# TWO-TONE-TERMINATOR MIXER/LO-AMPLIFIER T3A3-08

The T3A3-08 is a broadband Two-Tone-Terminator (T3) mixer integrated with a single positive bias only LO buffer amplifier. The T3A3 is a cost effective, "plug and play" solution for applications where excellent mixer linearity is required (IIP3, spurious and $P_{1dB}$) with low (0 dBm) Sine Wave drive. The T3A3 is extremely power efficient (+5V @ 145 mA) while still delivering excellent linearity from 10 MHz to 8 GHz.


### Features

- Optimized square-wave LO amplifier integrated with T3 mixer
- High IIP3 performance with 0 dBm sine wave input
- Application Note: T3 Mixer Primer
- Power efficient design (+5 V @ 145 mA)
- Low cost plug and play solution shortens design cycle and time to market
- Available in .920" x .320" CKG Package (PCB Footprint)

### Electrical Specifications - Specifications guaranteed from -30 to +70°C, measured in a 50Ω system.

| Parameter | LO (GHz) | RF (GHz) | IF (GHz) | Min | Typ | Max |
|---|---|---|---|---|---|---|
| Conversion Loss (dB) | .01-8<br>.01-8 | .01-8<br>.01-8 | .001-0.5<br>.001-4.0 | | See<br>Plots | 9.0<br>10.5 |
| Noise Figure (dB) | .01-8 | .01-8 | .001-4.0 | | See Plot | 10.5 |
| LO Drive Level (dBm) | | | | -1 | 0 | +3 |
| LO Leakage (dBm)<br>LO-RF<br>LO-IF | <br>.01-8<br>.01-8 | <br>.01-8<br>.01-8 | | | <br>See<br>Plots | |
| RF-IF Isolation (dB) | .01-8 | .01-8 | | | See Plot | |
| Input 1 dB Compression (dBm) | .01-8 | .01-8 | | +17 | +18 | |
| Input Two-Tone Third Order Intercept Point (dBm) | .01-8 | .01-8 | | | See Plot | |
| Bias Requirements (mA)[1]<br>+5.0 Volts DC | | | | | <br>145 | <br>200 |

[1]Positive-bias only required.

### Part Number Options

| *Please specify diode level and package style by adding to model number.* | | | | |
|---|---|---|---|---|
| **Package Style** | | **Examples** | | |
| Connectorized | **CKP** | T3A3-08CKP, T3A3-08CKG-2 | | |
| Surface Mount [1,2] | CKG (RoHS) | T3A3-08 (Model) | CKG (Package) | -2 (I-Port Configuration) |

[1]Connectorized test fixtures available for most surface mount packages. Consult factory.
[2]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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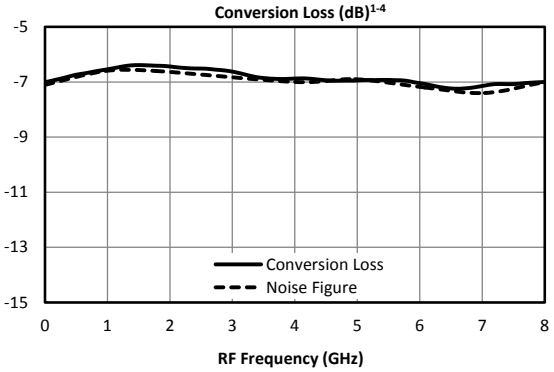
# TWO-TONE-TERMINATOR MIXER/LO AMPLIFIER T3A3-08



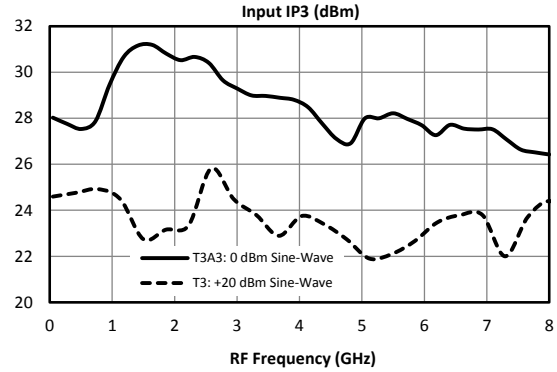
**LO/RF 10 MHz to 8 GHz**
**IF 1 MHz to 4 GHz**

Typical Performance

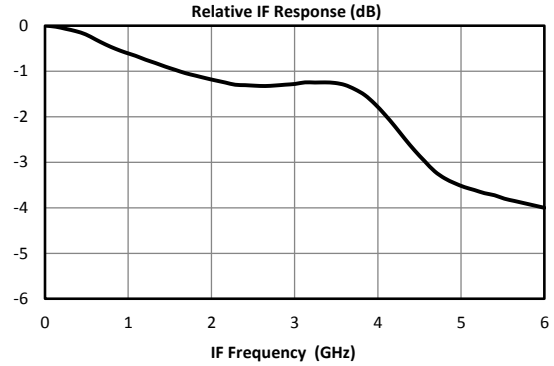
**Conversion Loss (dB)[1-4]**



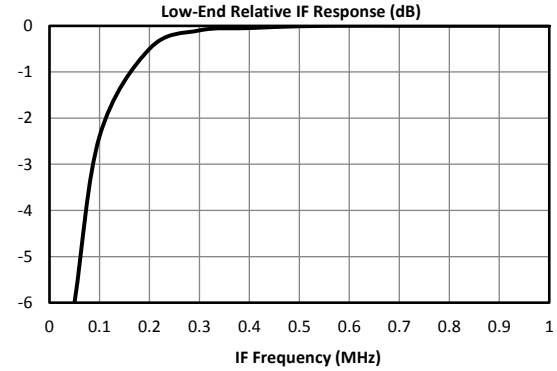

**Input IP3 (dBm)**



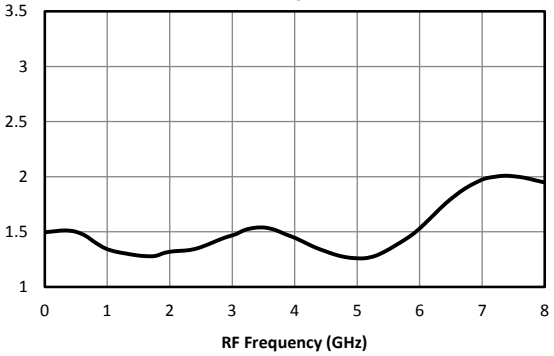

**Relative IF Response (dB)**



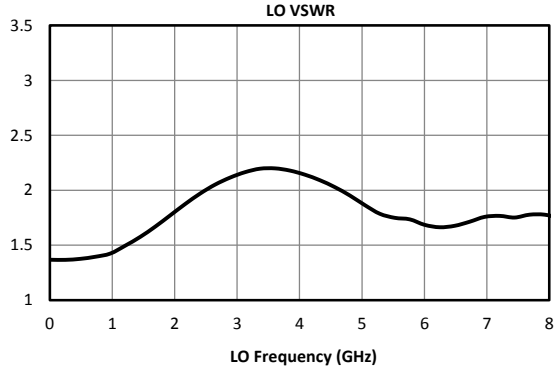

**Low-End Relative IF Response (dB)**



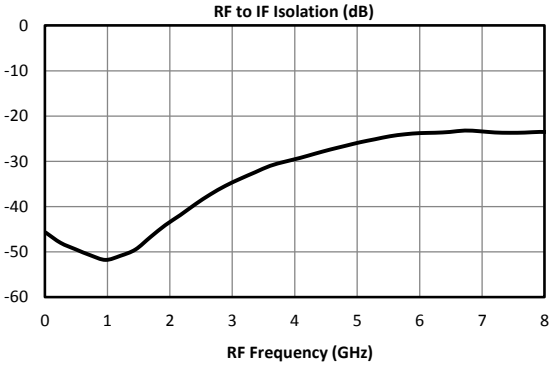

**RF VSWR**



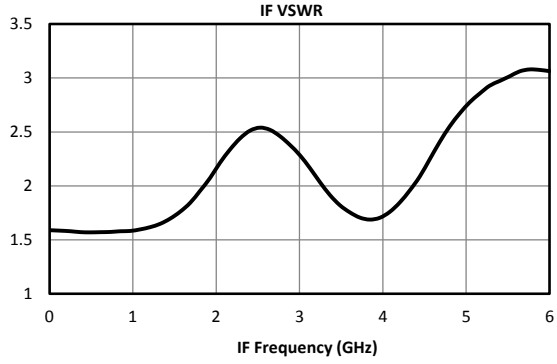

**LO VSWR**




**RF to IF Isolation (dB)**




**IF VSWR**



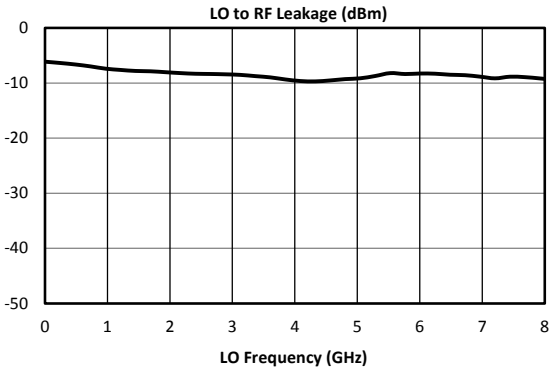
# TWO-TONE-TERMINATOR MIXER

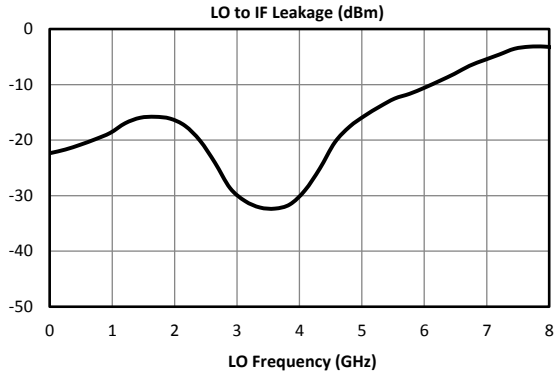
**T3A3-08**

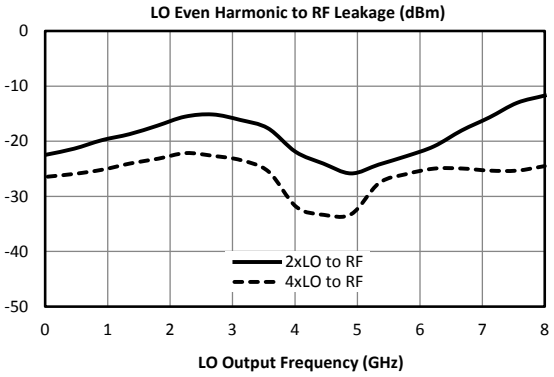


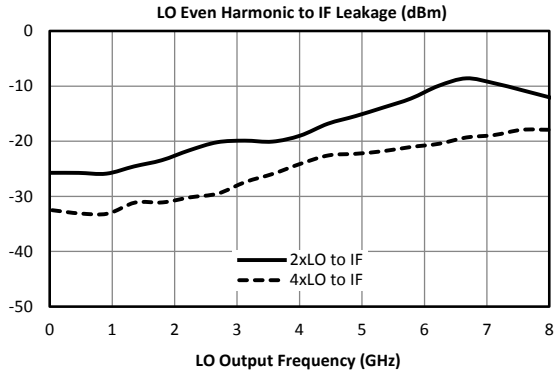
**LO/RF 10 MHz to 8 GHz**
**IF 1 MHz to 4 GHz**

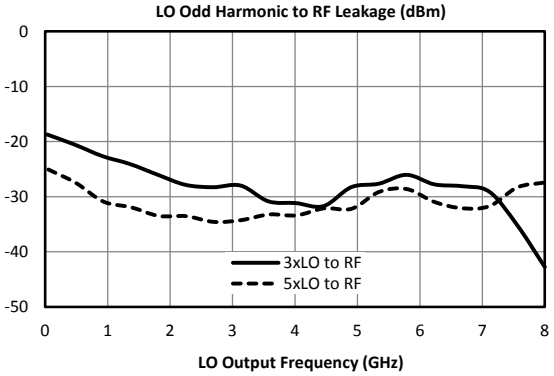
Typical Performance

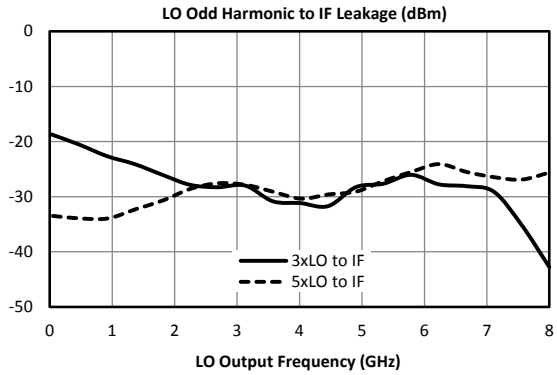


# TWO-TONE-TERMINATOR MIXER

**T3A3-08**



**LO/RF 10 MHz to 8 GHz**
**IF 1 MHz to 4 GHz**

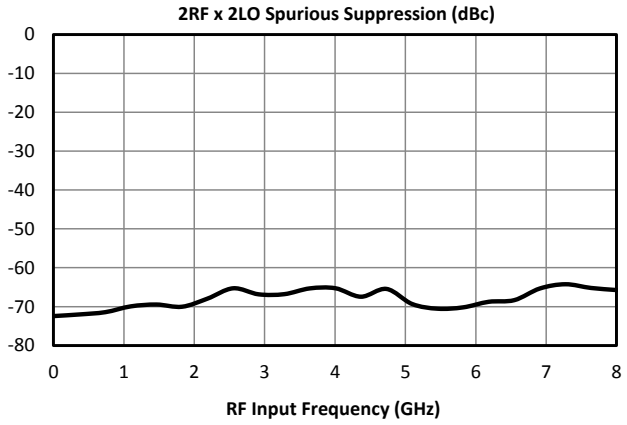
## Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (±mLO±nRF) within the 10 MHz to 8 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 68 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 78 dBc.

**Typical Downconversion Spurious Suppression (dBc): 0 dBm Sine Wave LO**

| **-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 | 22 | Reference | 25 | 11 | 22 | 17 |
| 2xRF | 66 | 65 | 68 | 65 | 66 | 67 |
| 3xRF | 98 | 88 | 93 | 84 | 88 | 83 |
| 4xRF | >110 | >110 | >110 | >110 | >110 | >110 |
| 5xRF | >120 | >120 | >120 | >120 | >120 | >120 |

A sample downconversion spurious sweep is shown below. An LO 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 10 MHz to 8 GHz RF input band is the number shown in the table above.




**Downconversion 2RFx2LO**
**Spurious Data Example:**

RF Input: 10 MHz to 8.0 GHz @ -10 dBm
**LO for Reference: 110 MHz to 8.1 GHz**
**LO for Spurious: 60 MHz to 8.05 GHz**
IF Output: 100 MHz

# TWO-TONE-TERMINATOR MIXER

**T3A3-08**



**LO/RF 10 MHz to 8 GHz**
**IF 1 MHz to 4 GHz**

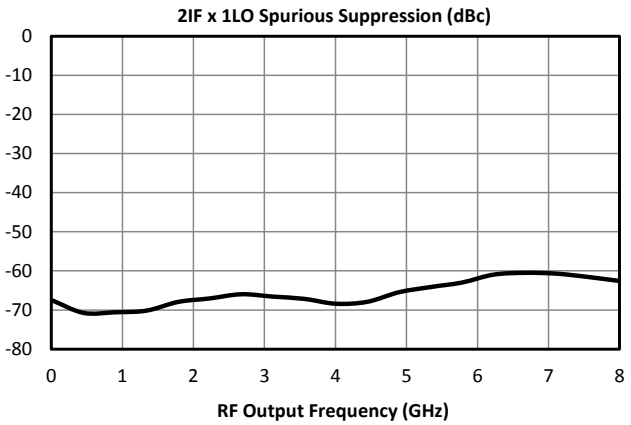
## Upconversion Spurious Suppression

Spurious data is taken by mixing a 100 MHz IF with LO frequencies (±mLO±nIF), which creates an RF within the 10 MHz to 8 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 66 dBc for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 76 dBc.

**Typical Upconversion Spurious Suppression (dBc): 0 dBm Sine Wave LO**

| **-10 dBm RF Input** | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 0xIF | ---------- | See LO to RF Isolation and LO Harmonic to RF Isolation Plots (Page 3) | | | | |
| 1xIF | 14 | Reference | 23 | 11 | 22 | 17 |
| 2xIF | 74 | 66 | 70 | 64 | 66 | 67 |
| 3xIF | 98 | 87 | 92 | 85 | 87 | 84 |
| 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 10 MHz to 8 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.




**Upconversion 2IF x 1LO Spurious Data Example:**

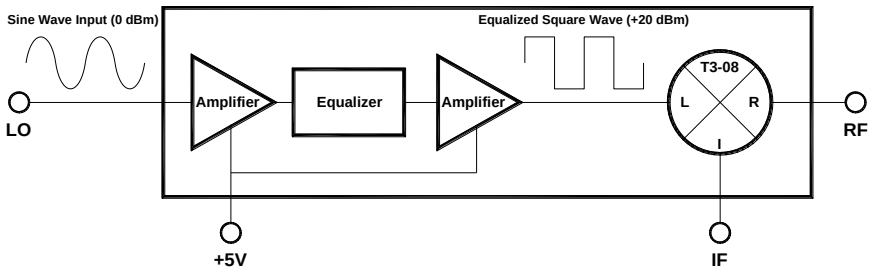
IF Input: 100 MHz @ -10 dBm
**LO for Reference: 110 MHz to 8.1 GHz**
**LO for Spurious: 210 MHz to 8.2 GHz**
RF Output: 10 MHz to 8 GHz

# TWO-TONE-TERMINATOR MIXER

**T3A3-08**



**LO/RF 10 MHz to 8 GHz**
**IF 1 MHz to 4 GHz**




| Port | Description | DC Interface Schematic |
|---|---|---|
| LO | The LO port is DC blocked and AC matched to 50 Ohms from 10 MHz to 8 GHz. |   |
| RF | The RF port is DC short to ground and AC matched to 50 Ohms from 10 MHz to 8 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 Voltage | 6 Volts |
| RF Power Handling | +25 dBm |
| LO Power Handling | +15 dBm |
| Operating Temperature | -30ºC to +70ºC |
| Storage Temperature | -65ºC to +125ºC |
| ESD Sensitivity (HBM) | Class 0 |

DATA SHEET NOTES:

1. Mixer Conversion Loss Plot IF frequency is 100 MHz.
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 +70°C and improves less than 0.5 dB at -30°C.
4. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
5. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.



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