QUICK START GUIDE FOR DEMONSTRATION CIRCUIT DC963B

LOW POWER ACTIVE UP-CONVERTING MIXER

LT5560

DESCRIPTION

Demonstration circuit DC963B is optimized for an up-converting mixer test & measurement for input frequency range of 45MHz to 190MHz, output frequency range of 850MHz to 935MHz, (12dB return loss BW). The LO port frequency range is 520MHz to 920MHz (10dB return loss BW).

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 minus 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} = 140MHz, f_{LO}=760MHz)	VALUE
Supply Voltage		2.7V to 5.0V
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	< 4000MHz
LO Signal Frequency Range	Requires External Matching	< 4000MHz
Signal Output Frequency Range	Requires External Matching	< 4000MHz
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	2.4dB
SSB Noise Figure	P_{LO} = -2dBm	9.3dB
Input 3rd Order Intercept	2-Tone, -20dBm/Tone, •f = 1MHz, P_{LO} = -2dBm	+9.0dBm
Input 2nd Order Intercept	2-Tone, -20dBm/Tone, •f = 1MHz, P_{LO} = -2dBm	+47dBm
Input 1dB Compression	P_{LO} = -2dBm	-2.8dBm
LO to IN leakage	P_{LO} = -2dBm	-54dBm
LO to OUT leakage	P_{LO} = -2dBm	-41dBm

QUICK START PROCEDURE

Demonstration circuit DC963B 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 140MHz, and the other at 141MHz.
6. To measure 3rd order distortion and conversion gain, set the Spectrum Analyzer start and stop frequencies to 898MHz and 903MHz, 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 900MHz and 901MHz, P_3 is the 3rd order product at 899MHz and 902MHz, and P_{in} is the input power (in this case, -20dBm). All units are in dBm.
8. Output 2nd order distortion product (OIM2) can be measured at 1041MHz, (140MHz+141MHz) + 760MHz = 1041MHz. To measure 2nd order distortion, set the Spectrum Analyzer start and stop frequencies to 1040MHz and 1042MHz, respectively. Sufficient spectrum analyzer input attenuation should be used to avoid distortion in the instrument.
9. The input referred 2nd order intercept point (IIP2) is equal to $P_1 – P_2 + P_{in}$, where P_1 is the power level of the fundamental output tone at 900MHz or 901MHz, P_2 is the 2nd order distortion product at 1041MHz, and P_{in} is the input power (in this case -20dBm).

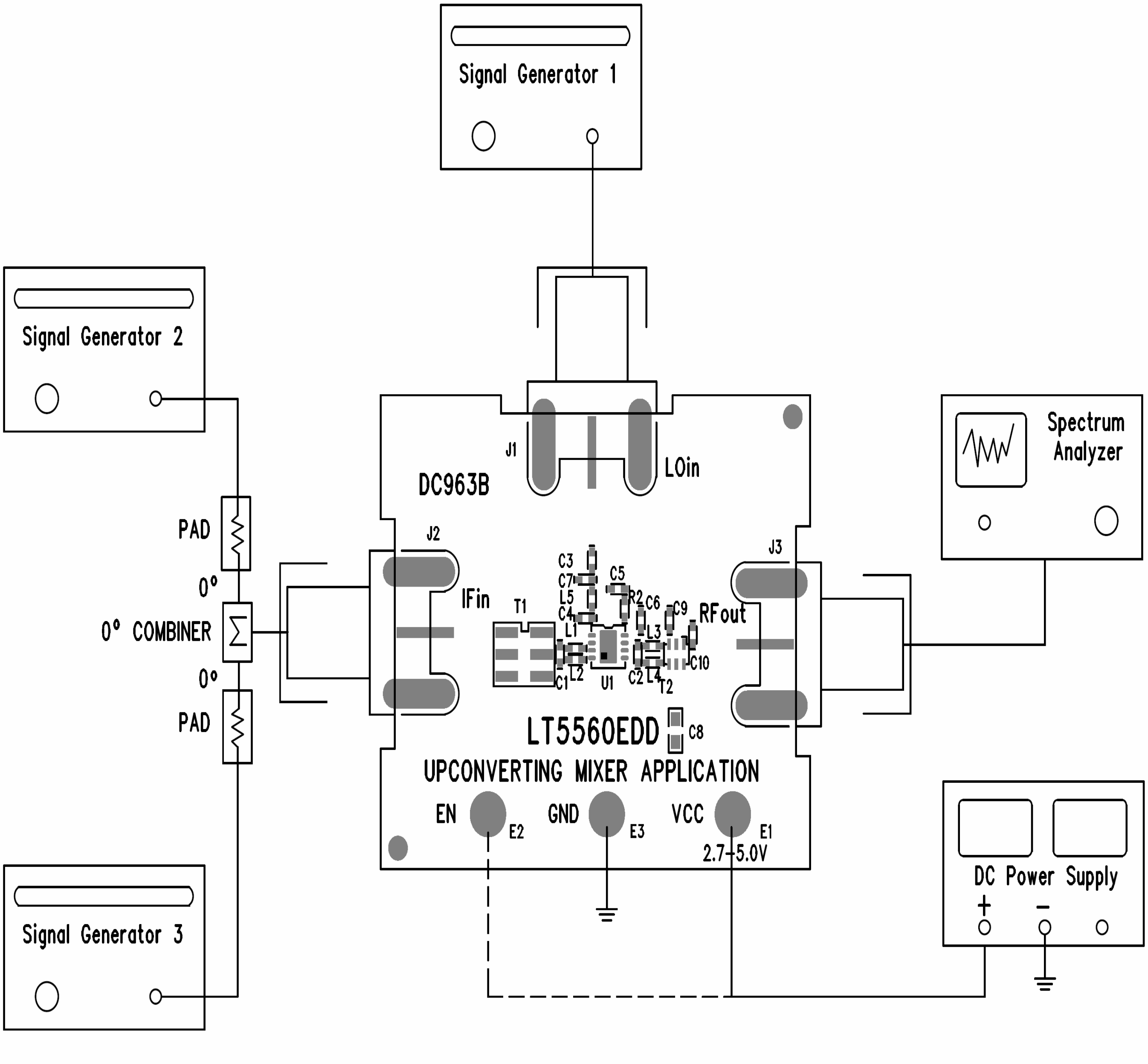
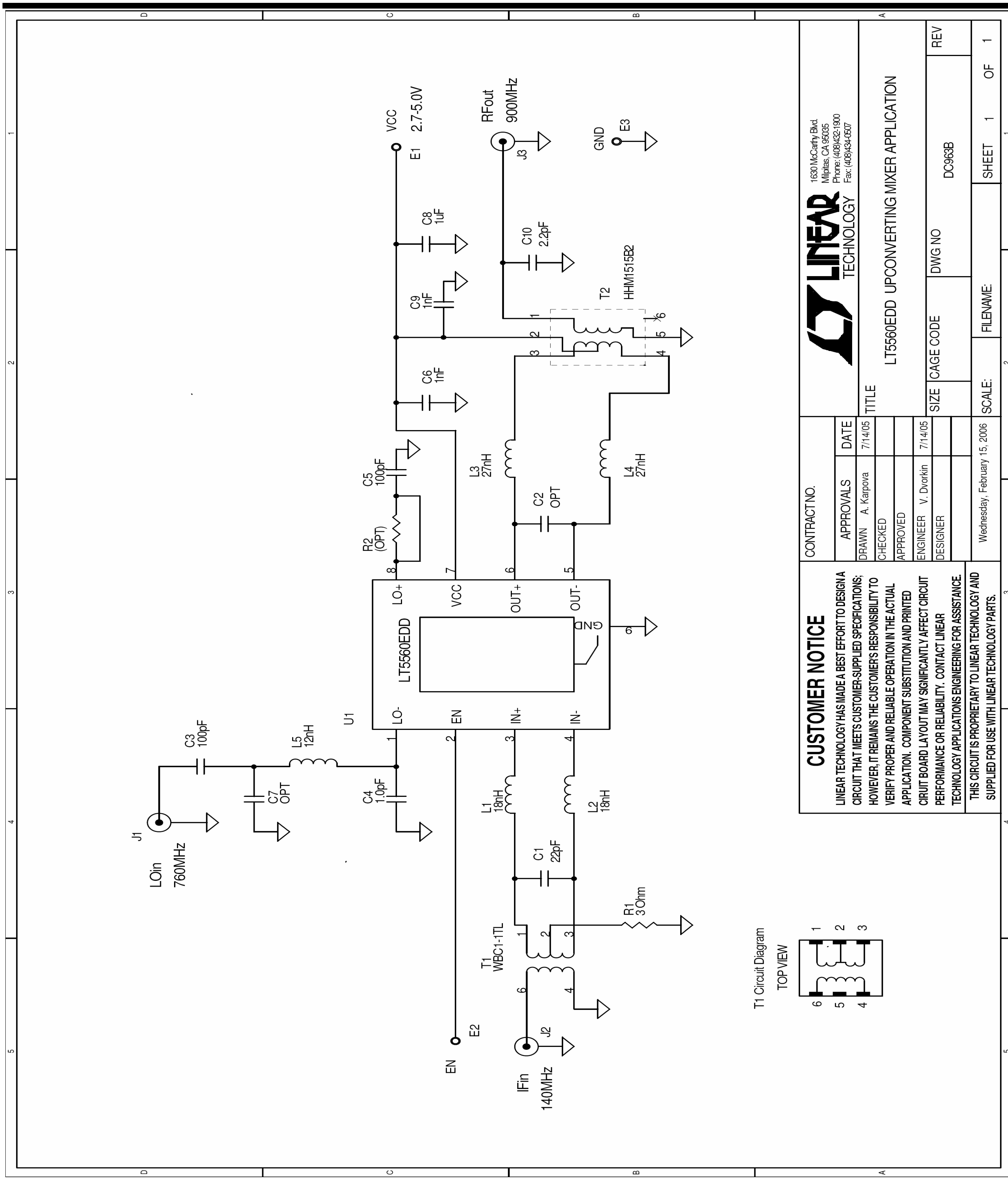


Figure 1. Proper Measurement Equipment Setup



VCC
E1
2.7-5.0V
RFout
900MHz
J3
GND
E3
C8
1uF
C10
2.2pF
C9
1nF
T2
HHM1515B2
C6
1nF
C5
100pF
L3
27nH
L4
27nH
C2
OPT
R2
(OPT)
LO+
VCC
OUT+
OUT-
GND
LT5560EDD
U1
LO-
EN
IN+
IN-
C3
100pF
L5
12nH
C7
OPT
C4
1.0pF
J1
LOin
760MHz
L1
18nH
L2
18nH
C1
22pF
R1
3 Ohm
T1
WBC1-1TL
T1 Circuit Diagram
TOP VIEW
E2
EN
J2
IFin
140MHz
CUSTOMER NOTICE
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.
THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.
CONTRACT NO.
APPROVALS
DATE
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TITLE
LT5560EDD UPCONVERTING MIXER APPLICATION
SIZE
CAGE CODE
DWG NO
DC963B
REV
SCALE:
FILENAME:
SHEET 1 OF 1