



# Low Distortion 1.5 Watt Audio Power Amplifier

## SSM2211\*

### FEATURES

1.5 Watt Output<sup>1</sup>  
Differential (BTL<sup>2</sup>) Output  
Single-Supply Operation: 2.7 V to 5.5 V  
Functions Down to 1.75 V  
Wide Bandwidth: 4 MHz  
Highly Stable, Phase Margin: > 80 Degrees  
Low Distortion: 0.2% THD @ 1 W Output  
Excellent Power Supply Rejection

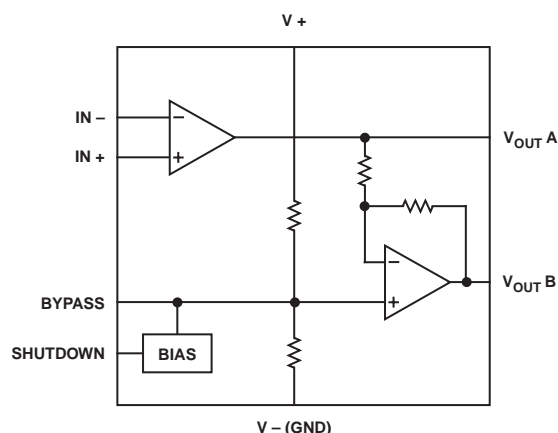
### APPLICATIONS

Portable Computers  
Personal Wireless Communicators  
Hands-Free Telephones  
Speakerphones  
Intercoms  
Musical Toys and Speaking Games

### GENERAL DESCRIPTION

The SSM2211 is a high performance audio amplifier that delivers 1 W RMS of low distortion audio power into a bridge-connected 8  $\Omega$  speaker load, (or 1.5 W RMS into 4  $\Omega$  load). It operates over a wide temperature range and is specified for single-supply voltages between 2.7 V and 5.5 V. When operating from batteries, it will continue to operate down to 1.75 V. This makes the SSM2211 the best choice for unregulated applications such as toys and games. Featuring a 4 MHz bandwidth, distortion below 0.2 % THD @ 1 W, and the patented Thermal Coastline leadframe, superior performance is delivered at higher power or lower speaker load impedance than competitive units. The advanced mechanical packaging of the SSM2211 gives lower chip temperature, which ensures highly reliable operation and enhanced trouble free life.

### FUNCTIONAL BLOCK DIAGRAM



The low differential dc output voltage results in negligible losses in the speaker winding, and makes high value dc blocking capacitors unnecessary. Battery life is extended by using the Shutdown mode, which reduces quiescent current drain to typically 100 nA.

The SSM2211 is designed to operate over the  $-20^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  temperature range. See Figure 49 for information on the Thermal Coastline lead frame. The SSM2211 is available in an SO-8 surface mount package. DIP samples are available; you should request a special quotation on production quantities. An evaluation board is available upon request of your local Analog Device sales office.

Applications include personal portable computers, hands-free telephones and transceivers, talking toys, intercom systems and other low voltage audio systems requiring 1 W output power.

\*Protected by U.S. Patent No. 5,519,576

<sup>1</sup>1.5 W @ 4  $\Omega$ ,  $+25^{\circ}\text{C}$  ambient, < 1% THD, 5 V supply, 4 layer PCB.

<sup>2</sup>Bridge Tied Load

REV. 0

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.  
Tel: 781/329-4700 World Wide Web Site: <http://www.analog.com>  
Fax: 781/326-8703 © Analog Devices, Inc., 1997

# SSM2211–SPECIFICATIONS

## ELECTRICAL CHARACTERISTICS ( $V_S = +5.0\text{ V}$ , $T_A = +25^\circ\text{C}$ , $R_L = 8\ \Omega$ , $C_B = 0.1\ \mu\text{F}$ , $V_{CM} = V_D/2$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>GENERAL CHARACTERISTICS</b>						
Differential Output Offset Voltage	$V_{OOS}$	$A_{VD} = 2$		4	50	mV
Output Impedance	$Z_{OUT}$			0.1		$\Omega$
<b>SHUTDOWN CONTROL</b>						
Input Voltage High	$V_{IH}$	$I_{SY} < 100\ \mu\text{A}$	3.0			V
Input Voltage Low	$V_{IL}$	$I_{SY} = \text{Normal}$			1.3	V
<b>POWER SUPPLY</b>						
Power Supply Rejection Ratio	PSRR	$V_S = 4.75\text{ V to }5.25\text{ V}$		66		dB
Supply Current	$I_{SY}$	$V_{O1} = V_{O2} = 2.5\text{ V}$		9.5		mA
Supply Current, Shutdown Mode	$I_{SD}$	Pin 1 = $V_{DD}$ , See Figure 29		100		nA
<b>DYNAMIC PERFORMANCE</b>						
Gain Bandwidth	GBP			4		MHz
Phase Margin	$\phi^0$			86		degrees
<b>AUDIO PERFORMANCE</b>						
Total Harmonic Distortion	THD + N	$P = 0.5\text{ W into }8\ \Omega$ , $f = 1\text{ kHz}$		0.15		%
Total Harmonic Distortion	THD + N	$P = 1.0\text{ W into }8\ \Omega$ , $f = 1\text{ kHz}$		0.2		%
Voltage Noise Density	$e_n$	$f = 1\text{ kHz}$		85		$\text{nV}/\sqrt{\text{Hz}}$

## ELECTRICAL CHARACTERISTICS ( $V_S = +3.3\text{ V}$ , $T_A = +25^\circ\text{C}$ , $R_L = 8\ \Omega$ , $C_B = 0.1\ \mu\text{F}$ , $V_{CM} = V_D/2$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>GENERAL CHARACTERISTICS</b>						
Differential Output Offset Voltage	$V_{OOS}$	$A_{VD} = 2$		5	50	mV
Output Impedance	$Z_{OUT}$			0.1		$\Omega$
<b>SHUTDOWN INPUT</b>						
Input Voltage High	$V_{IH}$	$I_{SY} < 100\ \mu\text{A}$	1.7			V
Input Voltage Low	$V_{IL}$				1	V
<b>POWER SUPPLY</b>						
Supply Current	$I_{SY}$	$V_{O1} = V_{O2} = 1.65\text{ V}$		5.2		mA
Supply Current, Shutdown Mode	$I_{SD}$	Pin 1 = $V_{DD}$ , See Figure 29		100		nA
<b>AUDIO PERFORMANCE</b>						
Total Harmonic Distortion	THD + N	$P = 0.35\text{ W into }8\ \Omega$ , $f = 1\text{ kHz}$		0.1		%

## ELECTRICAL CHARACTERISTICS ( $V_S = +2.7\text{ V}$ , $T_A = +25^\circ\text{C}$ , $R_L = 8\ \Omega$ , $C_B = 0.1\ \mu\text{F}$ , $V_{CM} = V_S/2$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>GENERAL CHARACTERISTICS</b>						
Differential Output Offset Voltage	$V_{OOS}$	$A_{VD} = 2$		5	50	mV
Output Impedance	$Z_{OUT}$			0.1		$\Omega$
<b>SHUTDOWN CONTROL</b>						
Input Voltage High	$V_{IH}$	$I_{SY} < 100\ \mu\text{A}$	1.5			V
Input Voltage Low	$V_{IL}$	$I_{SY} = \text{Normal}$			0.8	V
<b>POWER SUPPLY</b>						
Supply Current	$I_{SY}$	$V_{O1} = V_{O2} = 1.35\text{ V}$		4.2		mA
Supply Current, Shutdown Mode	$I_{SD}$	Pin 1 = $V_{DD}$ , See Figure 29		100		nA
<b>AUDIO PERFORMANCE</b>						
Total Harmonic Distortion	THD + N	$P = 0.25\text{ W into }8\ \Omega$ , $f = 1\text{ kHz}$		0.1		%

Specifications subject to change without notice

**ABSOLUTE MAXIMUM RATINGS<sup>1,2</sup>**

Supply Voltage.....	+6 V
Input Voltage.....	$V_{DD}$
Common Mode Input Voltage.....	$V_{DD}$
ESD Susceptibility.....	2000 V
Storage Temperature Range .....	-65°C to +150°C
Operating Temperature Range .....	-20°C to +85°C
Junction Temperature Range.....	-65°C to +165°C
Lead Temperature Range (Soldering, 60 sec) .....	+300°C

**NOTES**

<sup>1</sup>Absolute maximum ratings apply at +25°C, unless otherwise noted.

<sup>2</sup>Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; the functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Package Type	$\theta_{JA}$ <sup>1</sup>	$\theta_{JC}$	Units
8-Lead SOIC (S)	98	43	°C/W
8-Lead PDIP (P) <sup>2</sup>	103	43	°C/W

**NOTES**

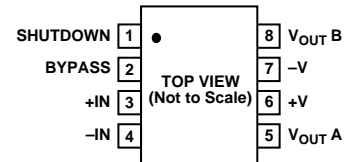
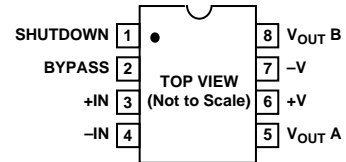
<sup>1</sup>For the SOIC package,  $\theta_{JA}$  is measured with the device soldered to a 4-layer printed circuit board.

<sup>2</sup>Special order only.

**ORDERING GUIDE**

Model	Temperature Range	Package Description	Package Options
SSM2211S	-20°C to +85°C	8-Lead SOIC	SO-8
SSM2211S-reel	-20°C to +85°C	8-Lead SOIC	SO-8
SSM2211S-reel7	-20°C to +85°C	8-Lead SOIC	SO-8
SSM2211P	-20°C to +85°C	8-Lead PDIP	N-8*

\*Special order only.

**PIN CONFIGURATIONS**  
**8-Lead SOIC**  
**(SO-8)**

**8-Lead Plastic DIP**  
**(N-8)**
**CAUTION**

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the SSM2211 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

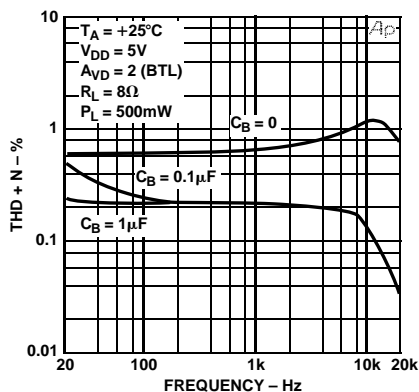


Figure 1. THD+N vs. Frequency

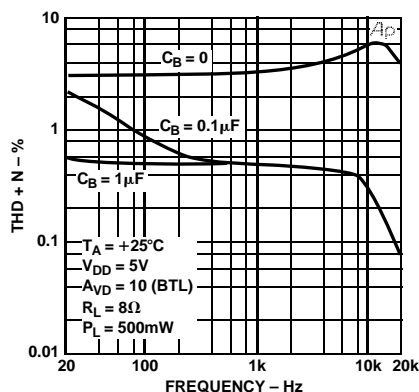


Figure 2. THD+N vs. Frequency

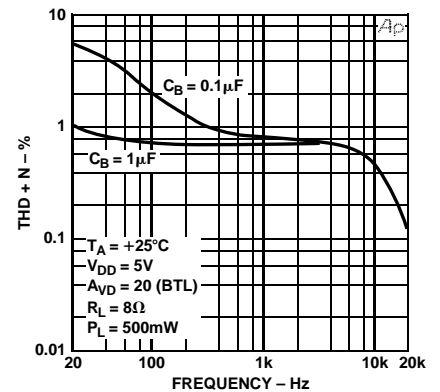


Figure 3. THD+N vs. Frequency