# LTC5555
# 1.5GHz to 7GHz Programmable Gain Downconverting Mixer

## DESCRIPTION

Demonstration circuit 2524A is optimized for evaluation of the LTC®5555 programmable gain downconverting mixer. The IC incorporates an active mixer and a digital IF VGA with 15.5dB gain control range. The IF gain is programmed in 0.5dB steps through the SPI or parallel interface. The LTC5555 has single-ended 50Ω RF input, single-ended or differential-drive LO input, and differential IF output. It features an enable pin for fast turn-on and shutdown. A reduce power mode is also available through SPI or a CMOS logic pin reducing the total current consumption by approximately 25%.

Demonstration circuit 2524A's RF input port is 50Ω matched from 2.6GHz to 6.4GHz and can be easily tuned down to 1.5GHz or up to 7GHz. The LO port is 50Ω matched from 500MHz to 7GHz. The demo circuit's differential IF outputs has 100Ω differential impedance and are match for 115MHz to 495MHz IF frequencies. The IF outputs can be modified for other IF frequencies or impedances. Transformer footprint pads are included on the PCB allowing the use of IF transformer to provide 50Ω single-ended IF output. See data sheet for more details on input and output impedance matching.

CAUTION: This part is sensitive to electrostatic discharge (ESD). Observe proper ESD precautions when handling the LTC5555.

**Design files for this circuit board are available.**



## BOARD LAYOUT

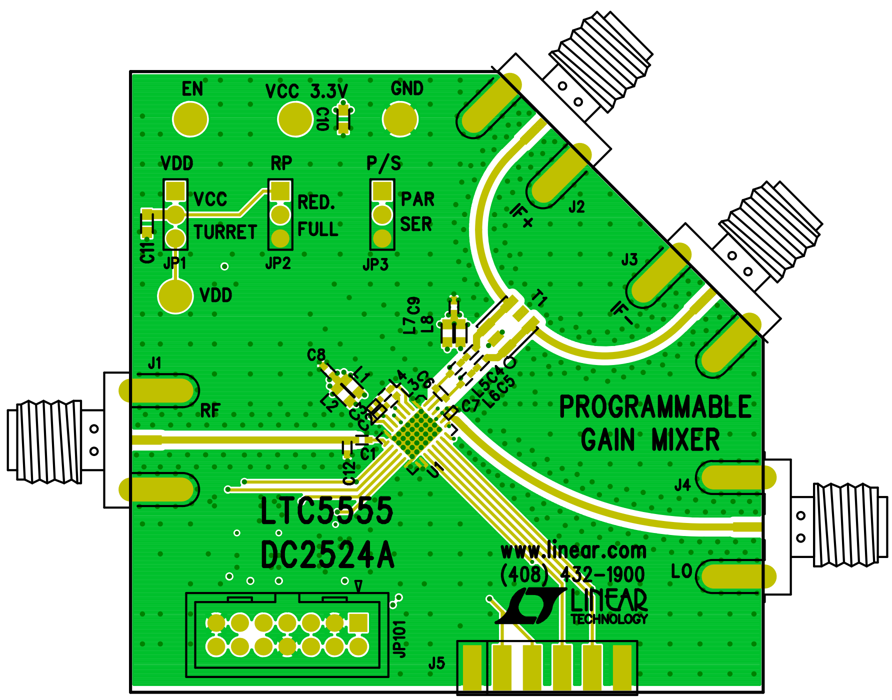


Figure 1. Demonstration Circuit 2524A

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ($V_{DD}$, $V_{CC}$, $IF^+$, $IF^-$) ............................4V
EN Input Voltage ...............–0.3V to $V_{CC}$ + 0.3V, 4V MAX
$LO^+$, $LO^-$ Input Power (500MHz to 8GHz) .......... +10dBm
RF Input Power (1.5GHz to 7GHz) ......................+20dBm
$LO^+$, $LO^-$ DC Voltage .............................................±0.5V
IF DVGA Peak Differential Input Voltage....................±4V
PS Input Voltage .............. –0.3V to $V_{DD}$ + 0.3V, 4V MAX
SDI, CLK, CSB, RP, DX Input
Voltages........................... –0.3V to $V_{DD}$ + 0.3V, 4V MAX
SDO Voltage..................... –0.3V to $V_{DD}$ + 0.3V, 4V MAX
Operating Temperature Range ($T_C$)........ –40°C to 105°C
Junction Temperature ($T_J$) .................................... 150°C
Storage Temperature Range .................. –65°C to 150°C

## NOTE ON TEST EQUIPMENT AND SETUP

1. High performance signal generators with low harmonic output and low phase noise should be used. Filters at the signal generators' outputs may also be used to suppress higher-order harmonics.
2. High quality power combiners with good port-to-port isolation and broadband 50Ω termination on all ports should be used. The 180° IF combiner should have accurate phase and amplitude balance.
3. Use high performance RF power amplifiers with high IP3 and high reverse isolation at the outputs of the RF signal generators to improve source isolation to prevent the sources from producing intermodulation products.
4. Small attenuator pads at the demonstration circuit's input and output ports improve source and load match and reduce reflections.
5. A high performance spectrum analyzer with wide dynamic range should be used for linearity measurement.
6. Use narrow resolution bandwidth (RBW) and engage video averaging on the spectrum analyzer to lower the displayed average noise level (DANL) to improve sensitivity and to increase dynamic range. However, the trade off is increased sweep time.
7. Spectrum analyzers can produce significant internal distortion products if they are overdriven. Generally, spectrum analyzers are designed to operate at their best with about –30dBm to –40dBm at their input. Optimize spectrum analyzer's input attenuation setting for best sensitivity and dynamic range while minimizing internal distortions.
8. Before performing measurements, the system performance should be evaluated to ensure that a) a clean test signal is obtained, b) the spectrum analyzer is optimized for high linearity measurement, and c) the system is accurately calibrated for power level and frequency.

## QUICK START PROCEDURE

NOTE 1: Care should be taken to never exceed absolute maximum input ratings.

NOTE 2: To prevent damages to test equipment and the demo circuit, only make connections with RF and DC power off.

NOTE 3: During turn on, apply $V_{CC}$ voltage before any control and data pin voltages. During turn off, remove all control and data pin voltages before removing $V_{CC}$ voltage.

1. Adjust all signal generator outputs to minimum and turn off the outputs.
2. Set DC power supply output voltage to minimum and output current limit to 250mA. Turn off its output.
3. Connect all test equipment as shown in Figure 2.
4. Increase DC power supply voltage to 3.3V and verify demo board current consumption.
5. Set the LO signal generator to provide a 3330MHz CW signal at 0dBm to the demo board's LO input port.
6. Set the RF signal generators to provide two –6dBm CW tones to the demo board RF input port, one at 3599MHz and the other at 3601MHz.
7. Set up the LTC5555 digital settings to get the desired RF attenuation and power mode.
8. Set the spectrum analyzer's center frequency to 270MHz and perform various measurements (Conversion Gain, OIP3, OIP2, leakages, etc.)

## PROPER TEST SETUP

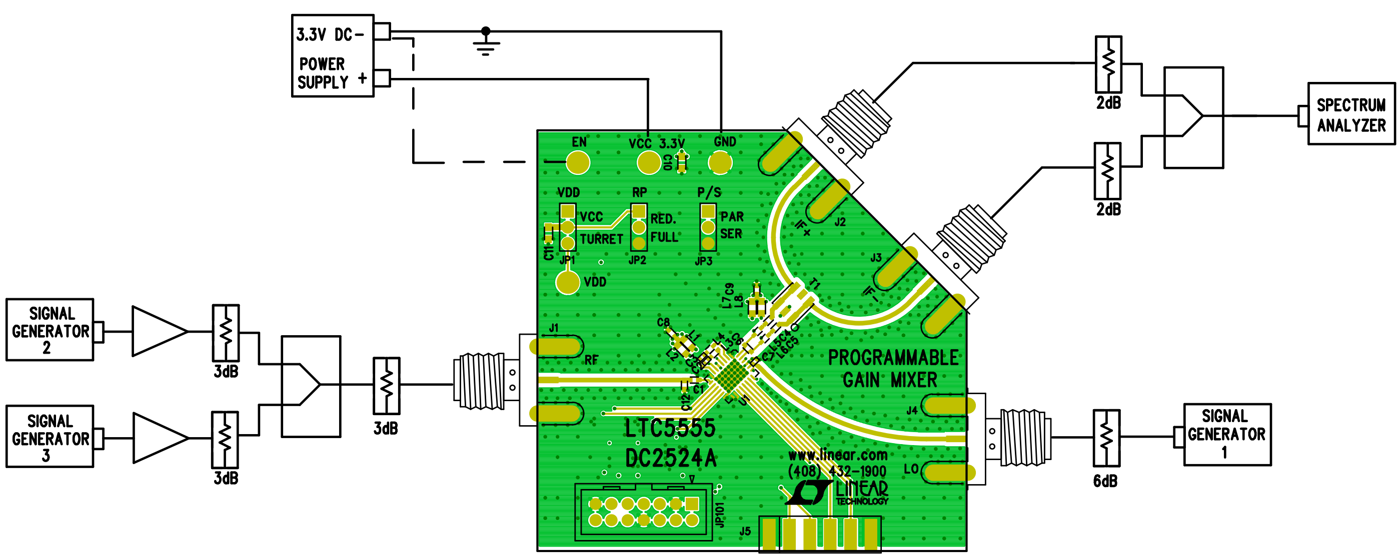


Figure 2. Test Setup for 2-Tone Measurement

**ESD Caution**

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.