Features
- Wideband Distributed Amplifier
- 26 dB Small Signal Gain
- +20 dBm P1dB Compression Point
- +30 dBm IP3
- 6 dB Noise Figure
- 100% On Wafer DC and RF Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010

Description
The MAAM-015023-DIE is a four stage 18 - 40 GHz GaAs MMIC distributed amplifier that has a small signal gain of 26 dB and a P1dB Compression Point of +20 dBm. The device has a Third Order Intercept Point of +30 dBm.

This device is well suited for Millimeter-wave Point-to-Point Radio, Radar, SATCOM and VSAT applications.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAM-015023-DIE</td>
<td>DIE in Gel Pack</td>
</tr>
</tbody>
</table>

*Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.*
Distributed Amplifier
18 - 40 GHz

Electrical Specifications³: Freq. = 18 - 40 GHz, $T_A = +25^\circ$C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Signal Gain</td>
<td>dB</td>
<td>22</td>
<td>26</td>
<td>—</td>
</tr>
<tr>
<td>21.0 - 35.0 GHz</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.7 GHz</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>dB</td>
<td>—</td>
<td>+/- 0.5</td>
<td>—</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>dB</td>
<td>—</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>dB</td>
<td>—</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>dB</td>
<td>—</td>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>Saturated Power</td>
<td>dBm</td>
<td>—</td>
<td>22</td>
<td>—</td>
</tr>
<tr>
<td>Output Power @ Pin = -2 dBm</td>
<td>dBm</td>
<td>18</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>21.0 - 35.0 GHz</td>
<td></td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.7 GHz</td>
<td></td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output IP3 @ 10 dBm per tone</td>
<td>dBm</td>
<td>—</td>
<td>30</td>
<td>—</td>
</tr>
<tr>
<td>P1dB</td>
<td>dBm</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Supply Current (I_D1,2,3,4)</td>
<td>mA</td>
<td>—</td>
<td>335</td>
<td>—</td>
</tr>
<tr>
<td>Drain Voltage (V_D1,2,3,4)</td>
<td>V</td>
<td>—</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>Gate Voltage (V_G1,2,3,4)</td>
<td>V</td>
<td>—</td>
<td>-0.3</td>
<td>—</td>
</tr>
</tbody>
</table>

3. Gate voltage must be applied prior to drain voltage. Set $V_{G1}, V_{G2}, V_{G3}, V_{G4}$ to $-1.0V$, apply $V_{DD}$, then adjust $V_{G1}, V_{G2}, V_{G3}, V_{G4}$ to achieve specified current.

Absolute Maximum Ratings⁴,⁵

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>+5 VDC</td>
</tr>
<tr>
<td>Gate Bias Voltage</td>
<td>-1.5 V ≤ V_g ≤ -0.1 V</td>
</tr>
<tr>
<td>Supply Current</td>
<td>500 mA</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +165°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+175°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.

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Typical Performance Curves

Gain vs. Frequency

Reverse Isolation vs. Frequency

Input Return Loss vs. Frequency

Output Return Loss vs. Frequency

Output Power vs. Frequency, $V_D = -0.3$ V, $V_D = 4$ V

Gain vs. $P_{OUT}$, $V_G = -0.3$ V, $V_D = 4$ V
Typical Performance Curves

**P1dB vs. Frequency**

**Output IP3 vs. Frequency (Lower Side Band)**

**Output IP3 Loss vs. Frequency (Upper Side Band)**

**Output IP3 vs. Output Power per tone (Lower Side Band)**

\[ V_G = -0.3 \, \text{V}, \, V_D = 4 \, \text{V} \]

**Output IP3 vs. Output Power per tone (Upper Side Band)**

\[ V_G = -0.3 \, \text{V}, \, V_D = 4 \, \text{V} \]
Bias Arrangement

App Note [1] Biasing

The gate bias (Vg1, Vg2, Vg3 and Vg4) should always be applied before the drain voltage (Vd1, Vd2, Vd3 and Vd4) is applied and when switching off the amplifier the drain voltage must be switched off first before the gate voltage.

The MAAM-015023-DIE is biased directly through the gates (Vg1,Vg2, Vg3 and Vg4). The amplifier is biased typically with Vg = -0.3 V and Vd = 4 V.

App Note [2] Bias Arrangement

Each DC pin (Vd and Vg) needs to have DC bypass capacitance of 100 pF as close to the device as possible. It is recommended to also use a further capacitance of 10 nF on the DC pins.

Mechanical Dimensions
Die Attachment
This product is 0.100 mm (0.004") thick and has vias through to the backside to enable grounding to the circuit. Microstrip substrates should be brought as close to the die as possible. The mounting surface should be clean and flat. If using conductive epoxy, recommended epoxies are Tanaka TS332LD, Die Mat DM6030HK or DM6030HK-Pt cured in a nitrogen atmosphere per manufacturer's cure schedule. Apply epoxy sparingly to avoid getting any on to the top surface of the die. An epoxy fillet should be visible around the total die periphery. For additional information please see the MACOM "Epoxy Specifications for Bare Die" application note. If eutectic mounting is preferred, then a flux-less gold-tin (AuSn) preform, approximately 0.0012 thick, placed between the die and the attachment surface should be used. A die bonder that utilizes a heated collet and provides scrubbing action to ensure total wetting to prevent void formation in a nitrogen atmosphere is recommended. The gold-tin eutectic (80% Au 20% Sn) has a melting point of approximately 280°C (Note: Gold Germanium should be avoided). The work station temperature should be 310°C +/- 10°C. Exposure to these extreme temperatures should be kept to minimum. The collet should be heated, and the die pre-heated to avoid excessive thermal shock. Avoidance of air bridges and force impact are critical during placement.

Life Support Policy
This product is not authorized for use as critical components in life support devices or systems without the express written approval of the President and General Counsel of MACOM. As used herein: (1) Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user. (2) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.
Distributed Amplifier
18 - 40 GHz

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