19-1094; Rev 2; 4/05

EVALUATION KIT AVAILABLE

DC-to-Microwave, Low-Noise Amplifier

General Description

The MAX2611 is a low-voltage, low-noise amplifier for use from DC to microwave frequencies. Operating from a single +5V supply, it has a 3dB bandwidth of 1100MHz. The MAX2611's low noise figure and high drive capability make it ideal for a variety of transmit, receive, and buffer applications.

In a typical application, the only external components needed are input and output blocking capacitors and a V_{CC} series resistor. To improve gain and output power, an RF choke can be added in series to the bias resistor.

The MAX2611 comes in a 4-pin SOT143 package, requiring minimal board space.

Features

- **Single +5V Supply Operation**
- **3dB Bandwidth: DC to 1100MHz**
- **High Gain: 18dB at 500MHz**
- **Low Noise Figure: 3.5dB at 500MHz**
- **High Drive Capability: +3dBm at 16mA I_D**
- **Ultra-Small SOT143 Package**

Applications

Satellite Receivers

TV Tuners

Wireless Local Loops

ISM Radios

Global Positioning Systems

Wireless Local-Area Networks

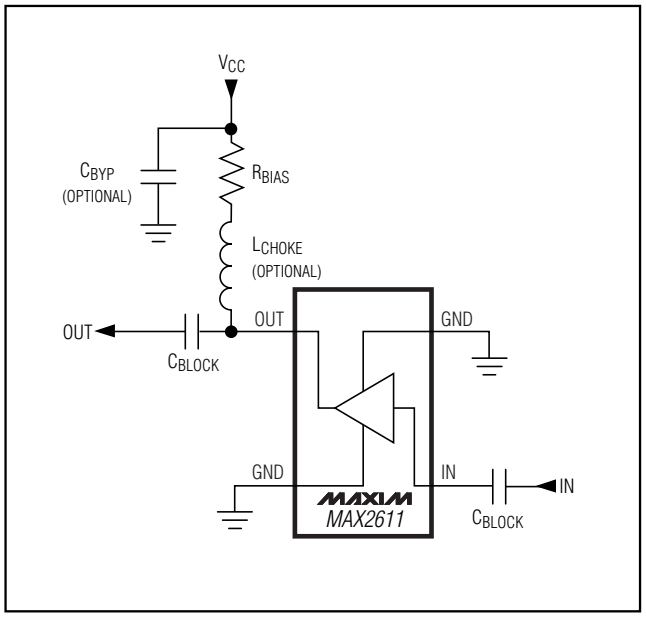
Land Mobile Radios

Set-Top Boxes

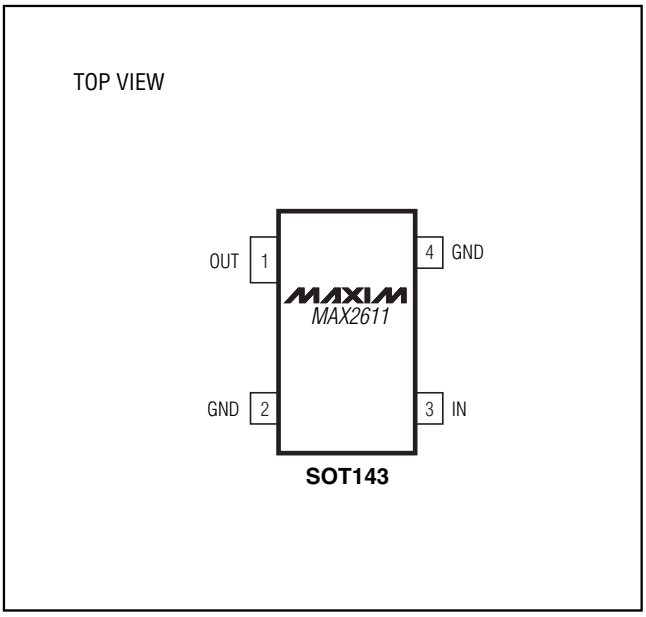
Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX2611EUS-T	-40°C to +85°C	4 SOT143-4

Typical Operating Circuit



Pin Configuration



For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

DC-to-Microwave, Low-Noise Amplifier

ABSOLUTE MAXIMUM RATINGS

I_D 40mA
Input Power .....+13dBm
Continuous Power Dissipation (T_A = +70°C)
SOT143-4 (derate 4mW/°C above +70°C).....320mW

Operating Temperature Range .....-40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range.....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+300°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.

CAUTION! ESD SENSITIVE DEVICE

ELECTRICAL CHARACTERISTICS

(I_D = 16mA, Z_0 = 50Ω, f_{IN} = 500MHz, T_A = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Temperature Range	(Note 1)	-40		85	°C
Power Gain	f_{IN} = 100MHz		19.0		dB
	f_{IN} = 500MHz	17.3	18.3		
Gain Flatness	f_{IN} = 100MHz to 500MHz		±0.3		dB
3dB Bandwidth			1100		MHz
Input Voltage Standing-Wave Maximum Ratio	f_{IN} = 100MHz to 1500MHz		1.9:1		
Output Voltage Standing-Wave Maximum Ratio	f_{IN} = 100MHz to 1500MHz		1.6:1		
Output 1dB Compression Point			2.9		dBm
Noise Figure			3.5		dB
Output IP3			13		dBm
Group Delay			210		ps
Device Voltage		3.5	3.8	4.0	V
	T_A = T_{MIN} to T_{MAX} (Note 2)	3.25	3.8	4.26	
Device Voltage Temperature Coefficient			-6.1		mV/°C

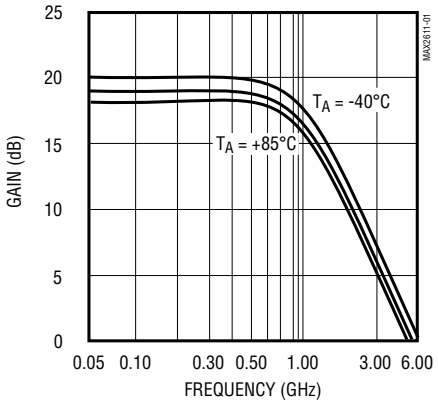
Note 1: Parts are designed to operate over specified temperature range. Specifications are production tested and guaranteed at +25°C.

Note 2: Guaranteed by design, not tested.

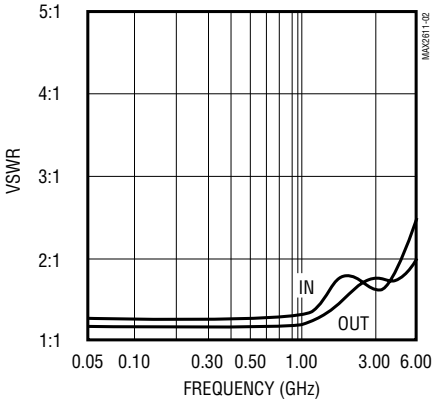
Typical Operating Characteristics

(I_D = 16mA, Z_0 = 50Ω, f_{IN} = 500MHz, T_A = +25°C, unless otherwise noted.)

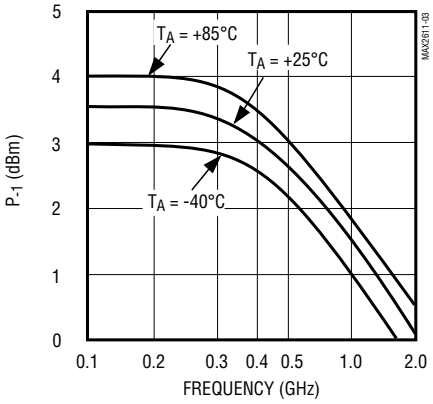
GAIN vs. FREQUENCY



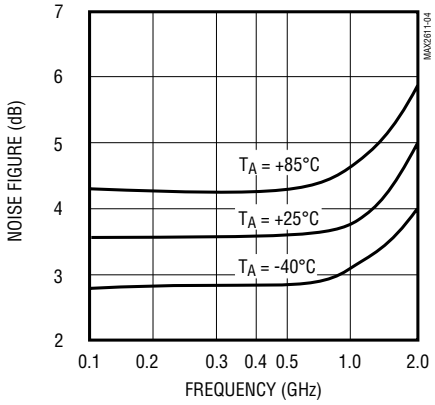
VOLTAGE STANDING-WAVE RATIO vs. FREQUENCY



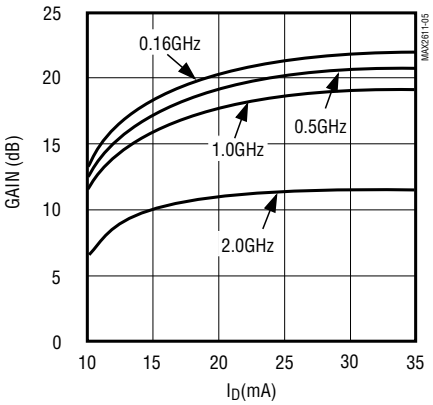
OUTPUT 1dB COMPRESSION POINT vs. FREQUENCY



NOISE FIGURE vs. FREQUENCY



GAIN vs. CURRENT



DC-to-Microwave, Low-Noise Amplifier

Pin Description

PIN	NAME	FUNCTION
1	OUT	Amplifier Output. Use a series blocking capacitor with less than 3Ω reactance at your lowest operating frequency. Bias with an external resistor and an optional RF choke.
2, 4	GND	Ground Connection. For optimum performance, provide a low-inductance connection to the ground plane.
3	IN	Amplifier Input. Use a series blocking capacitor with less than 3Ω reactance at your lowest operating frequency.

Table 1. Typical Scattering Parameters

(I_D = 16mA, Z_0 = 50Ω, T_A = +25°C)

FREQUENCY (GHz)	S11 (mag)	S11 (ang)	S21 (dB)	S21 (mag)	S21 (ang)	S12 (dB)	S12 (mag)	S12 (ang)	S22 (mag)	S22 (ang)	K
0.1	0.12	-11	19.0	8.90	173	-22.6	0.074	2	0.05	53	1.08
0.2	0.11	-44	18.8	8.73	166	-21.9	0.081	4	0.03	12	1.06
0.3	0.13	-58	18.6	8.53	158	-21.6	0.083	5	0.04	45	1.05
0.4	0.14	-78	18.5	8.43	151	-21.6	0.083	6	0.06	32	1.06
0.5	0.15	-89	18.3	8.26	144	-21.6	0.083	7	0.08	34	1.06
0.6	0.15	77	18.1	7.99	137	-21.6	0.083	9	0.09	26	1.07
0.8	0.13	50	17.4	7.45	123	-21.6	0.083	10	0.10	23	1.10
1.0	0.12	16	16.6	6.79	109	-20.9	0.090	10	0.10	35	1.11
1.5	0.32	-60	14.1	5.07	79	-21.8	0.081	11	0.21	-86	1.29
2.0	0.31	-72	10.3	3.27	59	-22.2	0.078	18	0.22	-72	1.87
2.5	0.32	-76	7.9	2.48	47	-22.6	0.074	25	0.26	-53	2.44
3.0	0.20	-70	5.9	1.98	32	-22.3	0.077	37	0.24	-29	3.10
3.5	0.24	-64	3.0	1.41	13	-21.4	0.086	30	0.19	47	3.83
4.0	0.31	-68	-0.7	0.92	17	-23.0	0.070	35	0.24	82	6.66

Detailed Description

The MAX2611 is a broadband amplifier with flat gain and 50Ω input and output ports. Its small size and simple bias circuitry make it ideal for applications where board space is limited.

Applications Information

External Components

As shown in the *Typical Operating Circuit*, the MAX2611 is easy to use. Input and output series capacitors may be necessary to block DC bias voltages (generated by the MAX2611) from interacting with adjacent circuitry. These capacitors must be large enough to contribute negligible reactance in a 50Ω system at the minimum operating frequency. Use the following equation to calculate their minimum value:

$$C_{BLOCK} = \frac{53{,}000}{f} \quad (pF)$$

where f (in MHz) is the minimum operating frequency.

Bias current is supplied to the MAX2611 through an external resistor and optional RF choke connected between V_{CC} and the OUT pin. A bypass capacitor from V_{CC} to GND may be necessary to isolate the V_{CC} line from other circuitry. The resistor value determines the bias current from the following equation:

$$I_D = \frac{V_{CC} - V_D}{R_{BIAS}}$$

where V_D is the device voltage, nominally 3.8V.

An optional RF choke can be added to improve the MAX2611's gain and output power. The choke should be large enough to reduce the loading effect that the bias resistor has on the amplifier output. This is a function of R_{BIAS}, frequency of operation, and output impedance.

Grounding

Proper grounding of the GND pins is essential. If the PC board uses a topside RF ground, the GND pins should be connected directly to it. For a board where the ground plane is not on the component side, the best technique is to connect the GND pins to it through multiple plated through-holes.

PC Board Layout Example

An example PC board layout is given in Figure 1. It uses FR-4 with 31mil layer thickness between the RF lines and the ground plane. This board satisfies all the above requirements.

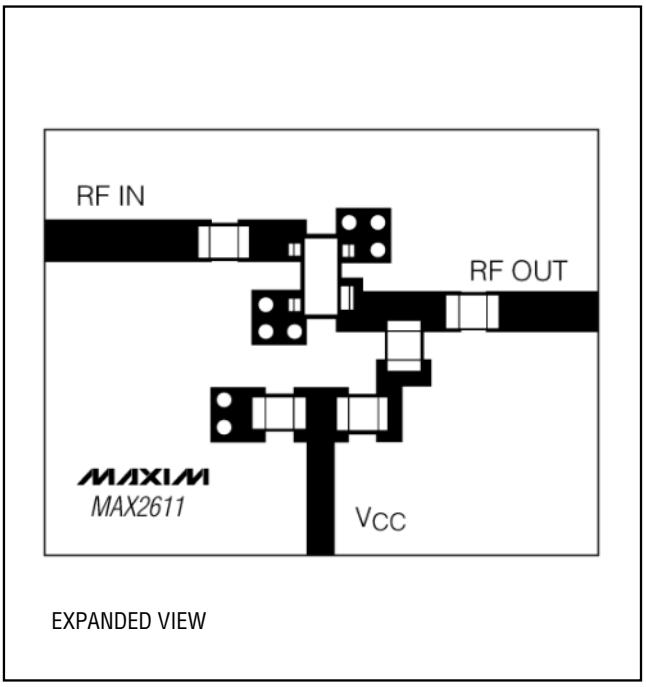
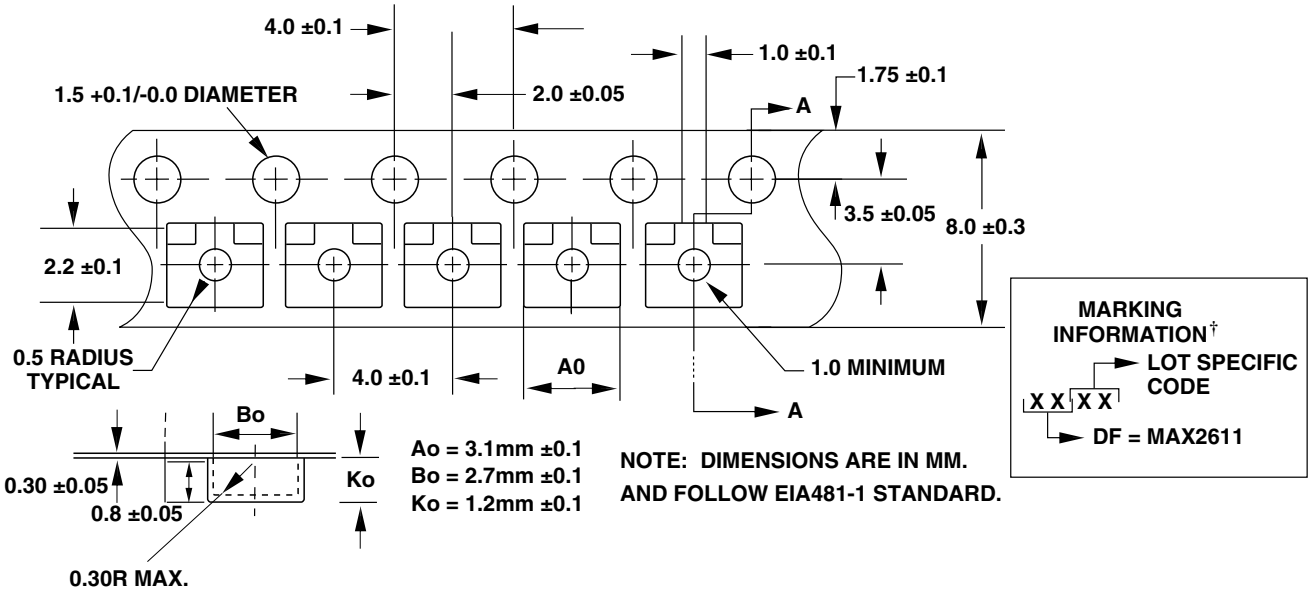


Figure 1. Example PC Board Layout

DC-to-Microwave, Low-Noise Amplifier

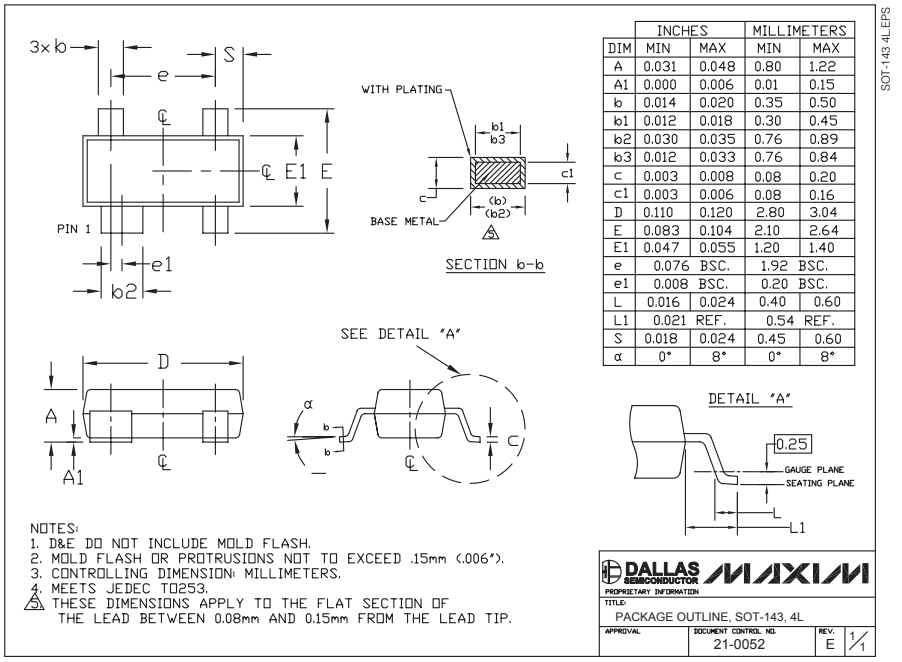
Tape-and-Reel Information



†ICs MAY ALSO BE MARKED WITH FULL PART NAME: 2611

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.031	0.048	0.80	1.22
A1	0.000	0.006	0.01	0.15
b	0.014	0.020	0.35	0.50
b1	0.012	0.018	0.30	0.45
b2	0.030	0.035	0.76	0.89
b3	0.012	0.033	0.76	0.84
c	0.003	0.008	0.08	0.20
c1	0.003	0.006	0.08	0.16
D	0.110	0.120	2.80	3.04
E	0.083	0.104	2.10	2.64
E1	0.047	0.055	1.20	1.40
e	0.076 BSC.		1.92 BSC.	
e1	0.008 BSC.		0.20 BSC.	
L	0.016	0.024	0.40	0.60
L1	0.021 REF.		0.54 REF.	
S	0.018	0.024	0.45	0.60
α	0°	8°	0°	8°

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