CO-E1320303
GaAs PHEMT MMIC LOW NOISE AMPLIFIER 75-90GHz

Overview

CO-E1320303 is a 4-stage MMIC low noise amplifier that covers frequencies from 75GHz to 90GHz and is especially suited for the 76GHz to 82GHz automotive band. The CO-E1320303 provides up to 20dB of stable gain, with a noise figure of 4.5dB from a 2.5V supply voltage and 30mA current. With less than ±2dB variation in gain across the band, CO-E1320303 provides a low noise solution for both radar and communication applications.

All bond pads and the backside of the MMIC are gold plated. The CO-E1320303 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, with 100pF decoupling capacitors on all DC connections and is contacted using RF probes.

An option with two CO-E1320303 circuits on a single MMIC die is available on request.

Features

• 75 – 90GHz
• 20dB Gain
• 4.5dB Noise Figure
• Unconditionally Stable
• < ±2dB Gain Variation

Applications

• Millimetre-wave Imaging
• High Resolution Radar
• Sensing
• P2P Communications; short haul / high capacity / low interference links
• Medical
### Specification Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
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<tbody>
<tr>
<td>Frequency</td>
<td>75</td>
<td>90</td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Gain</td>
<td>17.5</td>
<td>18.5</td>
<td>20.5</td>
<td>dB</td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>±2</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>10</td>
<td></td>
<td></td>
<td>dB</td>
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<tr>
<td>Output Return Loss</td>
<td>12</td>
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<td></td>
<td>dB</td>
</tr>
<tr>
<td>P1dB</td>
<td>4</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Noise Figure*</td>
<td>4.5</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Drain Voltage</td>
<td>2.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Current**</td>
<td>30</td>
<td></td>
<td></td>
<td>mA</td>
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### 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</td>
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<tr>
<td>Drain Voltage</td>
<td>3.5V</td>
</tr>
<tr>
<td>Drain Current</td>
<td>40mA</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>
</tr>
</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.

*Measured over the 76-82GHz band.

**Gate voltage is set to draw the correct drain current.

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**
CO-E1320303
Gain

**Figure 2**
CO-E1320303
Noise Figure

Vdd=2.5V, Idd=30mA

Gain (dB)

RF Frequency (GHz)

Noise Figure (dB)

RF Frequency (GHz)
Measured Performance Data

Figure 3
CO-E1320303
Input Return Loss

Figure 4
CO-E1320303
Output Return Loss

GaAs PHEMT MMIC LOW NOISE AMPLIFIER 75-90GHz
Measured Performance Data

**Figure 5**

CO-E1320303

Power Characteristic

**Figure 6**

CO-E1320303

Gain Compression
Notes
1. All dimensions are in um.
2. Typical dc bond pads are 92um square.
3. RF bond pads are 52 x 115um.
4. All pads have gold metalisation.
5. Gold backside metalisation.
6. Backside metal is ground.
7. Connections are not required for unlabeled bond pads.
8. Die thickness is 70um.
Pad Descriptions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<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>VD1</td>
<td>Drain bias pad for stage 1.</td>
</tr>
<tr>
<td>VD24</td>
<td>Drain bias pad for stages 2, 3 &amp; 4.</td>
</tr>
<tr>
<td>VG1</td>
<td>Gate bias pad for stage 1.</td>
</tr>
<tr>
<td>VG24</td>
<td>Gate bias pad for stages 2, 3 &amp; 4.</td>
</tr>
<tr>
<td>BOTTOM</td>
<td>The die backside must be connected to RF/dc ground.</td>
</tr>
</tbody>
</table>

Connection Configurations

To BIAS Connections

RF Connection Configuration

Keep as short as possible
General Notes on Assembly

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.