

LTC5597
100MHz to 70GHz RMS Power Detector

DESCRIPTION

Demonstration circuit 2932A hosts a high accuracy RMS power detector featuring the LTC5597 IC. This ultrawide bandwidth device has a RMS response that measures RF and microwave signals from 100MHz to 70GHz. The input signal converts to a DC voltage that is logarithmically proportional to the input signal level. Moreover, the LTC5597 offers unprecedented sensitivity, capable of detecting signals of -37dBm typical. Additionally, it has outstanding input dynamic range up to 35dB, achieving 1dB accuracy, depending on frequency. The detector output voltage slope is normally 29mV/dB. The PCB layout employs the recommended microstrip transmission line structure, as well as the recommended endpoint transitions. Input impedance to LTC5597 is internally matched to 50Ω. It is suitable for RMS measurements of high crest factor waveforms up to 12dB peak/average ratio. No external coupling capacitor is necessary if DC voltage at RF_{IN} pin is kept below 1V. Contact applications support for more information.

[Design files for this circuit board are available.](#)

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V _{CC}):	.....	3.8V
DC Voltage at RF _{IN}:	.....	-0.3V to 1V
DC Voltage at FLTR:	.....	-0.3V to 0.4V
DC Voltage at EN:	.....	-0.3V to 3.8V
RF _{IN} Input Power-Average:	.....	15dBm
T _{JMAX}:	.....	150°C
Case Operating Temperature Range:	.....	-40°C to 105°C
Storage Temperature Range:	.....	-65°C to 150°C

Note 1: Voltage on all pins must not exceed V_{CC} + 0.3V or be less than -0.3V.

CAUTION: THIS PART IS SENSITIVE TO ELECTRO-STATIC DISCHARGE (ESD). OBSERVE PROPER ESD PRECAUTIONS WHEN HANDLING THE LTC5597.

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TEST SETUP

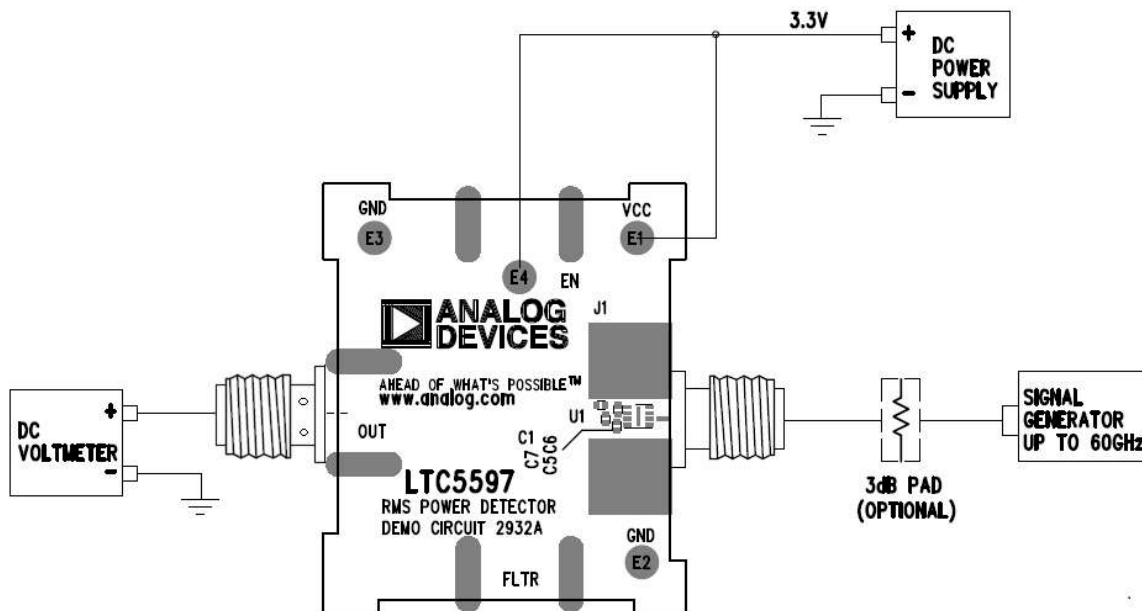


Figure 1. Test Setup for RF Performance Measurements

NOTES ON TEST EQUIPMENT AND SETUP

- Use a high performance signal generator with accurate output power levels up to 70GHz, such as Agilent E8257D.
- Demo board 2932A includes the 1.85mm connector for best performance up to 70GHz.
- Connecting cable for RF signal should be rated up to 70GHz for the best performance.
- Optional input attenuation can be used to improve return loss, but also shifts the log intercept point accordingly.
- Use high quality power supply with low noise, able to support 3.3V with 40mA of current

QUICK START PROCEDURE

1. Remove the DC2932A from its protective packaging in an ESD-safe working area (see Figure 1).
2. With power supply turned off, connect the V_{CC} and EN turrets to the supply positive output. Connect GND to the negative supply output. Keep the leads as short as possible to avoid voltage overshoot.
3. Slowly ramp up V_{CC} together with EN supply to 3.3V. Recommended ramp time is 1ms minimum. Do not float EN.
4. Connect the signal generator to the RF input at the 1.85mm connector.
5. Set the frequency and power level (less than +10dBm) of the signal generator.
6. Measure the output voltage with a DMM.
7. Sweep the power level to generate the transfer curve V_{OUT} vs Input Power.

DEMO BOARD USAGE NOTES

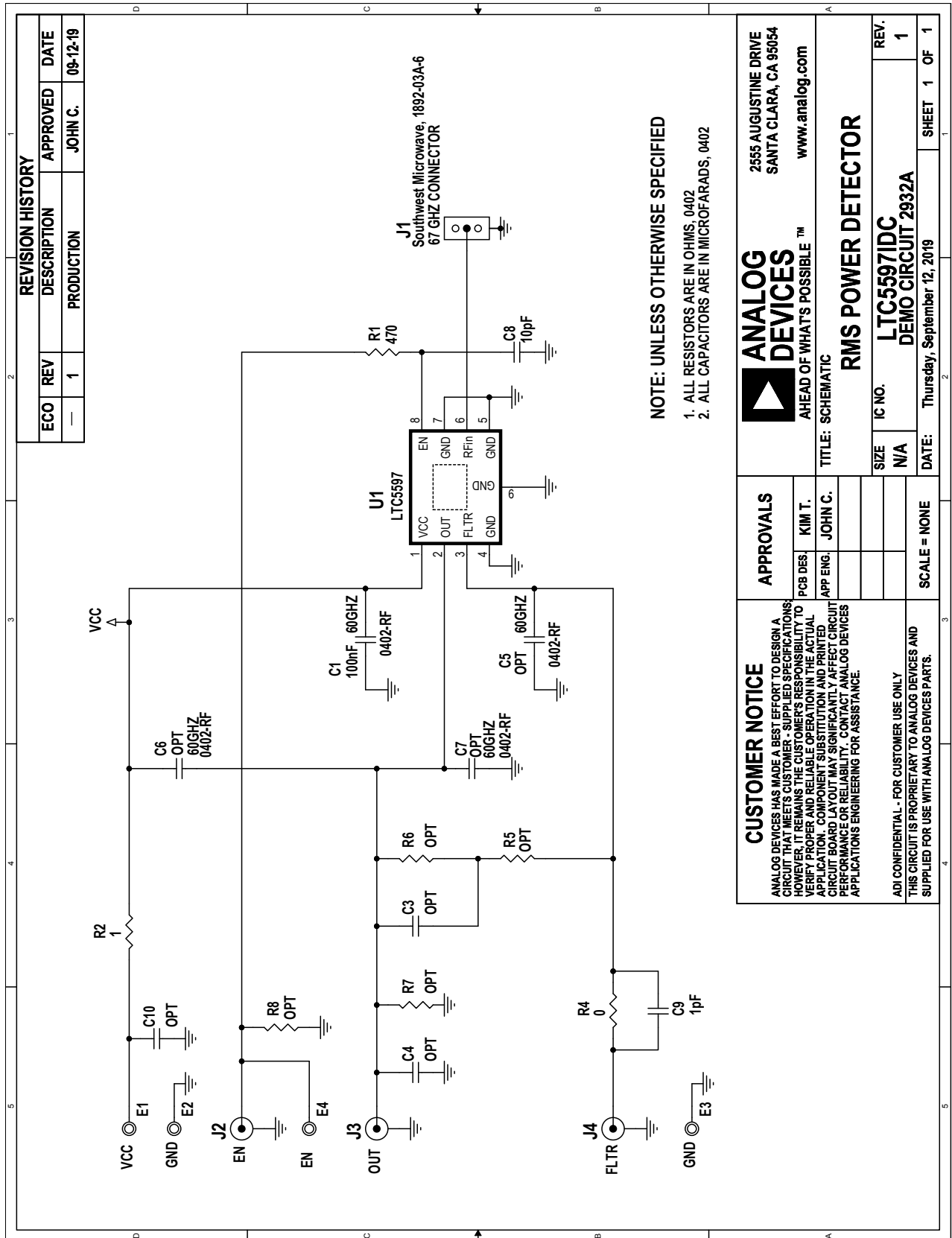
1. Demo board 2932A has provisions for adding an interstage filter cap. The capacitor (C3) can be inserted by shorting R5 and installing C3. Adding a filter has the benefit of reducing the output ripple, and hence, stabilizing the output reading. However, a trade off of adding the filter is that it slows the transient response. C3 can be in the range of 10pF to 1nF.
2. The detector output slope is approximately 29mV/dB.
3. Linear regression is used to generate the slope and intercept point from the best fit straight line.
4. $\text{Linearity_Error} = V_{\text{OUT}}/\text{Slope} + \text{Log_Intercept} - \text{Input_Power}$.
5. A minimum two point calibration is necessary for most applications. Additional calibration points will improve the accuracy of the power detection.

DEMO MANUAL DC2932A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, 100nF, 60GHz, 0402, 11V, UBSC SERIES (SILICON CAPACITORS)	MURATA, 935152424610-T3N
2	7	C3, C4, R5, R6, R7, R8, C10	NC, 0402	
3	3	C5, C6, C7	NC, 0402	
4	1	C8	CAP, NPO, 10pF, 5%, 50V, 0402	MURATA, GRM1555C1H100JA01D
5	1	C9	CAP, NPO, 1pF, $\pm 0.25\text{pF}$, 50V, 0402	MURATA, GRM1555C1H1R0CZ01D
6	4	E1-E4	TURRET, PAD 0.061"	MILL-MAX, 2308-2-00-80-00-00-07-0
8	1	J1	CONN, 1.85mm JACK TO END-LAUNCH, DC - 67GHz	SOUTHWEST MICROWAVE, 1892-03A-6
9	3	J2-J4	CONN, SMA 50 Ω EDGE-LAUNCH	E. F. JOHNSON, 142-0701-851
10	1	R1	RES, CHIP, 470 Ω , 1%, 0402	VISHAY, CRCW0402470RFKED
11	1	R2	RES, CHIP, 1 Ω , 1%, 0402	VISHAY, CRCW04021R00FNED
12	1	R4	RES, CHIP, 0 Ω , 0402	VISHAY, CRCW04020000Z0ED
13	1	U1	IC, ANALOG DEVICES, LTC5597, DFN 2X2	ANALOG DEVICES., LTC5597

SCHEMATIC DIAGRAM





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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