LTC5556
1.5GHz to 7GHz Dual Programmable Gain Downconverting Mixer

DESCRIPTION

Demonstration circuit 2693A is optimized for evaluation of the LTC®5556 dual programmable gain downconverting mixer. Each channel incorporates an active mixer and a digital IF VGA with 15.5dB gain control range. The IF gain of each channel is independently programmable through the SPI in 0.5dB steps. Its single-ended RF ports have a range from 1.5GHz to 7GHz. The LO port is internally matched to 50Ω from 500MHz to 8GHz with 9dB return loss. The differential IF port is usable from 1MHz to 1000MHz. There is a reduced power mode available through the SPI or RP pin, which lowers the total current consumption by 25%.

Design files for this circuit board are available at http://www.analog.com/DC2693A

ABSOLUTE MAXIMUM INPUT RATINGS

Supply Voltage
(V_{DD}, V_{CC1}, V_{CC2}, IF1+, IF1–, IF2+, IF2–) 4V
EN1, EN2 Input Voltages .....–0.3V to V_{CC} + 0.3V
LO+, LO– Input Power (500MHz to 8GHz) ..... +10dBm
RF1, RF2 Input Power (1.5GHz to 7GHz) .....+20dBm
LO+, LO– Input DC Voltage.....±0.5V
IF DVGA Peak Differential Input Voltage.....±4V
SDI, CLK, CSB, RP Input Voltages ..–0.3V to V_{DD} + 0.3V
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 LTC556.

BOARD LAYOUT

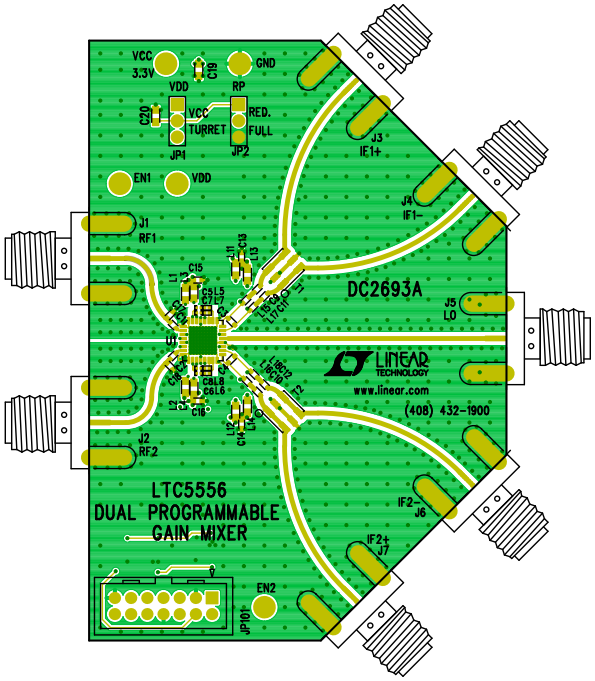


Figure 1. DC2693A

PROPER TEST SETUP

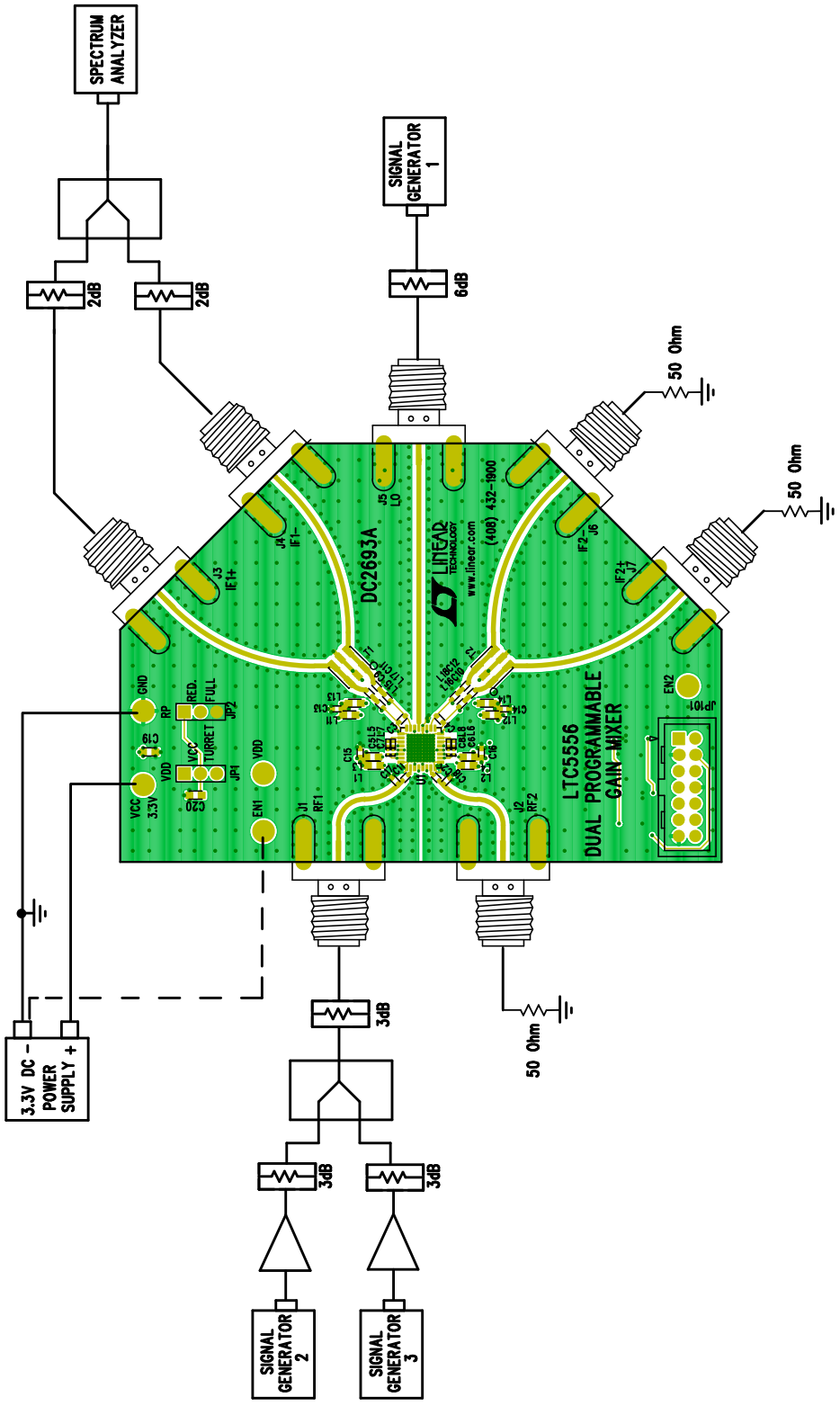


Figure 2. Test Setup for Downconverting Mixer 2-Tone Measurement

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 50Ω 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 –30dBm to –40dBm 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.

QUICK START PROCEDURE

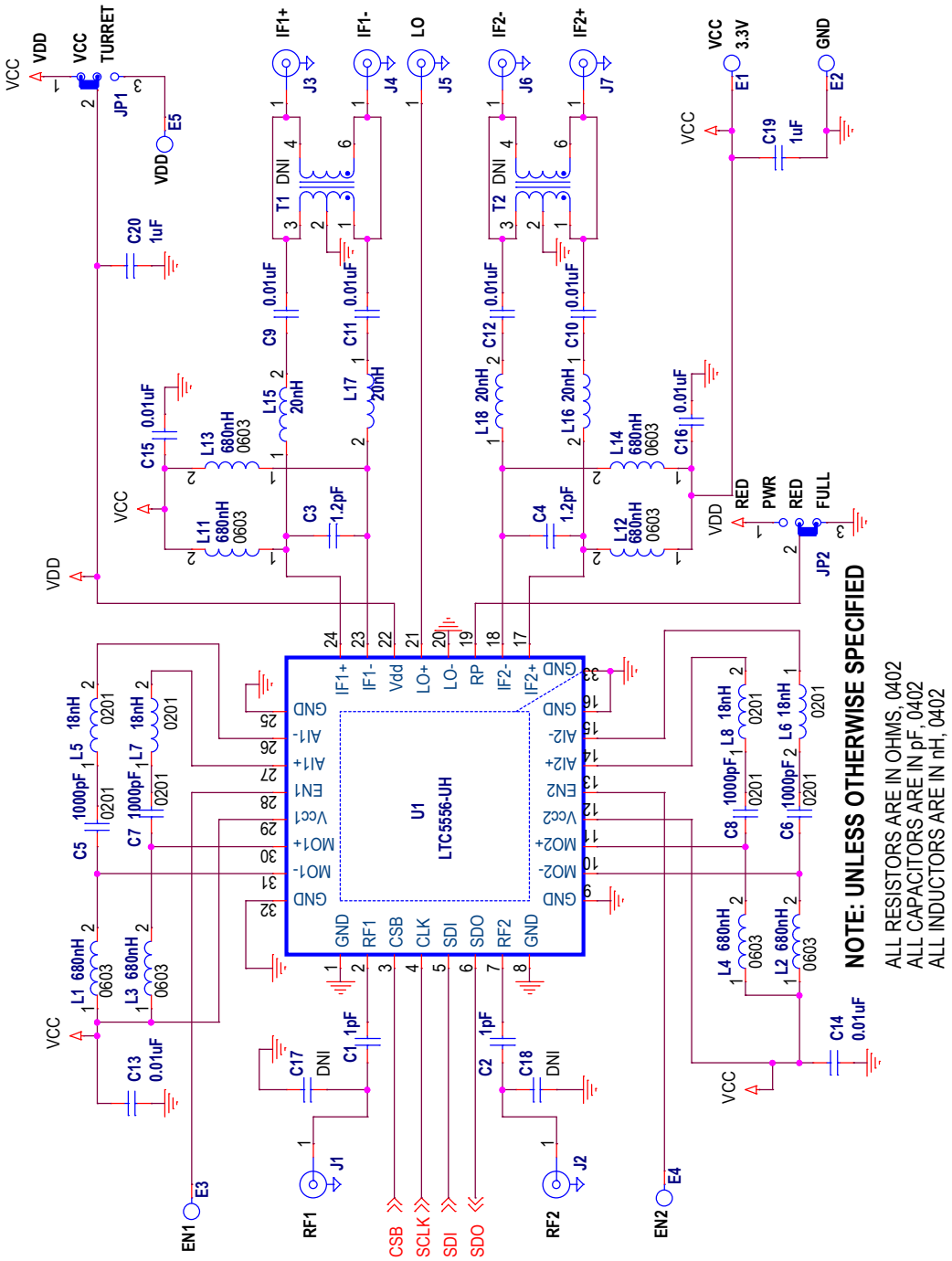
1. Connect all test equipment as shown in Figure 2.
2. Set the power supply output voltage to 3.3V and set the current limit to 500mA.
3. Connect the ground and V_{CC} turrets to the power supply.

   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 3330MHz CW signal at about 0dBm to the demo board's LO port.
6. Set the RF signal generators to provide one 3599MHz CW signal and one 3601MHz 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 –5dBm each at the mixer's RF input port.
7. Set up the LTC5556 digital settings to get the RF attenuation and power mode that you'd like to test.
8. Set the spectrum analyzer's center frequency to 270MHz with a span of 10MHz. Combine the DC2693A $IF1^+$ and IF^- outputs using a 180° combiner. Connect the combiner's output to the spectrum analyzer
9. Perform various measurements (Conversion Gain, OIP3, LO leakage, etc.).

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	2	C1, C2	CAP., 1pF, C0G, 50V, ±0.05pF, 0402, HIGH Q	MURATA, GJM1555C1H1R0WB01D
2	2	C3, C4	CAP., 1.2pF, C0G, 50V, ±0.05pF, 0402, HIGH Q	MURATA, GJM1555C1H1R2WB01D
3	4	C5, C6, C7, C8	CAP.,1000pF, X7R, 50V, 10%, 0201	MURATA, GRM033R71H102KA12D
4	8	C9, C10, C11, C12, C13, C14, C15, C16	CAP., 0.01µF, X7R, 50V, 10%, 0402	MURATA, GRM155R71H103KA88
5	0	C17, C18	DNI	DNI
6	2	C19, C20	CAP., 1µF, X7R, 16V, 10%, 0603	MURATA, GRM188R71C105KA12D
7	2	C101, C102	CAP., 0.1µF, X7R, 50V, 10%, 0402	MURATA, GRM155R71H104KE14D
8	5	E1, E2, E3, E4, E5	TEST POINT, TURRET, 0.064", MTG. HOLE	MILL-MAX, 2308-2-00-80-00-00-07-0
9	7	J1, J2, J3, J4, J5, J6, J7	CONN., SMA, JACK, RCPT, END LAUNCH, STR, 50Ω	CINCH, 142-0701-851
10	2	JP1, JP2	CONN., HDR., MALE, 1×3, 2mm, THT, STR	SAMTEC, TMM-103-02-L-S
11	1	JP101	CONN., HDR., MALE, 2×7, 2mm,THT, VERT, SHROUDED	MOLEX, 87831-1420
12	8	L1, L2, L3, L4, L11, L12, L13, L14	IND., 680nH, RF, FERRITE, 5%, 0603	COILCRAFT, 0603AF-681XJEU
13	4	L5, L6, L7, L8	IND., 18nH, FILM, 3%, 0201, HIGH Q	MURATA, LQP03HQ18NH02D
14	4	L15, L16, L17, L18	IND., 20nH, CER., 2%, 0402, HIGH Q	COILCRAFT, 0402HP-20NXGLU
17	2	R101, R107	RES., 200kΩ, 1%,1/16W, 0402	VISHAY, CRCW0402200KFKED
18	5	R102, R103, R104, R105, R106	RES.,1kΩ, 1%, 1/16W, 0402	VISHAY, CRCW04021K00FKED
20	0	T1, T2	DNI	DNI
21	1	U1	1.5GHz to 7GHz DUAL PROGRAMMABLE GAIN DOWNCONVERTING MIXER	LINEAR TECH., LTC5556IUH#PBF
22	1	U101	DUAL SUPPLY TRANSLATING TRANSCEIVER, 3-STATE	NXP, 74LVC1T45GW
23	2	U102, U103	DUAL BUFFER WITH 3-STATE OUTPUT	FAIRCHILD, NC7WZ17P6X

SCHEMATIC DIAGRAM



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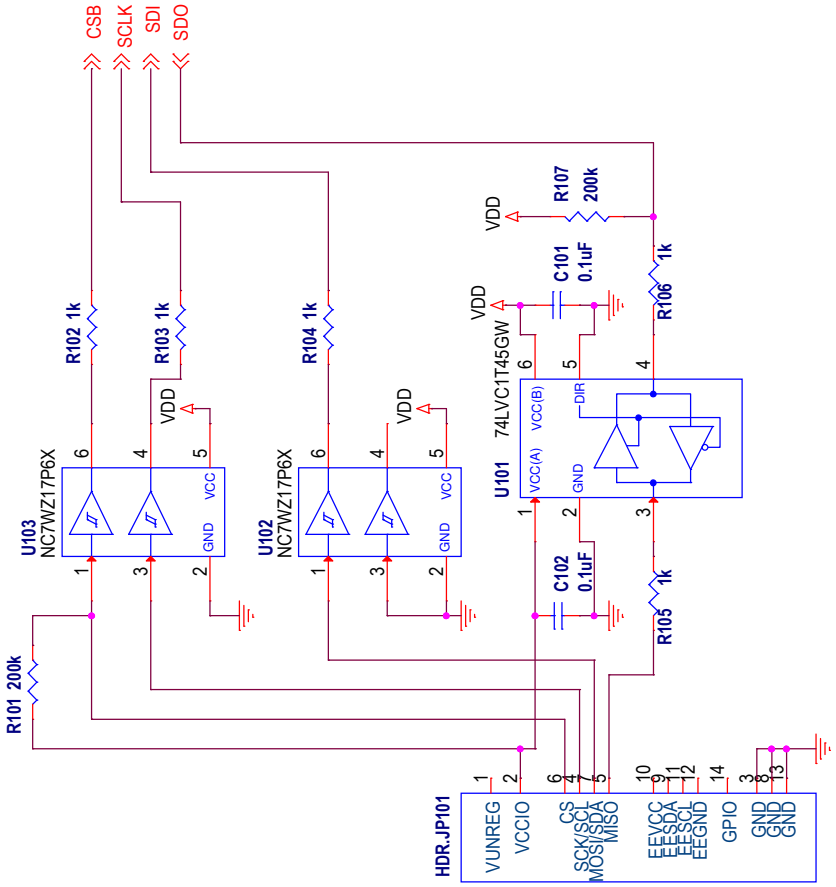

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should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

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