DESCRIPTION
The MP8102 is a rail-to-rail output, operational amplifier in a TSOT-23 package. This amplifier provides 600kHz bandwidth while consuming an incredibly low 7.5µA of supply current. The MP8102 can operate with a single supply voltage as low as 1.8V.

FEATURES
- Single Supply Operation: 1.8V to 5.5V
- TSOT23-5 Package
- 600KHz –3dB Bandwidth
- 7.5µA Supply Current
- Rail-to-Rail Output
- Unity-Gain Stable
- Input Common Mode to Ground
- Drives Up to 1000pF of Capacitive Loads

APPLICATIONS
- Portable Equipment
- PDAs
- Pagers
- Cordless Phones
- Handheld GPS
- Consumer Electronics

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TYPICAL APPLICATION
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part Number*</th>
<th>Package</th>
<th>Top Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP8102DJ</td>
<td>TSOT23-5</td>
<td>See Below</td>
</tr>
</tbody>
</table>

* For Tape & Reel, add suffix –Z (e.g. MP8102DJ–Z);
For RoHS, compliant packaging, add suffix –LF (e.g. MP8102DJ–LF–Z).

TOP MARKING

| H6YW |

H6: product code of MP8102DJ;
Y: year code;
W: week code:

PACKAGE REFERENCE

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V+ to V-) ..................+6.0V
Differential Input Voltage (V_{IN+} – V_{IN-}).......+6.0V
Input Voltage (V_{IN+} – V_{IN-})..V_{IN+} + 0.3V, V_{IN-} – 0.3V
Junction Temperature.........................150°C

Recommended Operating Conditions

Supply Voltage ....................+1.8V to +5.5V
Operating Temperature..........–40°C to +85°C

Thermal Resistance

<table>
<thead>
<tr>
<th>Thermal Resistance</th>
<th>θ_{JA}</th>
<th>θ_{JC}</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSOT23-5</td>
<td>220</td>
<td>110</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.
ELECTRICAL CHARACTERISTICS

\( V_+ = +5V, \ V_- = 0V, \ V_{CM} = V+/2, \ R_L = 10k\Omega, \ T_A = +25^\circ C, \) 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_{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></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>( \mu V/^\circ C )</td>
</tr>
<tr>
<td>Input Bias Current (^{(4)})</td>
<td>( I_B )</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Input Offset Current (^{(4)})</td>
<td>( I_{OS} )</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>( V_{CM} )</td>
<td>( CMRR &gt; 60\text{dB} )</td>
<td>0</td>
<td>3.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Common-Mode Rejection Ratio</td>
<td>( CMRR )</td>
<td>( 0 &lt; V_{CM} &lt; 3.5V )</td>
<td>82</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Power Supply Rejection Ratio</td>
<td>( PSRR )</td>
<td>Supply Voltage change of 1.0V</td>
<td>80</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Large Signal Voltage Gain</td>
<td>( A_{VOL} )</td>
<td>( R_L = 100k\Omega, \ V_{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_{OUT} )</td>
<td>( R_L = 10k\Omega )</td>
<td></td>
<td></td>
<td>( V_+ - 23mV )</td>
<td>V</td>
</tr>
<tr>
<td>Minimum Output Voltage Swing</td>
<td>( V_{OUT} )</td>
<td>( R_L = 10k\Omega )</td>
<td></td>
<td></td>
<td>( V_- + 19mV )</td>
<td>V</td>
</tr>
<tr>
<td>Gain-Bandwidth Product (^{(4)})</td>
<td>( GBW )</td>
<td>( R_L = 200k\Omega, C_L = 2pF, \ V_{OUT} = 0 )</td>
<td>200</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>600</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_{SC} )</td>
<td>Source</td>
<td>–20</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sink</td>
<td>20</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Supply Current</td>
<td></td>
<td>No Load</td>
<td>7.5</td>
<td>10</td>
<td></td>
<td>( \mu A )</td>
</tr>
</tbody>
</table>

Note:
\(^{(4)}\) Guaranteed by design.
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

Notes: Close S3 for positive gain. Input signal to RF(+Av) connector.
The gain $Av = 1 + \frac{R_B}{R_N}$.
For unity gain, remove $R_N$ and short $R_B$.
Open S3 for negative gain. Input signal to RF(-Av) connector.
The gain $Av = -\frac{R_B}{R_N}$.
S1 and S2 are switches for possible resistor and capacitor load connections.

Figure 1—AC Test Circuit
TEST CIRCUITS (continued)

Figure 2—Positive Power Supply Rejection Ratio Measurement
TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = +25^\circ C$, unless otherwise noted.

- **Output Voltage vs. Output Current**
  - Sourcing
  - Output Voltage vs. Output Current
  - Sinking
- **Short Circuit Current vs Supply Voltage**
  - Sourcing
- **Offset Voltage vs. Common Mode Voltage**
  - $R_F = 50k\Omega$, $V_- = -5V$ to $0V$, $V_+ = 0V$ to $+5V$
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A = +25^\circ C$, unless otherwise noted.

![Gain Bandwidth and Phase Margin](image1)

- For $V_{+/-} = +/-2.50V$, Gain = 1, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 1, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 2, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 10, $R_L = 1\Omega$

![Gain Bandwidth and Phase Margin](image2)

- For $V_{+/-} = +/-2.50V$, Gain = 1, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 1, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 2, $R_L = 1\Omega$
- For $V_{+/-} = +/-1.35V$, Gain = 10, $R_L = 1\Omega$

![Close-Loop Unity Gain Frequency Response](image3)

- For $V_{+/-} = +/-2.50V$, Gain = 1
- $C_L = 1000\mu F$, $C_L = 100\mu F$, $C_L = 10\mu F$

![PSRR vs. Frequency](image4)

- For $V_i = -2.5V$, $V_o = 2.5V$

![Output Noise vs. Frequency](image5)
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A = +25^\circ C$, unless otherwise noted.

**Small Signal Pulse Response**

- $A_V = 1$, $V_+ = 2.5V$, $V_- = -2.5V$
- $R_L = 1\Omega$, $C_L = 8pF$

**Small Signal Pulse Response**

- $A_V = 1$, $V_+ = 1.25V$, $V_- = -1.25V$
- $R_L = 1\Omega$, $C_L = 8pF$

**Small Signal Pulse Response**

- $A_V = 1$, $V_+ = 2.5V$, $V_- = -2.5V$
- $R_L = 1\Omega$, $C_L = 50pF$

**Small Signal Pulse Response**

- $A_V = 1$, $V_+ = 1.25V$, $V_- = -1.25V$
- $R_L = 1\Omega$, $C_L = 50pF$

**Small Signal Pulse Response**

- $A_V = -1$, $V_+ = 2.5V$, $V_- = -2.5V$
- $R_L = 5k\Omega$, $C_L = 8pF$

**Small Signal Pulse Response**

- $A_V = -1$, $V_+ = 1.25V$, $V_- = -1.25V$
- $R_L = 5k\Omega$, $C_L = 8pF$
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

\( T_A = +25^\circ \text{C}, \) unless otherwise noted.

**Large Signal Pulse Response**

\[ \text{\( A_v = 1, V^+ = 2.5V, V^- = -2.5V \)} \]
\[ \text{\( R_L = 1\Omega, C_L = 8pF \)} \]

**Large Signal Pulse Response**

\[ \text{\( A_v = 1, V^+ = 1.25V, V^- = -1.25V \)} \]
\[ \text{\( R_L = 1\Omega, C_L = 8pF \)} \]

**Rail to Rail Output Operation**

\[ \text{\( A_v = -2, V^+ = 2.5V, V^- = -2.5V \)} \]
\[ \text{\( R_L = 1\Omega, C_L = 8pF \)} \]

\[ \text{\( A_v = 2, V^+ = 2.5V, V^- = -2.5V \)} \]
\[ \text{\( R_L = 1\Omega, C_L = 8pF \)} \]

\[ \text{\( A_v = 2, V^+ = 1.25V, V^- = -1.25V \)} \]
\[ \text{\( R_L = 1\Omega, C_L = 8pF \)} \]
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.

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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