W-PA-9296-M  
Previously named TU-W1330305M
GaAs PHEMT MMIC POWER AMPLIFIER, 92 - 96GHz

Overview

W-PA-9296-M is a 4-stage MMIC power amplifier that covers frequencies from 92GHz to 96GHz. This MMIC provides up to 20dB of flat, stable gain, and a power output of more than 18dBm from a 4V supply voltage and <210mA current.

All bond pads and the die backside are gold plated. The MMIC is compatible with precision die attach methods, as well as thermo-compression and thermosonic wire bonding, making it ideal for MCM and hybrid microcircuit applications. All data shown is measured with the chip in a 50 Ohm environment and contacted with RF probes.

- An Evaluation Board for this device is available with WR-10 Interfaces to fast and efficiently verify the performance of the MMIC.
- W band 92-96GHz Amplified Modules are also available as Gain and Power blocks; W-PA-9296-M-GM and W-PA-9296-M-PM available on request.
- A mirrored version ‘W-PA-9296’ of this MMIC is also available on request.

Features

- 92 – 96GHz
- 20 dB Gain
- 18dBm Psat
- Unconditionally Stable

Applications

- Narrow Bandwidth Millimeter-wave Imaging
- High Resolution Radar
- Sensing
- P2P Communications; short haul/high capacity/low interference links
- Medical
- High Power Amplifier
## Specification Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>90</td>
<td></td>
<td>100</td>
<td>GHz</td>
</tr>
<tr>
<td>Gain</td>
<td>19</td>
<td>20</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>8</td>
<td>15</td>
<td></td>
<td>dB</td>
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<tr>
<td>Output Return Loss</td>
<td>3</td>
<td>6</td>
<td></td>
<td>dB</td>
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<tr>
<td>Maximum OP Power</td>
<td>18</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Drain Voltage</td>
<td>4</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Nominal Gate Voltage*</td>
<td>0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Current</td>
<td>210</td>
<td></td>
<td></td>
<td>mA</td>
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</table>

## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
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</thead>
<tbody>
<tr>
<td>Gate Voltage</td>
<td>-5V to 0.2V dc</td>
</tr>
<tr>
<td>Drain Voltage</td>
<td>5V</td>
</tr>
<tr>
<td>Drain Current</td>
<td>400mA</td>
</tr>
<tr>
<td>RF Input Power</td>
<td>5dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>+150°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>~40°C to +85°C</td>
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</tbody>
</table>

Notes

The tests indicated have all been performed with 100pF de-coupling capacitors on all bias pads. All tests are carried out at 25°C.

*Should be adjusted to ensure the correct current is drawn.

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features proprietary protection circuitry, damage may occur on devices subjected to ESD. Proper ESD precautions should be taken to avoid performance degradation or loss of functionality.
Measured Performance Data

**Figure 1**
Gain

(Vdd= 4V, Vgg=0V, Idd=208mA)

Gain (dB) vs. RF Frequency (GHz)

**Figure 2**
Input Return Loss

(Vdd= 4V, Vgg=0V, Idd=208mA)

Return Loss (dB) vs. RF Frequency (GHz)
Measured Performance Data

**Figure 3**
Output Return Loss

(Vdd= 4V, Vgg=0V, ldd=208mA)

Return Loss (dB)

RF Frequency (GHz)

**Figure 4**
Saturated Output Power
(Calibrated @ 96GHz)

Pout (dBm)

RF Frequency (GHz)
Outline Drawing

Notes

1. All dimensions are in um.
2. Typical DC bond pads are 80um square.
3. RF bond pads are 60um square.
4. All pads have gold metalisation.
5. Gold backside metalisation.
6. Backside metal is ground.
7. Connections are not required for unlabelled bond pads.
8. Die thickness is 50um
Pad Descriptions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>RFIN</td>
<td>Input RF pad. This pad is AC coupled.</td>
</tr>
<tr>
<td>RFOUT</td>
<td>Output RF pad. This pad is AC coupled.</td>
</tr>
<tr>
<td>VDx</td>
<td>Drain bias pad for stage x</td>
</tr>
<tr>
<td>VGx</td>
<td>Gate bias pad for stage x.</td>
</tr>
<tr>
<td>BOTTOM</td>
<td>The die backside must be connected to RF/DC ground.</td>
</tr>
</tbody>
</table>

General Notes on Assembly

(Not actual die – these rules are applied to all MMICs unless otherwise stated)
Die should be mounted on conductive material such as gold-plated metal to provide a good ground and suitable heat sink, if necessary.

1. Attaching the die using Au/Sn preforms is preferable. The Eutectic melt for Au/Sn occurs at approximately 280°C so the die (plus mount and preform) is initially heated up to 180°C and then it is heated for approximately 10 seconds to 280°C using a nitrogen heat gun. The device will survive 10 seconds at this temperature. The static breakdown for GaAs devices is approximately 330°C.

2. Pure, dry Nitrogen should be used as the heat source

3. If the devices cannot be lifted/ placed by a vacuum device, then ESD die-lifting tweezers are preferable.

4. Supply lines should be decoupled with 100pF capacitors. Larger planar capacitors could be used if available.

5. Aluminium wire must not be used.

Die Packing Information

All die are normally delivered using gel-paks, Arralis also offer the W-PA-9296-M die already eutectically die-attached on a gold plated carrier.
Carrier Outline Drawing

Note:
Fabricated using 0.5mm gold plated brass CZ108
Note:
0.0007 99.99% Au wire
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