SINGLE SUPPLY QUAD OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION
The NJM13403 is single-supply quad operational amplifier, which can operate from 2V supply. The features are low offset voltage, low bias current, high slew-rate, and free crossover distortion through the AB class output stage.

The package lineup is DIP, DMP and others compact, so that the NJM13403 is suitable for audio for low voltage operation and any other kind of signal amplifier.

■ FEATURES
● Operating Voltage (+2V~+14V )
● Slew Rate (1.2V/µs typ.)
● Operating Current (3.0mA typ.)
● Bipolar Technology
● Package Outline DIP14, DMP14, SSOP14

■ PIN CONFIGURATION

![PIN FUNCTION Diagram]

■ EQUIVALENT CIRCUIT (1/4 Shown)
## ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V +</td>
<td>15 V</td>
<td></td>
</tr>
<tr>
<td>Differential Input Voltage</td>
<td>V ID</td>
<td>14 V</td>
<td></td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V IC</td>
<td>-0.3~+14 V</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>P D</td>
<td>(DIP14) 700 mW</td>
<td></td>
</tr>
<tr>
<td>(DMP14) 300 mW</td>
<td></td>
<td>(SSOP14) 300 mW</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>T OFR</td>
<td>-40~+85°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>T SFR</td>
<td>-40~+125°C</td>
<td></td>
</tr>
</tbody>
</table>

## ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>V opr</td>
<td>R D=0Ω</td>
<td>2</td>
<td>-</td>
<td>14</td>
<td>V</td>
</tr>
<tr>
<td>Input Offset Voltage</td>
<td>V IO</td>
<td>R s=0Ω</td>
<td>-</td>
<td>0.5</td>
<td>4</td>
<td>mV</td>
</tr>
<tr>
<td>Input Offset Current</td>
<td>I IO</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>50</td>
<td>nA</td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>I b</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>150</td>
<td>nA</td>
</tr>
<tr>
<td>Large Signal Voltage Gain sag</td>
<td>A V</td>
<td>R L≥2kΩ</td>
<td>88</td>
<td>100</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Maximum Output Voltage Swing</td>
<td>V CM</td>
<td>R L=2kΩ</td>
<td>4.0</td>
<td>4.2</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Input Common Mode Voltage Range</td>
<td>V CM</td>
<td>0~3.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Common Mode Rejection Ratio</td>
<td>CMR</td>
<td>-</td>
<td>70</td>
<td>90</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Supply Voltage Rejection Ratio</td>
<td>SVR</td>
<td>-</td>
<td>80</td>
<td>94</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Output Source Current</td>
<td>I SOURCE</td>
<td>V IN=1V,V IN=0V</td>
<td>20</td>
<td>35</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Output Sink Current</td>
<td>I SINK</td>
<td>V IN=0V,V IN=1V</td>
<td>10</td>
<td>30</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Operating Current</td>
<td>I CC</td>
<td>R L=∞</td>
<td>-</td>
<td>3.0</td>
<td>5.0</td>
<td>mA</td>
</tr>
<tr>
<td>Slew Rate</td>
<td>SR</td>
<td>V/V±2.5V,R L=2kΩ</td>
<td>-</td>
<td>1.2</td>
<td>-</td>
<td>V/μs</td>
</tr>
<tr>
<td>Unity Gain Bandwidth</td>
<td>f T</td>
<td>R L=2kΩ</td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>THD</td>
<td>R L=2kΩ,A V=40dB, f=20kHz,V O=1.0Vrms</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>%</td>
</tr>
</tbody>
</table>
TYPICAL CHARACTERISTICS

- Operating Current vs. Operating Voltage (Ta=25°C)
- Input Offset Voltage vs. Operating Voltage (Ta=25°C)
- Input Bias Current vs. Operating Voltage (Ta=25°C)
- Maximum Output Voltage Swing vs. Operating Voltage (Ta=25°C)
- Input Common Mode Voltage Range (V+=5V, Ta=25°C)
- Large Signal Voltage Gain vs. Operating Voltage (Ta=25°C, RL=2kΩ)

- Operating Current Icc (mA)
- Input Bias Current IB (nA)
- Input Offset Voltage VIO (mV)
- Maximum Output Voltage Vom (V)
- Large Signal Voltage Gain AV (dB)

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TYPICAL CHARACTERISTICS

Maximum Output Voltage vs. Frequency
(Ta=25°C)

Output Voltage vs. Output Sink Current
(Ta=25°C)

Output Voltage vs. Output Source Current
(Ta=25°C)

Gain/Phase vs. Frequency
(Ta=25°C)

Slew Rate (Rise)

Slew Rate (Fall)
## TYPICAL CHARACTERISTICS

### Maximum Output Voltage vs. Load Resistance

- **Load Resistance RL (Ω)**
- **Maximum Output Voltage V_out (V)**

### Total Harmonic Distortion

- **Output Voltage V_o (Vrms)**
- **Total Harmonic Distortion THD (%)**
  - 1kHz
  - 20kHz
  - 100Hz

### Equivalent Noise Voltage vs. Frequency

- **Frequency f (Hz)**
- **Equivalent Input Noise Voltage en (nV/√Hz)**

### Operating Voltage vs. Ambient Temperature

- **Ambient Temperature Ta (°C)**
- **Operating Current Icc (mA)**
  - V+/V-=2.5V
  - V+/V-=1.5V
  - V+/V-=6V

### Input Bias Current vs. Ambient Temperature

- **Ambient Temperature Ta (°C)**
- **Input Bias Current IB (mA)**
  - V+/V-=1.5V,2.5V,6V

### Maximum Output Voltage vs. Load Resistance

- **Load Resistance RL (Ω)**
- **Maximum Output Voltage VOM (V)**

### Input Offset Voltage vs. Ambient Temperature

- **Ambient Temperature Ta (°C)**
- **Input Offset Voltage VIO (mV)**
  - V+/V-=1.5V,2.5V,6V

### Input Bias Current vs. Ambient Temperature

- **Ambient Temperature Ta (°C)**
- **Input Bias Current IB (mA)**
  - V+/V+=1.5V,2.5V,6V
TYPICAL CHARACTERISTICS

Maximum Output Voltage vs. Ambient Temperature

Output Source Current vs. Ambient Temperature

Open Loop Voltage Gain vs. Ambient Temperature

Common Mode Rejection Ratio vs. Ambient Temperature

Supply Voltage Rejection Ratio vs. Ambient Temperature

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