is a rail-to-rail output, high voltage operational amplifier in a TSOT-23 package. This amplifier provides 200KHz bandwidth while consuming an incredibly low 10µA of supply current. The MP8130 can operate over a single supply range of 2.7V to 36V. It is available in tiny TSOT23-5 packages.

FEATURES

- Single Supply Operation: 2.7V to 36V
- TSOT23-5 Package
- 200KHz –3dB Bandwidth
- 10µA Supply Current
- Rail-to-Rail Output
- Unity-Gain Stable
- Input Common Mode to Ground
- Drives Up to 1000pF of Capacitive Loads
- Available in a TSOT23-5 Package

APPLICATIONS

- Precision Micropower Amplifiers
- Micropower Signal Processing
- Test Equipment

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**PACKAGE REFERENCE**

<table>
<thead>
<tr>
<th>Part Number*</th>
<th>Package</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP8130DJ</td>
<td>TSOT23-5</td>
<td>–40°C to +85°C</td>
</tr>
</tbody>
</table>

* For Tape & Reel, add suffix –Z (eg. MP8130DJ–Z)  
For RoHS compliant packaging, add suffix –LF (eg. MP8130DJ–LF–Z)

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage (V+ to V−)....................... +40.0V
Differential Input Voltage (V_{\text{IN+}} – V_{\text{IN−}})....... +6.0V
Input Voltage
V_{\text{IN+}} = V_{\text{IN−}}...................... (V−) – 0.3V, (V+) + 0.3V

**Recommended Operating Conditions**

Supply Voltage ..................................+2.7V to +36V  
Operating Temperature ......................–40°C to +85°C

**Thermal Resistance**

\[ \theta_{JA}, \theta_{JC} \]

TSOT23-5.............................. 220 .... 110.. °C/W

**ELECTRICAL CHARACTERISTICS**

\[ V_+ = +20V, V_− = 0V, V_{\text{CM}} = V+/2, R_L = 50k\Omega, T_A = +25°C, \text{ unless otherwise noted.} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Offset Voltage</td>
<td>( V_{\text{OS}} )</td>
<td></td>
<td>–5</td>
<td>1</td>
<td>+5</td>
<td>mV</td>
</tr>
<tr>
<td>Input Offset Voltage Temp Coefficient</td>
<td>( I_{\text{B}} )</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>( \mu V/°C )</td>
</tr>
<tr>
<td>Input Bias Current (4)</td>
<td>( I_{\text{OS}} )</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Input Offset Current (4)</td>
<td>( I_{\text{OS}} )</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>( V_{\text{CM}} )</td>
<td>CMRR &gt; 60dB (V+ = 36V)</td>
<td>0</td>
<td></td>
<td>36</td>
<td>V</td>
</tr>
<tr>
<td>Common-Mode Rejection Ratio</td>
<td>CMRR</td>
<td>0 &lt; V_{\text{CM}} &lt; 36.0V (V+ = 36V)</td>
<td>80</td>
<td>82</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Power Supply Rejection Ratio</td>
<td>PSRR</td>
<td>Supply Voltage change of 2.7V/ 36V</td>
<td>80</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Large Signal Voltage Gain</td>
<td>( A_{\text{VOL}} )</td>
<td>( R_L = 100k\Omega, V_{\text{OUT}} = 5.0 \text{ Peak to Peak} )</td>
<td>60</td>
<td>88</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Maximum Output Voltage Swing</td>
<td>( V_{\text{OUT}} )</td>
<td>( R_L = 100k ) (V+) – 50mV</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Minimum Output Voltage Swing</td>
<td>( V_{\text{OUT}} )</td>
<td>( R_L = 100k ) (V−) + 50mV</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Gain-Bandwidth Product (4)</td>
<td>GBW</td>
<td>( R_L = 1M\Omega, C_L = 2pF, V_{\text{OUT}} = 0V )</td>
<td>100</td>
<td></td>
<td></td>
<td>KHz</td>
</tr>
<tr>
<td>–3dB Bandwidth (4)</td>
<td>BW</td>
<td>( A_v = 1, C_L = 2pF, R_L = 1M\Omega )</td>
<td>200</td>
<td></td>
<td></td>
<td>KHz</td>
</tr>
<tr>
<td>Slew Rate (4)</td>
<td>SR</td>
<td>( A_v = 1, C_L = 2pF, R_L = 1M\Omega )</td>
<td>0.1</td>
<td></td>
<td></td>
<td>V/\mu s</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>( I_{\text{SC}} )</td>
<td>Source</td>
<td>–20</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Supply Current</td>
<td>( I_{\text{sup}} )</td>
<td>No Load</td>
<td>10</td>
<td>15</td>
<td></td>
<td>( \mu A )</td>
</tr>
</tbody>
</table>

**Notes:**
1) Exceeding these ratings may damage the device.  
2) The device is not guaranteed to function outside of its operating conditions.  
3) Measured on approximately 1” square of 1 oz copper.

4) Guaranteed by design.
TYPICAL PERFORMANCE CHARACTERISTICS
C1= C3 =0.1μF, C2=C4=10μF, R_L = 1MΩ (Reference Figure 3)
TYPICAL PERFORMANCE CHARACTERISTICS
C1 = C3 = 0.1 μF, C2 = C4 = 10 μF, R_L = 1 MΩ (Reference Figure 3)

Small Signal Pulse Response

AV = 2, V+ = V- = 10 V, R_L = 1 MΩ

AV = 2, V+ = V- = 15 V, R_L = 1 MΩ

AV = -1, V+ = V- = 5 V, R_L = 1 MΩ

AV = -1, V+ = V- = 12 V, R_L = 1 MΩ

AV = 6, V+ = V- = 5 V, R_L = 1 MΩ

AV = 6, V+ = V- = 15 V, R_L = 1 MΩ

AV = -1, V+ = V- = 2.5 V, R_L = 1 MΩ

AV = 2, V+ = V- = 2.5 V, R_L = 1 MΩ

AV = -5, V+ = V- = 12 V, R_L = 1 MΩ
TYPICAL PERFORMANCE CHARACTERISTICS
C1 = C3 = 0.1 μF, C2 = C4 = 10 μF, R_L = 1MΩ (Reference Figure 3)

Large Signal Pulse Response

- AV = -1, V_+ = V_- = 2.5V, R_L = 1MΩ

Large Signal Pulse Response

- AV = 6, V_+ = V_- = 12V, R_L = 1MΩ

Large Signal Pulse Response

- AV = 2, V_+ = V_- = 5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = 6, V_+ = V_- = 2.5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = 3, V_+ = V_- = 2.5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = 2, V_+ = V_- = 2.5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = -5, V_+ = V_- = 5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = -5, V_+ = V_- = 2.5V, R_L = 1MΩ

Rail to Rail Output Operation

- AV = -1, V_+ = V_- = 5V, R_L = 1MΩ
PIN FUNCTIONS

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUT</td>
<td>Output.</td>
</tr>
<tr>
<td>2</td>
<td>V+</td>
<td>Supply Voltage.</td>
</tr>
<tr>
<td>3</td>
<td>IN+</td>
<td>Non-Inverting Input.</td>
</tr>
<tr>
<td>4</td>
<td>IN-</td>
<td>Inverting Input.</td>
</tr>
<tr>
<td>5</td>
<td>V-</td>
<td>Ground or Supply Return Pin.</td>
</tr>
</tbody>
</table>

TEST CIRCUITS

Figure 1—AC Test Circuit

Notes: Close S3 for positive gain. Input signal to RF(+Av) connector.
The gain \( Av = 1 + R_{FB}/R_{IN} \).
For unity gain, remove \( R_{IN} \) and short \( R_{FB} \).
Open S3 for negative gain. Input signal to RF(-Av) connector.
The gain \( Av = -R_{FB}/R_{IN} \).
S1 and S2 are switches for possible resistor and capacitor load connections.
TEST CIRCUITS (continued)

Figure 2—Positive Power Supply Rejection Ratio Measurement
APPLICATION INFORMATION

Power Supply Bypassing
Regular supply bypassing techniques are recommended. A 10µF capacitor in parallel with a 0.1µF capacitor on both the positive and negative supplies is ideal. For the best performance, all bypassing capacitors should be located as close to the op amp as possible and all capacitors should be low ESL (Equivalent Series Inductance) and low ESR (Equivalent Series Resistance). Surface mount ceramic capacitors are ideal.

For large input signals, the op amp needs two clamp diodes to the input side. (See Figure 3 Large Input Signal Schematic).

Figure 3—Large Input Signal Schematic Sold
PACKAGE INFORMATION

TSOT23-5

TOP VIEW

RECOMMENDED LAND PATTERN

FRONT VIEW

SIDE VIEW

NOTE:
1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.10 MILLIMETERS MAX.
5) DRAWING CONFORMS TO JEDEC MO-193, VARIATION AA.
6) DRAWING IS NOT TO SCALE.

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