DESCRIPTION

Demonstration circuit 1027A is optimized for down-converting mixer tests & measurements for input frequency range of 79MHz to 300MHz and an output frequency range of 3MHz to 67MHz, (for 12dB return loss). The LO port frequency range is 176MHz to 316MHz (10dB return loss). Demo circuit 1027A can also be optimized for HF, VHF up-converting applications.

The LT®5560 is a 0.01MHz to 4000MHz low power, high performance broadband Up/Down-converting active mixer. This double-balanced mixer can be driven by a single-ended LO source and requires –2dBm of LO power. The signal ports can be impedance matched to a broad range of frequencies, which allow the LT®5560 to be used as an up- or down-conversion mixer in a wide variety of applications.

The LT®5560 is characterized with a supply current of 10mA; however, the DC current is adjustable, which allows the performance to be optimized for each application by changing the value of resistor R1. For Icc=10mA the value of R1=3 Ohm. Operation at a lower supply current will, however, degrade linearity.

Design files for this circuit board are available. Call the LTC factory.

Table 1. Typical Performance Summary (T_A = 25°C)

PARAMETER	CONDITION (f_{INPUT} = 250MHz, f_{LO}=260MHz)	VALUE
Supply Voltage		2.7V to 5.3V
Supply Current	V_{CC} = 3V, EN = High, R1=3	10mA
Maximum Shutdown Current	V_{CC} = 3V, EN = 0.3V	10µA
Signal Input Frequency Range	Requires External Matching	< 4000 MHz
LO Signal Frequency Range	Requires External Matching	< 4000 MHz
Signal Output Frequency Range	Requires External Matching	< 4000 MHz
IF Input Return Loss	Z_0 = 50 , with External Matching	15dB
LO Input Return Loss	Z_0 = 50 , with External Matching	15dB
RF Output Return Loss	Z_0 = 50 , with External Matching	15dB
LO Input Power		-6dBm to 1dBm
Conversion Gain	P_{INPUT} = -20dBm, P_{LO} = -2dBm	2.7dB
SSB Noise Figure	P_{LO} = -2dBm	8.8dB
Input 3rd Order Intercept	2-Tone, -20dBm/Tone, delta f = 1MHz, P_{LO} = -2dBm	+9.6dBm
Input 2nd Order Intercept	2-Tone, -20dBm/Tone, delta f = 1MHz, P_{LO} = -2dBm	+46dBm
Input 1dB Compression	P_{LO} = -2dBm	0.4dBm
LO to IN leakage	P_{LO} = -2dBm	-63dBm
LO to OUT leakage	P_{LO} = -2dBm	-44dBm

QUICK START PROCEDURE

Demonstration circuit 1027A is easy to set up to evaluate the performance of the LT®5560. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE:

a. Use high performance signal generators with low harmonic output. Otherwise, low-pass filters at the signal generator outputs should be used to suppress harmonics, particularly the 2^{nd} harmonic.

b. High quality combiners that provide a 50 Ohm termination on all ports and have good port-to-port isolation should be used. Attenuators on the outputs of the signal generators are recommended to further improve source isolation and to reduce reflection into the sources.

1. Connect all test equipment as shown in Figure 1.
2. Set the DC power supply's current limit to 15mA, and adjust output voltage to 3V.
3. Connect Vcc to the 3V DC supply, and then connect EN to 3V; the Mixer is enabled (on).
4. Set Signal Generator #1 to provide a 260MHz, -2dBm, CW signal to the demo board LO input port.
5. Set the Signal Generators #2 and #3 to provide two -20dBm CW signals to the demo board RF input port—one at 250MHz, and the other at 251MHz.
6. To measure 3^{rd} order distortion and conversion gain, set the Spectrum Analyzer start and stop frequencies to 7MHz and 12MHz, respectively. Sufficient spectrum analyzer input attenuation should be used to avoid distortions in the instrument.
7. The 3^{rd} order intercept point is equal to $(P_1 – P_3) / 2 + P_{in}$, where P_1 is the power level of the two fundamental output tones, at 9MHz and 10MHz, P_3 is the 3^{rd} order distortion products at 8MHz or 11MHz, and P_{in} is the input power (in this case minus 20dBm). All units are in dBm.
8. Using the same signal generator settings, output IM2 product can be measured at 1MHz, which is a difference between two input frequencies (250MHz and 251MHz). However we recommend increasing the frequency of the second signal generator from 251MHz to 253MHz and measure the output IM2 product at 3MHz frequency (253MHz-250MHz=3MHz). At 3MHz the mixer output matching circuit has good return loss. To measure input 2^{nd} order distortion, set the Spectrum Analyzer center frequency to 3MHz.
9. The 2^{nd} order intercept point is equal to $P_1 – P_2 + P_{in}$, where P_1 is the power level of the fundamental output tone at 7MHz, P_2 is the 2^{nd} order product at 3MHz, and P_{in} is the input power (in this case minus 20dBm).

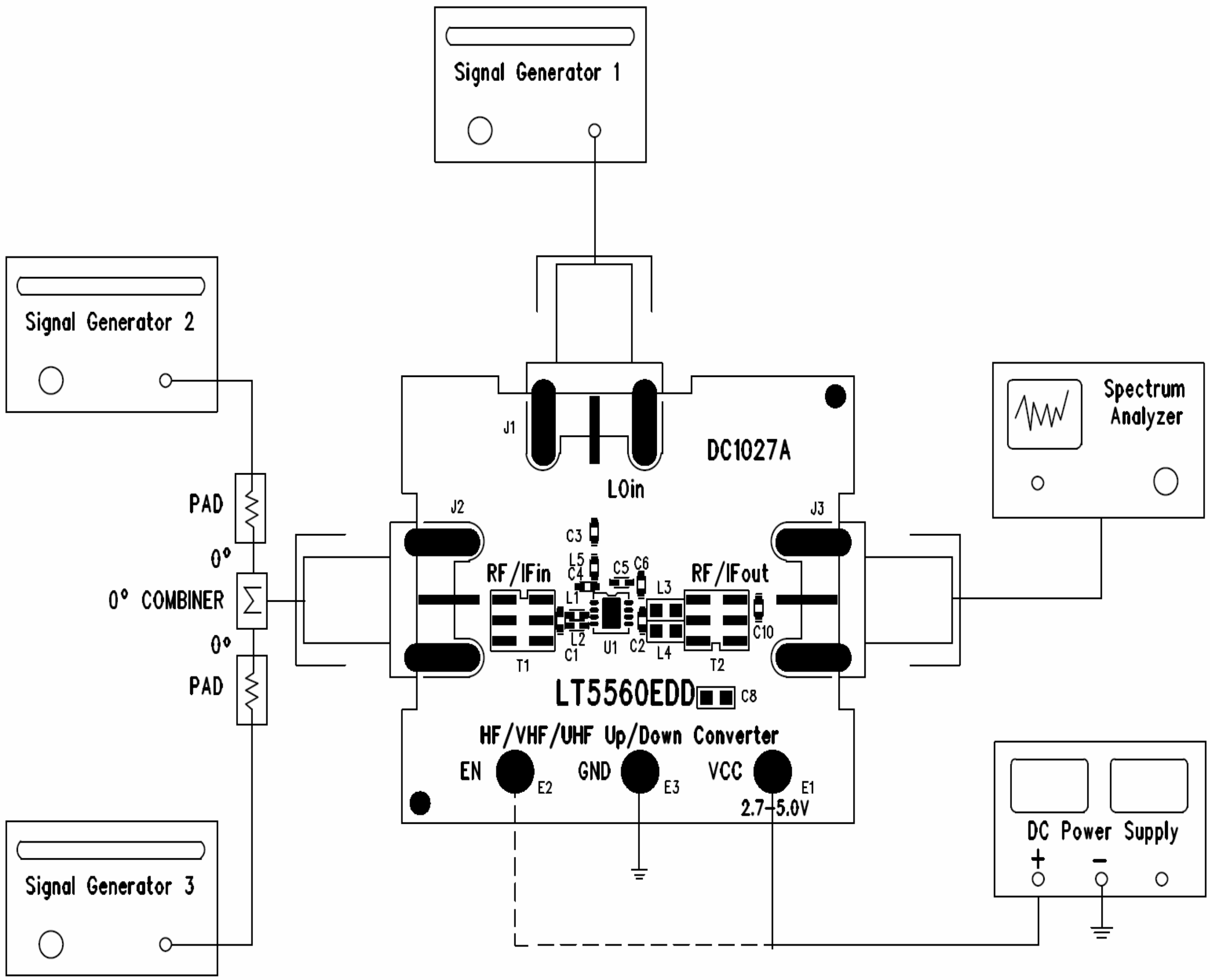
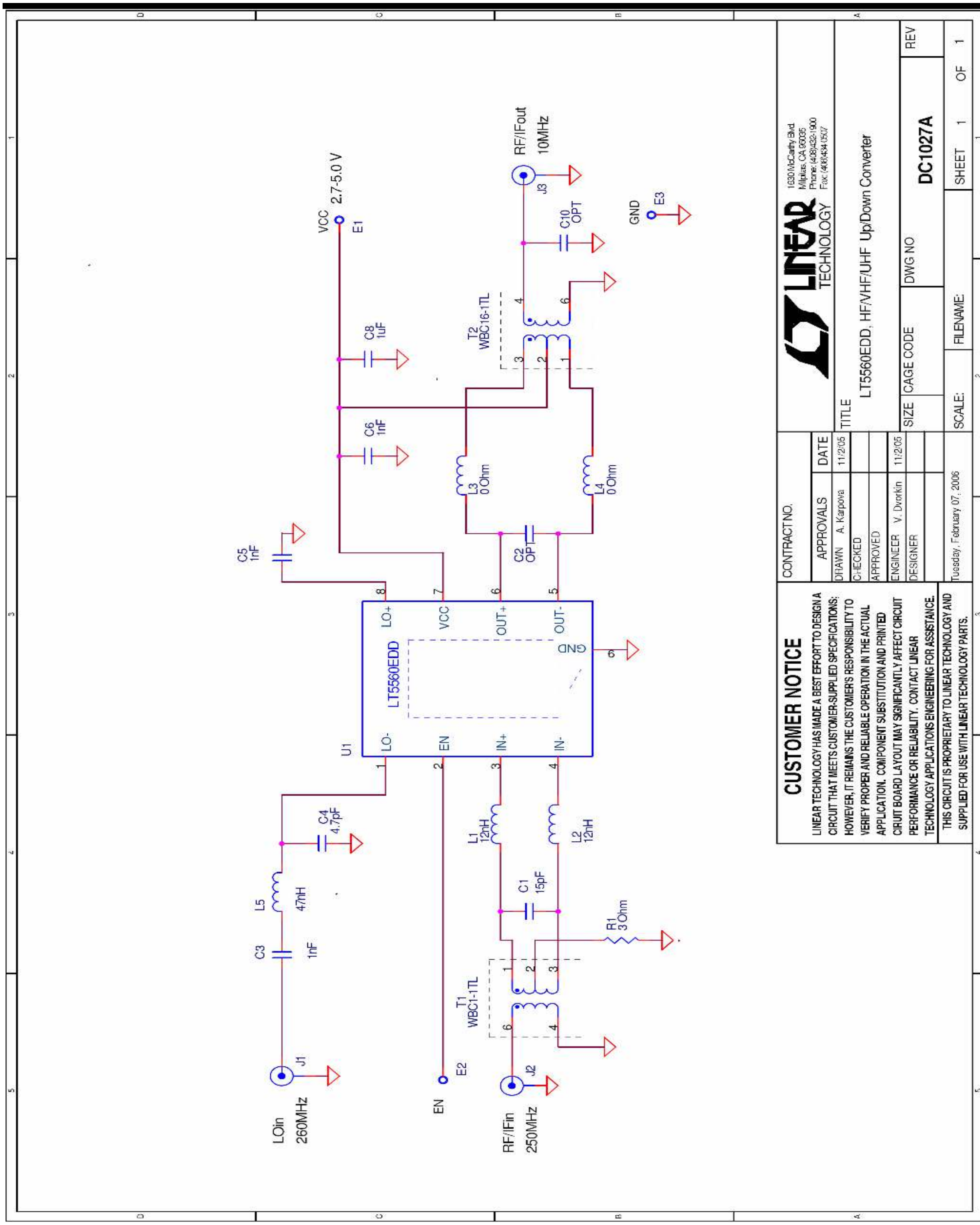


Figure 1. Proper Measurement Equipment Setup


VCC
2.7-5.0 V
E1
RF/IFout
10MHz
J3
C10
OPT
GND
E3
T2
WBC16-1TL
C8
1uF
C6
1nF
L3
0 Ohm
L4
0 Ohm
C2
OPT
C5
1nF
LO+
VCC
OUT+
OUT-
GND
LT5560EDD
U1
LO-
EN
IN+
IN-
C4
4.7pF
L1
12nH
L2
12nH
L5
47nH
C3
1nF
C1
15pF
R1
3 Ohm
T1
WBC1-1TL
J1
LOin
260MHz
EN
E2
J2
RF/IFin
250MHz
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TITLE
LT5560EDD, HF/VHF/UHF Up/Down Converter
SIZE
CAGE CODE
DWG NO
DC1027A
REV
SCALE:
FILENAME:
SHEET 1 OF 1