

## TWO-TONE-TERMINATOR MIXER

## T3-05

The T3-05 is a high performance mixer featuring LO/RF from 1 MHz to 5 GHz and IF from 1 MHz to 4 GHz. As with all T3 mixers, this mixer offers unparalleled nonlinear performance in terms of IIP3, P<sub>1dB</sub>, and spurious performance with a flexible LO drive requirement from +15 dBm to +27 dBm. The T3-05 is offered in connectorized, surface mount, and drop-in style packaging, suitable for any type of system level integration. RoHS compliant versions are also available.



NOTE: Connectorized & Microstrip packages have gone under part number modifications. Leaded Surface Mount CQ package is obsolete. [Please see this letter for LTB and recommended part information.](#)

### Features

- Ultra-Broadband RF, LO, and IF
- Compatible with Sine or Square-Wave LO
- Square-Wave LO delivers Industry-Leading Spurious, IP3, and P<sub>1dB</sub> Performance
- Application Note: [T3 Mixer Primer](#)
- Recommended Surface Mount Amplifiers: [ADM-0026-5929SM](#), [ADM-0126-5835SM](#), [ADM-0012-5931SM](#), [ADM-0026-5931SM](#)
- Recommended Amplifier Modules: [ADM1-0026PA](#), [ADM2-0026PA](#)

**Electrical Specifications** - Specifications guaranteed from -55 to +100°C, measured in a 50Ω system.

| Parameter                                        | LO (GHz) | RF (GHz) | IF (GHz)             | Min | Typ        | Max         | Diode Option<br>LO drive level (dBm) |
|--------------------------------------------------|----------|----------|----------------------|-----|------------|-------------|--------------------------------------|
| Conversion Loss (dB)                             | .001-5   | .001-5   | .001-0.5<br>.001-4.0 |     | 6.5<br>7.5 | 8.5<br>10.0 |                                      |
| Isolation (dB)                                   |          |          |                      |     |            |             |                                      |
| LO-RF                                            | .001-5   | .001-5   |                      | 20  | See Plots  |             |                                      |
| LO-IF                                            |          |          |                      | 20  |            |             |                                      |
| RF-IF                                            |          |          |                      |     |            |             |                                      |
| Input 1 dB Compression (dBm)                     | .001-5   | .001-5   |                      |     | See Plot   |             | L (+15 to +25)<br>M (+17 to +27)     |
| Input Two-Tone Third Order Intercept Point (dBm) | .001-5   | .001-5   |                      |     | See Plots  |             | L (+15 to +25)<br>M (+17 to +27)     |

### Part Number Options

| Please specify diode level and package style by adding to model number. |                                     |                       |                |            |                        |  |
|-------------------------------------------------------------------------|-------------------------------------|-----------------------|----------------|------------|------------------------|--|
| Package Styles                                                          |                                     | Examples              |                |            |                        |  |
| Connectorized                                                           | <u>QP</u> (PCN)                     | T3-05LQP, T3-05LCQG-2 |                |            |                        |  |
| Microstrip <sup>1,2,3</sup>                                             | <u>Q</u> (PCN)                      | <u>T3-05</u>          | <u>L</u>       | <u>CQG</u> | <u>-2</u>              |  |
| Surface Mount <sup>1,2</sup>                                            | <u>CQG</u> (PCN)<br><u>CQ</u> (OBS) | (Model)               | (Diode Option) | (Package)  | (I-Port Configuration) |  |

<sup>1</sup>Connectorized test fixtures available for most microstrip and surface mount packages. Consult factory.

<sup>2</sup>For non-connectorized packages, specify I-port configuration by adding -1 or -2 suffix to model number. Default is -2 configuration when not specified.

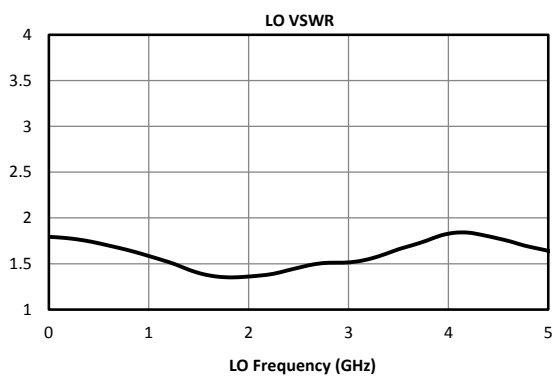
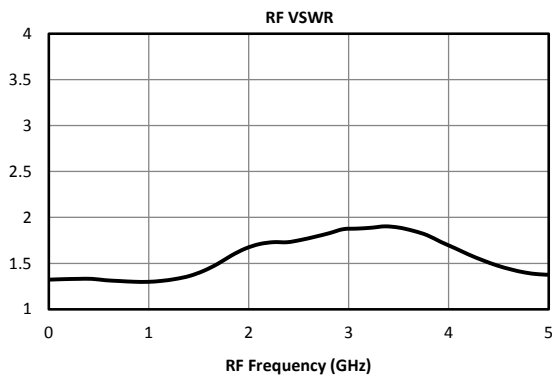
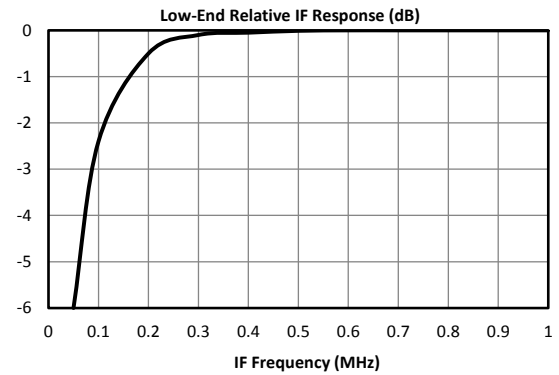
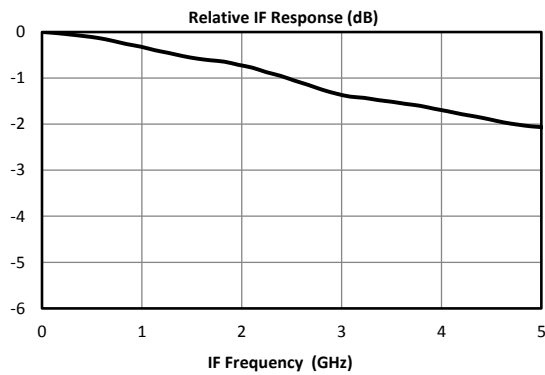
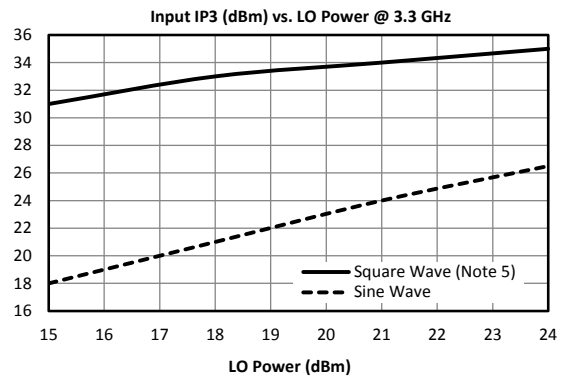
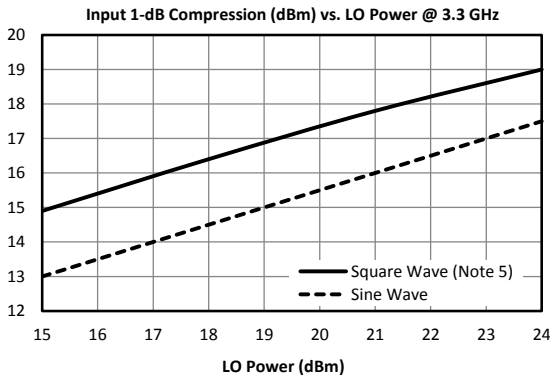
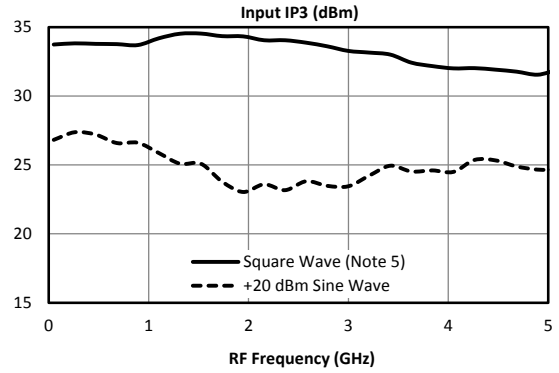
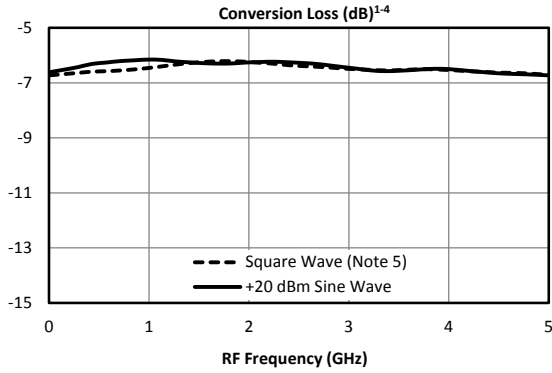
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LO/RF 1 MHz to 5 GHz  
IF 1 MHz to 4 GHz

## Typical Performance



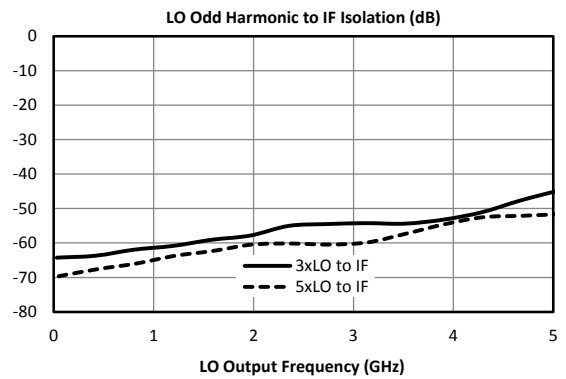
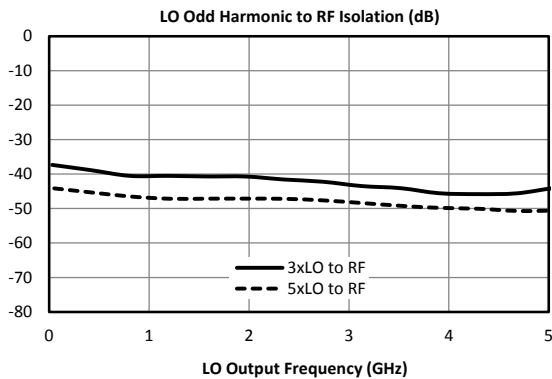
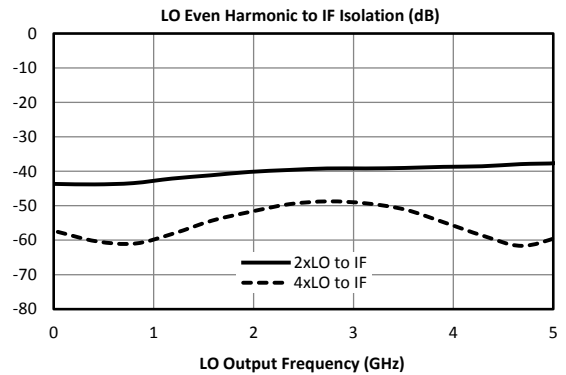
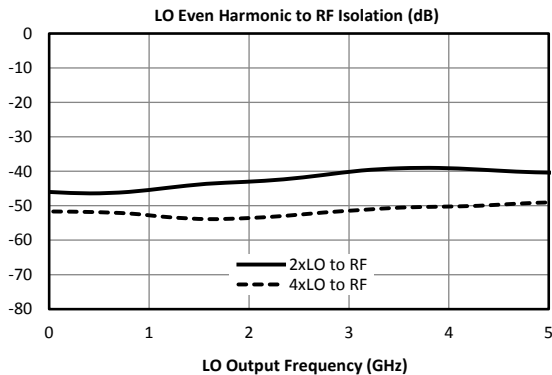
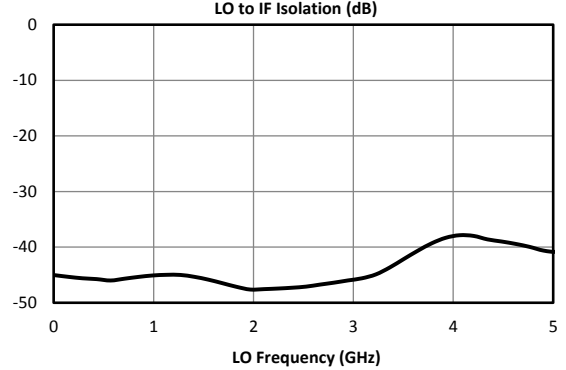
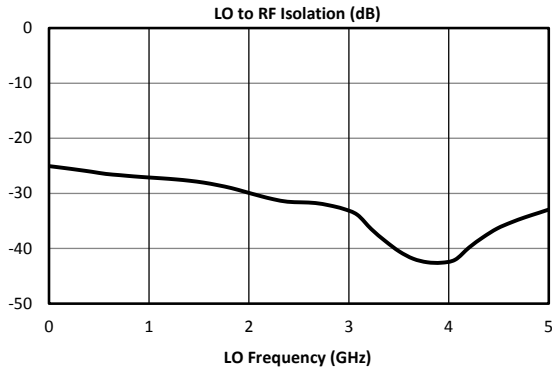
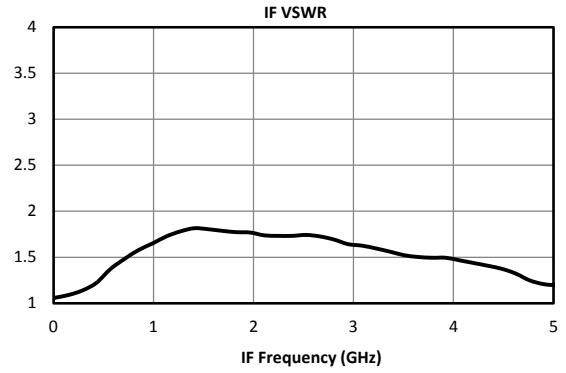
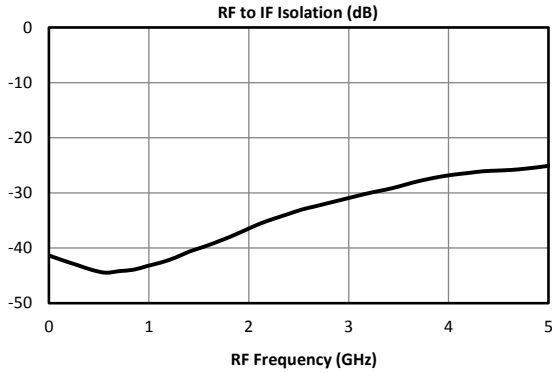
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LO/Rf 1 MHz to 5 GHz  
IF 1 MHz to 4 GHz

Typical Performance



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**LO/RF 1 MHz to 5 GHz  
IF 1 MHz to 4 GHz**

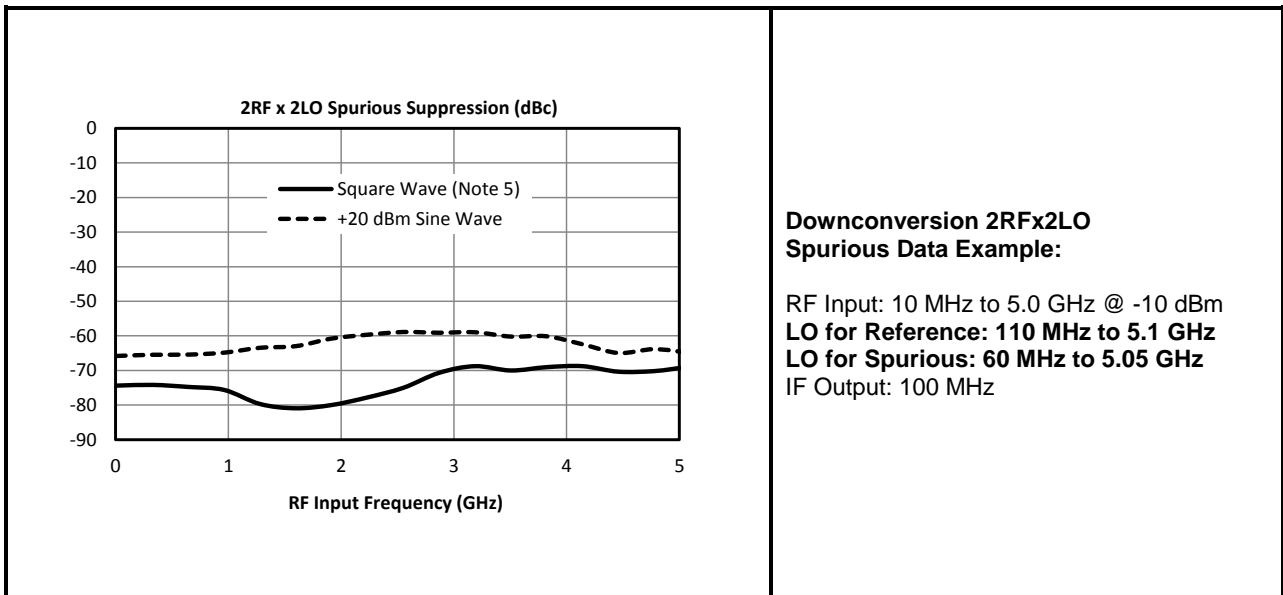
### Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies ( $\pm mLO \pm nRF$ ) within the 1 MHz to 5 GHz RF/LO bands, which create a 100 MHz 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 73 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is  $(2-1) \times (-10 \text{ dB})$  dB lower, or 83 dBc.

### Typical Downconversion Spurious Suppression (dBc): Square Wave (Sine Wave) LO<sup>5</sup>

| -10 dBm RF Input | 0xLO     | 1xLO                                                                  | 2xLO     | 3xLO    | 4xLO    | 5xLO    |
|------------------|----------|-----------------------------------------------------------------------|----------|---------|---------|---------|
| 0xRF             | -----    | See LO to IF Isolation and LO Harmonic to IF Isolation Plots (Page 3) |          |         |         |         |
| 1xRF             | 21 (24)  | Reference                                                             | 17 (27)  | 11 (12) | 16 (28) | 19 (20) |
| 2xRF             | 73 (60)  | 74 (66)                                                               | 73 (63)  | 77 (65) | 70 (62) | 75 (63) |
| 3xRF             | 105 (83) | 95 (83)                                                               | 100 (87) | 95 (74) | 97 (75) | 98 (75) |
| 4xRF             | >110     | >110                                                                  | >110     | >110    | >110    | >110    |
| 5xRF             | >120     | >120                                                                  | >120     | >120    | >120    | >120    |

A sample downconversion spurious sweep is shown below. An LO which is 100 MHz higher than the RF is used to create a 100 MHz reference IF. A second LO is used to create a 2x2 spurious IF, also at 100 MHz (50 MHz fundamental IF). The difference between these two output levels is the spurious suppression in dBc. The mean value across the full 1 MHz to 5 GHz RF input band is the number shown in the table above.



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**LO/RF 1 MHz to 5 GHz  
IF 1 MHz to 4 GHz**

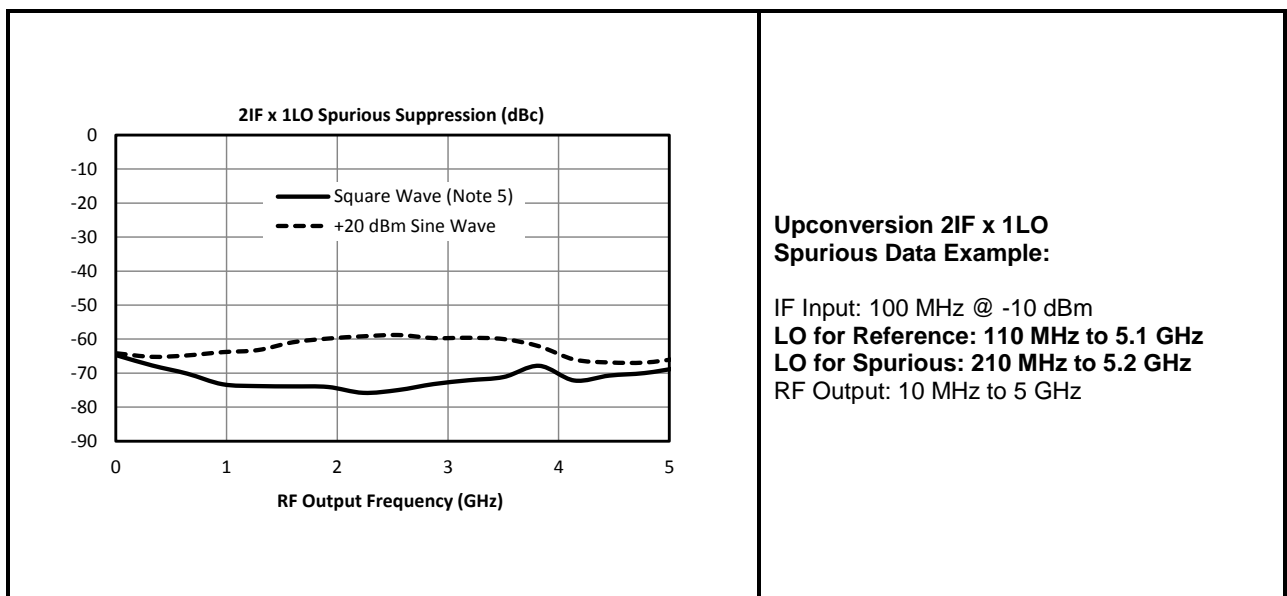
### Upconversion Spurious Suppression

Spurious data is taken by mixing a 100 MHz IF with LO frequencies ( $\pm mLO \pm nIF$ ), which creates an RF within the 1 MHz to 5 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 72 dBc for a -10 dBm input, so a -20 dBm IF input creates a spur that is  $(2-1) \times (-10 \text{ dB})$  dB lower, or 82 dBc.

#### Typical Upconversion Spurious Suppression (dBc): Square Wave (Sine Wave) LO<sup>5</sup>

| -10 dBm IF Input | 0xLO     | 1xLO                                                                  | 2xLO     | 3xLO     | 4xLO     | 5xLO    |
|------------------|----------|-----------------------------------------------------------------------|----------|----------|----------|---------|
| 0xIF             | -----    | See LO to RF Isolation and LO Harmonic to RF Isolation Plots (Page 3) |          |          |          |         |
| 1xIF             | 20 (24)  | Reference                                                             | 16 (24)  | 11 (12)  | 17 (24)  | 18 (19) |
| 2xIF             | 74 (66)  | 72 (62)                                                               | 81 (65)  | 79 (63)  | 77 (67)  | 79 (65) |
| 3xIF             | 104 (83) | 100 (77)                                                              | 103 (85) | 102 (75) | 100 (79) | 98 (75) |
| 4xIF             | >110     | >110                                                                  | >110     | >110     | >110     | >110    |
| 5xIF             | >120     | >120                                                                  | >120     | >120     | >120     | >120    |

A sample upconversion spurious sweep is shown below. A 100 MHz reference IF input is used to create an RF output that is 100 MHz below the LO input ( $LO-IF=RF$ ). A second LO (100 MHz higher) is combined with the same 100 MHz IF input ( $LO-2xIF=RF$ ) to create the same 1 MHz to 5 GHz RF output band. The difference between these two output levels is the spurious suppression in dBc. The mean value across the full RF output band is the number shown in the table above.

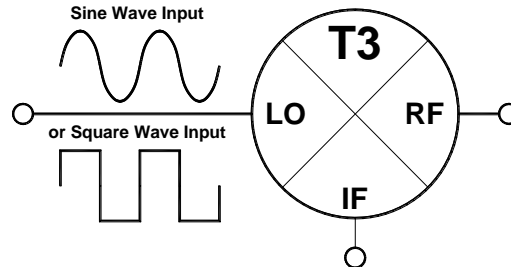





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LO/RF 1 MHz to 5 GHz  
IF 1 MHz to 4 GHz



| Port | Description                                                                                                      | DC Interface Schematic                                                               |
|------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| LO   | The LO port is DC short to ground and AC matched to 50 Ohms from 1 MHz to 5 GHz. Blocking capacitor is optional. |   |
| RF   | The RF port is DC short to ground and AC matched to 50 Ohms from 1 MHz to 5 GHz. Blocking capacitor is optional. |   |
| IF   | The IF port is DC blocked and AC matched to 50 Ohms from 1 MHz to 4 GHz.                                         |  |

| Absolute Maximum Ratings  |                                            |
|---------------------------|--------------------------------------------|
| Parameter                 | Maximum Rating                             |
| RF DC Current             | 1 Amp                                      |
| LO DC Current             | 1 Amp                                      |
| RF Power Handling (RF+LO) | +25 dBm (L-Version)<br>+27 dBm (M-Version) |
| Operating Temperature     | -55°C to +100°C                            |
| Storage Temperature       | -65°C to +125°C                            |
| ESD Sensitivity (HBM)     | Class 0                                    |

**DATA SHEET NOTES:**

- Mixer Conversion Loss Plot IF frequency is 100 MHz.
- Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.
- Conversion Loss typically degrades less than 0.5 dB for LO drives 2 dB below the lowest and 3 dB above highest nominal LO drive levels.
- Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.
- Square Wave Drive created with an A0010, biased at + 6 Volts, with a +10 dBm input. Sine Wave data is taken with a +20 dBm LO input.
- Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
- Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

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