

40 MHz to 10GHz RMS Power Detector with 60dB Dynamic Range

DESCRIPTION

Demonstration circuit 1528A is a Mean-Squared Power Detector featuring the LTC[®]5582 IC.

The LTC5582 is a wide dynamic range Mean Squared RF Power Detector, operational from 40MHz to 6GHz. The input dynamic range with ± 1 dB nonlinearity is 60dB depending on frequency (from -58 dBm to $+2$ dBm, single-ended 50Ω input). The detector output voltage slope is normally 30mV/dB, and the typical

output variation over temperature is ± 0.5 dB at 2140MHz.

The DC1528A Demo Circuit is optimized for wide frequency range of 40MHz to 5.5GHz. However, input match can be optimized above 6GHz with simple external matching. Operating above 6GHz is possible with reduced performance. Contact applications for more information.

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

Typical Performance Summary ($V_{CC} = 3.3V$, $V_{EN} = 3.3V$, $T_A = 25^\circ C$, unless otherwise noted. Test circuit shown in Figure 1.)

| PARAMETER | CONDITION | VALUE |
|---------------------------------|---|--------------------------|
| Supply Voltage | | 3.1V to 3.5V |
| Supply Current | | 41.6mA |
| Shutdown Current | EN = Low | 0.1 μ A |
| EN Voltage | Low, Chip Disabled HIGH, Chip Enabled | 0.4V max 1V min |
| EN Input Current | $V_{EN} = 0V$ $V_{EN} = 3.3V$ | 0 μ A 125 μ A |
| Output DC Voltage | No Input Signal Present | 0.69V |
| Rise Time | 0.8V to 2.4V, C3 = 8nF, $F_{RF} = 100$ MHz | 90nS |
| Fall Time | 2.4V to 0.8V, C3 = 8nF, $F_{RF} = 100$ MHz | 5 μ S |
| Input Frequency Range | Operation over wider frequency range with reduced performance | 40MHz to 10GHz |
| f = 2140MHz | | |
| RF Input Power Range | CW; Single-Ended, 50Ω | -56dB to 1dB |
| Linear Dynamic Range | ± 1 dB linearity error | 57 dB |
| Slope | | 29.5mV/dB |
| Logarithmic Intercept | | -85dBm |
| Output Variation vs Temperature | Normalized to Output at 25° , $P_{IN} = -47$ to $+0$ dBm | ± 0.5 dB |
| Deviation from CW Response | 12 dB peak-to-average ratio (4 carrier WCDMA) | 0.1 dB |
| f = 5800MHz | | |
| RF Input Power Range | CW; Single-Ended, 50Ω | -46dB to 3dB |
| Linear Dynamic Range | ± 1 dB linearity error | 49dB |
| Slope | | 30.9mV/dB |

| | | |
|---------------------------------|--|-------|
| Logarithmic Intercept | | -74.7 |
| Output Variation vs Temperature | Normalized to Output at 25°C, P _{IN} = -46 to +2dBm | ±1 dB |
| Deviation from CW Response | 12dB Peak to Average Ratio(WiMAX OFDM) | 0.2dB |

QUICK START PROCEDURE

Demonstration circuit 1528A is easy to set up to evaluate the performance of the LTC5582. Care should be taken during V_{CC} power up, to ensure the supply voltage transient does not exceed the absolute maximum.

Refer to Figure 2 for measurement equipment setup and follow the procedure below:

1. Connect voltmeter's negative (-) lead to demo board GND test point (TP2).
2. Connect voltmeter's positive (+) lead to the demo board VOUT test point (TP6).
3. Connect DC power supply's negative (-) output to demo board GND test point (TP2).
4. Connect DC power supply's positive (+) output (3.15V to 3.5V) to demo board V_{CC} test point (TP1).
5. Connect signal generator's output to demo board RFIN port (SMA connector J1) via coaxial cable. An optional 3dB attenuator may be inserted to improve input match, the power range will be shifted higher by 3dB.
6. Using a jumper cable, connect demo board V_{CC} test point (TP1) to EN1 test point (TP3). Now the detector is enabled (on) and is ready for measurement.
7. Apply RF input signal at RFIN and measure the output DC voltage.

APPLICATION NOTES:

Absolute maximum ratings

| | |
|--|--------------------------------|
| Supply voltage..... | 3.8V |
| Enable voltage..... | -0.3V to V _{CC} +0.3V |
| Input signal Power(Single-ended, 50Ω)..... | 18dBm |
| Input signal Power(Differential, 50Ω)..... | 24dBm |
| Operating Temperature Range..... | -40°C to 85°C |

NOTE. For digitally modulated signals, an oscilloscope can be used to observe the AC components of the output.

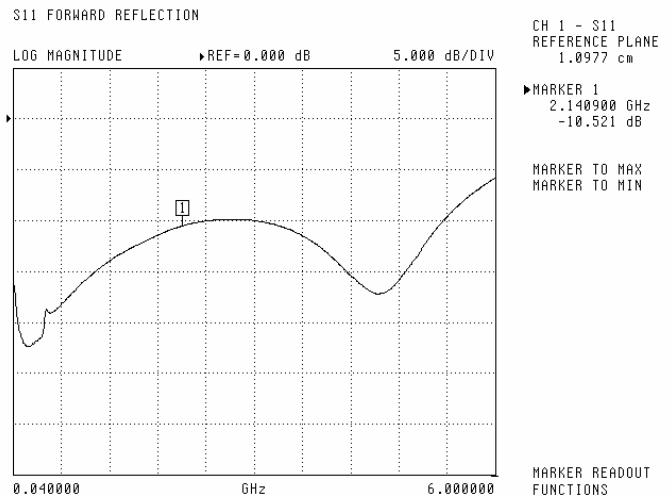


Figure 1. Standard demo board RF input return loss

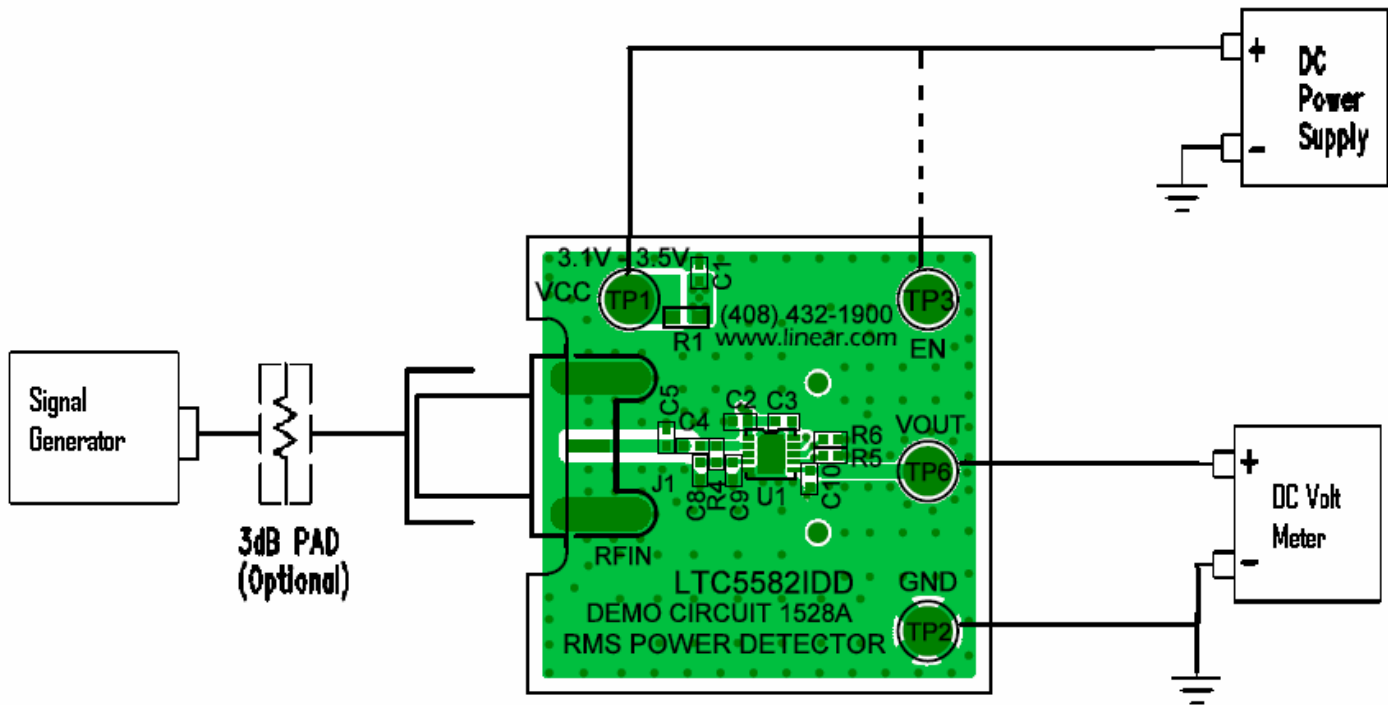


Figure2 Proper Equipment Measurement Set-Up

Temperature compensation

R5 and R6 are optional external resistors used for temperature compensation. Short them to ground will disable the compensation circuitry. R6 controls the 1st order compensation, and R5 controls the 2nd order temperature compensation. Standard demo board is optimized for the best temperature performance at 2140MHz.

| Frequency(MHz) | R6,RT1(kΩ) | R5,RT2(kΩ) |
|----------------|------------|------------|
| 450 | 12 | 2 |
| 800 | 12.4 | 1.4 |
| 880 | 12 | 2 |
| 2000 | 0 | 2 |
| 2140 | 0 | 2 |
| 2600 | 0 | 1.6 |
| 2700 | 0 | 1.6 |
| 3000 | 0 | 1.6 |
| 3600 | 0 | 1.6 |
| 5800 | 0 | 3 |
| 7000 | 10 | 1.43 |
| 8000 | 10 | 1.43 |

Table 1. Suggested R5, R6 values for optimal temperature performance at various frequencies.

