**FEATURES**
- Tight Output Voltage Tolerance
- Low Output Noise
- Operating Current 250µA to 100mA
- Low Dynamic Impedance
- Low Temperature Coefficient
- Available in the sub-miniature SOT-23 Package
- 1.2V Device (AMS4041) also available

**APPLICATIONS**
- Battery Powered Systems
- Instrumentation
- Energy Management
- Automotive
- Precision Audio Components
- Product Testing
- Data Acquisition Systems

**GENERAL DESCRIPTION**
The AMS4040 is a two-terminal micropower band-gap voltage reference diode featuring a very low dynamic impedance and good temperature coefficient, operating over a 250µA to 100mA current range. On-chip trimming is used to provide tight voltage tolerance. Since the AMS4040 band-gap reference uses only transistors and resistors, low noise and good long term stability result. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation. The extremely low power drain of the AMS4040 makes these reference diodes useful for micropower circuitry. These voltage references can be used to make portable meters, regulators or general purpose analog circuitry with battery life approaching shelf life.

The AMS4040 is operational in the full industrial temperature range of -40°C to +85°C and is available in small space saving TO-92, SO-8, SOT-89 and SOT-23 packages.

**ORDERING INFORMATION:**

<table>
<thead>
<tr>
<th>TOL.</th>
<th>PACKAGE TYPE</th>
<th>OPERATING TEMP. RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TO-92</td>
<td>8 LEAD SOIC</td>
</tr>
<tr>
<td>±0.25%</td>
<td>AMS4040AN</td>
<td>AMS4040AS</td>
</tr>
<tr>
<td>±0.5%</td>
<td>AMS4040BN</td>
<td>AMS4040BS</td>
</tr>
<tr>
<td>±1.0%</td>
<td>AMS4040CN</td>
<td>AMS4040CS</td>
</tr>
</tbody>
</table>

**PIN CONNECTIONS**

**TO-92**
Plastic Package (N)

**8L SOIC**
SO Package (S)

**SOT-89**
(L)

**3L SOT-23**
(M)

*This pin must be left floating or connected to pin 2*
ABSOLUTE MAXIMUM RATINGS (Note 1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>AMS4040A</th>
<th></th>
<th>AMS4040B</th>
<th></th>
<th>AMS4040C</th>
<th></th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Breakdown Voltage</td>
<td></td>
<td>2.494</td>
<td>2.500</td>
<td>2.506</td>
<td>2.488</td>
<td>2.500</td>
<td>2.512</td>
<td>V</td>
</tr>
<tr>
<td>Deviation of Reverse</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = Full Range</td>
<td>8.0</td>
<td>17</td>
<td>8.0</td>
<td>17</td>
<td>8.0</td>
<td>25</td>
<td>mV</td>
</tr>
<tr>
<td>Breakdown Voltage over</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Breakdown Voltage</td>
<td>I&lt;sub&gt;RMIN&lt;/sub&gt; ≤ I&lt;sub&gt;R&lt;/sub&gt; ≤</td>
<td>0.3</td>
<td>0.8</td>
<td>1.0</td>
<td>0.3</td>
<td>0.8</td>
<td>1.0</td>
<td>mV</td>
</tr>
<tr>
<td>Voltage Change with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Current Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Breakdown Voltage</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C ±1°C</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>ppm</td>
</tr>
<tr>
<td>Voltage Long Term Stability</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C ±1°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide Band Noise</td>
<td>10HZ ≤ f ≤ 10kHz</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>µV&lt;sub&gt;ref&lt;/sub&gt;</td>
</tr>
<tr>
<td>Reverse Dynamic Impedance</td>
<td>I&lt;sub&gt;R&lt;/sub&gt; = 1mA, f = 120Hz,</td>
<td>0.25</td>
<td>0.5</td>
<td>0.25</td>
<td>0.5</td>
<td>0.25</td>
<td>0.5</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td>I&lt;sub&gt;AC&lt;/sub&gt; = 0.1mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Operating Current</td>
<td></td>
<td>80</td>
<td>2500</td>
<td>80</td>
<td>250</td>
<td>80</td>
<td>250</td>
<td>µA</td>
</tr>
</tbody>
</table>

Parameters identified with **boldface type** apply at temperature extremes. All other numbers apply at T<sub>A</sub> = T<sub>J</sub> = 25°C.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at I<sub>R</sub> = 100 µA and T<sub>A</sub> = +25°C unless otherwise specified.

TYPICAL APPLICATIONS

Shunt Regulator

Advanced Monolithic Systems, Inc.  www.advanced-monolithic.com  Phone (925) 443-0722  Fax (925) 443-0723
TYPICAL APPLICATIONS

Precision 1µA to 1mA Current Sources

\[ I_{\text{OUT}} = \frac{2.5V}{R_2} \]

Precision ±2.500V Reference

START-UP CHARACTERISTICS

Test Circuit

AMS4040-2.5 \quad R_S = 30k

\begin{align*}
V_{R} (V) & \quad V_{IN} (V) \\
5 & \quad 0 \\
3 & \quad 2 \\
1 & \quad 4 \\
0 & \quad 6 \\
0 & \quad 8 \\
0 & \quad 0 \\
2 & \quad 2 \\
0 & \quad 4 \\
4 & \quad 6 \\
2 & \quad 8 \\
4 & \quad 0 \\
2 & \quad 2 \\
0 & \quad 4 \\
4 & \quad 6 \\
2 & \quad 8
\end{align*}

\begin{align*}
\text{RESPONSE TIME (µs)} & \quad V_R (V) \\
0 & \quad 0 \\
20 & \quad 1 \\
40 & \quad 2 \\
60 & \quad 3 \\
80 & \quad 4
\end{align*}
TYPICAL PERFORMANCE CHARACTERISTICS

Temperature Drift for Different
Average Temperature Coefficient

Reverse Characteristics and
Minimum Operating Current

Noise Voltage vs Frequency

Output Impedance vs Frequency

Output Impedance vs Frequency
PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

3 LEAD TO-92 PLASTIC PACKAGE (N)

8 LEAD SOIC PLASTIC PACKAGE (S)

*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE
PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted (Continued).

SOT-89 PLASTIC PACKAGE (L)

3 LEAD SOT-23 PLASTIC PACKAGE (M)