**MECX10W-2**

**X-Band GaAs pHEMT High Power Amplifier**

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**Main Features**

- 0.25µm GaAs pHEMT Technology
- 8.5 – 10.8 GHz full performances Frequency Range
- Saturated Output Power > 11W
- PAE = 32% - 43%
- Small Signal Gain > 21 dB
- Bias: Vd = 8.5V, Id = 2.6A, Vg = -0.43V (Typ.)
- Chip Size: 5 x 3.3 x 0.07 mm

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**Product Description**

**MECX10W-2** is a 0.25µm GaAs pHEMT based High Power Amplifier designed by MEC for X-Band applications.

The MECX10W-2 provides more than 11W of saturated output power in the frequency range from 8.5 GHz to 10.8 GHz, with PAE up to 43% and 21 dB of small signal Gain.

The MECX10W-2 is fully matched to 50 Ω with DC decoupling capacitors on both Input and Output ports. Bond Pad are gold plated for compatibility with thermo-compression bonding process.

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**Primary Applications**

- Radar
- Telecom

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**Measured Data**

![Graph]
**MECX10W-2**

X-Band GaAs pHEMT High Power Amplifier

## Main Characteristics

Test Conditions: $T_{\text{base, plate}} = 20^\circ \text{C}$, $V_d = 8.5 \text{ V}$, $I_{dq} = 2.6 \text{ A}$, Pulse Width = 100 $\mu\text{s}$, Duty Cycle = 30%

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency</td>
<td>8.5</td>
<td></td>
<td>10.8</td>
<td>GHz</td>
</tr>
<tr>
<td>Small Signal Gain</td>
<td></td>
<td>23.3</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td></td>
<td>-14</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td></td>
<td>-19</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Saturated Output Power</td>
<td></td>
<td>41</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Power Added Efficiency @ Pout=Psat</td>
<td>32</td>
<td></td>
<td>43</td>
<td>%</td>
</tr>
<tr>
<td>Gain @ Pout=Psat</td>
<td>18.8</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Drain Supply Voltage</td>
<td>8.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Supply Quiescent Drain Current</td>
<td>2.6</td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Supply Drain Current</td>
<td>3.2</td>
<td></td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Psat Vs. Temperature</td>
<td></td>
<td>-0.007</td>
<td></td>
<td>dB/°C</td>
</tr>
<tr>
<td>PAE @Psat Vs. Temperature</td>
<td></td>
<td>-0.03</td>
<td></td>
<td>%/°C</td>
</tr>
<tr>
<td>Drain Current @Psat Vs. Temperature</td>
<td></td>
<td>-0.004</td>
<td></td>
<td>A/°C</td>
</tr>
<tr>
<td>Linear Gain Vs. Temperature</td>
<td></td>
<td>-0.028</td>
<td></td>
<td>dB/°C</td>
</tr>
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</table>
## Absolute Maximum Rating*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Compression Level</td>
<td>6</td>
<td>dB</td>
</tr>
<tr>
<td>Drain Supply Voltage with RF input Power</td>
<td>9.0</td>
<td>V</td>
</tr>
<tr>
<td>Drain Supply Voltage without RF input Power</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>Supply Quiescent Drain Current</td>
<td>3.5</td>
<td>A</td>
</tr>
<tr>
<td>Max. forward gate current</td>
<td>12</td>
<td>mA</td>
</tr>
<tr>
<td>Max. negative gate source voltage</td>
<td>-2.5</td>
<td>V</td>
</tr>
<tr>
<td>Max. negative gate drain voltage</td>
<td>-10</td>
<td>V</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>175</td>
<td>°C</td>
</tr>
</tbody>
</table>

*Tamb = 20°C

## Thermal and Reliability Information*

<table>
<thead>
<tr>
<th>Test Conditions</th>
<th>Parameter</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VD = 8.5 V, ID = 2.6 A, PDC = 22W, No RF Input, Tbaseplate = 80°C</td>
<td>Equivalent Thermal Resistance (No RF Drive)</td>
<td>4</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td>Channel Temperature (No RF Drive)</td>
<td>168</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Mean Time Failure (No RF Drive)</td>
<td>3E+5</td>
<td>Hrs</td>
</tr>
<tr>
<td>VD = 8.5 V, ID = 3.3 A, PDC = 28W, Pout= 41dBm, Tbaseplate = 80°C</td>
<td>Thermal Resistance (Under RF Drive)</td>
<td>4</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td>Channel Temperature (Under RF Drive)</td>
<td>142</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Mean Time Failure (Under RF Drive)</td>
<td>2.8E+6</td>
<td>Hrs</td>
</tr>
</tbody>
</table>

*Assumes eutectic attach using 1.5 mil thick 80/20 AuSn mounted to a 20 mil CuMo Carrier Plate.
Small Signal Measurements

Linear Gain, Input and Output Return Loss

Gain [dB]

Return Loss [dB]

Frequency [GHz]

Gain
S11
S22

Broadband Small Signal Measurements

Input and Output Return Loss

Linear and Reverse Gain

S11, S22 [dB]

S21, S12 [dB]

Frequency [GHz]

Frequency [GHz]
Measured Performances Vs. Pin @ Frequency [9, 9.7, 10.4] GHz

Output Power Vs. Input Power

PAE Vs. Input Power

- 5/13 -
Gain vs. Input Power

- 9 GHz
- 9.7 GHz
- 10.4 GHz

Drain Current vs. Input Power

- 9 GHz
- 9.7 GHz
- 10.4 GHz
**Measured Performances Vs. Frequency @ 1dB of Gain Compression**

- **Output Power and PAE Vs. Frequency @ Pin=18.5dBm**
  - Pout [dBm]
  - PAE [%]

- **Gain and Drain Current Vs. Frequency @ Pin=18.5dBm**
  - Gain [dB]
  - Id0 [A]
Measured Performances Vs. Frequency @ Temperature [-30, 20, 80]°C

Saturated Output Power Vs. Frequency

PAE Vs. Frequency @ Saturation
Linear Gain Vs. Frequency

-30 °C
20 °C
80 °C

Drain Current Vs. Frequency @ Saturation

-30 °C
20 °C
80 °C
**Bond Pad Configuration**

- A tolerance of ± 35µm has to be considered for chip dimensions
- Chip Thickness is 70 µm ± 10 µm
- RF Pads [IN, OUT] = 118µm x 196µm
- DC Pads {1, 2, 3, 4, 5, 7, 10, 11, 14, 16, 17, 18, 19, 20} = 100µm x 100µm
- DC Pads {6, 8, 13, 15} = 200µm x 100µm
- DC Pads {9, 12} = 300µm x 100µm

<table>
<thead>
<tr>
<th>Bond Pad #</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>RFin</td>
<td>Input RF Port</td>
</tr>
<tr>
<td>OUT</td>
<td>RFOut</td>
<td>Output RF Port</td>
</tr>
<tr>
<td>1, 5, 16, 20</td>
<td>Vg</td>
<td>Gate Negative Supply Voltage</td>
</tr>
<tr>
<td>6, 9, 12, 15</td>
<td>Vd</td>
<td>Drain Positive Supply Voltage</td>
</tr>
<tr>
<td>2, 4, 7, 10, 11, 14, 17, 19</td>
<td>GND</td>
<td>Ground Pads – Not Connected</td>
</tr>
<tr>
<td>3, 8, 13, 18</td>
<td>\</td>
<td>Not Connected</td>
</tr>
</tbody>
</table>
Assembly Recommendations

- Eutectic Die bond using AuSn (80/20) solder is recommended.
- Great care must be used for thermal dimensioning.
- The backside of the die is the Source (ground) contact.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.

<table>
<thead>
<tr>
<th>Bond Pad #</th>
<th>Connection</th>
<th>External Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN and OUT</td>
<td>2 Bonding Wires</td>
<td>L_bond = 0.3nH</td>
</tr>
<tr>
<td>1, 5, 16, 20 - Vg</td>
<td>L_bond ≤ 1 nH</td>
<td>C1 = 100pF/10V</td>
</tr>
<tr>
<td>6, 15 - Vd</td>
<td>2 Bonding Wires</td>
<td>L_bond ≤ 1nH</td>
</tr>
<tr>
<td>9, 12 - Vd</td>
<td>3 Bonding Wires</td>
<td>L_bond ≤ 1nH</td>
</tr>
</tbody>
</table>

Bias Procedure

Bias-Up
1. Vg set to -1.5 V.
2. Vd set to +8.5 V.
3. Adjust Vg until quiescent Id is 2.6 A (Vg = -0.43 V Typical).
4. Apply RF signal.

Bias-Down
1. Turn off RF signal.
2. Reduce Vg to -1.5 V (Id0 ≈ 0 mA).
3. Set Vd to 0 V.
4. Turn off Vd.
5. Turn off Vg.
# MECX10W-2

**X-Band GaAs pHEMT High Power Amplifier**

## Contact Information

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## Notice

The furnished information is believed to be reliable. However, performances and specifications contained herein are based on preliminary characterizations and then susceptible to possible variations. On the basis of customer requirements the product can be tested and characterized in specific operating conditions and, if needed, tuned to meet custom specifications.

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