The CMD201 is wideband GaAs MMIC distributed power amplifier die which operates from DC to 20 GHz. The amplifier delivers greater than 12 dB of gain with a corresponding output 1 dB compression point of +29 dBm and output IP3 of 38 dBm at 10 GHz. The CMD201 is a 50 ohm matched design which eliminates the need for RF port matching. The CMD201 offers full passivation for increased reliability and moisture protection.

**Features**
- Ultra wideband performance
- High linearity
- High output power
- Excellent return losses
- Small die size

**Description**

**Electrical Performance - \( V_{dd} = 10.0 \, \text{V}, \, V_{gg1} = -0.55 \, \text{V}, \, V_{gg2} = 5.0 \, \text{V}, \, T_A = 25 \, ^\circ \text{C}, \, F = 10 \, \text{GHz} \)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>DC</td>
<td>20</td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Gain</td>
<td>12</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>3.4</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>16</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>17</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>29</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Supply Current</td>
<td>400</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>
## Specifications

### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Voltage, Vdd</td>
<td>12.0 V</td>
</tr>
<tr>
<td>Gate1 Voltage, Vgg1</td>
<td>-2.0 to 0 V</td>
</tr>
<tr>
<td>Gate2 Voltage, Vgg2</td>
<td>6.0 V</td>
</tr>
<tr>
<td>RF Input Power</td>
<td>+30 dBm</td>
</tr>
<tr>
<td>Channel Temperature, Tch</td>
<td>150 °C</td>
</tr>
<tr>
<td>Power Dissipation, Pdiss</td>
<td>5.43 W</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>11.9 °C/W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55 to 85 °C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-55 to 150 °C</td>
</tr>
</tbody>
</table>

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vdd</td>
<td>8.0</td>
<td>10.0</td>
<td>12.0</td>
<td>V</td>
</tr>
<tr>
<td>Idd</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>mA</td>
</tr>
<tr>
<td>Vgg1</td>
<td>-0.55</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Vgg2</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electrical performance is measured at specific test conditions. Electrical specifications are not guaranteed over all recommended operating conditions.

Operation of this device outside the maximum ratings may cause permanent damage.

### Electrical Specifications, \( V_{dd} = 10.0 \text{ V}, V_{gg1} = -0.55 \text{ V}, V_{gg2} = 5.0 \text{ V}, T_A = 25 \degree \text{C} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>DC-6</td>
<td>6-20</td>
<td>GHz</td>
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<tr>
<td>Gain</td>
<td>8</td>
<td>11</td>
<td>9</td>
<td>12</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>5</td>
<td></td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>15</td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>10</td>
<td></td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output P1dB</td>
<td>27</td>
<td>29.5</td>
<td>25</td>
<td>29</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Output IP3</td>
<td>40</td>
<td></td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Supply Current</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>Gain Temperature Coefficient</td>
<td>0.009</td>
<td></td>
<td>0.014</td>
<td></td>
<td></td>
<td></td>
<td>dB/°C</td>
</tr>
<tr>
<td>Noise Figure Temperature Coefficient</td>
<td>0.01</td>
<td></td>
<td>0.012</td>
<td></td>
<td></td>
<td></td>
<td>dB/°C</td>
</tr>
</tbody>
</table>

ver 1.4 0218
Typical Performance

Broadband Performance, $V_{dd} = 10\, V$, $V_{gg1} = -0.55\, V$, $V_{gg2} = 5\, V$, $I_{dd} = 400\, mA$, $T_A = 25\, ^\circ C$

Narrow-band Performance, $V_{dd} = 10\, V$, $V_{gg1} = -0.55\, V$, $V_{gg2} = 5\, V$, $I_{dd} = 400\, mA$, $T=25\, ^\circ C$
**Typical Performance**

Gain vs. Temperature, $V_{dd} = 10$ V, $V_{gg1} = -0.55$ V, $V_{gg2} = 5$ V

![Gain vs. Temperature Graph](image)

Noise Figure vs. Temperature, $V_{dd} = 10$ V, $V_{gg1} = -0.55$ V, $V_{gg2} = 5$ V

![Noise Figure vs. Temperature Graph](image)
**Output Power,** $V_{dd} = 10$ V, $V_{g1} = -0.55$ V, $V_{g2} = 5$ V, $T_A = 25$ °C

![](image1)

**P1dB vs. Temperature,** $V_{dd} = 10$ V, $V_{g1} = -0.55$ V, $V_{g2} = 5$ V

![](image2)
Output IP3 vs. Temperature, $V_{dd} = 10$ V, $V_{gg1} = -0.55$ V, $V_{gg2} = 5$ V
Die Outline (all dimensions in microns)

Notes:
1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 85 microns thick
5. DC bond pads are 78 microns square
6. RF bond pads are 108 x 193 microns
### Functional Description

<table>
<thead>
<tr>
<th>Pad</th>
<th>Function</th>
<th>Description</th>
<th>Schematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF in</td>
<td>50 ohm matched input</td>
<td><img src="image1" alt="Schematic" /></td>
</tr>
<tr>
<td>2</td>
<td>Vgg2</td>
<td>Power supply voltage Decoupling and bypass caps required</td>
<td><img src="image2" alt="Schematic" /></td>
</tr>
<tr>
<td>3, 4</td>
<td>ACG1, 2</td>
<td>Low frequency termination. Attach bypass capacitor per application circuit</td>
<td><img src="image3" alt="Schematic" /></td>
</tr>
<tr>
<td>5</td>
<td>RF out &amp; Vdd</td>
<td>Power supply voltage and 50 ohm matched output</td>
<td><img src="image4" alt="Schematic" /></td>
</tr>
<tr>
<td>6, 7</td>
<td>ACG3, 4</td>
<td>Low frequency termination. Attach bypass capacitor per application circuit</td>
<td><img src="image5" alt="Schematic" /></td>
</tr>
<tr>
<td>8</td>
<td>Vgg1</td>
<td>Power supply voltage Decoupling and bypass caps required</td>
<td><img src="image6" alt="Schematic" /></td>
</tr>
<tr>
<td></td>
<td>Backside</td>
<td>Ground</td>
<td>Connect to RF / DC ground</td>
</tr>
</tbody>
</table>
Assembly Guidelines

The backside of the CMD201 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines, and the RF decoupling capacitors placed in close proximity to the DC connections on chip.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized. The RF input and output require a double bond wire as shown.

The semiconductor is 85 um thick and should be handled by the sides of the die or with a custom collet. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

Assembly Diagram

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

ver 1.4 0218

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Applications Information

Application Circuit

![Application Circuit Diagram]

Note: Drain voltage (Vdd) must be applied through a broadband bias tee or external bias network. External DC block is required on RF input.

Biasing and Operation

The CMD201 is biased with a positive drain supply, a negative gate1 supply and a positive gate2 supply. Performance is optimized when the drain voltage is set to +10 V. The recommended gate1 and gate2 voltages are -0.55 V and +5 V respectively.

Turn ON procedure:

1. Apply gate voltage $V_{gg1}$ and set to -0.55 V
2. Apply drain voltage $V_{dd}$ and set to +10 V
3. Apply gate voltage $V_{gg2}$ and set to +5 V

Turn OFF procedure:

1. Turn off gate voltage $V_{gg2}$
2. Turn off drain voltage $V_{dd}$
3. Turn off gate voltage $V_{gg1}$