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

Matching & bias

1. Pin #
2. Function
3. VDET
4. VDC
5. VREF

Bond-pad Configuration²

<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>$V_{ref} - V_{det} &gt; 5$ mV</td>
<td>dB</td>
<td>30</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vdelta</td>
<td>$V_{delta} = V_{ref} - V_{det}$</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>-9</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>-9</td>
<td>-9</td>
</tr>
<tr>
<td></td>
<td>$42 - 44$ GHz</td>
<td>—</td>
<td>-6.5</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>µA</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 Temp.</td>
<td>-55°C to +85°C</td>
</tr>
<tr>
<td>Storage Temp.</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 kΩ resistors are required for optimum performance.
7. Typical $V_{ref} = 0.83$ V
8. Attach bare die to PCB or carrier using conductive epoxy

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Typical Performance Curves

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

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

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

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

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

V\text{delta} vs. Input Power, 39 - 44 GHz
Typical Performance Curves

**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

1. **Vdelta vs. Frequency, P_{IN} = -15 dBm**
   - Graph showing Vdelta (V) vs. Frequency (GHz) for different temperatures (-25°C, -55°C, +85°C).

2. **Vdelta vs. Frequency, P_{IN} = 0 dBm**
   - Graph showing Vdelta (V) vs. Frequency (GHz) for different temperatures (-25°C, -55°C, +85°C).

3. **Vdelta vs. Frequency, P_{IN} = +15 dBm**
   - Graph showing Vdelta (V) vs. Frequency (GHz) for different temperatures (-25°C, -55°C, +85°C).

4. **Input Return Loss vs. Frequency**
   - Graph showing Response (dB) vs. Frequency (GHz) for different temperatures (-25°C, -55°C, +85°C).
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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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