Features

- Attenuation: 1 dB Steps to 50 dB
- Single Positive Supply
- Contains Internal DC to DC Converter
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance
- Lead-Free CSP-1 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT90-1106

Description

The MAAD-007080 is a GaAs FET 6-bit digital attenuator with integral TTL driver. Step size is 1 dB providing a 50 dB total attenuation range. This device is in a PQFN plastic surface mount package. MAAD-007080 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

For dual supply designs without switching noise, use MAAD-007082-000100.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAD-007080-00100</td>
<td>Bulk Packaging</td>
</tr>
<tr>
<td>MAAD-007080-001TR</td>
<td>1000 piece reel</td>
</tr>
<tr>
<td>MAAD-0007080-001TB</td>
<td>Sample Test Board</td>
</tr>
</tbody>
</table>

Note: Reference Application Note M513 for reel size information.

MAAD-007080

Digital Attenuator
50.0 dB, 6-Bit, TTL Driver, DC-2.4 GHz

Electrical Specifications: $T_A = 25^\circ$C, $Z_0 = 50\ \Omega$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Frequency</th>
<th>Units</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td></td>
<td>DC - 2.4 GHz</td>
<td>dB</td>
<td>—</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Attenuation Accuracy</td>
<td>Individual Bits 1-2-4-8-16-32 dB</td>
<td>DC - 2.4 GHz</td>
<td>dB</td>
<td>—</td>
<td>±(3  +5% of atten setting)</td>
<td>±(5  +8% of atten setting)</td>
</tr>
<tr>
<td></td>
<td>Any Combination of Bits 1 to 50 dB</td>
<td>DC - 2.4 GHz</td>
<td>dB</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>VSWR</td>
<td>Full Range</td>
<td>DC - 2.4 GHz</td>
<td>Ratio</td>
<td>—</td>
<td>1.8:1</td>
<td>2:1</td>
</tr>
<tr>
<td>Switching Speed</td>
<td>50% Cntl to 90%/10% RF</td>
<td>10% to 90% or 90% to 10%</td>
<td>ns</td>
<td>—</td>
<td>75</td>
<td>—</td>
</tr>
<tr>
<td>1 dB Compression</td>
<td>50 MHz</td>
<td>0.5 - 2.4 GHz</td>
<td>dBm</td>
<td>—</td>
<td>+21</td>
<td>+24</td>
</tr>
<tr>
<td>Input IP$_3$</td>
<td>Two-tone inputs up to +5 dBm</td>
<td>50 MHz</td>
<td>dB</td>
<td>—</td>
<td>+35</td>
<td>+48</td>
</tr>
<tr>
<td>VCC</td>
<td></td>
<td>—</td>
<td>V</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
</tr>
<tr>
<td>$V_{IL}$</td>
<td>LOW-level input voltage</td>
<td>—</td>
<td>V</td>
<td>0.0</td>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>$V_{IH}$</td>
<td>HIGH-level input voltage</td>
<td>—</td>
<td>V</td>
<td>0.0</td>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>lin (Input Leakage Current)</td>
<td>Vin = $V_C$ or GND</td>
<td>—</td>
<td>$\mu$A</td>
<td>-1.0</td>
<td>—</td>
<td>1.0</td>
</tr>
<tr>
<td>Icc$^4$</td>
<td>$V_C$ min to max, Logic “0” or “1”</td>
<td>—</td>
<td>mA</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Turn-on Current$^5$</td>
<td>For guaranteed start-up</td>
<td>—</td>
<td>mA</td>
<td>—</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>$\Delta$Icc$^6$ (Additional Supply Current Per TTL Input Pin)</td>
<td>$V_C = Max, V_{Cntl} = V_C - 2.1 V$</td>
<td>mA</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Switching Noise</td>
<td>Generated from DC-DC Converter with recommended capacitors</td>
<td>3.5 MHz</td>
<td>dBm</td>
<td>—</td>
<td>-93</td>
<td>—</td>
</tr>
<tr>
<td>Thermal Resistance $\theta_{jc}$</td>
<td>—</td>
<td>$^\circ$C/W</td>
<td>—</td>
<td>15</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

4. During turn-on, the device requires an initial “Turn-on Current”. Once operational, Icc will drop to the specified levels.
5. The DC-DC converter is guaranteed to start in 100 µs as long as the power supplies can provide a minimum of 100 mA “Turn-on Current”.

Absolute Maximum Ratings$^6,7$

<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 - 2.4 GHz</td>
<td></td>
</tr>
<tr>
<td>$V_{CC}$</td>
<td>-0.5V $\leq V_{CC} \leq +6.0V$</td>
</tr>
<tr>
<td>$Vin^8$</td>
<td>-0.5V $\leq Vin \leq V_{CC} + 0.5V$</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +125°C</td>
</tr>
</tbody>
</table>

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

Recommended PCB Configuration$^9$

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.

**Moisture Sensitivity**
The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

**Typical Performance Curves**

*Insertion Loss*

![Insertion Loss Graph](image)

*VSWR @ Insertion Loss*

![VSWR Graph](image)

*Attenuation Error, 1 dB Bit*

![Attenuation Error 1 dB Graph](image)

*Attenuation Error, 2 dB Bit*

![Attenuation Error 2 dB Graph](image)
Typical Performance Curves

- **Attenuation Error, 4 dB Bit**
  - Frequency (MHz) vs. Attenuation Error (dB)

- **Attenuation Error, 8 dB Bit**
  - Frequency (MHz) vs. Attenuation Error (dB)

- **Attenuation Error, 16 dB Bit**
  - Frequency (MHz) vs. Attenuation Error (dB)

- **Attenuation Error, 32 dB Bit**
  - Frequency (MHz) vs. Attenuation Error (dB)

- **Attenuation Error, Max. Attenuation**
  - Frequency (MHz) vs. Attenuation Error (dB)

- **VSWR, 1 dB Bit**
  - Frequency (MHz) vs. VSWR

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Digital Attenuator
50.0 dB, 6-Bit, TTL Driver, DC-2.4 GHz

Typical Performance Curves

VSWR, 2 dB Bit

VSWR, 4 dB Bit

VSWR, 8 dB Bit

VSWR, 16 dB Bit

VSWR, 32 dB Bit

VSWR, Maximum attenuation

For further information and support please visit:
https://www.macom.com/support
Digital Attenuator
50.0 dB, 6-Bit, TTL Driver, DC-2.4 GHz

Typical Performance Curves

Maximum IP3 over Temperature Range and
Attenuation @ 50 MHz

Maximum IP3 over Temperature Range and
Attenuation @ 950 MHz

Maximum IP3 over Temperature Range and
Attenuation @ 1900 MHz
CSP-1, Lead-Free 4 x 6 mm, 32-lead PQFN†

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