



# Low Distortion 1.5 Watt Audio Power Amplifier

## SSM2211\*

### FEATURES

**1.5 W 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**

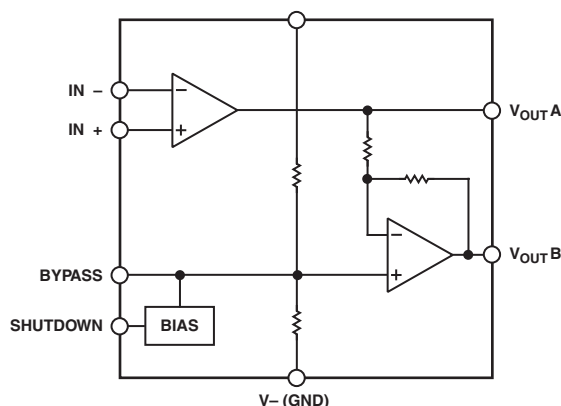
**Hands-Free Telephones**

**Speakerphones**

**Intercoms**

**Musical Toys and Speaking Games**

### FUNCTIONAL BLOCK DIAGRAM



### 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 and distortion below 0.2 % THD @ 1 W, superior performance is delivered at higher power or lower speaker load impedance than competitive units.

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. The SSM2211 is available in SO-8 and LFCSP (Lead Frame Chip Scale Package) surface mount packages. The SO-8 features the patented Thermal Coastline lead frame (see Figure 12). The advanced mechanical packaging of the SSM2211 ensures lower chip temperature and enhanced performance relative to standard packaging options. 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

### NOTES

<sup>1</sup>1.5 W @ 4  $\Omega$ , 25°C ambient, <1% THD, 5 V supply, 4 layer PCB.

<sup>2</sup>Bridge Tied Load

### REV. A

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# 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	Unit
<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 TPC 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	Unit
<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 TPC 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	Unit
<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 TPC 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.

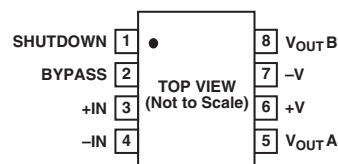
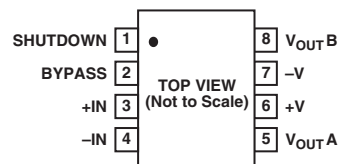
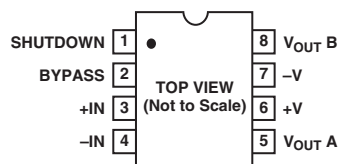
Package Type	$\theta_{JA}$ <sup>1</sup>	$\theta_{JC}$	Units
8-Lead LFCSP (CP) <sup>2</sup>	50		°C/W
8-Lead SOIC (S)	98	43	°C/W
8-Lead PDIP (P) <sup>3</sup>	103	43	°C/W

**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>For the LFCSP package,  $\theta_{JA}$  is measured with exposed lead frame soldered to the printed circuit board.

<sup>3</sup>Special order only.

**PIN CONFIGURATIONS****8-Lead SOIC  
(SO-8)****8-Lead LFCSP  
(CP-8)****8-Lead Plastic DIP  
(N-8)****ORDERING GUIDE**

Model	Temperature Range	Package Description	Package Options	Brand
SSM2211CP-Reel	–20°C to +85°C	8-Lead LFCSP	CP-8	B5A
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.

**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.

