Advanced Monolithic Systems

AMS421

0.5V SHUNT REGULATOR

RoHS compliant

FEATURES
- Trimmed 0.5% Tolerance
- Wide Operating Current Range 0.1\(\mu\)A to 10mA
- Low Reference Input Current 1.5nA
- Low Dynamic Output Impedance
- Low Output Noise
- Nominal Temperature Range to 125°C
- Temperature-Compensated: 50ppm/°C
- Low supply current: typ. 10\(\mu\)A

APPLICATIONS
- Battery Powered Systems
- Switching Power Supplies
- Isolated Power Supplies
- Telecommunications
- Error Amplifiers
- Notebook/Personal Computer
- Monitors/ VCR/ TV
- Opto-isolator driver

GENERAL DESCRIPTION
The AMS421 is a four-terminal adjustable open collector shunt regulator with guaranteed temperature stability over the entire range of operation. The output voltage can be set to any value between 0.5V (\(V_{REF}\)) and 15V by adding two external resistors. The AMS421 features 0.5% initial tolerance, low dynamic output impedance and operates over a wide current range. Due to the sharp turn-on characteristics this device is an excellent replacement for Zener diodes in many applications. AMS421 is available 5 pin SOT-23 packages.

ORDERING INFORMATION:

<table>
<thead>
<tr>
<th>TOL.</th>
<th>Package</th>
<th>OPERATING TEMP. RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>±0.5%</td>
<td>AMS421AM1</td>
<td>-40 to +125°C</td>
</tr>
<tr>
<td>±1.0%</td>
<td>AMS421BM1</td>
<td>-40 to +125°C</td>
</tr>
<tr>
<td>±2.0%</td>
<td>AMS421CM1</td>
<td>-40 to +125°C</td>
</tr>
</tbody>
</table>

PIN CONNECTIONS

```
5L SOT-23
(M1)

VCC 1
GND 2
NC 3
5L SOL-23
(COL1)

Top View

Ref
4
VCC
1
GND
2
Co
5
0.5V
2
```

BLOCK DIAGRAM

Advanced Monolithic Systems, Inc.  www.advanced-monolithic.com  Phone (925) 443-0722  Fax (925) 443-0723
ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage (VCC) 15V
Continuous Collector Current (IC) 10mA
Reference Input Current (IREF) 0.5mA
Junction Temperature (TJ) -40°C to +125°C
Storage temperature -65°C to +150°C
Lead Temperature (Soldering, 10sec.) 265°C

Internal Power Dissipation (PD)
SOT-23-5 Package 0.3 W
Thermal Resistance (θJA)
SOT-23-5 Package 410°C/W

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

ELECTRICAL CHARACTERISTICS
Electrical Characteristics at ICOL = 1 mA and TA = +25°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>AMS421A</th>
<th>AMS421B</th>
<th>AMS421C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>Reference Voltage</td>
<td></td>
<td>497.5</td>
<td>500.0</td>
<td>502.25</td>
</tr>
<tr>
<td>Deviation of Reference Voltage</td>
<td>VCOL = VREF, TA = -40°C to +125°C</td>
<td>0.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Change in Reference Voltage</td>
<td>ICOL = 100µA, VCC=1.4V to 15V</td>
<td>0.5</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Reference Input Current</td>
<td>ICOL = 0.1µA to 10mA</td>
<td>0.5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Reference Input Current Deviation</td>
<td>ICOL = 0.1µA to 10mA, TA = Full Range</td>
<td>0.1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Off State Collector Current</td>
<td>VREF = 0V</td>
<td>0.04</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Dynamic Output Impedance</td>
<td>f &lt; 1KHz, ICOL = 1 µA to 10mA</td>
<td>0.35</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Minimum Operating Current</td>
<td>VCOL = VREF</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Supply Current</td>
<td>ICOL = 100 µA</td>
<td>15</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

RECOMMENDED OPERATING CONDITIONS:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Voltage (VCOL)</td>
<td>VREF</td>
<td>15 V</td>
</tr>
<tr>
<td>Collector Current (ICOL)</td>
<td>1µA</td>
<td>10mA</td>
</tr>
</tbody>
</table>
TYPICAL APPLICATIONS

LOW NOISE PRECISION 1.000V REFERENCE

Low cost LDO using an External PNP
Set the \( V_{\text{OUT}} \) according to the following equation:

\[
V_{\text{OUT}} = V_{\text{REF}} \left( 1 + \frac{R_1}{R_2} \right) + I_{\text{REF}} R_1
\]

Maximum output current is (PNP Hfe)10mA. The transistor current rating and package depends on the application dropout. The power dissipation for the PNP transistor is \( I_{\text{out}} (V_{\text{in}} - V_{\text{out}}) \). The package type should be selected according to the Power dissipation.
TYPICAL PERFORMANCE CHARACTERISTICS

Output voltage vs. Supply voltage @ 100 µA

Output resistance Vs load

Supply Current vs Input Voltage @100uA

Supply current vs load

Very low current regulation

Input output transfer characteristic
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

**PSRR**

![PSRR Graph](image1)

**Output rejection Load 1k/10n**

![Output rejection Graph](image2)

**Input Bias Current**

![Input Bias Current Graph](image3)

**2 mA load Transient @ VCC=5V, Output Cap=10 nF**

**2 mA load Transient at VCC=15V, Output Cap=10 nF**

**Fast Start up 0-2V with common supply**

![Fast Start up Graph](image4)
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

Slow Start up 0-2V with common supply
PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

5 LEAD SOT-23 PLASTIC PACKAGE (M1)