Upconverter
71 - 86 GHz

Features
- E-Band Upconverter
- Direct Up-Conversion with I/Q BW up to 2.25 GHz
- WR12 Interface for the RF Output
- LO×8 with Buffer
- Wide Dynamic Range Power Detector
- 30 dB Conversion Gain
- 25.5 dBm Saturated Output Power
- 40 dB of Linear Gain Turn-Down
- Tunable Carrier and Sideband Suppression
- RoHS* Compliant Surface Mount Package
- Size: 12000 × 8000 × 2220 µm

Applications
- Point to Point
- Infrastructure

Description
The MAMF-011142 is a surface mount E-band transmitter. The module operates from 71 - 86 GHz and is designed to be used in direct conversion or heterodyne applications. The RF output is a WR12 interface.

The module provides 30 dB small signal gain and a saturated output power of 25.5 dBm at the optimum bias. Linear turn-down of the gain allows for a wide range of output powers from the radio, over temperature and process variation. Carrier leakage and sideband rejection performance can be enhanced by tuning the DC offsets on the IF lines.

Other features include a local oscillator ×8 multiplier and buffer, and a wide dynamic range power detector on the output. The module is ideally suited for low to high capacity, high power E-band point to point radios.

Each device is 100% RF tested to ensure performance compliance.

Functional Schematic

1. The exposed pad centered on the package bottom must be connected to RF, DC and Thermal GROUND.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAMF-011142</td>
<td>Parts shipped in tray</td>
</tr>
<tr>
<td>MAMF-011142-TR0200</td>
<td>200 part reel</td>
</tr>
<tr>
<td>MAMF-011142-TR0500</td>
<td>500 part reel</td>
</tr>
<tr>
<td>MAMF-011142-001SMB</td>
<td>Evaluation Board</td>
</tr>
</tbody>
</table>

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

For further information and support please visit: https://www.macom.com/support
## Upconverter
### 71 - 86 GHz

**Electrical Specifications:**
VD = 4 V, UC ID1,2,3,4 = 90, 190, 105, 65 mA, PA ID1,2,3,4 = 120, 120, 200, 320 mA, VG5 = -1.5 V, PLO = -5 dBm, Backside Temperature (TB) = +25°C

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Frequency</td>
<td>—</td>
<td>GHz</td>
<td>71</td>
<td>—</td>
<td>86</td>
</tr>
<tr>
<td>IF Bandwidth</td>
<td>—</td>
<td>GHz</td>
<td>DC</td>
<td>—</td>
<td>2.25</td>
</tr>
<tr>
<td>LO Frequency</td>
<td>—</td>
<td>GHz</td>
<td>8.625</td>
<td>—</td>
<td>11</td>
</tr>
<tr>
<td>LO Multiplication Factor</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>LO Input Power</td>
<td>IF = 700 MHz</td>
<td>dBm</td>
<td>—</td>
<td>-5</td>
<td>—</td>
</tr>
<tr>
<td>Conversion Gain</td>
<td>IF = 700 MHz</td>
<td>dB</td>
<td>24</td>
<td>30</td>
<td>—</td>
</tr>
<tr>
<td>Output P_{SAT}</td>
<td>IF = 700 MHz</td>
<td>dBm</td>
<td>23</td>
<td>25.5</td>
<td>—</td>
</tr>
<tr>
<td>Output IP3</td>
<td>P_{IN} = -10 dBm total, IF = 21.4 MHz, ΔIF = 4.6 MHz</td>
<td>dBm</td>
<td>—</td>
<td>31</td>
<td>—</td>
</tr>
<tr>
<td>Total P_{OUT} at C/I3 = 25 dBc</td>
<td>P_{IN} = -10 dBm total, IF = 21.4 MHz, ΔIF = 4.6 MHz, RF = 86 GHz</td>
<td>dBm</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Total P_{OUT} at C/I3 = 20 dBc</td>
<td>P_{IN} = -10 dBm total, IF = 21.4 MHz, ΔIF = 4.6 MHz, RF = 86 GHz</td>
<td>dBm</td>
<td>—</td>
<td>22</td>
<td>—</td>
</tr>
<tr>
<td>Total P_{OUT} at C/I2 = 43 dBc</td>
<td>P_{IN} = -10 dBm total, IF = 21.4 MHz, ΔIF = 4.6 MHz, RF = 76 GHz</td>
<td>dBm</td>
<td>—</td>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>Conversion Gain Variation Over 2 GHz BW</td>
<td>IF = 700 MHz</td>
<td>dB/GHz</td>
<td>—</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Gain Adjust Dynamic Range</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Carrier Leakage Tuning (DC) Range</td>
<td>—</td>
<td>V</td>
<td>—</td>
<td>+/-1</td>
<td>—</td>
</tr>
<tr>
<td>Tunable Carrier Leakage with 1 mV Tuning Step</td>
<td>—</td>
<td>dBc</td>
<td>—</td>
<td>-30</td>
<td>—</td>
</tr>
<tr>
<td>LO×7 Leakage</td>
<td>P_{IN} = -10 dBm, RF = 83.5 GHz</td>
<td>dBc</td>
<td>—</td>
<td>36</td>
<td>—</td>
</tr>
<tr>
<td>LO×9 Leakage</td>
<td>P_{IN} = -10 dBm, RF = 73.5 GHz</td>
<td>dBc</td>
<td>—</td>
<td>37</td>
<td>—</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>IF = 21.4 MHz</td>
<td>dB</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>IF = 2.25 GHz</td>
<td>dB</td>
<td>—</td>
<td>16</td>
<td>—</td>
</tr>
<tr>
<td>Return Loss</td>
<td>RF</td>
<td>dB</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>LO</td>
<td></td>
<td></td>
<td>12</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>IF</td>
<td></td>
<td></td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>Power Detector Directivity</td>
<td>—</td>
<td>dB</td>
<td>—</td>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>Output Power Detector</td>
<td>—</td>
<td>—</td>
<td>10 mV @ -10 dBm</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Drain Voltage</td>
<td>—</td>
<td>V</td>
<td>—</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Quiescent Drain Current (DC)</td>
<td>—</td>
<td>A</td>
<td>—</td>
<td>1.21</td>
<td>—</td>
</tr>
</tbody>
</table>

**MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.**

Visit [www.macom.com](https://www.macom.com) for additional data sheets and product information.
Biasing over Temperature

It is recommended to have a current controlled biasing method. Temperature data presented here is at the following bias levels unless otherwise specified. For graphs labelled ID12_UC, stages 1 and 2 of the upconverter are combined to create ID1_UC + ID2_UC; similarly for ID34_UC.

<table>
<thead>
<tr>
<th>Pin Label</th>
<th>Current @ -40°C (mA)</th>
<th>Gate Voltage @ -40°C (V)</th>
<th>Current @ +25°C (mA)</th>
<th>Gate Voltage @ +25°C (V)</th>
<th>Current @ +85°C (mA)</th>
<th>Gate Voltage @ +85°C (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VD1_UC</td>
<td>52.5</td>
<td>-0.62</td>
<td>90</td>
<td>-0.48</td>
<td>105</td>
<td>-0.35</td>
</tr>
<tr>
<td>VD2_UC</td>
<td>107.5</td>
<td>-0.62</td>
<td>190</td>
<td>-0.48</td>
<td>205</td>
<td>-0.35</td>
</tr>
<tr>
<td>VD3_UC</td>
<td>100</td>
<td>-0.73</td>
<td>105</td>
<td>-0.65</td>
<td>120</td>
<td>-0.55</td>
</tr>
<tr>
<td>VD4_UC</td>
<td>60</td>
<td>-0.73</td>
<td>65</td>
<td>-0.65</td>
<td>80</td>
<td>-0.55</td>
</tr>
<tr>
<td>VG5_UC</td>
<td>-2</td>
<td>-1.50</td>
<td>-2</td>
<td>-1.50</td>
<td>-2</td>
<td>-1.50</td>
</tr>
<tr>
<td>VD1_PA</td>
<td>120</td>
<td>-0.42</td>
<td>120</td>
<td>-0.41</td>
<td>120</td>
<td>-0.39</td>
</tr>
<tr>
<td>VD2_PA</td>
<td>120</td>
<td>-0.42</td>
<td>120</td>
<td>-0.41</td>
<td>120</td>
<td>-0.39</td>
</tr>
<tr>
<td>VD3_PA</td>
<td>200</td>
<td>-0.42</td>
<td>200</td>
<td>-0.41</td>
<td>200</td>
<td>-0.39</td>
</tr>
<tr>
<td>VD4_PA</td>
<td>320</td>
<td>-0.42</td>
<td>320</td>
<td>-0.41</td>
<td>320</td>
<td>-0.39</td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Voltage</td>
<td>+4.3 V</td>
</tr>
<tr>
<td>Gate Bias Voltage (VG1,2,3,4_UC and PA)</td>
<td>-1.5 V &lt; VG &lt; +0.3 V</td>
</tr>
<tr>
<td>Gate Bias Voltage (VG5_UC)</td>
<td>-5 V &lt; VG &lt; 0 V</td>
</tr>
<tr>
<td>Total Input Power</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>Input Power per IF</td>
<td>+4 dBm</td>
</tr>
<tr>
<td>LO Input Power</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+150°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-55°C to +150°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
</tbody>
</table>

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with \( T_J \leq 150°C \) will ensure MTTF > 1 x 10^6 hours.
5. Junction Temperature (\( T_J \)) = \( T_B \) + \( \Theta_{JC} \) \( \times (V \times I) \), where \( T_B \) is backside temperature of package and \( \Theta_{JC} \) is thermal resistance of the device.

See table below for Junction Temperature for each stage of the module. Each stage must remain below 150°C.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B static sensitive devices.

<table>
<thead>
<tr>
<th>Pin Label</th>
<th>Thermal Resistance (°C/W)</th>
<th>Current @ +85°C (mA)</th>
<th>( T_J ) for ( T_B = +85°C ) (°C)</th>
<th>Maximum Drain Current Rating (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VD1_UC</td>
<td>116</td>
<td>105</td>
<td>134</td>
<td>140</td>
</tr>
<tr>
<td>VD2_UC</td>
<td>66</td>
<td>205</td>
<td>139</td>
<td>240</td>
</tr>
<tr>
<td>VD3_UC</td>
<td>75</td>
<td>120</td>
<td>121</td>
<td>135</td>
</tr>
<tr>
<td>VD4_UC</td>
<td>116</td>
<td>80</td>
<td>122</td>
<td>140</td>
</tr>
<tr>
<td>VD1_PA</td>
<td>75</td>
<td>120</td>
<td>121</td>
<td>200</td>
</tr>
<tr>
<td>VD2_PA</td>
<td>79</td>
<td>120</td>
<td>123</td>
<td>200</td>
</tr>
<tr>
<td>VD3_PA</td>
<td>59</td>
<td>200</td>
<td>132</td>
<td>275</td>
</tr>
<tr>
<td>VD4_PA</td>
<td>35</td>
<td>320</td>
<td>130</td>
<td>460</td>
</tr>
</tbody>
</table>
Upconverter
71 - 86 GHz

Typical Performance Curves over Temperature at Total $P_{IN} = -10$ dBm

- **Conversion Gain at Nominal Bias at IF = 21.4 MHz**
- **Conversion Gain at Nominal Bias at IF = 700 MHz**
- **Conversion Gain at Nominal Bias at IF = 2.25 GHz**
- **Gain vs. RF Buffer Bias at IF = 21.4 MHz, RF = 86 GHz**
- **Gain vs. RF Buffer and PA at IF = 21.4 MHz, RF = 86 GHz**
- **Gain vs. LO Bias at IF = 21.4 MHz, RF = 86 GHz**
- **Gain vs. IDUC and ID_PA at IF = 21.4 MHz, RF = 86 GHz**

For further information and support please visit:
https://www.macom.com/support

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.
Visit www.macom.com for additional data sheets and product information.
Upconverter
71 - 86 GHz

Typical Performance Curves over Temperature at Total $P_{IN} = -10$ dBm

**Gain vs. Mixer Bias at IF = 21.4 MHz, RF = 86 GHz**

**Image Rejection at IF = 21.4 MHz**

**Gain vs. LO Power at IF = 21.4 MHz, +25°C**

**Image Rejection at IF = 700 MHz**

**Image Rejection at IF = 2.25 GHz**

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

For further information and support please visit:
[https://www.macom.com/support](https://www.macom.com/support)

DC-0022708
Upconverter
71 - 86 GHz

Typical Performance Curves over Temperature

**Saturated Power at Nominal Bias, IF = 21.4 MHz**

![Saturated Power at Nominal Bias, IF = 21.4 MHz](image)

**P1dB at Nominal Bias, IF = 21.4 MHz**

![P1dB at Nominal Bias, IF = 21.4 MHz](image)

**Saturated Power at Nominal Bias, IF = 700 MHz**

![Saturated Power at Nominal Bias, IF = 700 MHz](image)

**P1dB at Nominal Bias, IF = 700 MHz**

![P1dB at Nominal Bias, IF = 700 MHz](image)
Upconverter
71 - 86 GHz

Typical Performance Curves over Temperature at IF = 21.4 MHz

Gain vs. Input Power at -40°C

Gain vs. Input Power at +25°C

Gain vs. Input Power at +85°C

Pout vs. Input Power at -40°C

Pout vs. Input Power at +25°C

Pout vs. Input Power at +85°C

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit www.macom.com for additional data sheets and product information.

For further information and support please visit: https://www.macom.com/support

DC-0022708
Upconverter  
71 - 86 GHz

Typical Performance Curves over Temperature at Total P<sub>IN</sub> = -10 dBm

**OIP3 at Nominal Bias at IF = 21.4 and 26.0 MHz**

-40°C  -  +25°C  -  +85°C

**OIP3 vs. LO Power at IF = 21.4 and 26.0 MHz, +25°C**

-10 dBm  -  -5 dBm  -  0 dBm  -  +5 dBm  -  +10 dBm

**OIP3 at Nominal Bias at IF = 700 and 704.6 MHz**

LSB  -  USB

**OIP3 at Nominal Bias at IF = 2.25 and 2.261 GHz**

LSB  -  USB

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.
Upconverter
71 - 86 GHz

Typical Performance Curves over Temp. at Total $P_{IN} = -10$ dBm, IF = 21.4 and 26 MHz

6. Output power controlled by RF buffer current.

7. Output power controlled by RF buffer and PA currents.
Upconverter
71 - 86 GHz

Typical Performance Curves over Temp. at Total $P_{IN} = -10$ dBm, IF = 21.4 and 26 MHz

C/I3 at Nominal Bias

C/I3 vs. LO Power, +25°C

C/I3 vs. LO Bias, RF = 86 GHz

C/I3 vs. Mixer Bias, RF = 86 GHz

For further information and support please visit: www.macom.com/support
Upconverter
71 - 86 GHz

Typical Performance Curves over Temp. at Total P_{IN} = -10 dBm, IF = 21.4 and 26 MHz

C/I2 vs. RF Buffer Bias, RF = 86 GHz

C/I2 vs. RF Buffer and PA Bias, RF = 86 GHz

C/I2 vs. Total Output Power^8, RF = 86 GHz

C/I2 vs. Total Output Power^9, RF = 86 GHz

C/I2 vs. Total Output Power^8, +25°C

C/I2 vs. Total Output Power^9, +25°C

8. Output power controlled by RF buffer current.

9. Output power controlled by RF buffer and PA currents.
Upconverter
71 - 86 GHz

Typical Performance Curves over Temp. at Total $P_{IN} = -10$ dBm, IF = 21.4 and 26 MHz

C/I2 at Nominal Bias

C/I2 vs. LO Power

C/I2 vs. LO Bias, RF = 86 GHz

C/I2 vs. Mixer Bias, RF = 86 GHz

For further information and support please visit: https://www.macom.com/support
Upconverter
71 - 86 GHz

Typical Performance Curves over Temperature, P_{IN} = -10 dBm, IF = 21.4 MHz

7×LO Leakage at Nominal Bias

8×LO Leakage at Nominal Bias

9×LO Leakage at Nominal Bias

7,8,9×LO Spurs at +25°C

8×LO Nulling Voltages, I and Q = 0.2 V

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit www.macom.com for additional data sheets and product information.

For further information and support please visit: https://www.macom.com/support
Typical Performance Curves over Temperature

**RF Return Loss**
- Frequency (GHz) range: 60 to 90
- Temperature conditions: -40°C, +25°C, +85°C

**IF “I” Return Loss**
- Frequency (GHz) range: 0 to 6
- Temperature conditions: -40°C, +25°C, +85°C

**LO Return Loss**
- Frequency (GHz) range: 0 to 25
- Temperature conditions: -40°C, +25°C, +85°C

**All IF Return Loss at +25°C**
- Frequency (GHz) range: 0 to 6
Typical Performance Curves over Temperature

**Noise Figure, IF = 2.25 GHz**

**Noise Figure vs. LO Power, RF = 76 GHz, IF = 2.25 GHz**

**Power Detector, RF = 71, 76, 81, 86 GHz**

**Detector Directivity at Nominal Bias**

For further information and support please visit: [www.macom.com/support](https://www.macom.com/support)
LO Nulling
LO nulling is achieved by applying a fixed voltage on ports I and Q while tuning the voltages on I* and Q*. Typically I and Q are set to 0.2 V; however, any voltage between -1 V and +1 V may be used. DACs with a common mode voltage offset may be sufficient for the fixed voltage. If a separate voltage is used, bias tees are required for the implementation of LO suppression. Below is an example of a potential bias tee however depending on the input frequency (be it baseband or at an intermediate frequency) the inductor may require tuning to generate the appropriate performance. Depending on the resolution of the DAC, suppression of the LO should be able to reach with minimal effort values exceeding -30 dBc.

Detector Application Schematic
As shown in the schematic below, the power detector is implemented by providing 5 V bias and measuring the difference in output voltage. This measure can be achieved by means of either standard op-amp in a differential mode configuration or analog-to-digital converters.

LSB/USB Operation

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

For further information and support please visit:
https://www.macom.com/support

DC-0022708
Compared DC Stages

There is a number of bias stages that are accessible for the user. It is not necessary to have individual bias supplies for each stage. Combining stages of similar purpose creates a stable system. That is, the RF buffer stages can be combined (Vx1_UC and Vx2_UC), the LO multiplier stages can be combined (Vx3_UC and Vx4_UC) and lastly the PA stages can be combined (Vx1_PA, Vx2_PA, Px3_PA and Vx4_PA).

It is not recommended to directly connect stages together, rather the stages should have some isolation between them. On the gates, a 10 nF capacitor and a series 10 \( \Omega \) resistor should be used before combining the stages. On the drains, a 10 nF capacitor should be used. Evaluation boards also have a ferrite bead with impedance of 100 \( \Omega \) at 100 MHz to minimize feedback through PCB having an effect on the performance of the device. The ferrite bead minimizes any voltage drop that could occur if a resistor is used.

If there are multiple capacitors in parallel to ground it is recommended that one of the capacitors has a small series resistor to dequeue the network to avoid parallel capacitor resonances.

Bias Sequencing

All gates should be pinched off (VG < -2 V) before the drain voltage (VD = 4 V) is applied. This requirement includes VG5 even though there is no external drain voltage. The gate voltages should then be adjusted as per bias table on Page 3. The current will change when LO is applied to stages three and four. The currents that are listed are the quiescent currents for operation. This is these currents are without RF applied. For maximum performance, it is recommended to set the drain quiescent drain current and then fix the gate voltage for this quiescent current before applying the RF signals. This will ensure the best performance for the device.

Package Alignment

The SMD package is ideal for pick and place assembly. The package should self align. It is recommended that a solder stencil is used complying with Application Note S2083. To minimize solder flowing into waveguide area, stencil can be inset an additional 25 \( \mu \text{m} \).

Reflow Profile

This package is capable of lead free reflow. The recommended reflow profile depends on the solder used however Application Note S2083 has guidelines that can be applied to this product.
Upconverter
71 - 86 GHz

Layout of Evaluation Board

PCB Layout Recommendations
The gerbers, DXF and Altium files for the evaluation board are available on request. It is recommended that all traces are separated to minimize on board coupling. A simple way to separate traces is to have them running on different PCB layers on the board. The image above is a capture of the evaluation board.
### Pin Table

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Pin Name</th>
<th>Function</th>
<th>Pin #</th>
<th>Pin Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
<td>22</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>2</td>
<td>VG5_UC</td>
<td>Mixer Bias</td>
<td>23</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>3</td>
<td>LO_IN</td>
<td>LO Input</td>
<td>24</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>4</td>
<td>VG3_UC</td>
<td>LO Multiplier</td>
<td>25</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>5</td>
<td>VD3_UC</td>
<td>LO Multiplier</td>
<td>26</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>6</td>
<td>VG4_UC</td>
<td>LO Multiplier Post Amplifier</td>
<td>27</td>
<td>VD4_PA</td>
<td>Stage 4 Power Amplifier</td>
</tr>
<tr>
<td>7</td>
<td>VG1_UC</td>
<td>LO Multiplier Post Amplifier</td>
<td>28</td>
<td>VD3_PA</td>
<td>Stage 3 Power Amplifier</td>
</tr>
<tr>
<td>8</td>
<td>VD4_UC</td>
<td>RF Buffer Stage 1</td>
<td>29</td>
<td>VD2_PA</td>
<td>Stage 2 Power Amplifier</td>
</tr>
<tr>
<td>9</td>
<td>VD1_UC</td>
<td>RF Buffer Stage 1</td>
<td>30</td>
<td>VD1_PA</td>
<td>Stage 1 Power Amplifier</td>
</tr>
<tr>
<td>10</td>
<td>VG2_UC</td>
<td>RF Buffer Stage 2</td>
<td>31</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Future Envelope Detector VSS</td>
</tr>
<tr>
<td>11</td>
<td>VD2_UC</td>
<td>RF Buffer Stage 2</td>
<td>32</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Future Envelope Detector Output</td>
</tr>
<tr>
<td>12</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
<td>33</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Future Envelope Detector VDD</td>
</tr>
<tr>
<td>13</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
<td>34</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>14</td>
<td>VG1_PA</td>
<td>Stage 1 Power Amplifier</td>
<td>35</td>
<td>I*</td>
<td>IF Port</td>
</tr>
<tr>
<td>15</td>
<td>VG2_PA</td>
<td>Stage 2 Power Amplifier</td>
<td>36</td>
<td>I</td>
<td>IF Port</td>
</tr>
<tr>
<td>16</td>
<td>VG3_PA</td>
<td>Stage 3 Power Amplifier</td>
<td>37</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
</tr>
<tr>
<td>17</td>
<td>VG4_PA</td>
<td>Stage 4 Power Amplifier</td>
<td>38</td>
<td>Q</td>
<td>IF Port</td>
</tr>
<tr>
<td>18</td>
<td>VREF</td>
<td>Reference Detector Diode</td>
<td>39</td>
<td>Q*</td>
<td>IF Port</td>
</tr>
<tr>
<td>19</td>
<td>VDET</td>
<td>Detector Diode</td>
<td>40</td>
<td>RF_OUT</td>
<td>RF Output</td>
</tr>
<tr>
<td>20</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
<td>41</td>
<td>Paddle&lt;sup&gt;11&lt;/sup&gt;</td>
<td>Ground</td>
</tr>
<tr>
<td>21</td>
<td>NC&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Not Connected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. For optimum RF performance, all NCs should be terminated to ground.
11. The exposed paddle centered on the package bottom must be connected to RF, DC and thermal ground.
Upconverter
71 - 86 GHz

Layout Dimensions

Bottom Layer Viewed From The Top

Top View

Major dimensions provided are in millimeters [inches]
DXF of footprint is available on request
Reference Application Note M538/S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 3 requirements.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.
Visit www.macom.com for additional data sheets and product information.

For further information and support please visit:
https://www.macom.com/support