MAAP-011022

7 W Pulsed High Power Amplifier
2.7 - 3.0 GHz, 6 mm PQFN 28-LD

Features
- 7 W Pulsed Output Power (Saturated)
- 23 dB Gain
- +10 V Bias Operation
- 50 Ω Impedance, Balanced Design
- Lead-Free 6 mm 28-lead PQFN Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description
The MAAP-011022 is a 2.7 to 3.0 GHz high power balanced amplifier, which is designed for S-Band aviation and weather radar applications. This device puts out 7 W pulsed and is designed to operate at an 8% duty cycle.

The MAAP-011022 is packaged in a lead-free 6 mm 28-lead plastic package for high volume manufacturing. This IC utilizes one of MACOM’s advanced 0.5 µm processes, which has been optimized so amplifiers, passives, and control components can be combined on a single IC.

This MAAP-011022 is specifically targeted for avionics and weather radar.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAP-011022-TR0500</td>
<td>500 piece reel</td>
</tr>
<tr>
<td>MAAP-011022-001SMB</td>
<td>Sample Test Board</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.
2. Sample board includes 5 loose parts.


Pin Configuration

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VD2A</td>
<td>15</td>
<td>VC\text{OUT}</td>
</tr>
<tr>
<td>2</td>
<td>No Connection</td>
<td>16</td>
<td>VG1B</td>
</tr>
<tr>
<td>3</td>
<td>VD1A</td>
<td>17</td>
<td>VG2B</td>
</tr>
<tr>
<td>4</td>
<td>No Connection</td>
<td>18</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>VG2A</td>
<td>19</td>
<td>VD1B</td>
</tr>
<tr>
<td>6</td>
<td>VG1A</td>
<td>20</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>No Connection</td>
<td>21</td>
<td>VD2B</td>
</tr>
<tr>
<td>8</td>
<td>No Connection</td>
<td>22</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>RF\text{IN}</td>
<td>23</td>
<td>RF\text{OUT}</td>
</tr>
<tr>
<td>10</td>
<td>No Connection</td>
<td>24</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>No Connection</td>
<td>25</td>
<td>No Connection</td>
</tr>
<tr>
<td>12</td>
<td>No Connection</td>
<td>26</td>
<td>No Connection</td>
</tr>
<tr>
<td>13</td>
<td>HPA\text{CNTRL}</td>
<td>27</td>
<td>DET\text{OUT}</td>
</tr>
<tr>
<td>14</td>
<td>-5 V</td>
<td>28</td>
<td>T\text{SENSE}</td>
</tr>
<tr>
<td>29</td>
<td>Ground Pad</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. See the evaluation board schematic for the recommended external components.
4. VDAx and VDBx are connected to the +10 V bias.
5. The gates are controlled internally from the bias circuit shown on the evaluation board schematic but need to be bypassed as shown. VGAx must be connected to VGBx.
6. HPA\text{CNTRL} is tied to +5 V for drain switching. For gate switching the PA is turned off when HPA\text{CNTRL} is at 0 V.
7. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

For further information and support please visit: https://www.macom.com/support
**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input Power</td>
<td>+25 dBm</td>
</tr>
<tr>
<td>Drain Voltage</td>
<td>12 V</td>
</tr>
<tr>
<td>Gate Voltage (VGAx, VGBx)</td>
<td>-3 V to 0 V[13]</td>
</tr>
<tr>
<td>Negative Voltage</td>
<td>-6 V ≤ -5 V Bias ≤ 0.5 V</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>10 %</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature[14]</td>
<td>160°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +125°C</td>
</tr>
</tbody>
</table>

**Handling Procedures**

Please observe the following precautions to avoid damage:

**Static Sensitivity**

Gallium Arsenide and Silicon 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.

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8. Under RF drive.
9. Slope -1.69 mV/°C

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**Electrical Specifications:** Freq. = 2.7 - 3.0 GHz, T_A = 25°C, VDAx = VDBx = +10 V, I_DQ = ~2.0 A, Z_0 = 50 Ω, 80 µs Pulse, 8% Duty Cycle

<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>21.0</td>
<td>23.5</td>
<td>25</td>
</tr>
<tr>
<td>Input / Output Return Loss</td>
<td>dB</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>P1dB</td>
<td>dBm</td>
<td>-</td>
<td>37.5</td>
<td>-</td>
</tr>
<tr>
<td>P_SAT (P_IN = +18 dBm)</td>
<td>dBm</td>
<td>37.0</td>
<td>38.3</td>
<td>-</td>
</tr>
<tr>
<td>PAE</td>
<td>%</td>
<td>-</td>
<td>28.0</td>
<td>-</td>
</tr>
<tr>
<td>Power Detector Voltage[6] @ P3dB</td>
<td>mV</td>
<td>-</td>
<td>2200</td>
<td>-</td>
</tr>
<tr>
<td>Temperature Sensor Voltage[9] @ 25°C</td>
<td>V</td>
<td>-3.50</td>
<td>-3.24</td>
<td>-3.00</td>
</tr>
<tr>
<td>-5 V Current</td>
<td>mA</td>
<td>-</td>
<td>9.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Drain Current</td>
<td>A</td>
<td>-</td>
<td>2.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>

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10. Exceeding any one or combination of these limits may cause permanent damage to this device.
11. MACOM does not recommend sustained operation near these survivability limits.
12. Operating at nominal conditions with T_J ≤ 160°C will ensure MTTF > 1 x 10^6 hours.
13. VGAx, VGBx can go to +0.3 V if no drain voltage is applied.
14. Junction Temperature (T_J) = T_C + θ_JC * ((V * I) - (P_OUT - P_IN))

Typical thermal resistance:
80 µs pulse, 8% duty cycle, θ_JC = 2.0°C/W
a) For T_C = +25°C,
   T_J = 62 °C @ 10 V, 2.5 A, P_OUT = 6.6 W, P_IN = 0.07 W
b) For T_C = +85°C,
   T_J = 143 °C @ 10 V, 3.4 A, P_OUT = 5.0 W, P_IN = 0.07 W
15. The standard build configuration is to omit resistors R15 & R16. This configuration activates the on-board +10 V pulser circuit.
16. In order to bypass on-board +10 V pulser circuit, remove R13, R14, R17 & R18, and add R15 & R16.
Typical Performance Curves: $V_{DAx}=V_{DBx}=10\,V$, $I_{DQ}=2.0\,A$ (80 µs Pulse, 8% Duty Cycle)

- **Gain vs. Frequency**
  - $S_{21}\,(\text{dB})$
  - Frequency (GHz)

- **Input Return Loss vs. Frequency**
  - $S_{11}\,(\text{dB})$
  - Frequency (GHz)

- **Output Return Loss vs. Frequency**
  - $S_{22}\,(\text{dB})$
  - Frequency (GHz)

- **Reverse Isolation vs. Frequency**
  - $S_{12}\,(\text{dB})$
  - Frequency (GHz)

- **Gain vs. Output Power**
  - Gain (dB)
  - Output Power (dBm)

- **Drain Current vs. Output Power**
  - $I_{DQ}\,(A)$
  - Output Power (dBm)

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7 W Pulsed High Power Amplifier
2.7 - 3.0 GHz, 6 mm PQFN 28-LD

Rev. V3

Typical Performance Curves: VDAx=VDBx=10 V, I_DQ=2.0 A (80 µs Pulse, 8% Duty Cycle)

P1dB vs. Frequency

P3dB vs. Frequency

PAE vs. Frequency

Power Detector Voltage vs. Output Power

Temperature Sensor Voltage vs. Temperature

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https://www.macom.com/support
Typical Performance Curves: VDAx=VDBx=10 V, IDQ=2.0 A (80 µs Pulse, 8% Duty Cycle)

Load Ruggedness 2:1 vs. Input Power

Load Ruggedness 3:1 vs. Input Power

Load Ruggedness 6:1 vs. Input Power

Load Ruggedness 9:1 vs. Input Power
Typical Performance Curves: \( V_{\text{DAx}}=V_{\text{DBx}}=10 \, \text{V}, \quad I_{\text{DQ}}=2.0 \, \text{A} \) (80 µs Pulse, 8% Duty Cycle)

1. **2nd Harmonic @ P1dB vs. Frequency**
2. **3rd Harmonic @ P1dB vs. Frequency**
3. **2nd Harmonic @ P3dB vs. Frequency**
4. **3rd Harmonic @ P3dB vs. Frequency**
5. **2nd Harmonic @ -10 dBm vs. Frequency**
**Lead-Free 6 mm 28-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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