

**LTC5548**
**2GHz to 14GHz Microwave Mixer with Low IF Frequency**
**DESCRIPTION**

Demonstration circuit 2461A is optimized for evaluation of the [LTC®5548](#) passive double-balanced mixer with integrated LO frequency doubler. Its RF port is matched to 50Ω from 2GHz to 13.6GHz with 9dB return loss, and the LO port is matched to 50Ω from 1GHz to 12GHz with 10dB return loss. The differential IF port is usable from DC to 6GHz. The LTC5548 can be used for upconverting and downconverting applications.

The internal LO doubler can be enabled to allow operation with a lower frequency LO input signal such as that from the [LTC6945/LTC6946](#) or [LTC6947/LTC6948](#) family of frequency synthesizers.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2461A>**

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**ABSOLUTE MAXIMUM INPUT RATINGS**

|  |                          |
|--|--------------------------|
| Supply Voltage (EN).....                   | 4V                       |
| Enable Input Voltage (EN) .....            | -0.3V to $V_{CC} + 0.3V$ |
| LO Input Power (1GHz to 12GHz) .....       | 10dBm                    |
| LO Input DC Voltage.....                   | $\pm 0.1V$               |
| RF Input Power (2GHz to 14GHz) .....       | 20dBm                    |
| RF Input DC Voltage.....                   | $\pm 0.1V$               |
| IF Input Power (LF to 6GHz).....           | 20dBm                    |
| IF Input DC Voltage .....                  | $\pm 0.1V$               |
| Operating Temperature Range ( $T_C$ )..... | -40°C to 105°C           |
| Junction Temperature ( $T_J$ ) .....       | 150°C                    |
| Storage Temperature Range .....            | -65°C to 150°C           |

Caution: This part is sensitive to electrostatic discharge (ESD). Observe proper ESD precautions when handling the LTC5548.

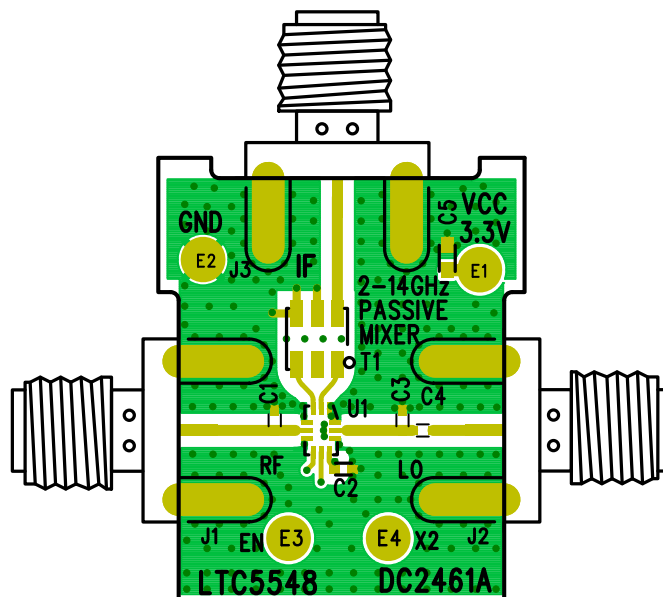
**BOARD LAYOUT**


Figure 1. DC2461A

## PROPER TEST SETUPS

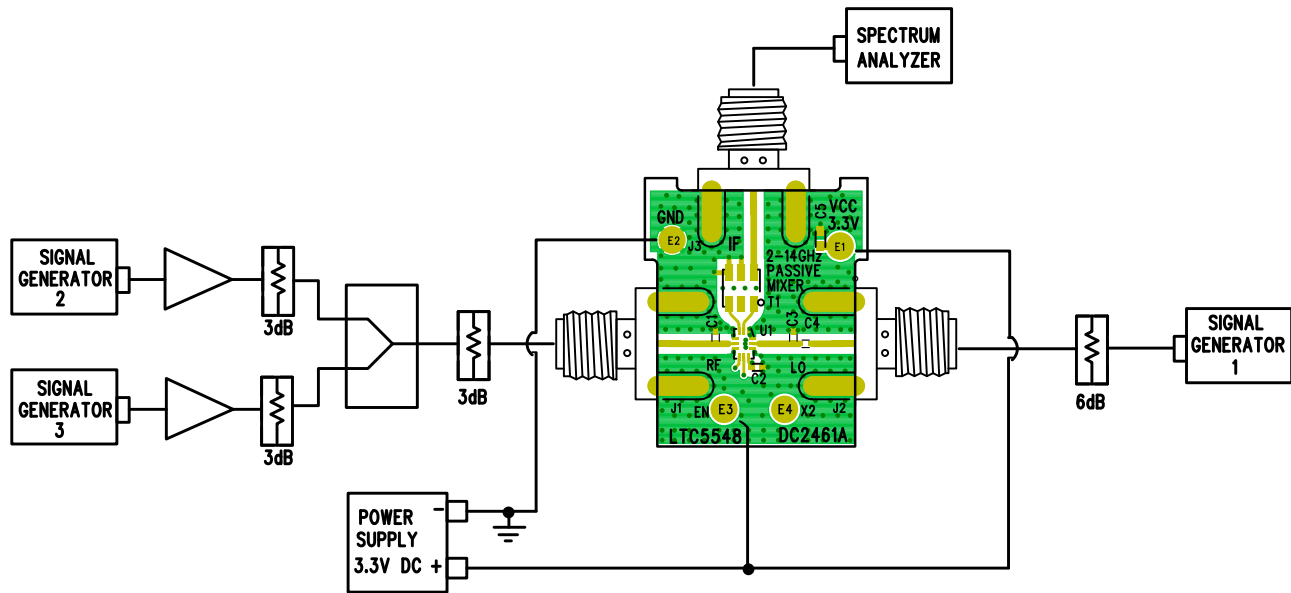


Figure 2. Test Setup for Downconverting Mixer 2-Tone Measurements

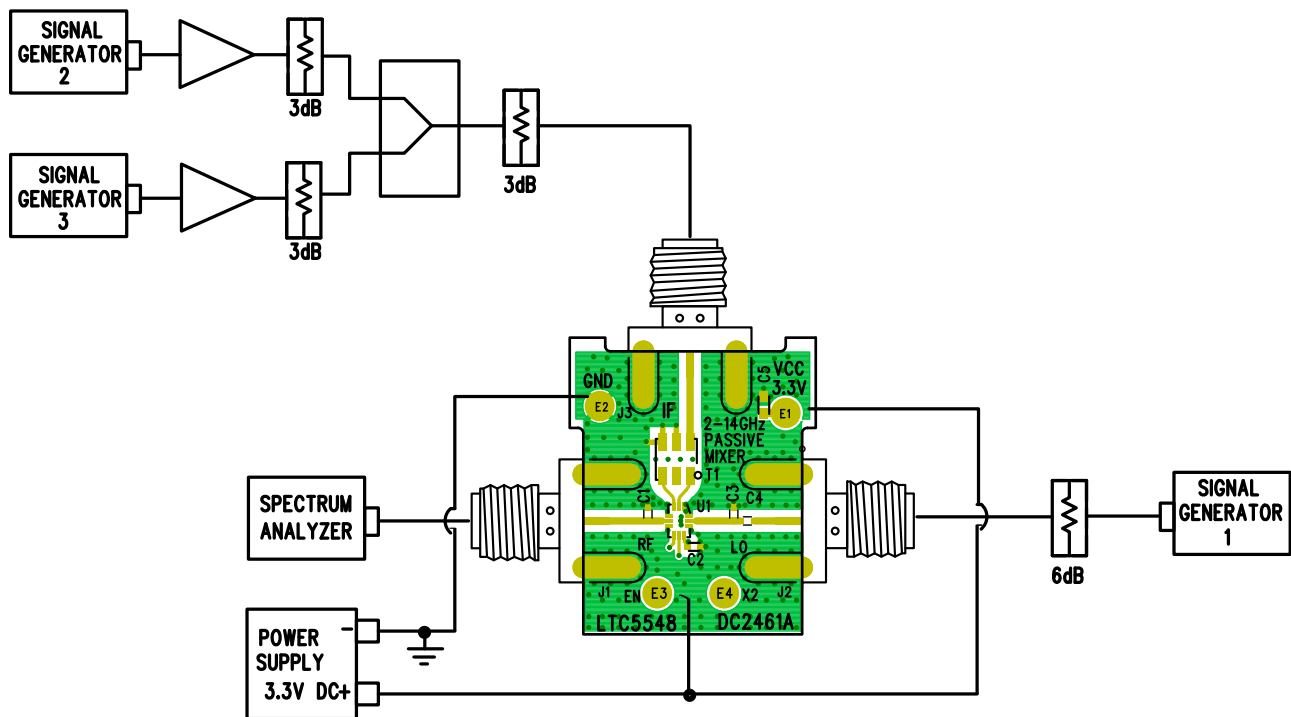


Figure 3. Test Setup for Upconverting Mixer 2-Tone Measurements

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## NOTES ON TEST EQUIPMENT AND SETUP

- High performance signal generators with low harmonic outputs should be used for 2-tone measurements. Otherwise, low pass filters at the signal generator outputs should be used to suppress harmonics.
- High quality combiners should be used to present a broadband  $50\Omega$  termination on all ports as well as provide good port-to-port isolation. Adding attenuator pads further improves source isolation and helps prevent the signal generators from producing intermodulation products.
- Spectrum analyzers can produce significant internal distortion products if they are overdriven. Generally, spectrum analyzers are designed to operate at their best with about  $-30\text{dBm}$  to  $-40\text{dBm}$  at their input. The spectrum analyzer's input attenuation setting should be used to avoid saturating the instrument.
- Set the spectrum analyzer's input attenuation depending on the spectrum analyzer used.
- Before performing measurements on the DUT, the system performance should be evaluated to ensure that a clean input signal is obtained and that the spectrum analyzer's internal distortion is minimized.

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## QUICK START PROCEDURE

1. Connect all test equipment as shown in Figure 2.
2. Set the power supply output voltage to 3.3V, and set the current limit to 200mA.
3. Connect the ground and  $V_{CC}$  turrets to the power supply. **BE SURE TO CONNECT THE  $V_{CC}$  TURRET *BEFORE* THE EN TURRET TO ENSURE THAT THE PART DOES NOT GET DAMAGED. ALSO, REMOVE POWER FROM EN TURRET *BEFORE* REMOVING POWER FROM THE  $V_{CC}$  TURRET.**
4. Connect the EN turret to the power supply.
5. Set the LO signal generator to provide a 5560MHz CW signal at about 0dBm to the demo board's LO port.
6. Set the RF signal generators to provide one 5799MHz CW signal and one 5801MHz CW signal. The signals should be applied to the 2-way combiner. The output of the combiner should be applied to the demo board's RF input port. The two tones should be set to  $-5\text{dBm}$  each at the mixer's RF input port.
7. Set the spectrum analyzer's center frequency to 240MHz with a span of 10MHz.
8. Perform various measurements (Conversion Gain, OIP3, LO leakage, etc.)

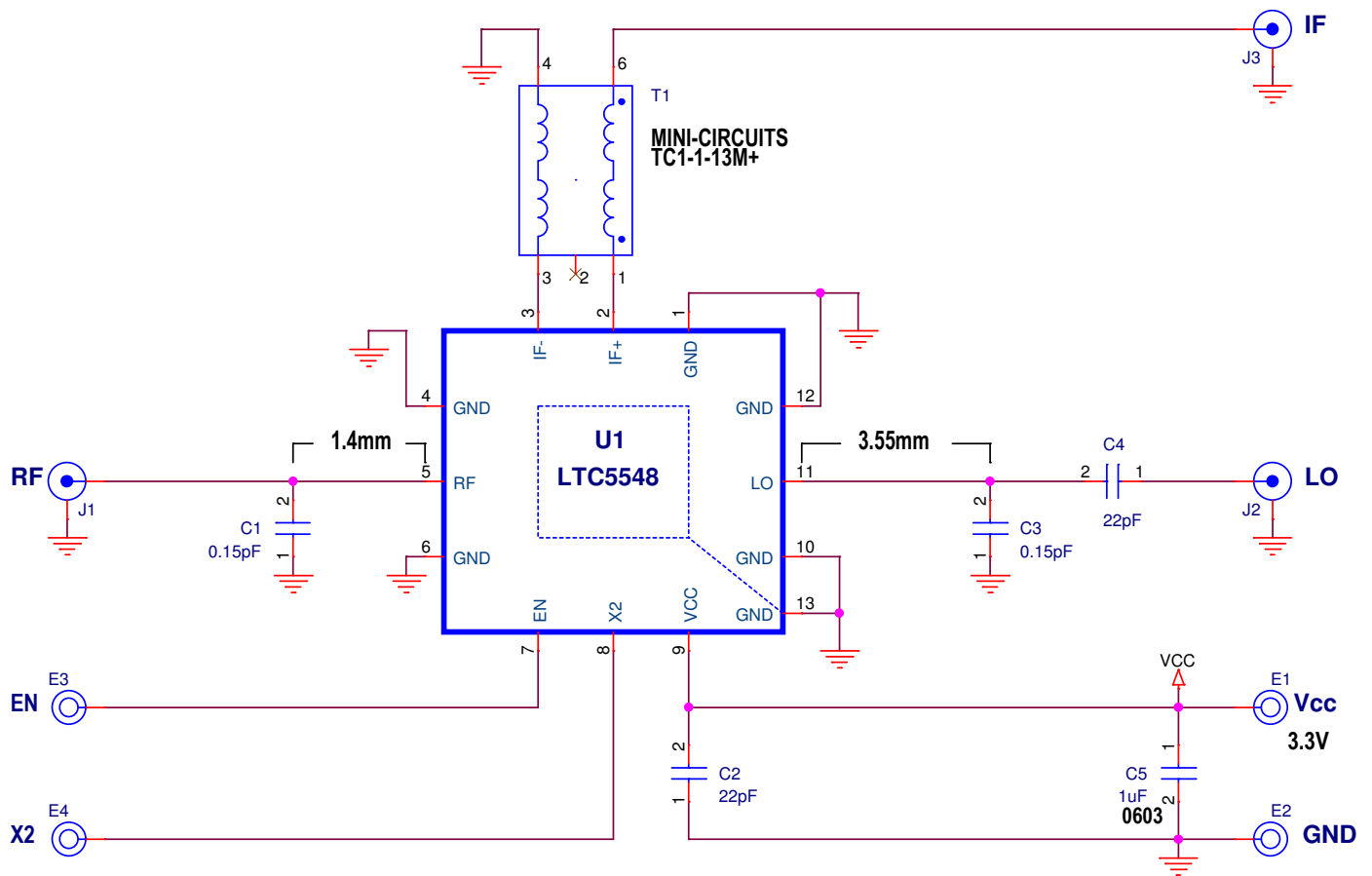
# DEMO MANUAL DC2461A

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## PARTS LIST

| ITEM                               | QTY | REFERENCE | PART DESCRIPTION                       | MANUFACTURER/PART NUMBER                       |
|------------------------------------|-----|-----------|--|--|
| <b>Required Circuit Components</b> |     |           |  |  |
| 1                                  | 2   | C1, C3    | CAP, 0.15pF, 100V, ±0.01pF, 0402       | AVX, 04021JR15ZBS                              |
| 2                                  | 2   | C2, C4    | CAP, 22pF, C0G, 50V, 5%, 0402          | AVX, 04025A220JAT2A                            |
| 3                                  | 1   | C5        | CAP, 1µF, X7R, 10V, 10%, 0603          | AVX, 0603ZD105KAT2A                            |
| 4                                  | 4   | E1 TO E4  | TEST POINT, TURRET, 0.061" MTG HOLE    | MILL-MAX, 2308-2-00-80-00-00-07-0              |
| 5                                  | 3   | J1 TO J3  | CONN, SMA 50Ω EDGE-LAUNCH              | E F JOHNSON, 142-0701-851                      |
| 6                                  | 1   | T1        | TRANS, MINI-CIRCUITS 4.5MHz TO 3000MHz | MINI-CIRCUITS TC1-1-13M+                       |
| 7                                  | 1   | U1        | IC LTC5548IUDB, QFN 12 PIN, 3mm × 2mm  | LINEAR TECHNOLOGY CORPORATION, LTC5548IUDB#PBF |

**SCHEMATIC DIAGRAM**



# DEMO MANUAL DC2461A

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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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