W-ICM-9296  Previously named TU-W1340310
Image Cancellation MMIC Mixer, 92 - 96GHz

Overview

W-ICM-9296 is a MMIC diode mixer with integrated quadrature coupler for single sideband (LO+IF / RF-LO) operation in both upconverter and downconverter modes. This MMIC is fabricated using GaAs Shottky diode technology and is designed for output frequencies in the range from 92GHz to 96GHz using either fixed IF and varying LO (86GHz - 90GHz) or fixed LO and varying IF (2GHz – 6GHz) signals. The circuit typically supplies flat conversion loss at moderate levels of LO power and low dc consumption.

All bond pads and the die underside 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 herein is measured with the chip in a 50 Ohm environment and contacted with RF probes, with results calibrated to the probe tips.

Features

- 92 – 96GHz.
- 15 dB conversion loss.
- 13dBm LO drive.
- >20dB RF / LO isolation.
- 20dB image rejection.

Applications

- Narrow or wide bandwidth millimeter-wave imaging.
- High resolution radar.
- Sensing.
- P2P communications; short haul/high capacity/low interference links.
Measured Performance Data

Test Conditions: IF = Fixed, 5.4GHz, 4dBm, LO = 86.6GHz – 90.6GHz, Bias=0.5V, 4mA

<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>97</td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>LO Frequency</td>
<td>86.6</td>
<td>90.6</td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>LO Power</td>
<td>10</td>
<td>13</td>
<td>90.6</td>
<td>dBm</td>
</tr>
<tr>
<td>IF Frequency</td>
<td>2</td>
<td>5.4</td>
<td>6</td>
<td>GHz</td>
</tr>
<tr>
<td>Conversion Loss</td>
<td>15</td>
<td>18</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>18</td>
<td>22</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>LO Leakage</td>
<td>23</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Vcx</td>
<td>0.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Icx</td>
<td>2</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
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</table>

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC Voltages</td>
<td>-10V to +2V dc</td>
</tr>
<tr>
<td>LO Power</td>
<td>25dBm</td>
</tr>
<tr>
<td>IF / RF Power</td>
<td>22dBm</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 Vc. All tests are carried out at 25°C.

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.
Specification Overview
(based on tests where $IF = 5.4 \text{ GHz}$, $LO = +13\text{dBm}$)

Figure 1
Conversion Loss

![Conversion Loss Graph](RF Frequency (GHz) vs. Conversion Loss (dB))

Figure 2
Image Rejection

![Image Rejection Graph](RF Frequency (GHz) vs. Image Rejection (dBc))
Measured Performance Data

Test Conditions: IF = Fixed, 5.4GHz, 4dBm, LO = 86.6GHz – 90.6GHz, Bias=0.5V, 4mA
Measured Performance Data

Test Conditions: LO = Fixed, 88.6GHz, 13dBm, IF = 2GHz – 6GHz, 4dBm, Bias=0.5V, 4mA

Figure 4
Conversion Loss

Figure 5
Image Rejection
Measured Performance Data

Test Conditions: LO = Fixed, 88.6GHz, 13dBm, IF = 2GHz – 6GHz, 4dBm, Bias=0.5V, 4mA
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 metallisation.
6. Backside metal is ground.
Pad Descriptions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO</td>
<td>LO pad. This pad is AC coupled.</td>
</tr>
<tr>
<td>RF</td>
<td>RF pad. This pad is AC coupled.</td>
</tr>
<tr>
<td>IF</td>
<td>IF pad. This pad is AC coupled.</td>
</tr>
<tr>
<td>VC1</td>
<td>Diode bias pad 1.</td>
</tr>
<tr>
<td>VC2</td>
<td>Diode bias pad 2.</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
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-ICM-9296 die already eutectically die-attached on a gold plated carrier, product code W-ICM-C-9296.
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product datasheet

www.arralis.com

Carrier Outline Drawing

![Carrier Outline Drawing Image]
Notes:
1) 0.0007 99.99\% Au wire
2) Bond to be of minimal length and loop (as allowed by the available wire-bonder)
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