Self-Contained Audio Preamplifier

SSM2019

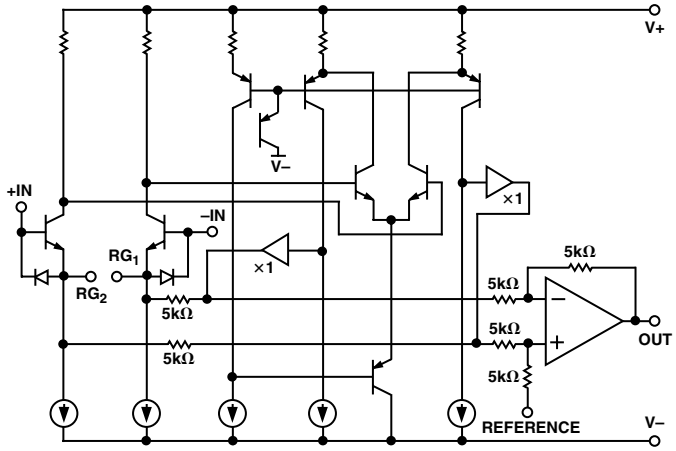
FEATURES

Excellent Noise Performance: 1.0 nV/√Hz or 1.5 dB Noise Figure
Ultra-low THD: < 0.01% @ G = 100 Over the Full Audio Band
Wide Bandwidth: 1 MHz @ G = 100
High Slew Rate: 16 V/μs @ G = 10
10 V rms Full-Scale Input, G = 1, V_S = ±18 V
Unity Gain Stable
True Differential Inputs
Subaudio 1/f Noise Corner
8-Lead PDIP or 16-Lead SOIC
Only One External Component Required
Very Low Cost
Extended Temperature Range: –40°C to +85°C

APPLICATIONS

Audio Mix Consoles
Intercom/Paging Systems
2-Way Radio
Sonar
Digital Audio Systems

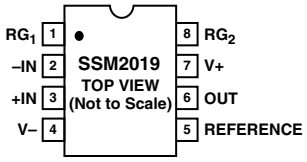
FUNCTIONAL BLOCK DIAGRAM



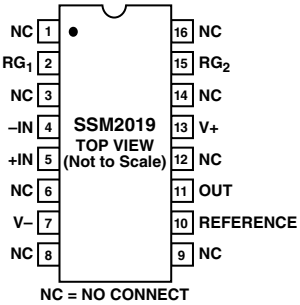
PIN CONNECTIONS

8-Lead PDIP (N Suffix)

8-Lead Narrow Body SOIC (RN Suffix)*



16-Lead Wide Body SOIC (RW Suffix)



*Consult factory for availability.

GENERAL DESCRIPTION

The SSM2019 is a latest generation audio preamplifier, combining SSM preamplifier design expertise with advanced processing. The result is excellent audio performance from a monolithic device, requiring only one external gain set resistor or potentiometer. The SSM2019 is further enhanced by its unity gain stability.

Key specifications include ultra-low noise (1.5 dB noise figure) and THD (<0.01% at G = 100), complemented by wide bandwidth and high slew rate.

Applications for this low cost device include microphone preamplifiers and bus summing amplifiers in professional and consumer audio equipment, sonar, and other applications requiring a low noise instrumentation amplifier with high gain capability.

REV. 0

SSM2019–SPECIFICATIONS (V_S = ±15 V and –40°C ≤ T_A ≤ +85°C, unless otherwise noted. Typical specifications apply at T_A = 25°C.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
DISTORTION PERFORMANCE		V_O = 7 V rms R_L = 2 kΩ				
Total Harmonic Distortion Plus Noise	THD + N	f = 1 kHz, G = 1000		0.017		%
		f = 1 kHz, G = 100		0.0085		%
		f = 1 kHz, G = 10		0.0035		%
		f = 1 kHz, G = 1		0.005		%
		BW = 80 kHz				
NOISE PERFORMANCE						
Input Referred Voltage Noise Density	e_n	f = 1 kHz, G = 1000		1.0		nV/√Hz
		f = 1 kHz, G = 100		1.7		nV/√Hz
		f = 1 kHz, G = 10		7		nV/√Hz
		f = 1 kHz, G = 1		50		nV/√Hz
Input Current Noise Density	i_n	f = 1 kHz, G = 1000		2		pA/√Hz
DYNAMIC RESPONSE						
Slew Rate	SR	G = 10 R_L = 2 kΩ C_L = 100 pF		16		V/µs
Small Signal Bandwidth	$BW_{-3\ dB}$	G = 1000		200		kHz
		G = 100		1000		kHz
		G = 10		1600		kHz
		G = 1		2000		kHz
INPUT						
Input Offset Voltage	V_{IOS}			0.05	0.25	mV
Input Bias Current	I_B	V_{CM} = 0 V		3	10	µA
Input Offset Current	Ios	V_{CM} = 0 V		±0.001	±1.0	µA
Common-Mode Rejection	CMR	V_{CM} = ±12 V				
		G = 1000	110	130		dB
		G = 100	90	113		dB
		G = 10	70	94		dB
		G = 1	50	74		dB
Power Supply Rejection	PSR	V_S = ±5 V to ±18 V				
		G = 1000	110	124		dB
		G = 100	110	118		dB
		G = 10	90	101		dB
		G = 1	70	82		dB
Input Voltage Range	IVR		±12			V
Input Resistance	R_{IN}	Differential, G = 1000		1		MΩ
		G = 1		30		MΩ
		Common Mode, G = 1000		5.3		MΩ
		G = 1		7.1		MΩ
OUTPUT						
Output Voltage Swing	V_O	R_L = 2 kΩ, T_A = 25°C	±13.5	±13.9		V
Output Offset Voltage	V_{OOS}			4	30	mV
Maximum Capacitive Load Drive				5000		pF
Short Circuit Current Limit	I_{SC}	Output-to-Ground Short		±50		mA
Output Short Circuit Duration				Continuous		sec
GAIN						
Gain Accuracy	$R_G = \frac{10\ k\Omega}{G-1}$	T_A = 25°C				
		R_G = 10 Ω, G = 1000	0.5	0.1		dB
		R_G = 101 Ω, G = 100	0.5	0.2		dB
		R_G = 1.1 kΩ, G = 10	0.5	0.2		dB
		R_G = ∞, G = 1	0.1	0.2		dB
Maximum Gain	G			70		dB
REFERENCE INPUT						
Input Resistance				10		kΩ
Voltage Range				±12		V
Gain to Output				1		V/V
POWER SUPPLY						
Supply Voltage Range	V_S		±5		±18	V
Supply Current	I_{SY}	V_{CM} = 0 V, R_L = ∞		±4.6	±7.5	mA
		V_{CM} = 0 V, V_S = ±18 V, R_L = ∞		±4.7	±8.5	mA

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . ±19 V
Input Voltage . . . . . Supply Voltage
Output Short Circuit Duration . . . . . 10 sec
Storage Temperature Range . . . . . –65°C to +150°C
Junction Temperature (T_J) . . . . . –65°C to +150°C
Lead Temperature Range (Soldering, 60 sec) . . . . . 300°C
Operating Temperature Range . . . . . –40°C to +85°C
Thermal Resistance[2]
8-Lead PDIP (N) . . . . . θ_{JA} = 96°C/W
. . . . . θ_{JC} = 37°C/W
16-Lead SOIC (RW) . . . . . θ_{JA} = 92°C/W
. . . . . θ_{JC} = 27°C/W

NOTES

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

[2] θ_{JA} is specified for worst-case mounting conditions, i.e., θ_{JA} is specified for device in socket for PDIP; θ_{JA} is specified for device soldered to printed circuit board for SOIC package.

ORDERING GUIDE

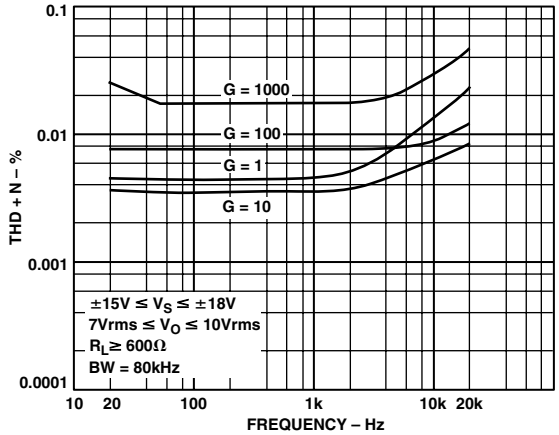
Model	Temperature Range	Package Description	Package Option
SSM2019BN	–40°C to +85°C	8-Lead PDIP	N-8
SSM2019BRW	–40°C to +85°C	16-Lead SOIC	RW-16
SSM2019BRWRL	–40°C to +85°C	16-Lead SOIC, Reel	RW-16
SSM2019BRN*	–40°C to +85°C	8-Lead SOIC	RN-8
SSM2019BRNRL*	–40°C to +85°C	8-Lead SOIC, Reel	RN-8

*Consult factory for availability.

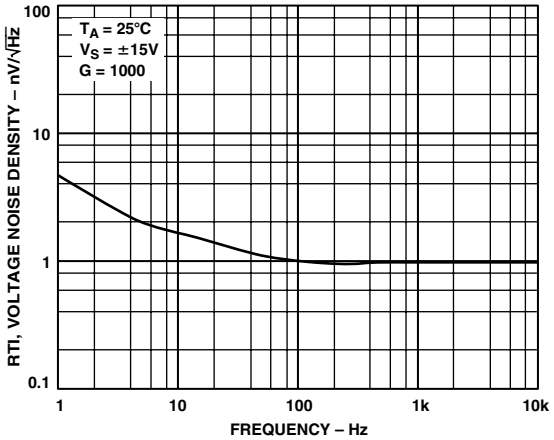
CAUTION

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 SSM2019 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.

Typical Performance Characteristics



TPC 1. Typical THD + Noise vs. Gain



TPC 2. Voltage Noise Density vs. Frequency

BUS SUMMING AMPLIFIER

In addition to its use as a microphone preamplifier, the SSM2019 can be used as a very low noise summing amplifier. Such a circuit is particularly useful when many medium impedance outputs are summed together to produce a high effective noise gain.

The principle of the summing amplifier is to ground the SSM2019 inputs. Under these conditions, Pins 1 and 8 are ac virtual grounds sitting about 0.55 V below ground. To remove the 0.55 V offset, the circuit of Figure 5 is recommended.

A2 forms a "servo" amplifier feeding the SSM2019 inputs. This places Pins l and 8 at a true dc virtual ground. R4 in conjunction with C2 removes the voltage noise of A2, and in fact just about any operational amplifier will work well here since it is removed from the signal path. If the dc offset at Pins l and 8 is not too critical, then the servo loop can be replaced by the diode biasing scheme of Figure 5. If ac coupling is used throughout, then Pins 2 and 3 may be directly grounded.

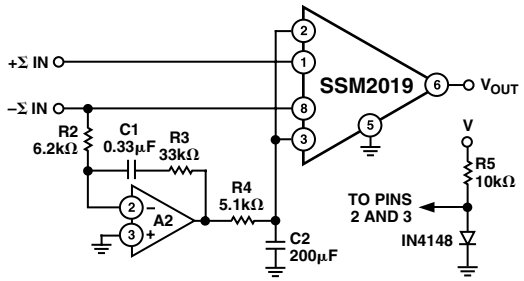
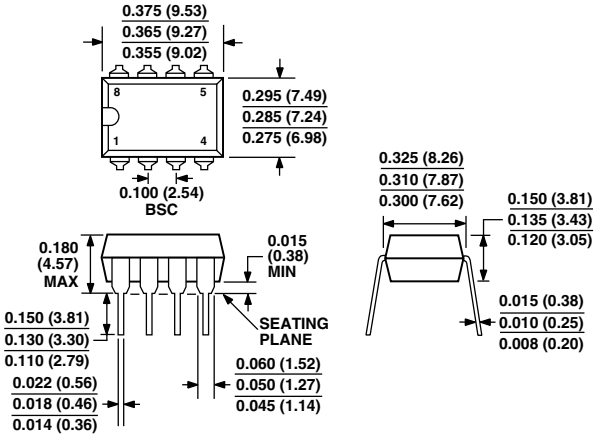


Figure 5. Bus Summing Amplifier

OUTLINE DIMENSIONS

8-Lead Plastic Dual In-Line Package [PDIP]
(N-8)

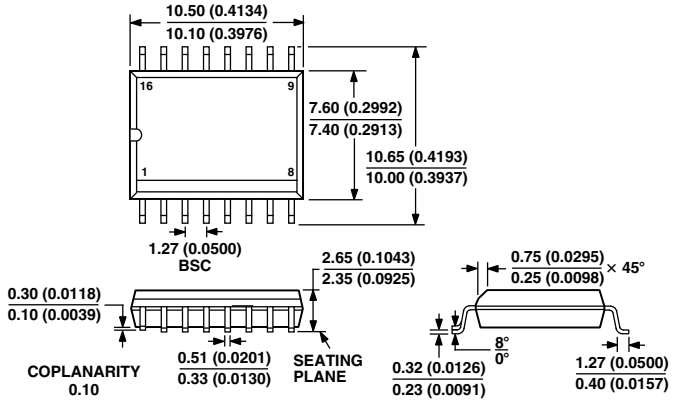
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-095AA
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

16-Lead Standard Small Outline Package [SOIC]
Wide Body
(RW-16)

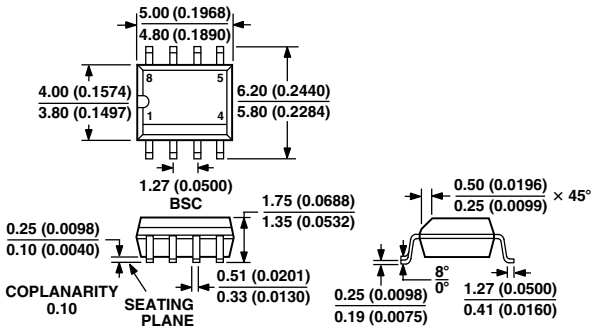
Dimensions shown in millimeters and (inches)



COMPLIANT TO JEDEC STANDARDS MS-013AA
CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

8-Lead Standard Small Outline Package [SOIC]*
Narrow Body
(RN-8)

Dimensions shown in millimeters and (inches)



COMPLIANT TO JEDEC STANDARDS MS-012AA
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