The MM2-0530LSM is a passive MMIC triple balanced mixer. It features a broadband IF port that spans from 2 to 20 GHz, and has excellent spurious suppression. GaAs MMIC technology improves upon the previous generation of hand assembled, hybrid M2 triple balanced mixers with improved isolations, unit-to-unit repeatability and reliability. The MM2-0530LSM is 4x4 mm QFN package. Evaluation boards are available.

**Features**
- Broadband IF Port
- Typical Input 1 dB Compression of +7 dBm
- High Input IP3 of +19 dBm
- Excellent LO to IF Isolation
- Unit-to-Unit Repeatability
- RoHS Compliant

**Electrical Specifications** - Specifications guaranteed from -55 to +100°C, measured in a 50Ω system. Specifications are shown for Configurations A (B). See page 2 for port locations.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LO (GHz)</th>
<th>RF (GHz)</th>
<th>IF (GHz)</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>LO drive level (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion Loss (dB)¹</td>
<td>5-30</td>
<td>5-30</td>
<td>2-20</td>
<td></td>
<td>9 (10)</td>
<td></td>
<td>+15</td>
</tr>
<tr>
<td>Isolation (dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>See</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LO-RF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LO-IF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF-IF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input 1 dB Compression (dBm)²</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td>9</td>
<td>Config. A: + 9 to +17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Config. B: + 9 to +17</td>
</tr>
<tr>
<td>Input Two-Tone Third Order Intercept Point (dBm)²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ 15</td>
<td>+ 19</td>
<td></td>
</tr>
</tbody>
</table>

¹Measured Conversion Loss measured at 3 GHz fixed IF
²IP3 depends on LO drive conditions, see plots for more details

**Part Number Options**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM2-0530LSM-2 ¹</td>
<td>Surface Mount, IF Port Configuration -2</td>
</tr>
<tr>
<td>EVAL-MM2-0530L</td>
<td>Connectorized Evaluation Fixture</td>
</tr>
</tbody>
</table>

¹Note: For port locations and I/O designations, refer to the drawings on page 2 of this document.
GaAs MMIC Triple Balanced Mixer

1. Configuration A/B refer to the same part number (MM2-0530LSM) used in one of two different ways for optimal spurious performance. For the lowest conversion loss, use the mixer in Configuration A (pin 4 as the LO input, pin 15 as the RF input or output). If you need to use a lower LO drive, use the mixer in Configuration B (pin 4 as the RF input or output, pin 15 as the LO input). For optimal spurious suppression, experimentation or simulation is required to choose between Configuration A and B. For more information, see here.

Outline Drawing – 4mm QFN package

1. Substrate material is Ceramic.
2. I/O leads and Die Paddle are: Ni: 8.89um MAX 1.27um MIN. Pd : 0.17um MAX 0.07um MIN. Au : 0.254um MAX 0.03um MIN
3. All unconnected pads should be connected to PCB RF ground
Typical Performance

Conversion Loss: 3 GHz IF, Lowside LO (dB)

-4 -6 -8 -10 -12 -14 -16 -18
5 7 9 11 13 15 17 19 21 23 25 27 29

Configuration A
--- Configuration B

Conversion Loss: 15 GHz IF, Highside LO (dB)

-4 -6 -8 -10 -12 -14 -16 -18
5 7 9 11 13 15 17 19 21 23 25 27 29

Configuration A
--- Configuration B

Configuration A Conversion Loss vs. LO Power: 3 GHz IF, Lowside LO (dB)

-32 -24 -16 -8 -4 0
5 7 9 11 13 15 17 19 21 23 25 27 29

+17 dBm
+15 dBm
+13 dBm
+11 dBm
+9 dBm

Configuration B Conversion Loss vs. LO Power: 3 GHz IF, Lowside LO (dB)

-32 -24 -16 -8 -4 0
5 7 9 11 13 15 17 19 21 23 25 27 29

+17 dBm
+15 dBm
+13 dBm
+11 dBm
+9 dBm

Configuration A Conversion Loss vs. LO Power: 15 GHz IF, Highside LO (dB)

-18 -16 -14 -12 -10 -8 -6 -4
5 7 9 11 13 15 17 19 21 23

+17 dBm
+15 dBm
+13 dBm
+11 dBm
+9 dBm

Configuration B Conversion Loss vs. LO Power: 15 GHz IF, Highside LO (dB)

-18 -16 -14 -12 -10 -8 -6 -4
5 7 9 11 13 15 17 19 21 23

+17 dBm
+15 dBm
+13 dBm
+11 dBm
+9 dBm

Relative IF Response (dB)

0 -2 -4 -6 -8 -10
5 7 9 11 13 15 17 19 21 23

6 GHz RF - Configuration A
6 GHz RF - Configuration B

Relative IF Response (dB)

0 -2 -4 -6 -8 -10
2 4 6 8 10 12 14 16 18 20

29 GHz RF - Configuration A
29 GHz RF - Configuration B
Typical Performance

LO to RF Isolation (dB)

RF to IF Isolation (dB)

RF Return Loss (dB)

IF Return Loss (dB)

LO Return Loss (dB)
GaAs MMIC Triple Balanced Mixer

Typical Performance

**Input IP3: 3 GHz IF, Sine Wave LSLO (dBm)**

- Configuration A
- Configuration B

**Output IP3: 3 GHz IF, Sine Wave LSLO (dBm)**

- Configuration A
- Configuration B

**Configuration A Input IP3 vs LO Power: 3 GHz IF, Sine Wave LSLO (dBm)**

- +17 dBm
- +15 dBm
- +13 dBm
- +11 dBm

**Configuration A Output IP3 vs LO Power: 3 GHz IF, Sine Wave LSLO (dBm)**

- +17 dBm
- +15 dBm
- +13 dBm
- +11 dBm

**Configuration B Input IP3 vs LO Power: 3 GHz IF, Sine Wave LSLO (dBm)**

- +17 dBm
- +15 dBm
- +13 dBm
- +11 dBm

**Configuration B Output IP3 vs LO Power: 3 GHz IF, Sine Wave LSLO (dBm)**

- +17 dBm
- +15 dBm
- +13 dBm
- +11 dBm
Typical Performance

Even LO Harmonic to RF Isolation (dB)

Odd LO Harmonic to RF Isolation (dB)

2RF x 2LO Spurious Suppression (dBc) -10 dBm RF Input

Even LO Harmonic to IF Isolation (dB)

Odd LO Harmonic to IF Isolation (dB)

2IF x 1LO Spurious Suppression (dBc) -10 dBm IF Input
Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the 5 to 30 GHz RF/LO bands, which create a 3 GHz IF spurious output. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where “n” is the RF spur order. For example, the 2RFx2LO spur is 60 dBc for the A configuration for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 70 dBc.

Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO

<table>
<thead>
<tr>
<th>-10 dBm IF Input</th>
<th>0xLO</th>
<th>1xLO</th>
<th>2xLO</th>
<th>3xLO</th>
<th>4xLO</th>
<th>5xLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1xRF</td>
<td>26 (30)</td>
<td>Reference</td>
<td>32 (37)</td>
<td>14 (12)</td>
<td>38 (41)</td>
<td>26 (19)</td>
</tr>
<tr>
<td>2xRF</td>
<td>67 (59)</td>
<td>55 (59)</td>
<td>60 (60)</td>
<td>60 (62)</td>
<td>65 (67)</td>
<td>68 (69)</td>
</tr>
<tr>
<td>3xRF</td>
<td>93 (88)</td>
<td>58 (61)</td>
<td>80 (86)</td>
<td>68 (69)</td>
<td>83 (84)</td>
<td>71 (68)</td>
</tr>
<tr>
<td>4xRF</td>
<td>153 (152)</td>
<td>82 (110)</td>
<td>114 (114)</td>
<td>115 (114)</td>
<td>115 (112)</td>
<td>117 (119)</td>
</tr>
<tr>
<td>5xRF</td>
<td>175 (171)</td>
<td>121 (121)</td>
<td>136 (140)</td>
<td>121 (124)</td>
<td>138 (142)</td>
<td>131 (128)</td>
</tr>
</tbody>
</table>

Upconversion Spurious Suppression

Spurious data is taken by mixing a 3 GHz IF with LO frequencies (±mLO±nIF), which creates an RF within the 5 to 30 GHz RF band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where “n” is the IF spur order. For example, the 2IFx1LO spur is typically 58 dBc for the A configuration for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 68 dBc.

Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO

<table>
<thead>
<tr>
<th>-10 dBm IF Input</th>
<th>0xLO</th>
<th>1xLO</th>
<th>2xLO</th>
<th>3xLO</th>
<th>4xLO</th>
<th>5xLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1xIF</td>
<td>27 (31)</td>
<td>Reference</td>
<td>33 (40)</td>
<td>12 (11)</td>
<td>38 (43)</td>
<td>21 (18)</td>
</tr>
<tr>
<td>2xIF</td>
<td>68 (69)</td>
<td>58 (63)</td>
<td>61 (61)</td>
<td>65 (67)</td>
<td>67 (68)</td>
<td>70 (63)</td>
</tr>
<tr>
<td>3xIF</td>
<td>84 (94)</td>
<td>68 (76)</td>
<td>88 (96)</td>
<td>70 (77)</td>
<td>84 (92)</td>
<td>67 (73)</td>
</tr>
<tr>
<td>4xIF</td>
<td>108 (111)</td>
<td>106 (112)</td>
<td>111 (115)</td>
<td>119 (120)</td>
<td>122 (117)</td>
<td>118 (123)</td>
</tr>
<tr>
<td>5xIF</td>
<td>131 (139)</td>
<td>125 (129)</td>
<td>137 (140)</td>
<td>120 (122)</td>
<td>138 (140)</td>
<td>124 (121)</td>
</tr>
</tbody>
</table>
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 4 DC Current</td>
<td>21 mA</td>
</tr>
<tr>
<td>Pin 10 DC Current</td>
<td>15 mA</td>
</tr>
<tr>
<td>Pin 15 DC Current</td>
<td>24 mA</td>
</tr>
<tr>
<td>RF Power Handling (RF+LO)</td>
<td>+25 dBm at +25°C, derated linearly to +20 dBm at +100°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55°C to +100°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +125°C</td>
</tr>
</tbody>
</table>

**DATA SHEET NOTES:**
1. Mixer Conversion Loss Plot IF frequency is 3 GHz unless otherwise specified.
2. Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.
3. Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.
4. Unless otherwise specified, data is taken with +15 dBm LO drive.
5. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
6. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.