



# MAXIM

## RF Power Detectors in UCSP Package

MAX2206/MAX2207/MAX2208

### General Description

The MAX2206/MAX2207/MAX2208 wideband (800MHz to 2GHz) power detectors are ideal for GSM/EDGE (MAX2206), TDMA (MAX2207), and CDMA (MAX2208) applications. These devices take an RF signal from a directional coupler at the input, and output a highly repeatable voltage. The output voltage increases monotonically with increasing input power. The output is compensated for temperature and process shifts, reducing the worst-case variation to less than  $\pm 1\text{dB}$  at full power and  $\pm 2.5\text{dB}$  at the lowest power.

The MAX2206 features 40dB dynamic range, making it ideally suited to GSM/EDGE applications. The MAX2207 offers reduced current consumption for TDMA applications. MAX2208 has an integrated filter to allow for average-power detection of CDMA signals over a 25dB dynamic range. Both the MAX2206/MAX2207 allow the user to control the averaging-time constant externally.

The MAX2206/MAX2207/MAX2208 come in space-saving 2x2, 0.5mm-pitch UCSP™ chip-scale packages and require only three external components.

### Applications

- Dual-Band GSM/EDGE Handsets
- Dual-Band CDMA/TDMA Handsets
- WCDMA Handsets
- PA Modules

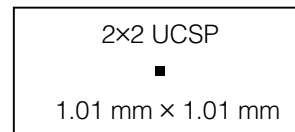
### Features

- ◆ Space-Saving 2x2 UCSP Only Occupies 1mm<sup>2</sup>
- ◆ Internal Temperature Compensation Gives  $\pm 0.3\text{dB}$  Detection Accuracy
- ◆ No External Filter or Op Amp Required
- ◆ Power-Detection Range  
40dB (MAX2206)  
25dB (MAX2207/2208)

### Ordering Information

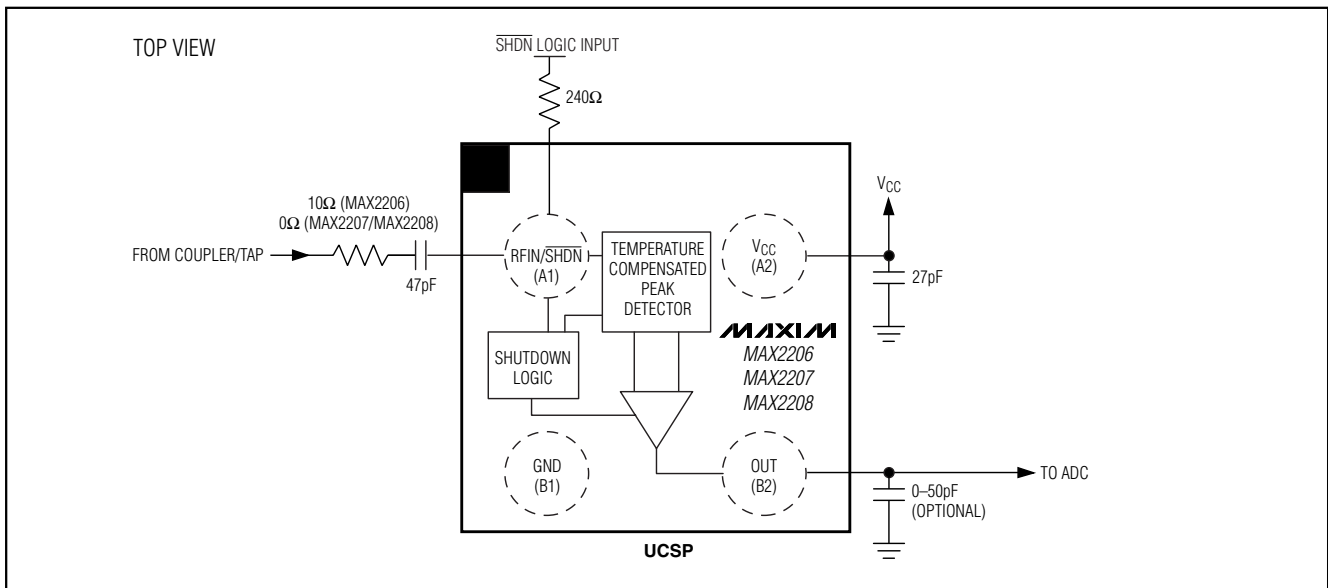
PART	TEMP. RANGE	BUMP-PACKAGE
MAX2206EBS	-40°C to +85°C	2x2 UCSP*
MAX2207EBS	-40°C to +85°C	2x2 UCSP*
MAX2208EBS	-40°C to +85°C	2x2 UCSP*

\*Requires solder temperature profile described in the Absolute Maximum Ratings section.



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### Pin Description/Functional Diagram/Typical Operating Circuit



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## ABSOLUTE MAXIMUM RATINGS

V<sub>CC</sub> to GND .....-0.3V to +6.5V  
 RFIN/ $\overline{\text{SHDN}}$  to GND.....-0.3V to (V<sub>CC</sub> + 0.3V)  
 RF Input Power (800MHz) .....+20dBm  
 RF Input Power (2GHz) .....+17dBm  
 Continuous Power Dissipation (T<sub>A</sub> = +70°C)  
     2×2 UCSP (derate 3.8mW/°C above T<sub>A</sub> = +70°C).....303mW

Operating Temperature Range .....-40°C to +85°C  
 Junction Temperature .....+150°C  
 Storage Temperature Range .....-65°C to +160°C  
 Bump Temperature (Soldering) (Note 1)  
     Infrared (15s) .....+220°C  
     Vapor Phase (60s) .....+215°C

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## DC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +2.7V to +5.0V, T<sub>A</sub> = -40°C to +85°C,  $\overline{\text{SHDN}}$  = +2.0V, no RF signal applied. Typical values are at V<sub>CC</sub> = +2.85V and T<sub>A</sub> = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V <sub>CC</sub>		2.7		5.0	V
Idle Supply Current	I <sub>IDLE</sub>	MAX2206		3.5	5.5	mA
		MAX2207/MAX2208		2	3.5	
Shutdown Supply Current	I $\overline{\text{SHDN}}$	$\overline{\text{SHDN}}$ = 0		0.5	10	μA
OUT Voltage During Shutdown	V <sub>OUT</sub>	$\overline{\text{SHDN}}$ = 0			0.01	V
Logic High Threshold	V <sub>H</sub>		2.0			V
Logic Low Threshold	V <sub>L</sub>				0.6	V
$\overline{\text{SHDN}}$ Input Current	I <sub>IH</sub>	$\overline{\text{SHDN}}$ = +2.0V	-1		10	μA
	I <sub>IL</sub>	$\overline{\text{SHDN}}$ = +0.6V	-1		1	
Output Current Source Capability		MAX2206/MAX2207, V <sub>OUT</sub> = 2.5V	400			μA
Output Current Sink Capability		MAX2206/MAX2207, V <sub>OUT</sub> = 0	300			μA

# RF Power Detectors in UCSP Package

MAX2206/MAX2207/MAX2208

## AC ELECTRICAL CHARACTERISTICS

(MAX2206/MAX2207/MAX2208 EV Kit,  $V_{CC} = +2.7V$  to  $+5.0V$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ ,  $\overline{SHDN} = +2.0V$ ,  $f_{RF} = 800MHz$  to  $2GHz$ ,  $50\Omega$  system. Typical values are at  $V_{CC} = +2.85V$  and  $T_A = +25^\circ C$ , unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Input Frequency	$f_{RF}$		800		2000	MHz
RF Input VSWR	VSWR	$f_{RF} = 800MHz$ to $2000MHz$		2:1		
Turn-On Time	$t_{ON}$			2		$\mu s$
Response Time (Note 3)	$t_R$	MAX2206/MAX2207		300		ns
		MAX2208		15		$\mu s$
Variation Due to Temperature		$V_{CC} = +2.85V$ , $T_A = -40^\circ C$ to $+85^\circ C$	High Input Power (Note 4)	$\pm 0.3$	$\pm 1$	dB
			Low Input Power (Note 5)	$\pm 1.3$	$\pm 2.5$	

**Note 1:** This device is constructed using a unique set of packaging techniques that imposes a limit on the thermal profile the device can be exposed to during board level solder attach and rework. This limit permits only the use of the solder profiles recommended in the industry standard specification, JEDEC 020A, paragraph 7.6, Table 3 for IR/VPR and convection reflow. Preheating is required. Hand or wave soldering is not allowed.

**Note 2:** Specifications over  $T_A = -40^\circ C$  to  $+85^\circ C$  are guaranteed by design. Production tests are performed at  $T_A = +25^\circ C$ .

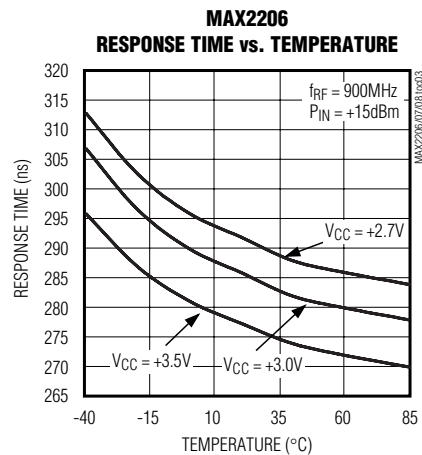
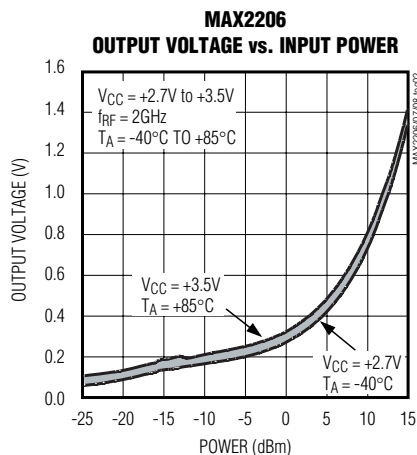
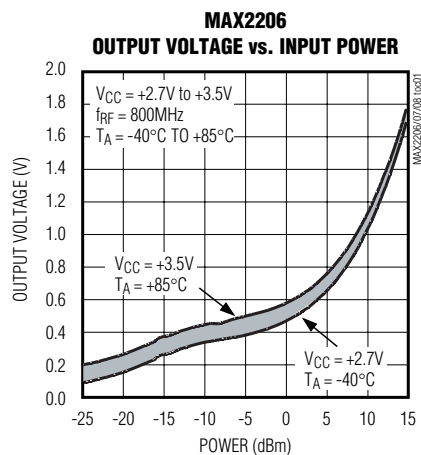
**Note 3:** Response time is taken from the time the RF signal is applied to 90% of  $V_{OUT}$ .

**Note 4:** At 800MHz, output voltage is held at a value that nominally results from  $+15dBm$  input power. Deviation from  $+15dBm$  is specified. At 2GHz, output voltage is held at a value that nominally results from  $+13dBm$  input power. Deviation from  $+13dBm$  is specified.

**Note 5:** For MAX2206, output voltage is held 40dB lower than specified in Note 4; for MAX2207/MAX2208, output voltage is held 25dB lower than specified in Note 4.

## Typical Operating Characteristics

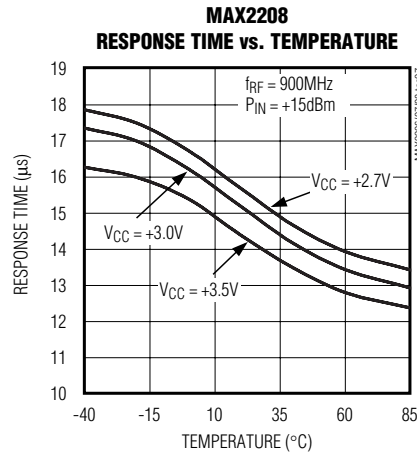
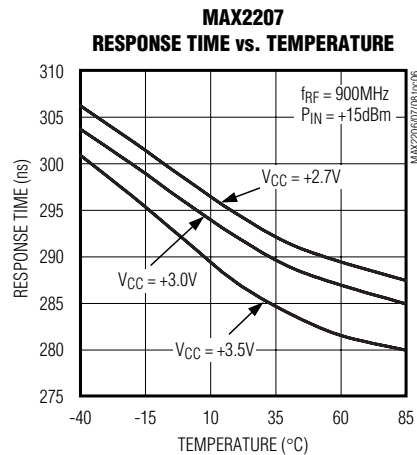
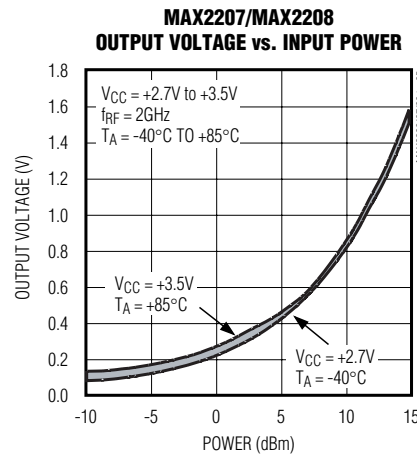
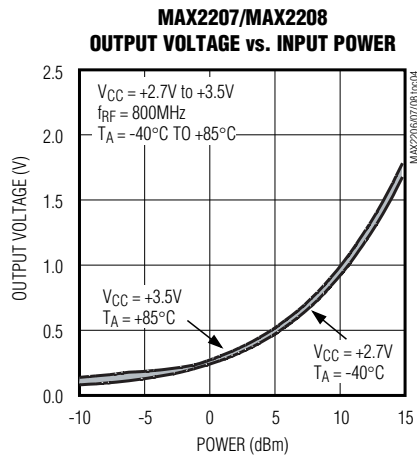
(MAX2206/MAX2207/MAX2208 EV Kit,  $T_A = +25^\circ C$ , unless otherwise noted.)



# RF Power Detectors in UCSP Package

## Typical Operating Characteristics (continued)

(MAX2206/MAX2207/MAX2208 EV Kit,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



## Pin Description

PIN	NAME	FUNCTION
A1	RFIN/SHDN	RF Input and Shutdown Logic Input. AC-couple the RF input to this pin and apply the shutdown logic input via a 240Ω resistor. Drive low to turn the part off, drive high or connect to $V_{CC}$ to turn the part on.
A2	$V_{CC}$	Power Supply Pin. Bypass to GND with a capacitor as close to the bump as possible.
B1	GND	Ground Connection. Multiple ground vias placed as close to the IC as possible should be used to connect the ground pin to the ground plane. Connect to PCB ground plane with as low inductance as possible.
B2	OUT	Detector Output.

# RF Power Detectors in UCSP Package

## Layout

As with any RF circuit, the layout of the MAX2206/MAX2207/MAX2208 circuits will affect performance. Use a short  $50\Omega$  line at the input with multiple ground vias along the length of the line. The input capacitor and resistor should both be placed as close to the IC as possible. The VCC input should be bypassed as close as possible to the IC with multiple vias connecting the capacitor to ground. See the MAX2206/MAX2207/MAX2208 EV kit data sheet for an example layout and further details.

## UCSP Reliability

The UCSP represents a unique package that greatly reduces board space compared to other packages. UCSP reliability is integrally linked to the user's assembly methods, circuit board material, and usage environment. The user should closely review these areas when considering use of a UCSP. This form factor may not perform equally to a packaged product through traditional mechanical reliability tests. Performance through

operating life test and moisture resistance remains uncompromised as it is primarily determined by the wafer-fabrication process.

Mechanical stress performance is a greater consideration for a UCSP. UCSP solder joint contact integrity must be considered since the package is attached through direct solder contact to the user's PC board. Testing done to characterize the UCSP reliability performance shows that it is capable of performing reliably through environmental stresses. Results of environmental stress tests and additional usage data and recommendations are detailed in the UCSP application note, which can be found on Maxim's website, [www.maxim-ic.com](http://www.maxim-ic.com).

## Chip Information

TRANSISTOR COUNT: 344

MAX2206/MAX2207/MAX2208

# RF Power Detector in UCSP Package

## Package Information

SYMBOL	DIMENSIONS
A	0.022 ±.002
E	0.040 ±.002
D	0.040 ±.002
e	0.0197 BASIC
b	∅ 0.0120 BASIC
A1	0.009±.0015
A2	0.013 Ref.
h	0.010 Ref.

NOTES:  
 1. ALL DIMENSIONS ARE IN INCHES.  
 2. MEETS JEDEC MO195.

4L UCSP 2x2 EPS

**MAXIM**  
 PROPRIETARY INFORMATION  
 TITLE:  
 PACKAGE OUTLINE, 4L UCSP, 2x2  
 APPROVAL: \_\_\_\_\_ DOCUMENT CONTROL NO. 21-0117 REV. A 1/1

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