Digital Attenuator, 10 dB, 1-Bit
DC - 2.0 GHz

Features
- Single 10 dB Step
- Low Loss: 0.3 dB @ 900 MHz
- Lead-Free SOT-25 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT-266

Description
The MAATSS0018 is a 1 bit, 10 dB step GaAs MMIC digital attenuator in a lead-free SOT-25 surface mount plastic package. This device uses a mature 1-micron process. The process features full chip passivation for increased performance and reliability.

The MAATSS0018 is ideally suited for use where high accuracy, very low power consumption and low intermodulation products are required. Typical applications include radio, wireless LANs, GPS equipment and other gain / level control circuits.

Functional Block Diagram

Pin Configuration

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF1</td>
<td>RF In/Out</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>RF Ground</td>
</tr>
<tr>
<td>3</td>
<td>RF2</td>
<td>RF In/Out</td>
</tr>
<tr>
<td>4</td>
<td>V1</td>
<td>Control Voltage</td>
</tr>
<tr>
<td>5</td>
<td>V2</td>
<td>Control Voltage</td>
</tr>
</tbody>
</table>

Ordering Information¹,²

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAATSS0018TR-3000</td>
<td>3000 piece reel</td>
</tr>
<tr>
<td>MAATSS0018SMB</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

¹ Reference Application Note M513 for reel size information.
² All sample boards include 5 loose parts.

Handling Procedures
Please observe the following precautions to avoid damage:

Static Sensitivity
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Electrical Specifications: \( T_A = +25^\circ C, V_C = 0 \, V / -3 \, V, Z_0 = 50 \, \Omega \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td>0 - 1 GHz</td>
<td>dB</td>
<td>—</td>
<td>0.3</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>1 - 2 GHz</td>
<td></td>
<td>0.5</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>Attenuation</td>
<td>DC - 2 GHz</td>
<td>dB</td>
<td>9.5</td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>VSWR</td>
<td>0 - 2 GHz</td>
<td>Ratio</td>
<td>—</td>
<td>1.4:1</td>
<td>—</td>
</tr>
<tr>
<td>( I_{P3} )</td>
<td>2 Tone @ 0 dBm, 5 MHz spacing</td>
<td>dBm</td>
<td>—</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>P1dB</td>
<td>1 GHz</td>
<td>dBm</td>
<td>—</td>
<td>28</td>
<td>—</td>
</tr>
<tr>
<td>( T_{RISE, , T_{FALL}} )</td>
<td>10% to 90% RF, 90% to 10% RF</td>
<td>ns</td>
<td>—</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>( T_{ON, , T_{OFF}} )</td>
<td>50% Control to 90% RF, 50% Control to 10% RF</td>
<td>ns</td>
<td>—</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Transients</td>
<td>In Band</td>
<td>mV</td>
<td>—</td>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>Control Current</td>
<td>(</td>
<td>V_C</td>
<td>= 3 , V )</td>
<td>( \mu A )</td>
<td>—</td>
</tr>
</tbody>
</table>

### Absolute Maximum Ratings\(^3,4\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>(+27 , dBm)</td>
</tr>
<tr>
<td>50 MHz</td>
<td>(+34 , dBm)</td>
</tr>
<tr>
<td>500 - 2000 MHz</td>
<td></td>
</tr>
<tr>
<td>Control Voltage</td>
<td>(-8.5 , V \leq V_C \leq +8 , V)</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>(-40^\circ C \text{ to } +85^\circ C)</td>
</tr>
<tr>
<td>Storing Temperature</td>
<td>(-65^\circ C \text{ to } +150^\circ C)</td>
</tr>
</tbody>
</table>

### Truth Table\(^5,6,7\)

<table>
<thead>
<tr>
<th>V1</th>
<th>V2</th>
<th>Attenuation State</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>10 dB</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Insertion Loss</td>
</tr>
</tbody>
</table>

**Notes:**

3. Exceeding any one or combination of these limits may cause permanent damage to this device.

4. MACOM does not recommend sustained operation near these survivability limits.

5. For positive voltage control, external DC blocking capacitors are required on all RF ports (pins 1, 2 and 3).

6. Differential voltage, \( V(\text{state 1}) - V(\text{state 0}) \), must be +2.8 V minimum and less than 8 V.

7. \( 0 = -8 \, V \text{ to } 0.2 \, V, 1 = -0.2 \, V \text{ to } 8 \, V \)
Typical Performance Curves (39 pF capacitors used for positive voltage control)

**Insertion Loss (Positive Control)**

- Frequency (GHz)
  - 0.0
  - 0.2
  - 0.4
  - 0.6
  - 0.8
  - 1.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- +25°C
- -40°C
- +85°C

**Insertion Loss (Negative Control)**

- Frequency (GHz)
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- +25°C
- -40°C
- +85°C

**Relative Attenuation (Positive Control)**

- Frequency (GHz)
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- +25°C
- -40°C
- +85°C

**Relative Attenuation (Negative Control)**

- Frequency (GHz)
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- +25°C
- -40°C
- +85°C

**Return Loss (Reference State)**

- Frequency (GHz)
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- Positive Control
- Negative Control

**Return Loss (10 dB State)**

- Frequency (GHz)
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0
- 0.0 0.5 1.0 1.5 2.0 2.5 3.0
- Positive Control
- Negative Control
Lead-Free SOT-25†

† Reference Application Note M538 for lead-free solder reflow recommendations.