AT-263-PIN

Digital Attenuator, 31 dB, 5-Bit, TTL Driver
DC - 2 GHz

Features
- Attenuation: 1 dB steps to 31 dB
- Temperature Stability: ±0.18 dB from -55°C to +85°C
- Low DC Power Consumption
- Hermetic Surface Mount Package
- Integral TTL Driver
- 50 Ω Nominal Impedance
- Lead-Free CR-12 Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description
The AT-263-PIN is a GaAs FET 5-bit digital attenuator with a 1 dB minimum step size and 31 dB total attenuation. This attenuator and integral TTL driver is in a hermetically sealed ceramic 16-lead surface mount package.

The AT-263-PIN is ideally suited for use where accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include dynamic range setting in precision receiver circuits and other gain/leveling control circuits.

Environmental screening is available. Contact the factory for information.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT-263-PIN</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>AT-263TR</td>
<td>1000 piece reel</td>
</tr>
<tr>
<td>AT-263-TB</td>
<td>Sample Test Board</td>
</tr>
</tbody>
</table>

Functional Schematic

Pin Configuration

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF1</td>
<td>9</td>
<td>C5</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>10</td>
<td>+5V</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>11</td>
<td>-5V</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>12</td>
<td>C4</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>13</td>
<td>C3</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>14</td>
<td>C2</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>15</td>
<td>C1</td>
</tr>
<tr>
<td>8</td>
<td>RF2</td>
<td>16</td>
<td>GND</td>
</tr>
</tbody>
</table>

2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

1. Reference Application Note M513 for reel size information.

# Electrical Specifications

### AT-263-PIN

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DC - 2 GHz

### Rev. V7

### Electrical Specifications

**-55°C to +85°C**

<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>DC - 0.5 GHz, DC - 1.0 GHz, DC - 2.0 GHz</td>
<td>dB</td>
<td>—</td>
<td>—</td>
<td>2.4</td>
</tr>
<tr>
<td>Attenuation Accuracy</td>
<td>Any single bits DC - 1.0 GHz</td>
<td>dB</td>
<td>±(0.25 + 3% of atten setting)</td>
<td>±(0.25 + 3% of atten setting) or ±0.4 whichever is greater</td>
<td></td>
</tr>
<tr>
<td>VSWR</td>
<td>Insertion Loss, DC - 2.0 GHz</td>
<td>Ratio</td>
<td>—</td>
<td>—</td>
<td>1.6:1</td>
</tr>
<tr>
<td>Switching Speed</td>
<td>50% Control to 90%/10% RF 10% to 90% or 90% to 10%</td>
<td>ns</td>
<td>40</td>
<td>9</td>
<td>—</td>
</tr>
<tr>
<td>Transients</td>
<td>In-Band (peak-peak)</td>
<td>mV</td>
<td>30</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1 dB Compression</td>
<td>0.05 GHz, 0.5 - 2.0 GHz</td>
<td>dBm</td>
<td>20</td>
<td>28</td>
<td>—</td>
</tr>
<tr>
<td>Input IP3</td>
<td>Two-tone inputs up to +5 dBm</td>
<td>dBm</td>
<td>40</td>
<td>48</td>
<td>—</td>
</tr>
<tr>
<td>Input IP2</td>
<td>Two-tone inputs up to +5 dBm</td>
<td>dBm</td>
<td>45</td>
<td>68</td>
<td>—</td>
</tr>
<tr>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>—</td>
<td>V</td>
<td>+4.5</td>
<td>+5.0</td>
<td>+5.5</td>
</tr>
<tr>
<td>V&lt;sub&gt;EE&lt;/sub&gt;</td>
<td>—</td>
<td>V</td>
<td>-8.0</td>
<td>—</td>
<td>-5.0</td>
</tr>
<tr>
<td>I&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; = 4.5 to 5.5 V</td>
<td>mA</td>
<td>—</td>
<td>—</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>V&lt;sub&gt;CONTROL&lt;/sub&gt; = 0 to 0.8 V, or V&lt;sub&gt;CC&lt;/sub&gt; = -2.1 V to V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>—</td>
<td>—</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;EE&lt;/sub&gt;</td>
<td>V&lt;sub&gt;EE&lt;/sub&gt; = -5 to -8 V</td>
<td>mA</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
</tr>
<tr>
<td>Voltage Control</td>
<td>Logic 0 (TTL)</td>
<td>V</td>
<td>0.0</td>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Logic 1 (TTL)</td>
<td></td>
<td>2.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Input Leakage Current</td>
<td>0 to 0.8 V</td>
<td>µA</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
</tr>
</tbody>
</table>

3. All specifications apply when operated with bias voltages of +5 V for V<sub>CC</sub> and -5 V for V<sub>EE</sub>.
4. This attenuator is guaranteed monotonic.
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DC - 2 GHz

Absolute Maximum Ratings\(^5,6\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td></td>
</tr>
<tr>
<td>0.05 GHz</td>
<td>27 dBm</td>
</tr>
<tr>
<td>0.5 - 2.0 GHz</td>
<td>34 dBm</td>
</tr>
<tr>
<td>(V_{CC})</td>
<td>-0.5 V \leq V_{CC} \leq +7.0 V</td>
</tr>
<tr>
<td>(V_{EE})</td>
<td>-8.5 V \leq V_{EE} \leq +0.5 V</td>
</tr>
<tr>
<td>(V_{CC} - V_{EE})</td>
<td>-0.5 V \leq V_{CC} - V_{EE} \leq 14.5 V</td>
</tr>
<tr>
<td>(V_{IN})</td>
<td>-0.5 V \leq V_{IN} \leq V_{CC} + 0.5 V</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +125°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

Truth Table\(^8\)

<table>
<thead>
<tr>
<th>Control Inputs</th>
<th>Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5 C4 C3 C2 C1</td>
<td></td>
</tr>
<tr>
<td>0 0 0 0 0</td>
<td>Reference</td>
</tr>
<tr>
<td>0 0 0 1 0</td>
<td>1 dB</td>
</tr>
<tr>
<td>0 0 1 0 0</td>
<td>2 dB</td>
</tr>
<tr>
<td>0 1 0 0 0</td>
<td>4 dB</td>
</tr>
<tr>
<td>1 0 0 0 0</td>
<td>8 dB</td>
</tr>
<tr>
<td>1 1 1 1 1</td>
<td>31 dB</td>
</tr>
</tbody>
</table>

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Recommended PCB Configuration
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Typical Performance Curves

Attenuation Accuracy vs. Frequency

VSWR vs. Frequency

Lead-Free, CR-12 Ceramic Package†

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