NCS5000

Integrated RF Schottky Detector

The NCS5000 is an integrated Schottky detector intended for use as a level detector in RF measurement/power control applications such as those found in GSM handsets. The detector converts the peak RF voltage applied to a DC level. The circuit consists of an RF Schottky detector, a reference Schottky diode, as well as biasing and control circuitry. There is an enable input that allows the part to be placed in a low power state when not in use.

The detector is designed for operation up to 2.0 GHz and can operate with input power levels up to +25 dBm. There is a fixed offset of 10 mV (nominal) between the Reference Detector and the RF Detector under no applied RF. The two detectors are monolithically integrated so that they closely track overtemperature, voltage and process.

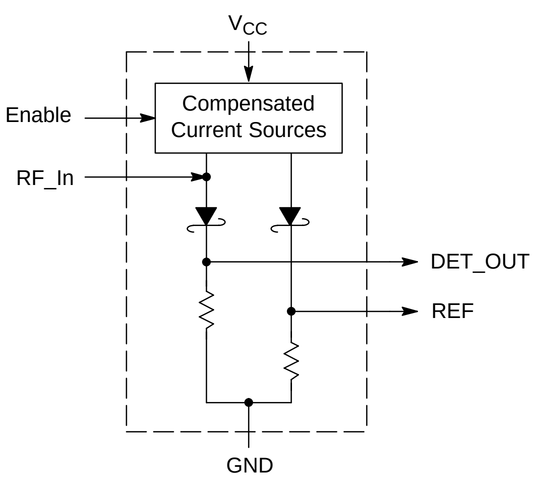
The NCS5000 is housed in a very small TSOP−6 package ideal for portable applications. The TSOP−6 package is a lower profile, footprint compatible package to the SOT23−6.

Features

- Wide Operating Frequency Range to 2.0 GHz
- 2.7 V − 5.5 V Operating Voltage
- Very Low Operating Current of 300 μA
- Enable Control to Place the Part in a Low Current Standby Mode
- Typical Standby Current of < 1.0 μA
- −40°C to 85°C Operating Temperature Range
- Very Small TSOP−6 Package
- Pb−Free Package is Available

Typical Applications

- Cellular Handsets (GSM and DCS1800/PCS1900)
- Wireless Data Modems
- Transmitter Power Measurement and Control
- Test Equipment

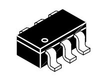


This circuit has 28 active transistors

Figure 1.

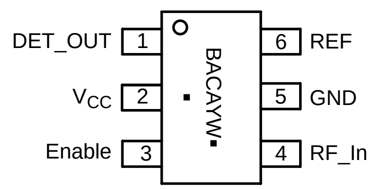
ON Semiconductor®

http://onsemi.com



TSOP−6
SN SUFFIX
CASE 318G

PIN CONNECTIONS AND MARKING DIAGRAM



(Top View)

BAC = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NCS5000SNT1	TSOP−6	3000/Tape & Reel
NCS5000SNT1G	TSOP−6 (Pb−Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PIN DESCRIPTION

Pin	Name	Description
1	DET_OUT	This is the RF Detector Output. This signal is proportional to the peak RF voltage applied at the RF_In pin.
2	V_{CC}	Input power supply.
3	Enable	Control signal to turn on and off the device. If this signal is not used, this pin should be connected directly to V_{CC}. A logic high on this input turns on the device.
4	RF_In	This is the input to the RF detector. The signal must be AC−coupled into this input with a good quality RF capacitor.
5	GND	Ground.
6	REF	This is the reference detector output. Nominal this signal is 10 mV higher than DET_OUT when no RF signal is applied at RF_In.

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Maximum Input Power on RF Pin	PMAX	28	dBm
Maximum Power Supply	VCCMAX	6.0	V
ESD Rating for RF_In (HBM) All Other Pins are 2.5 kV (HBM)	−	500	V
Storage Temperature Range	T_{stg}	−40 to +125	°C
Maximum Junction Temperature	T_J	+150	°C
Maximum Input Voltage on Pins	VIMAX	V_{CC} + 0.3 V	−
Minimum Input Voltage on Pins	VIMIN	−0.3 V	−

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Min	Typ	Max	Unit
RF Input (50 Ω Equivalent)	RF_{in}	−	−	25	dBm
Supply Voltage	V_{CC}	2.7	−	5.5	V
Operating Temperature Range	T_A	−40	−	85	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 2.8 V, for typical values; Min and Max values at T_A = 25°C)

Characteristic	Symbol	Pin	Min	Typ	Max	Unit
RF Operating Frequency	−	4	100	−	2000	MHz
Operating Current Consumption (V_{enable} = 2.4 V, No RF Applied)	I_{CC}(op)	2	−	−	500	μA
Standby Current Consumption (V_{enable} = 0.4 V, No RF Applied)	I_{CC}(stby)	2	−	1	10	μA
Power Supply Ripple Rejection (V_{CC} = 3.6 V, V_{ripple} = 0.5 V_{PP}, No RF)	R_R	2				dB
1 kHz			−	56	−	
10 kHz			−	41	−	
Detector Output (No RF Applied)	DET_OUT	1	40	45	50	mV
Reference Output (No RF Applied)	REF	6	50	55	60	mV
Reference − Detector Output Differential Voltage (No RF Applied)	REF−DET_OUT	1,6	5	10	15	mV
Detector Output	−	−				mV
F_{in} = 1.0 GHz, RF_{in} = −5.0 dBm (50 Ω)			−	100	−	
F_{in} = 1.0 GHz, RF_{in} = 5.0 dBm (50 Ω)			−	335	−	
F_{in} = 1.0 GHz, RF_{in} = 15 dBm (50 Ω)			−	1285	−	
Enable Logic High	V_{ih}	3	2.4	−	−	V
Enable Logic Low	V_{il}	3	0	−	0.4	V
Enable Input Current, V_{CC} = 2.7 V, V_{enable} = 2.4 V	I_{in}	3	0	−	30	μA

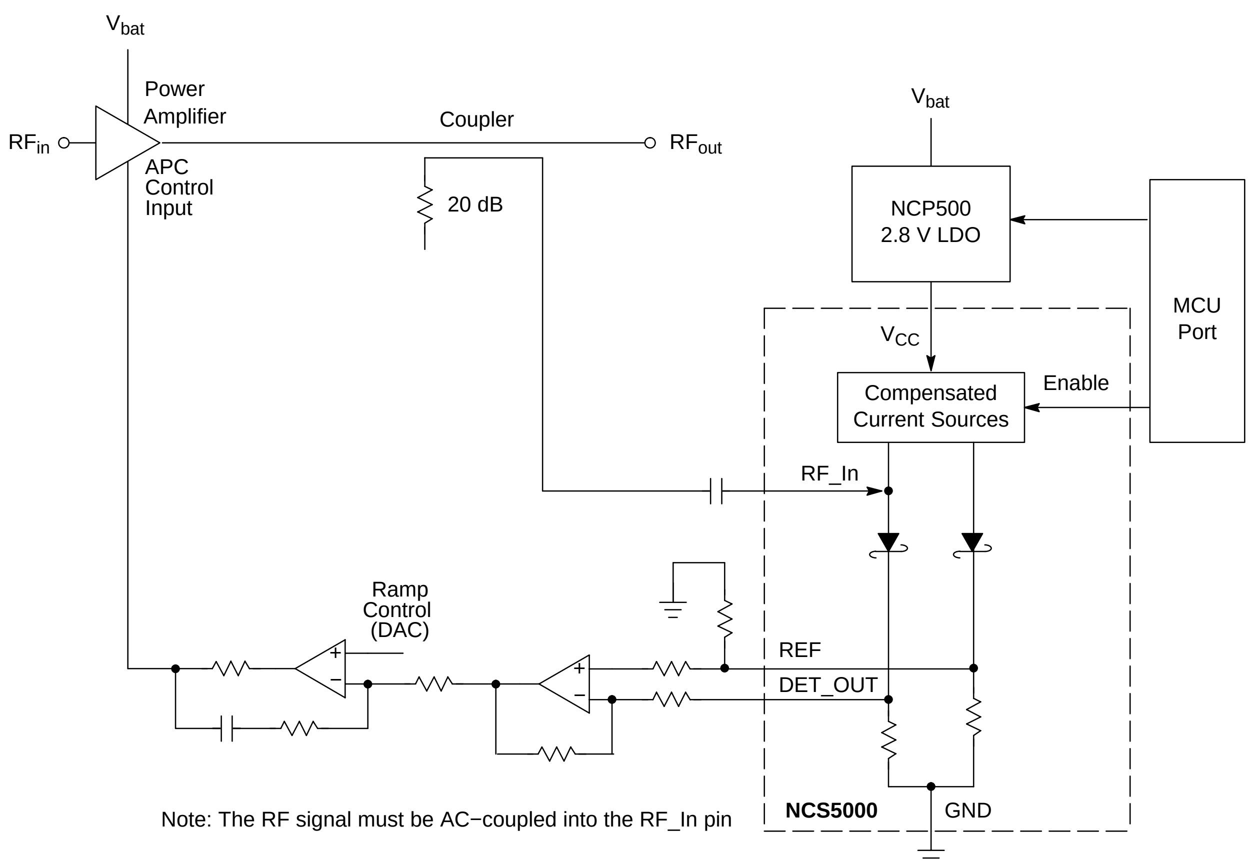


Figure 2. Typical Application Block Diagram

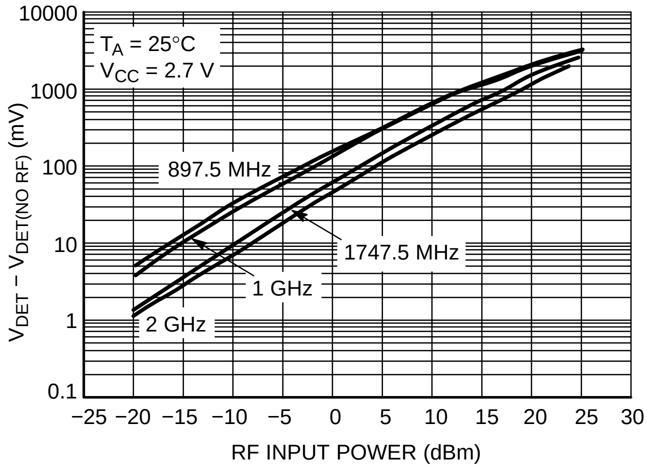


Figure 3. Detector Output Voltage vs. RF Input Power

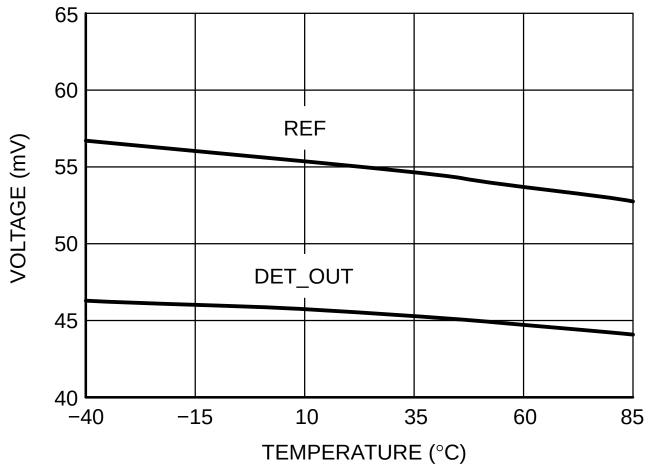


Figure 4. Detector and Reference Output Variation Overtemperature (V_{CC} = 2.7 V, No RF Applied)

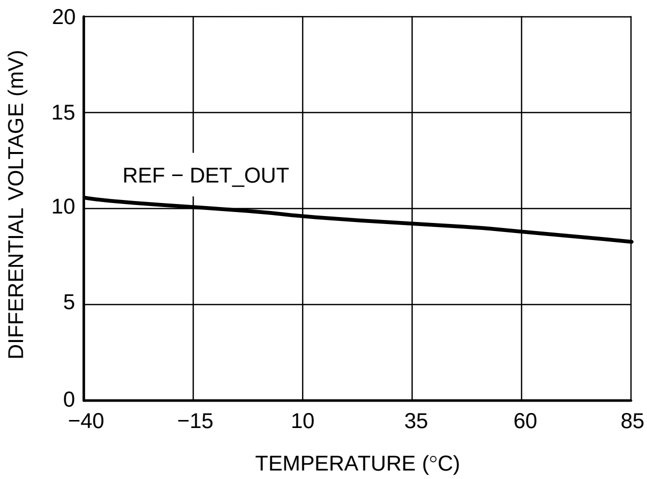


Figure 5. Offset Between RF Detector and Reference Detector Output Voltage Overtemperature (V_{CC} = 2.7 V, No RF Applied)

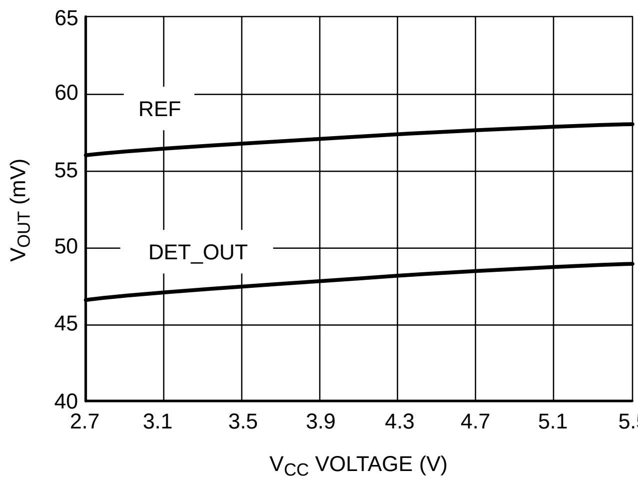


Figure 6. Detector and Reference Output Variation Over V_{CC} Bias (T_A = 25°C, No RF Applied)

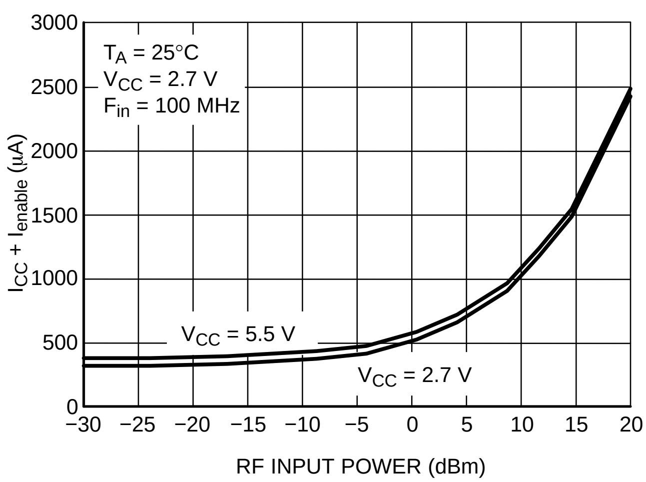


Figure 7. Current Consumption vs. Input Power

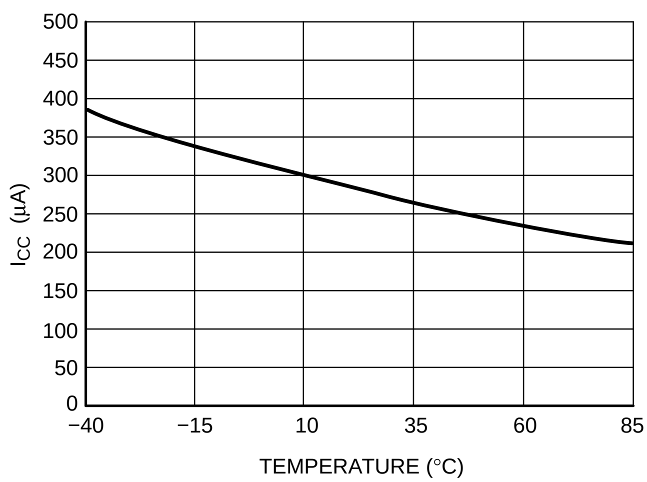


Figure 8. I_{CC} Variation Overtemperature V_{CC} = 5.5 V, No RF Applied

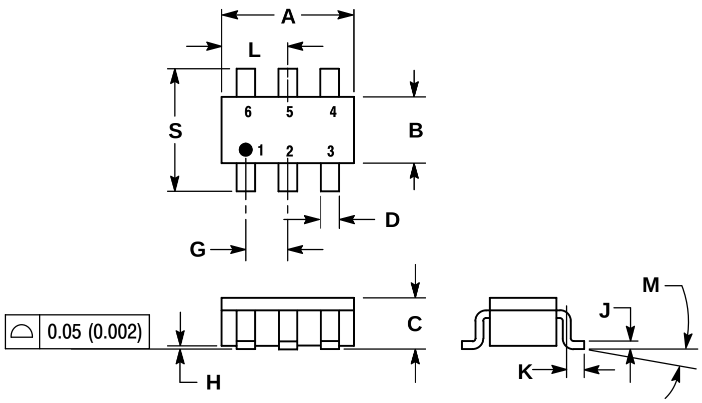
APPLICATION INFORMATION

The NCS5000 is an integrated RF Schottky detector designed for use in level detector and power amplifier control circuits. The device is optimized for large signal applications ($P_{in} > -20$ dBm) such as those found in GSM handsets and data modems. This device has been designed for applications that require operation from a single Li−Ion or multi− Ni−MH battery pack. The operating range is 2.7 V − 5.5 V so the device can be powered directly from the battery or a low drop out regulator. To support power sequencing, an Enable circuitry is included which allows the device to be placed into a very low power state ($<$ 3.0 μW) when not in use.

In addition to the RF detector, a reference detector is included so the NCS5000 can be used to implement a differential detector. Since the RF and reference detectors are integrated on the same silicon, they track each other tightly overtemperature, bias voltage, and process. Each detector is biased with approximately 45 μA of current and there is a built−in offset of 10 mV (nom) between the RF and the Reference Detector.

PACKAGE DIMENSIONS

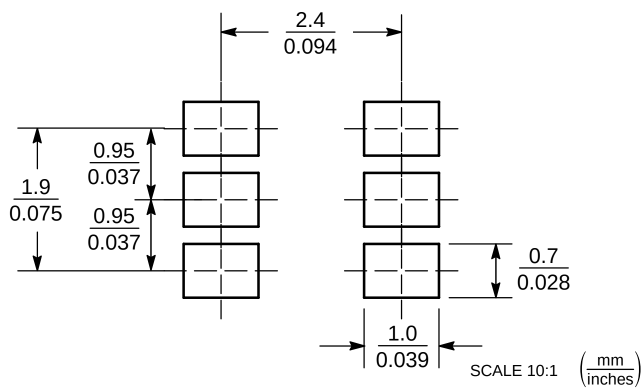
TSOP−6
SN SUFFIX
CASE 318G−02
ISSUE M



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0 °	10 °	0 °	10 °
S	2.50	3.00	0.0985	0.1181

SOLDERING FOOTPRINT



PUBLICATION ORDERING INFORMATION

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