Power Detector Bare Die
5 - 44 GHz

Features
- Input Power: -15 to +15 dBm
- Dynamic Range: 30 dB
- DC supply: 4.5 V, 70 µA
- Die size: 1.00 × 0.75 × 0.1 mm
- Passivated Die
- ESD Protected
- RoHS* Compliant

Description
MADT-011000-DIE is a single-ended, internally-matched power detector with wide frequency range 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 100 µm thick GaAs die is fully passivated for reliability and ease of handling.

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

MADT-011000-DIE is also available in a 3 mm QFN package. Refer to datasheet MADT-011000.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADT-011000-DIE</td>
<td>Vacuum release gel pack¹</td>
</tr>
<tr>
<td>MADT-011000-SB2</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

¹ Die quantity varies.

Functional Schematic

Bond-pad Configuration

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND/NC</td>
</tr>
<tr>
<td>2</td>
<td>RFIN</td>
</tr>
<tr>
<td>3</td>
<td>GND/NC</td>
</tr>
<tr>
<td>4</td>
<td>VDET</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
</tr>
<tr>
<td>6</td>
<td>VDC</td>
</tr>
<tr>
<td>7</td>
<td>VREF</td>
</tr>
<tr>
<td>8</td>
<td>GND²</td>
</tr>
</tbody>
</table>

² The die backside must be connected to RF, DC and thermal ground.

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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>Vref - Vdet &gt; 5 mV</td>
<td>dB</td>
<td>30</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vdelta</td>
<td>Vdelta = Vref - Vdet</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>-12</td>
<td>-11</td>
<td>-11</td>
</tr>
<tr>
<td></td>
<td>12 - 36 GHz</td>
<td></td>
<td>-12</td>
<td>-9</td>
<td>-9</td>
</tr>
<tr>
<td></td>
<td>36 - 42 GHz</td>
<td></td>
<td>-9</td>
<td>-6.5</td>
<td>-6.5</td>
</tr>
<tr>
<td></td>
<td>42 - 44 GHz</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</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>( \mu A )</td>
<td>60</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

3. All specifications refer to CW input signal.

Absolute Maximum Ratings

<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>-55°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. 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

6. External 27 k\( \Omega \) resistors are required for optimum performance.
7. Typical Vref = 0.83V
8. Attach bare die to PCB or carrier using conductive epoxy

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DC-0012069
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Typical Performance Curves

**Vdelta vs. Input Power, 5 - 10 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 5 to 10 GHz]

**Vdelta vs. Input Power, 11 - 17 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 11 to 17 GHz]

**Vdelta vs. Input Power, 18 - 24 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 18 to 24 GHz]

**Vdelta vs. Input Power, 25 - 31 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 25 to 31 GHz]

**Vdelta vs. Input Power, 32 - 38 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 32 to 38 GHz]

**Vdelta vs. Input Power, 39 - 44 GHz**

![Graph showing Vdelta vs. Input Power for frequencies 39 to 44 GHz]
Typical Performance Curves

**Vdelta vs. Temperature, 5 GHz**

-20 -15 -10 -5 0 5 10 15

**Vdelta vs. Temperature, 15 GHz**

-20 -15 -10 -5 0 5 10 15

**Vdelta vs. Temperature, 23 GHz**

-20 -15 -10 -5 0 5 10 15

**Vdelta vs. Temperature, 30 GHz**

-20 -15 -10 -5 0 5 10 15

**Vdelta vs. Temperature, 38 GHz**

-20 -15 -10 -5 0 5 10 15

**Vdelta vs. Temperature, 44 GHz**

-20 -15 -10 -5 0 5 10 15

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Typical Performance Curves

**V_{\text{delta}} vs. Frequency, P_{IN} = -15 \, \text{dBm}**

**V_{\text{delta}} vs. Frequency, P_{IN} = 0 \, \text{dBm}**

**V_{\text{delta}} vs. Frequency, P_{IN} = +15 \, \text{dBm}**

**Input Return Loss vs. Frequency**
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Outline Drawing

Notes:
All units are in microns, unless otherwise noted, with a tolerance of ±5 µm.
Die thickness is 100 ±10 µm
RF bond-pad is 100 × 200 µm.
All other bond-pads are 100 × 100 µm.
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