Digital Attenuator
30 dB, 4-Bit, TTL Driver, DC - 3 GHz

Features
- Attenuation: 2 dB Steps to 30 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 \( \Omega \) Impedance
- Temperature Stability: 
  \( \pm0.18 \) dB from -55°C to +85°C
- Lead-Free SO-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT65-0233

Description
The MAATCC0006 is a GaAs FET 4-bit digital attenuator with a 2 dB minimum step size and a 30 dB total attenuation range. This device is in a SOIC-16 plastic surface mount package.

The MAATCC0006 is ideally suited for use where accuracy, fast speed, very low power consumption is required. Typical applications include dynamic range setting in precision receiver circuits and other gain/leveling control circuits.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAATCC0006</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>MAATCC0006TR</td>
<td>1000 piece reel</td>
</tr>
<tr>
<td>MAATCC0006-TB</td>
<td>Sample Test Board</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

Schematic with Off-Chip Components or Functional Block Diagram

Pin Configuration

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Function</th>
<th>Pin #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>9</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>RF1</td>
<td>10</td>
<td>C1</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>11</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>NC²</td>
<td>12</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>Vee</td>
<td>13</td>
<td>NC²</td>
</tr>
<tr>
<td>6</td>
<td>Vcc</td>
<td>14</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>C4</td>
<td>15</td>
<td>RF2</td>
</tr>
<tr>
<td>8</td>
<td>C3</td>
<td>16</td>
<td>GND</td>
</tr>
</tbody>
</table>

2. NC = No Connection

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.
Digital Attenuator  
30 dB, 4-Bit, TTL Driver, DC – 3 GHz

**Electrical Specifications: \( T_A = 25^\circ \text{C} \)**

<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</td>
<td>dB</td>
<td>1.7</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>DC - 2.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC - 3.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attenuation Accuracy</td>
<td>Any Bit or Combination of Bits</td>
<td>dB</td>
<td>( \pm (.4 + 8% \text{ of attenuation}) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSWR</td>
<td>DC - 2.0 GHz</td>
<td>Ratio</td>
<td></td>
<td></td>
<td>1.7:1</td>
</tr>
<tr>
<td>Trise, Tfall</td>
<td>DC - 3.0 GHz</td>
<td>ns</td>
<td>10</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Ton, Toff Transients</td>
<td>DC - 3.0 GHz</td>
<td>mV</td>
<td>30</td>
<td>150</td>
<td>—</td>
</tr>
<tr>
<td>1 dB Compression</td>
<td>Input Power</td>
<td>dBm</td>
<td>—</td>
<td>+20</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>0.05 GHz</td>
<td></td>
<td></td>
<td>+28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 - 3.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input IP(_3)</td>
<td>Two-tone inputs up to +5 dBm</td>
<td>dBm</td>
<td>—</td>
<td>+40</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>0.05 GHz</td>
<td></td>
<td></td>
<td>+50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 - 3.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input IP(_2)</td>
<td>Two-tone inputs up to +5 dBm</td>
<td>dBm</td>
<td>—</td>
<td>+45</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>0.05 GHz</td>
<td></td>
<td></td>
<td>+68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 - 3.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC</td>
<td></td>
<td>V</td>
<td>-8.0</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>VEE</td>
<td></td>
<td></td>
<td>-5.0</td>
<td></td>
<td>-4.75</td>
</tr>
<tr>
<td>( V_{IL} )</td>
<td>LOW-level input voltage</td>
<td>V</td>
<td>0.0</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>( V_{IH} )</td>
<td>HIGH-level input voltage</td>
<td>V</td>
<td>2.0</td>
<td></td>
<td>5.0</td>
</tr>
<tr>
<td>Lin (Input Leakage Current)</td>
<td>( \text{Vin} = \text{V}_{\text{CC}} ) or ( \text{GND} )</td>
<td>( \mu \text{A} )</td>
<td>-1.0</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Icc (Quiescent Supply Current)</td>
<td>( \text{V}<em>{\text{Cntrl}} = \text{V}</em>{\text{CC}} ) or ( \text{GND} )</td>
<td>( \mu \text{A} )</td>
<td>-250</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>( \Delta I_{CC} ) (Additional Supply Current Per TTL Input Pin)</td>
<td>( \text{V}<em>{\text{CC}} = \text{Max}, \text{V}</em>{\text{Cntrl}} = \text{V}_{\text{CC}} - 2.1 \text{ V} )</td>
<td>mA</td>
<td>—</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>IEE</td>
<td>( \text{VEE} ) min to max, ( \text{Vin} = \text{V}<em>{\text{IL}} ) or ( \text{V}</em>{\text{IH}} )</td>
<td>mA</td>
<td>-1.0</td>
<td>-0.2</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>0.05 GHz</td>
<td>+34 dBm</td>
</tr>
<tr>
<td>0.5 - 3.0 GHz</td>
<td>—</td>
</tr>
<tr>
<td>( V_{CC} )</td>
<td>-0.5 V ( \leq V_{CC} ) ( \leq +7.0 \text{ V} )</td>
</tr>
<tr>
<td>( V_{EE} )</td>
<td>-8.5 V ( \leq V_{EE} ) ( \leq +0.5 \text{ V} )</td>
</tr>
<tr>
<td>( V_{CC} - V_{EE} )</td>
<td>-0.5 V ( \leq V_{CC} - V_{EE} ) ( \leq +14.5 \text{ V} )</td>
</tr>
<tr>
<td>( V_{IN} )</td>
<td>-0.5 V ( \leq V_{IN} ) ( \leq V_{CC} + 0.5 \text{ V} )</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40(^\circ)C to +85(^\circ)C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65(^\circ)C to +125(^\circ)C</td>
</tr>
</tbody>
</table>

**Truth Table (Digital Attenuator)\(^6\)**

<table>
<thead>
<tr>
<th>( C1 )</th>
<th>( C2 )</th>
<th>( C3 )</th>
<th>( C4 )</th>
<th>Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Loss, Reference</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.0 dB</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4.0 dB</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8.0 dB</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>16.0 dB</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>30.0 dB</td>
</tr>
</tbody>
</table>

6. 0 = TTL Low; 1 = TTL High

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. Standard CMOS TTL interface, latch-up will occur if logic signal applied prior to power supply.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.
Typical Performance Curves

Typical Insertion Loss (dB)

Attenuation Accuracy, 2 dB

Attenuation Accuracy, 4 dB

Attenuation Accuracy, 8 dB
Typical Performance Curves

**Attenuation Accuracy, 16 dB**

![Graph showing deviation from nominal attenuation for 16 dB attenuation accuracy.]

**Attenuation Accuracy, 30 dB**

![Graph showing deviation from nominal attenuation for 30 dB attenuation accuracy.]

**Typical RF1 VSWR**

![Graph showing VSWR for RF1 at various insertion losses (16 dB, 30 dB, 2, 4, & 8 dB).]

**Typical RF2 VSWR**

![Graph showing VSWR for RF2 at various insertion losses (16 dB, 30 dB, 2, 4, & 8 dB).]
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.

Lead-Free, SOIC-16†

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