Power Detector
5 - 44 GHz

Features
- Input Power: -15 to +15 dBm
- Dynamic Range: 30 dB
- DC supply: 4.5 V, 70 µA
- Lead-Free 3 mm 16-Lead QFN Package
- ESD protected
- RoHS* Compliant

Description
MADT-011000 is a single-ended, internally-matched power detector with wide input bandwidth and high dynamic range. The circuit consumes 70 µA from a 4.5 V supply, while matched detector and reference diodes provide temperature compensation in differential operation.

The power detector is housed in a 3 mm 16-lead QFN package and is ESD protected for reliability and ease of handling.

MADT-011000 is well suited for power control in microwave radios, test and measurement equipment, and radar applications.

MADT-011000 is also available in bare die format. Refer to datasheet MADT-011000-DIE.

Ordering Information1,2

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADT-011000</td>
<td>Bulk</td>
</tr>
<tr>
<td>MADT-011000-TR1000</td>
<td>1000 Piece Reel</td>
</tr>
<tr>
<td>MADT-011000-SB1</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.

Functional Schematic

Pin Configuration3

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 4, 8 - 16</td>
<td>GND3</td>
</tr>
<tr>
<td>3</td>
<td>RFIN</td>
</tr>
<tr>
<td>5</td>
<td>VDET</td>
</tr>
<tr>
<td>6</td>
<td>VDC</td>
</tr>
<tr>
<td>7</td>
<td>VREF</td>
</tr>
</tbody>
</table>

3. MACOM recommends connecting unused package pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Electrical Specifications: Freq. = 5 - 44 GHz, $T_A = +25^\circ$C, $V_{DC} = 4.5$ 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>Input Power</td>
<td></td>
<td>dBm</td>
<td>-15</td>
<td>—</td>
<td>+15</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>$V_{ref} - V_{det} &gt; 5\ mV$</td>
<td>dB</td>
<td>30</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vdelta</td>
<td>$V_{delta} = V_{ref} - V_{det}$, Input power = -15 to +15 dBm</td>
<td>mV</td>
<td>5</td>
<td>—</td>
<td>2200</td>
</tr>
<tr>
<td>Return Loss</td>
<td>5 - 10 GHz</td>
<td>dB</td>
<td>—</td>
<td>-11</td>
<td>-9</td>
</tr>
<tr>
<td></td>
<td>10 - 12 GHz</td>
<td></td>
<td>-11</td>
<td>-9</td>
<td>-9</td>
</tr>
<tr>
<td></td>
<td>12 - 36 GHz</td>
<td></td>
<td>-15</td>
<td>-9</td>
<td>-9</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td></td>
<td>V</td>
<td>—</td>
<td>4.5</td>
<td>—</td>
</tr>
<tr>
<td>Current Consumption</td>
<td></td>
<td>µA</td>
<td>60</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

5. All specifications refer to CW input signal.

Absolute Maximum Ratings$^{6,7}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>18 dBm</td>
</tr>
<tr>
<td>VDC</td>
<td>6 V</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°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.

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 Class 1B devices.

Application Circuit$^{8,9}$

8. External 27 kΩ resistors are recommended for optimum performance.
9. Typical $V_{ref} = 0.74$ V

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Typical Performance Curves: \(T_A = 25^\circ C\)

**V\text{delta} vs. Input Power, 5 - 10 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 5 GHz, 6 GHz, 7 GHz, 8 GHz, 9 GHz, 10 GHz

**V\text{delta} vs. Input Power, 11 - 17 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 11 GHz, 12 GHz, 13 GHz, 14 GHz, 15 GHz, 16 GHz, 17 GHz

**V\text{delta} vs. Input Power, 18 - 24 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 18 GHz, 19 GHz, 20 GHz, 21 GHz, 22 GHz, 23 GHz, 24 GHz

**V\text{delta} vs. Input Power, 25 - 31 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 25 GHz, 26 GHz, 27 GHz, 28 GHz, 29 GHz, 30 GHz, 31 GHz

**V\text{delta} vs. Input Power, 32 - 38 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 32 GHz, 33 GHz, 34 GHz, 35 GHz, 36 GHz, 37 GHz, 38 GHz

**V\text{delta} vs. Input Power, 39 - 44 GHz**

- Input Power (dBm) vs. V\text{delta} (V)
- Frequencies: 39 GHz, 40 GHz, 41 GHz, 42 GHz, 43 GHz, 44 GHz
Power Detector
5 - 44 GHz

Typical Performance Curves - Over Temperature

Vdelta vs. Temperature, 5 GHz

Vdelta vs. Temperature, 15 GHz

Vdelta vs. Temperature, 23 GHz

Vdelta vs. Temperature, 30 GHz

Vdelta vs. Temperature, 38 GHz

Vdelta vs. Temperature, 44 GHz

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Typical Performance Curves

**Vdelta vs. Frequency, P\text{IN} = -15\ dBm**

![Graph showing Vdelta vs. Frequency for P\text{IN} = -15\ dBm at different temperatures (+25°C, -40°C, +85°C).]

**Vdelta vs. Frequency, P\text{IN} = 0\ dBm**

![Graph showing Vdelta vs. Frequency for P\text{IN} = 0\ dBm at different temperatures (+25°C, -40°C, +85°C).]

**Vdelta vs. Frequency, P\text{IN} = +15\ dBm**

![Graph showing Vdelta vs. Frequency for P\text{IN} = +15\ dBm at different temperatures (+25°C, -40°C, +85°C).]

**Input Return Loss vs. Frequency**

![Graph showing Input Return Loss vs. Frequency with a response in dB across different temperatures (+25°C, -40°C, +85°C).]
Lead-Free 3 mm 16-Lead PQFN†

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg
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