

## FEATURES

- Temperature Compensated Internal Schottky Diode RF Detector
- Wide Input Power Range:  $-34\text{dBm}$  to  $14\text{dBm}$
- Ultra Wide Input Frequency Range:  $100\text{kHz}$  to  $1000\text{MHz}$
- Buffered Output
- Wide  $V_{CC}$  Range of  $2.7\text{V}$  to  $6\text{V}$
- Low Operating Current:  $550\mu\text{A}$
- Low Shutdown Current:  $<2\mu\text{A}$
- Low Profile ( $1\text{mm}$ ) ThinSOT™ Package

## APPLICATIONS

- Wireless Transceivers
- Wireless and Cable Infrastructure
- RF Power Alarm
- Envelope Detector

## DESCRIPTION

The LTC<sup>®</sup>5507 is an RF power detector for applications operating from  $100\text{kHz}$  to  $1000\text{MHz}$ . The input frequency range is determined by an external capacitor. A temperature-compensated Schottky diode peak detector and buffer amplifier are combined in a small 6-pin ThinSOT package.

The RF input voltage is peak detected using an on-chip Schottky diode and external capacitor. The detected voltage is buffered and supplied to the  $V_{OUT}$  pin. A power saving shutdown mode reduces supply current to less than  $2\mu\text{A}$ .

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## TYPICAL APPLICATION

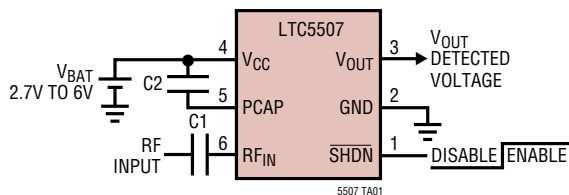
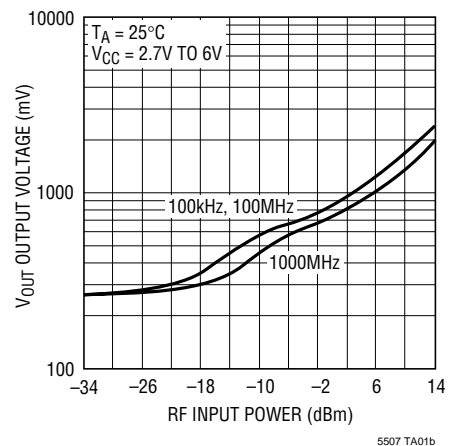


Figure 1.  $100\text{kHz}$  to  $1000\text{MHz}$  RF Power Detector

Typical Detector Characteristics  
 at  $100\text{kHz}$ ,  $100\text{MHz}$  and  $1000\text{MHz}$



5507 TA01b

## ABSOLUTE MAXIMUM RATINGS

(Note 1)

$V_{CC}$ , $V_{OUT}$ to GND .....	-0.3V to 6.5V
$RF_{IN}$ Voltage to GND .....	$(V_{CC} \pm 1.8V)$ to 7V
$\overline{SHDN}$ Voltage to GND .....	-0.3V to $(V_{CC} + 0.3V)$
PCAP Voltage to GND .....	$(V_{CC} - 1.8V)$ to 7V
$I_{VOUT}$ .....	5mA
Operating Temperature Range (Note 2) ..	-40°C to 85°C
Maximum Junction Temperature .....	125°C
Storage Temperature Range .....	-65°C to 150°C
Lead Temperature (Soldering, 10 sec).....	300°C

## PACKAGE/ORDER INFORMATION

	ORDER PART NUMBER
	LTC5507ES6
	S6 PART MARKING
	LTZX

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at  $T_A = 25^\circ\text{C}$ .  $V_{CC} = 3.6\text{V}$ , RF Input Signal is Off, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{CC}$ Operating Voltage		● 2.7		6	V
$I_{VCC}$ Shutdown Current	$\overline{SHDN} = 0V$	●		2	$\mu\text{A}$
$I_{VCC}$ Operating Current	$\overline{SHDN} = V_{CC}$ , $I_{VOUT} = 0\text{mA}$	●	0.55	0.85	mA
$V_{OUT}$ $V_{OL}$ (No RF Input)	$R_{LOAD} = 2k$ , $\overline{SHDN} = V_{CC}$ , Enabled $\overline{SHDN} = 0V$ , Disabled	130	250 1	370	mV mV
$V_{OUT}$ Output Current	$V_{OUT} = 1.75V$ , $V_{CC} = 2.7V$ to 6V, $\Delta V_{OUT} = 10\text{mV}$	● 1	2		mA
$V_{OUT}$ Enable Time	$\overline{SHDN} = V_{CC}$ , $C_{LOAD} = 33\text{pF}$ , $R_{LOAD} = 2k$	●	7	20	$\mu\text{s}$
$V_{OUT}$ Load Capacitance	(Note 4)	●		33	pF
$V_{OUT}$ Noise	$V_{CC} = 3V$ , Noise BW = 1.5MHz, 50 $\Omega$ RF Input Termination		2		mV <sub>p-p</sub>
$\overline{SHDN}$ Voltage, Chip Disabled	$V_{CC} = 2.7V$ to 6V	●		0.35	V
$\overline{SHDN}$ Voltage, Chip Enabled	$V_{CC} = 2.7V$ to 6V	● 1.4			V
$\overline{SHDN}$ Input Current	$\overline{SHDN} = 3.6V$	●	24	40	$\mu\text{A}$
$RF_{IN}$ Input Frequency Range			0.1–1000		MHz
Max $RF_{IN}$ Input Power	(Note 3)		14		dBm
$RF_{IN}$ AC Input Resistance	$F = 10\text{MHz}$ , RF Input = -10dBm $F = 1000\text{MHz}$ , RF Input = -10dBm		130 95		$\Omega$ $\Omega$
$RF_{IN}$ Input Shunt Capacitance			1.7		pF

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

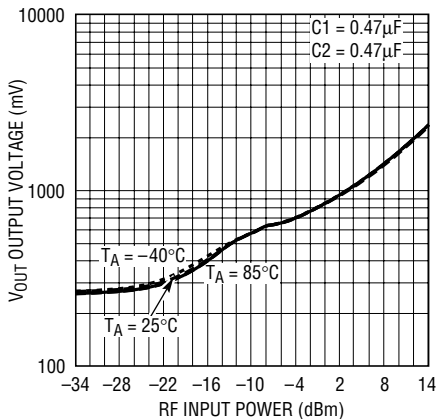
**Note 2:** Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

**Note 3:** RF performance is tested at: 80MHz, -4dBm

**Note 4:** Guaranteed by design.

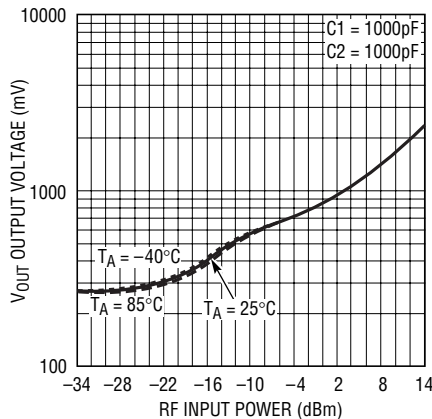
# TYPICAL PERFORMANCE CHARACTERISTICS

**LTC5507 Typical Detector Characteristics, 100kHz,  $V_{CC} = 2.7V$  TO  $6V$**



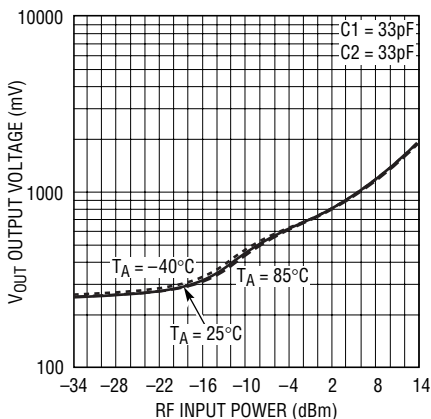
5507 G01

**LTC5507 Typical Detector Characteristics, 100MHz,  $V_{CC} = 2.7V$  TO  $6V$**



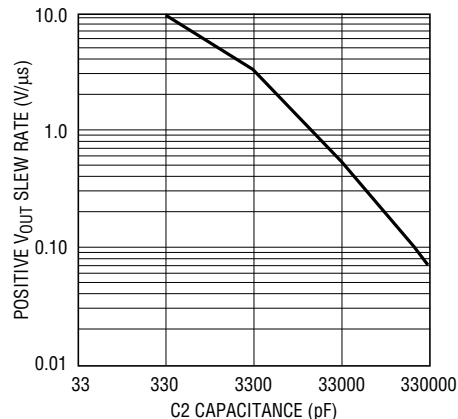
5507 G02

**LTC5507 Typical Detector Characteristics, 1000MHz,  $V_{CC} = 2.7V$  TO  $6V$**



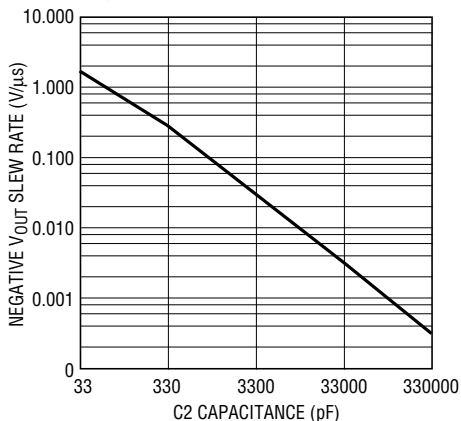
5507 G03

**Positive  $V_{OUT}$  Slew Rate vs  $C2$  Capacitance**



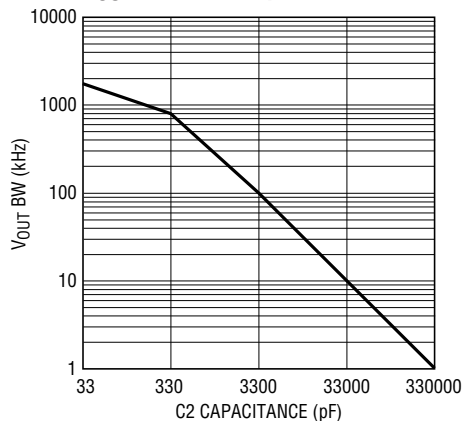
5507 G04

**Negative  $V_{OUT}$  Slew Rate vs  $C2$  Capacitance**



5507 G05

**$V_{OUT}$  BW vs  $C2$  Capacitance**



5507 G06

## PIN FUNCTIONS

**SHDN (Pin 1):** Shutdown Input. A logic low or no-connect on the SHDN pin places the part in shutdown mode. A logic high enables the part. SHDN has an internal 150k pull down resistor to ensure that the part is in shutdown when the enable driver is in a tri-state condition.

**GND (Pin 2):** System Ground.

**V<sub>OUT</sub> (Pin 3):** Buffered and Level Shifted Detector Output Voltage.

**V<sub>CC</sub> (Pin 4):** Power Supply Voltage, 2.7V to 6V. V<sub>CC</sub> should be bypassed with 0.1μF and 100pF ceramic capacitors.

**PCAP (Pin 5):** Peak Detector Hold Capacitor. Capacitor value is dependent on RF frequency. Capacitor must be connected between PCAP and V<sub>CC</sub>.

**RF<sub>IN</sub> (Pin 6):** RF Input Voltage. Referenced to V<sub>CC</sub>. A coupling capacitor must be used to connect to the RF signal source. This pin has an internal 250Ω termination and an internal Schottky diode detector.

## BLOCK DIAGRAM

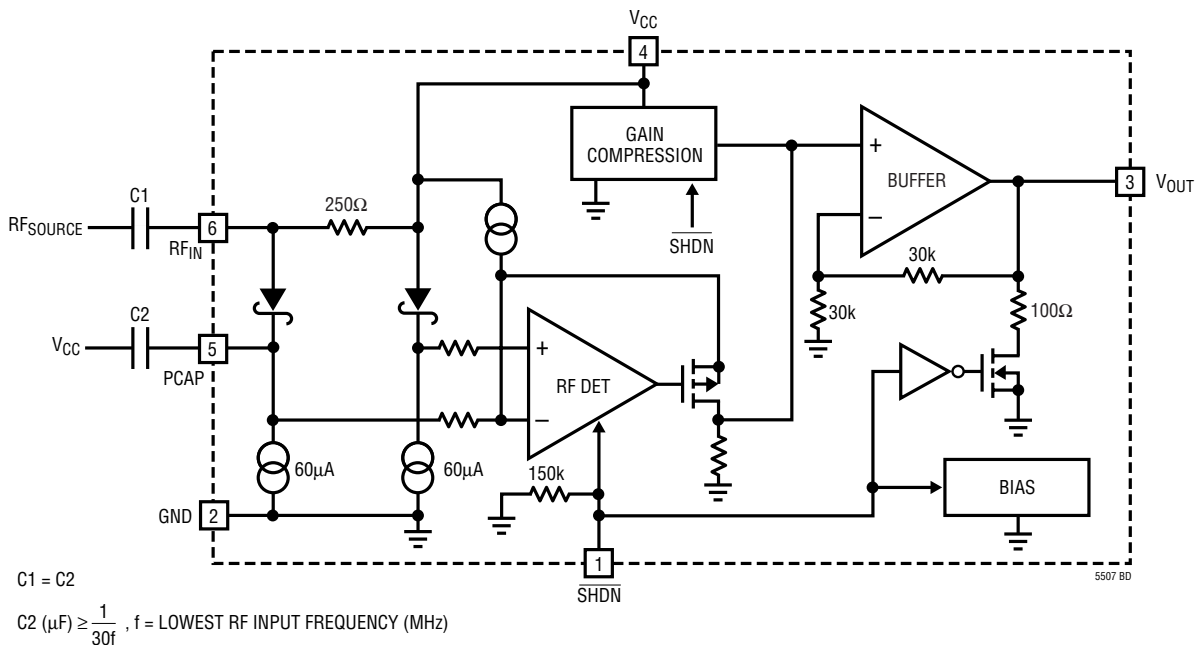


Figure 2.

## APPLICATIONS INFORMATION

### Operation

The LTC5507 integrates several functions to provide RF power detection over frequencies up to 1000MHz. These functions include an internally compensated buffer amplifier, an RF Schottky diode peak detector and level shift amplifier to convert the RF signal to DC, a delay circuit to avoid voltage transients at  $V_{OUT}$  when coming out of shutdown, and a gain compression circuit to extend the detector dynamic range.

### Buffer Amplifier

The buffer amplifier has a gain of two and is capable of driving a 2mA load. The buffer amplifier typically has an output voltage range of 0.25V to  $V_{CC} - 0.1V$ .

### RF Detector

The internal RF Schottky diode peak detector and level shift amplifier converts the RF input signal to a low frequency signal. The frequency range of the RF pin is typically up to 1000MHz. The detector demonstrates excellent operation over a wide range of input power. The Schottky detector is biased at about 70 $\mu$ A. The hold capacitor is external.

### Gain Compression

The gain compression circuit changes the feedback ratio as the RF peak-detected input voltage increases above 60mV. Below 60mV, the DC voltage gain from the peak detector to the buffer output is 4. Above 140mV, the DC voltage gain is reduced to 0.75. The compression expands the low power detector range due to higher gain.

### Modes of Operation

MODE	$\overline{\text{SHDN}}$	OPERATION
Shutdown	Low	Disabled
Enable	High	Power Detect

### Applications

The LTC5507 can be used as a self-standing signal strength measuring receiver for a wide range of input signals from -34dBm to 14dBm for frequencies up to 1000MHz.

The LTC5507 can be used as a demodulator for AM and ASK modulated signals with data rates up to 1.5MHz. Depending on specific application needs, the RSSI output can be split into two branches, providing AC-coupled data (or audio) output and DC-coupled, RSSI output for signal strength measurements and AGC.

### C1, C2 Capacitor Selection (Refer to Figure 3)

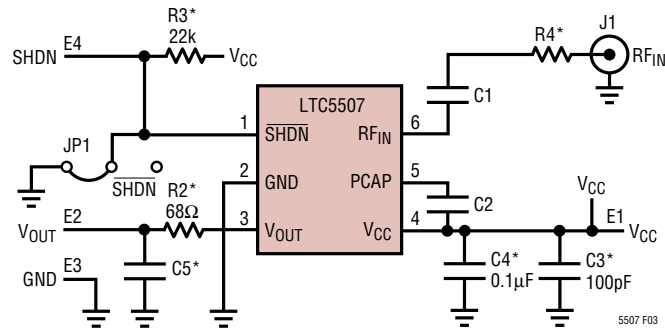
C1 couples the RF input signal to the detector input  $RF_{IN}$  which is referenced to  $V_{CC}$ . C2 is the peak detector capacitor connected between PCAP and  $V_{CC}$ . The value of C2 will affect the slew rate and bandwidth. Typically C1 can equal C2. Ceramic capacitors are recommended for C1 and C2. The values for C1 and C2 are dependent on the operating RF frequency. The capacitive reactance should be less than 5 $\Omega$  to minimize ripple on C2.

$$C2(\mu\text{F}) \geq 1/(30 \cdot f) \text{ where } f \text{ is the lowest RF input frequency (MHz)}$$

$$C1 = C2$$

In general, select C1 and C2 large enough to pass the lowest expected RF signal frequency, as described by the above formulas. But optimize C1 and C2, subject to this constraint, to improve output slew rate and bandwidth, and to enable good AC performance for the highest expected RF signal frequency.

APPLICATIONS INFORMATION



\* OPTIONAL COMPONENTS  
 R2 AND C5 FORM AN OPTIONAL OUTPUT LOWPASS FILTER.  
 R3 IS USED FOR DEMO PURPOSES ONLY, AND IS NOT USED IN ACTUAL PRODUCT IMPLEMENTATION.  
 R4 CAN BE USED FOR INPUT POWER LIMITING OR BROADBAND IMPEDANCE MATCHING.  
 C3 AND C4 ARE OPTIONAL POWER SUPPLY FILTERS.

Figure 3. Evaluation Demo Board Schematic

# PACKAGE DESCRIPTION

**S6 Package**  
**6-Lead Plastic TSOT-23**  
 (Reference LTC DWG # 05-08-1636)

