DESCRIPTION

Demonstration circuit DC991A is optimized for a down-converting mixer tests & measurements for input frequency range of 700MHz to 1680MHz, an output frequency range of 110 MHz to 170MHz (12 dB return loss BW). The LO port frequency range is 515 to 915MHz (10 dB return loss BW).

The LT®5560 is a 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} = 900MHz, f_{LO}=760MHz)	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	2.6dB
SSB Noise Figure	P_{LO} = -2dBm	10.1dB
Input 3rd Order Intercept	2-Tone, -20dBm/Tone, Δf = 1MHz, P_{LO} = -2dBm	+9.7dBm
Input 2nd Order Intercept	2-Tone, -20dBm/Tone, Δf = 1MHz, P_{LO} = -2dBm	+47dBm
Input 1dB Compression	P_{LO} = -2dBm	0dBm
LO to IN leakage	P_{LO} = -2dBm	-57dBm
LO to OUT leakage	P_{LO} = -2dBm	-63dBm

QUICK START PROCEDURE

Demonstration circuit DC991A 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 for 2nd & 3rd order distortion measurements. Otherwise, low-pass filters at the signal generator outputs should be used to suppress harmonics, particularly the 2nd 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 760MHz, -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 900MHz, and the other at 901MHz.
6. To measure 3rd order distortion and conversion gain, set the Spectrum Analyzer start and stop frequencies to 138MHz and 143MHz, respectively. Sufficient spectrum analyzer input attenuation should be used to avoid distortion in the instrument.
7. The 3rd 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 140MHz and 141MHz, P_3 is the 3rd order product at 139MHz and 142MHz, and P_{in} is the input power (in this case, -20dBm). All units are in dBm.
8. Using the same signal generators settings, output IM2 product can be measured at 1MHz, which is a difference between two input frequencies (900 and 901MHz). However we recommend increasing the frequency of the second signal generator from 901MHz to 1045MHz and measure OIM2 product at 145MHz frequency (1045MHz-900MHz=145MHz). At 145MHz the mixer output matching circuit has good return loss. To measure input 2nd order distortion, set the Spectrum Analyzer center frequency to 145MHz.
9. The 2nd 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 140MHz, P_2 is the 2nd order product at 145MHz, and P_{in} is the input power (in this case -20dBm).

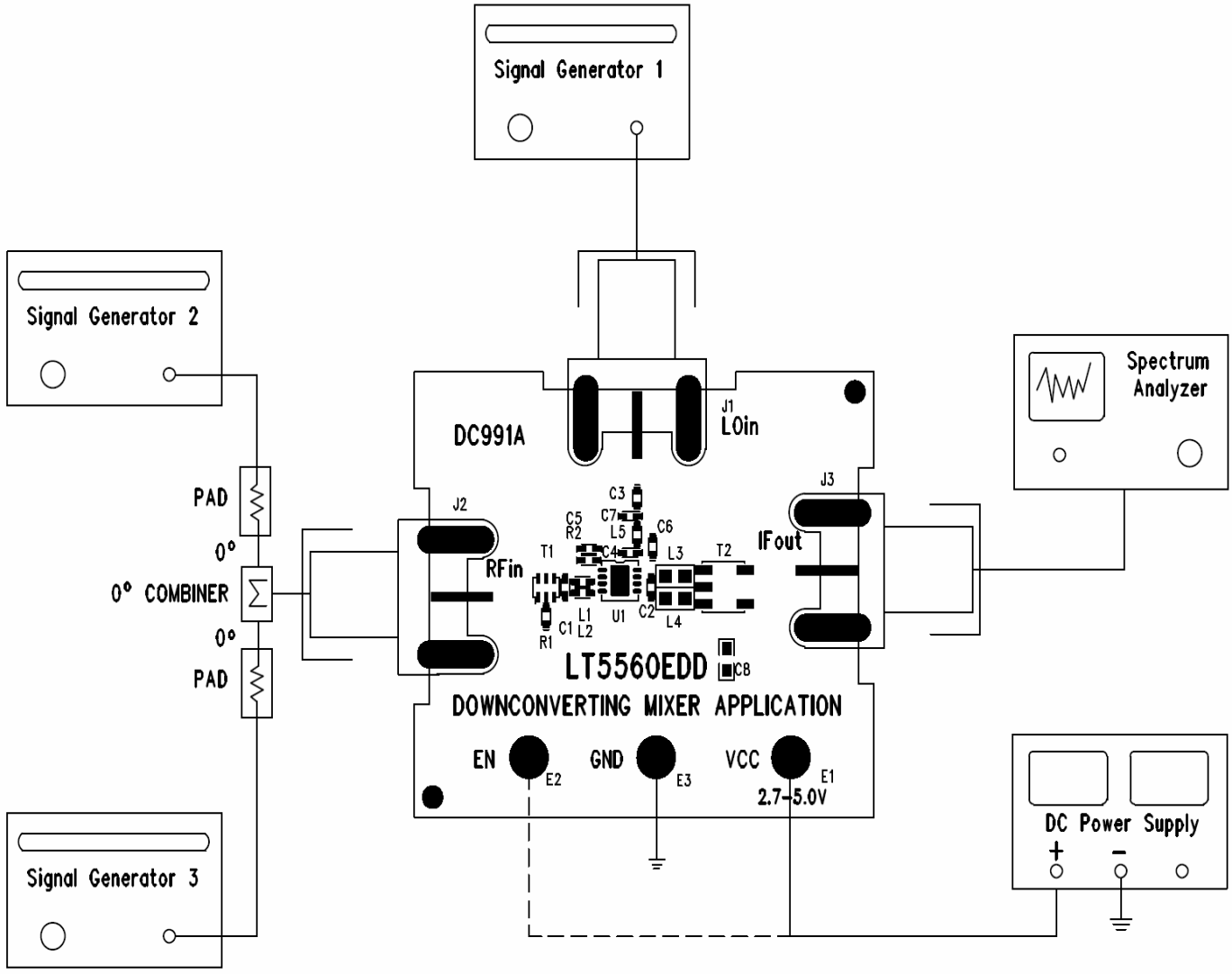
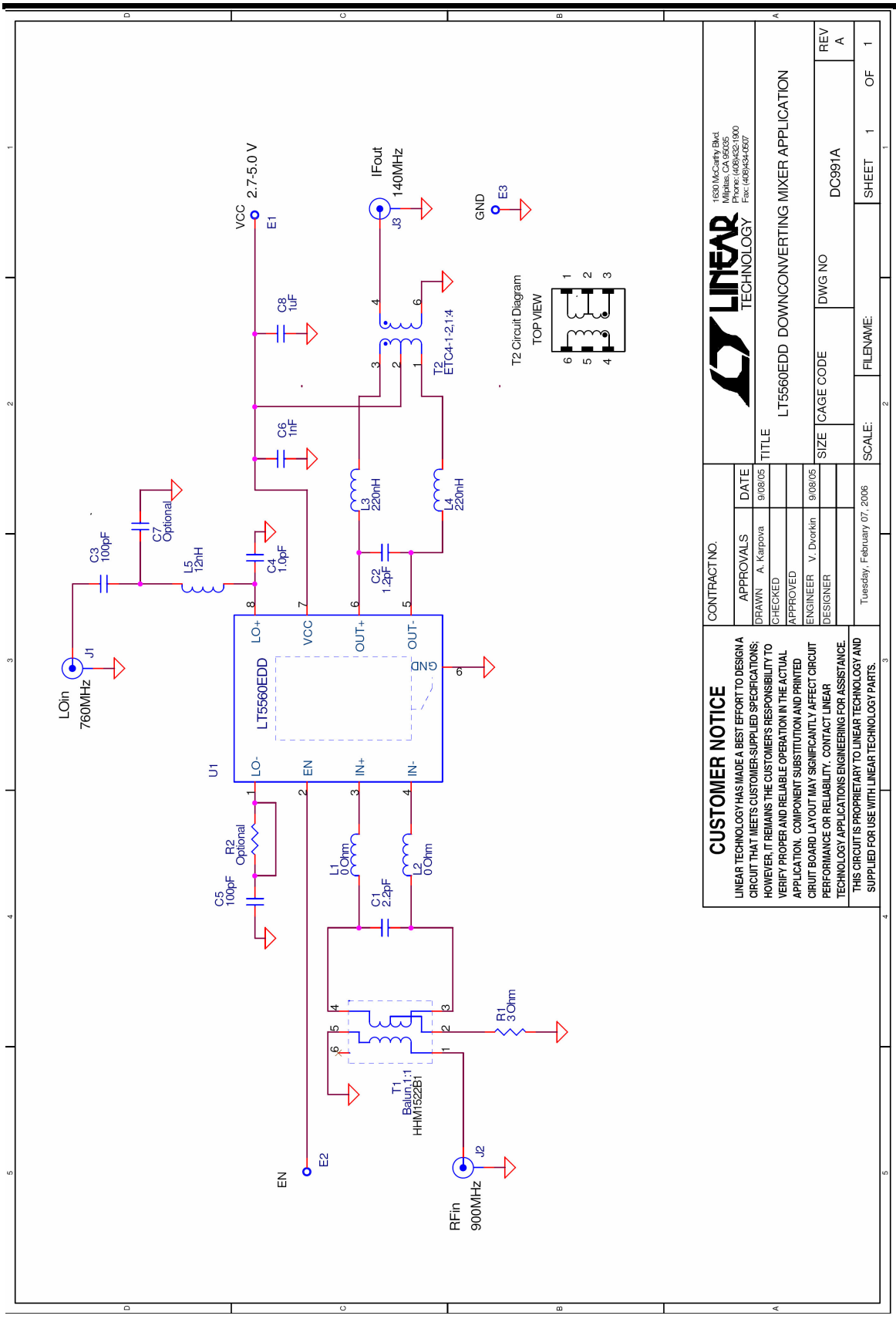


Figure 1. Proper Measurement Equipment Setup


LOin
760MHz
J1
C3
100pF
C7
Optional
L5
12nH
C4
1.0pF
U1
LT5560EDD
LO+
LO-
VCC
EN
OUT+
OUT-
IN+
IN-
GND
C2
1.2pF
L3
220nH
L4
220nH
T2
ETC4-1-2;1:4
VCC
2.7-5.0 V
E1
C8
1uF
C6
1nF
IFout
140MHz
J3
GND
E3
T2 Circuit Diagram
TOP VIEW
R2
Optional
C5
100pF
L1
0Ohm
L2
0Ohm
C1
2.2pF
R1
3Ohm
T1
Balun 1:1
HHMI522B1
EN
E2
RFin
900MHz
J2
CONTRACT NO.
APPROVALS
DATE
DRAWN A. Karpova 9/08/05
CHECKED
APPROVED
ENGINEER V. Dvorkin 9/08/05
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TITLE
LT5560EDD DOWNCONVERTING MIXER APPLICATION
SIZE
CAGE CODE
DWG NO
DC991A
REV
A
SCALE:
FILENAME:
Tuesday, February 07, 2006
SHEET 1 OF 1
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