19-2015; Rev 0; 4/01

EVALUATION KIT AVAILABLE

RF Power Detectors in UCSP Package

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 ±1dB at full power and ±2.5dB 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 2×2, 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 2×2 UCSP Only Occupies 1mm²**
- **Internal Temperature Compensation Gives ±0.3dB 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	2×2 UCSP*
MAX2207EBS	-40°C to +85°C	2×2 UCSP*
MAX2208EBS	-40°C to +85°C	2×2 UCSP*

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

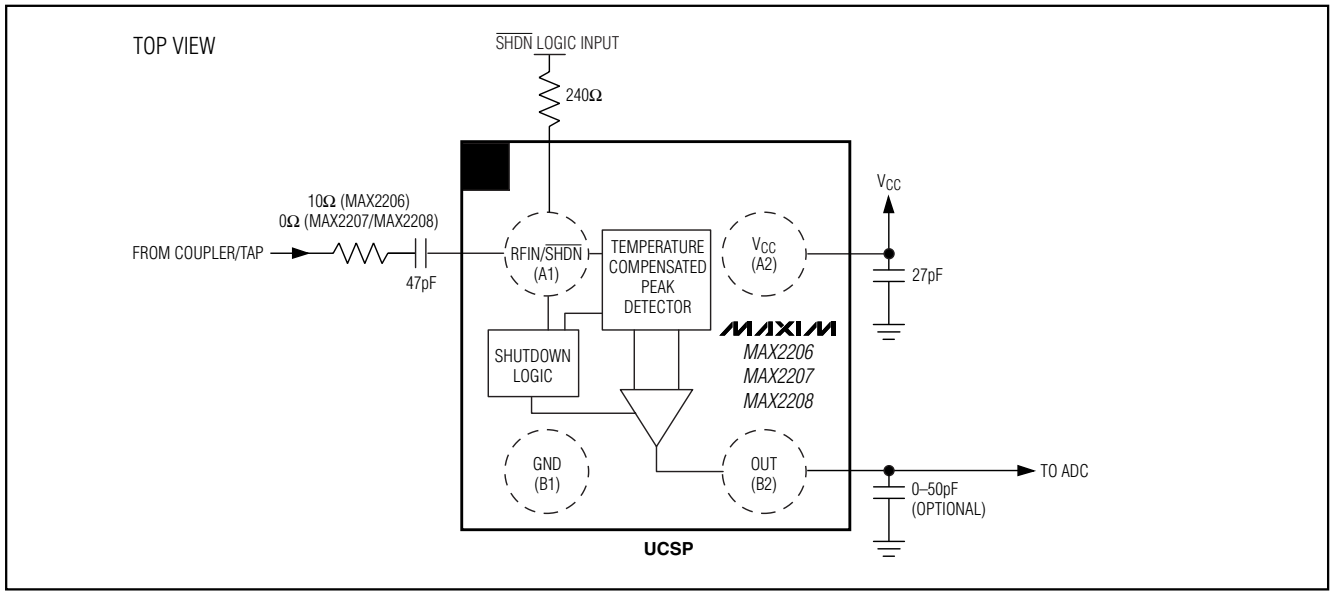
2×2 UCSP

■

1.01 mm × 1.01 mm

UCSP is a trademark of Maxim Integrated Products, Inc.

Pin Description/Functional Diagram/Typical Operating Circuit



RF Power Detectors in UCSP Package

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND .....-0.3V to +6.5V
RFIN/$\overline{SHDN}$ to GND.....-0.3V to (V_{CC} + 0.3V)
RF Input Power (800MHz) .....+20dBm
RF Input Power (2GHz) .....+17dBm
Continuous Power Dissipation (T_A = +70°C)
2×2 UCSP (derate 3.8mW/°C above T_A = +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_{CC} = +2.7V to +5.0V, T_A = -40°C to +85°C, $\overline{SHDN}$ = +2.0V, no RF signal applied. Typical values are at V_{CC} = +2.85V and T_A = +25°C, unless otherwise noted.) (Note 2)

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

AC ELECTRICAL CHARACTERISTICS

(MAX2206/MAX2207/MAX2208 EV Kit, V_{CC} = +2.7V to +5.0V, T_A = -40°C to +85°C, $\overline{SHDN}$ = +2.0V, f_{RF} = 800MHz to 2GHz, 50Ω system. Typical values are at V_{CC} = +2.85V and T_A = +25°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		µs
Response Time (Note 3)	t_R	MAX2206/MAX2207			300		ns
		MAX2208			15		µs
Variation Due to Temperature		V_{CC} = +2.85V, T_A = -40°C to +85°C	High Input Power (Note 4)		±0.3	±1	dB
			Low Input Power (Note 5)		±1.3	±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°C to +85°C are guaranteed by design. Production tests are performed at T_A = +25°C.

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

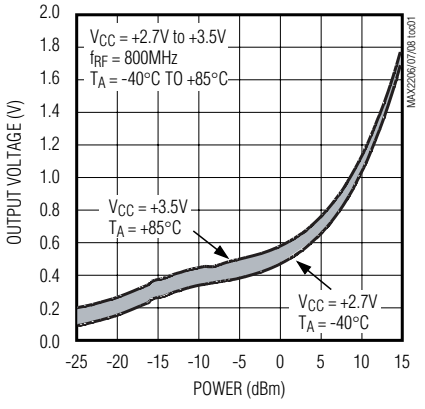
Note 4: At 800MHz, output voltage is held at a value that nominally results from +15dBm input power. Deviation from +15dBm is specified. At 2GHz, output voltage is held at a value that nominally results from +13dBm input power. Deviation from +13dBm is specified.

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.

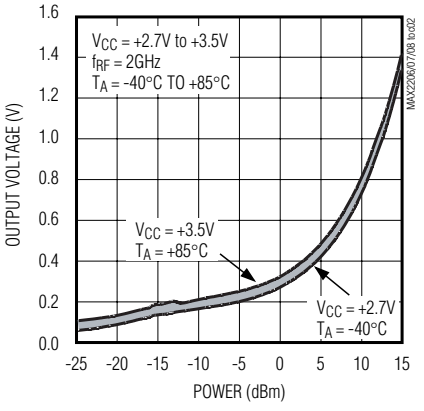
Typical Operating Characteristics

(MAX2206/MAX2207/MAX2208 EV Kit, T_A = +25°C, unless otherwise noted.)

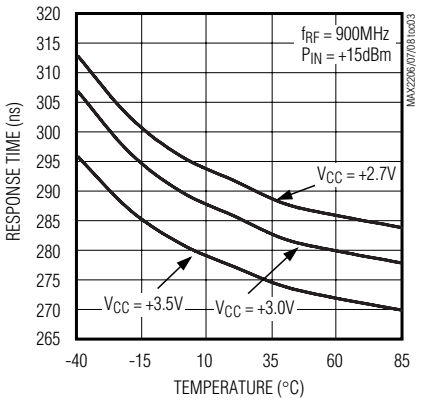
MAX2206
OUTPUT VOLTAGE vs. INPUT POWER



MAX2206
OUTPUT VOLTAGE vs. INPUT POWER



MAX2206
RESPONSE TIME vs. TEMPERATURE

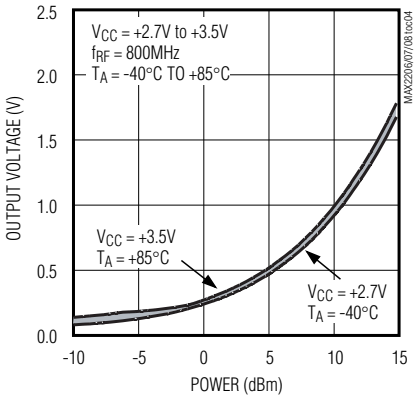


RF Power Detectors in UCSP Package

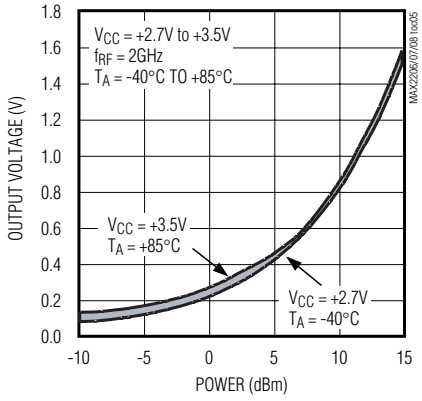
Typical Operating Characteristics (continued)

(MAX2206/MAX2207/MAX2208 EV Kit, T_A = +25°C, unless otherwise noted.)

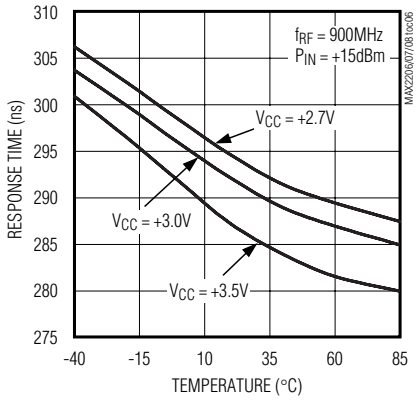
MAX2207/MAX2208
OUTPUT VOLTAGE vs. INPUT POWER



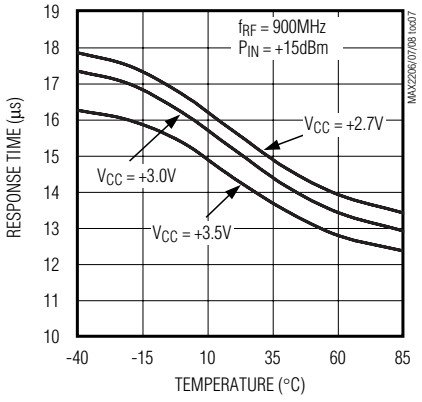
MAX2207/MAX2208
OUTPUT VOLTAGE vs. INPUT POWER



MAX2207
RESPONSE TIME vs. TEMPERATURE



MAX2208
RESPONSE TIME vs. TEMPERATURE



Pin Description

PIN	NAME	FUNCTION
A1	RFIN/$\overline{SHDN}$	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.

Layout

As with any RF circuit, the layout of the MAX2206/MAX2207/MAX2208 circuits will affect performance. Use a short 50Ω 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 V_{CC} 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*.

Chip Information

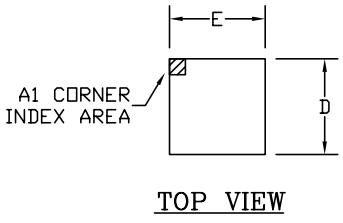
TRANSISTOR COUNT: 344

RF Power Detector in UCSP Package

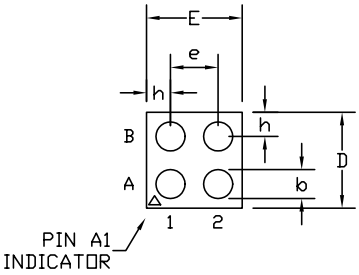
Package Information

4L, UCSP 2x2.EPS

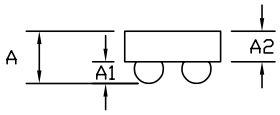
SYMBOL	DIMENSIONS
A	0.022 ±.002
E	0.040 ±.002
D	0.040 ±.002
e	0.0197 BASIC
b	ø 0.0120 BASIC
A1	0.009±.0015
A2	0.013 Ref.
h	0.010 Ref.



TOP VIEW



BOTTOM VIEW



SIDE VIEW

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

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