SSI2160

PROCIRCUIT™ VOLTAGE CONTROLLED AMPLIFIER

The SSI2160 is a budget single-channel VCA building block for high-performance audio applications. Voltage control of current-mode inputs and outputs allow an exponential gain range of +20dB to –100dB, with control provided by a ground-referenced –33mV/dB constant.

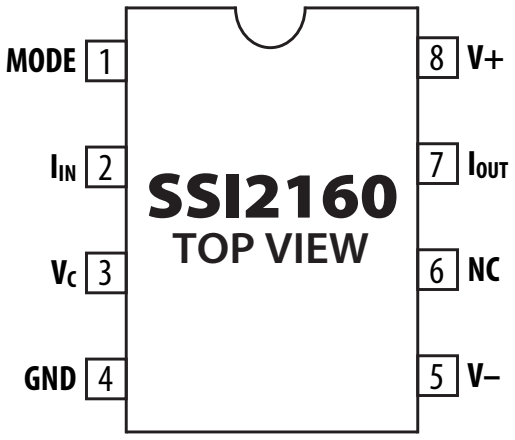
The device offers considerable flexibility for a wide range of design goals and applications. A unique mode control allows selection of Class A, Class AB, or in-between using a single resistor. The SSI2160 can be used as a high-quality building block for a variety of applications such as dynamic range processors, voltage controlled filters, exponential generators, and antilog converters.

The SSI2160 will operate on supplies as low as +8V for battery-powered devices such as guitar pedals, or up to ±18V in systems where maximum headroom is desired.

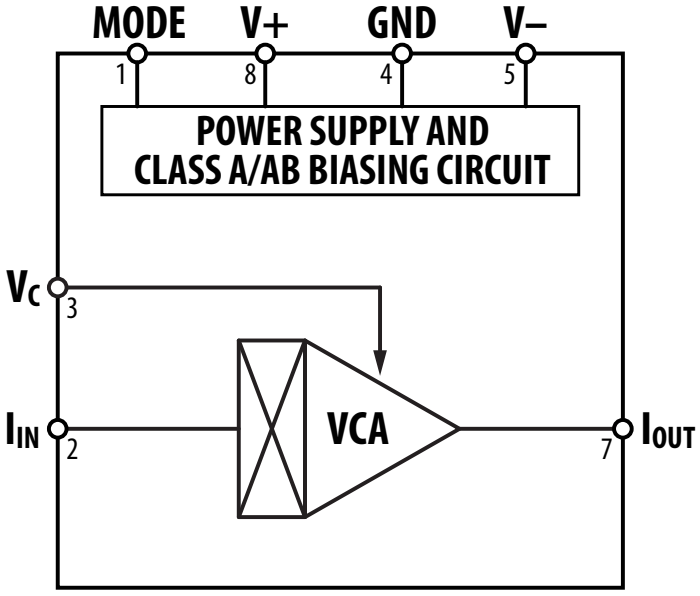
The SSI2160 is part of a family of affordable high-performance VCA's from Sound Semiconductor. The SSI2162 offers two channels with a small PCB footprint, the single-channel SSI2161 provides lowest noise, and the SSI2164 Quad VCA has become the industry-standard workhorse in countless applications.

FEATURES

- **Pro-Grade Exponential VCA for the Most Cost-Sensitive Applications**
- **High Input Current Handling 1mA**
- **Pin-Selectable Class A or AB Operation**
- **118dB Dynamic Range (Class AB)**
- **Low Distortion – Typical 0.025% (Class A)**
- **Large Gain Range: -100dB to +20dB**
- **±4V to ±18V Operation**
- **No External Trimming**
- **Low Control Feedthrough – Typical -60dB**



PIN CONNECTIONS
8-LEAD SOP



FUNCTIONAL BLOCK DIAGRAM

The SSI2160 is available exclusively from Sound Semiconductor and its authorized resellers
PO Box 1587, Arroyo Grande, CA 93421 USA, www.soundsemiconductor.com

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SPECIFICATIONS (V_S = ±15V, V_{IN} = 0.775V_{RMS}, f = 1kHz, A_V = 0dB, Class AB, T_A = 25°C; using Figure 1 circuit)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
POWER SUPPLY						
Supply Voltage Range	V_S		±4		±18	V
Supply Current	I_S	Class AB, V_C = GND		±xx	±xx	mA
Supply Current	I_S	Class A, V_C = GND, I_M = 1mA		±xx		mA
Power Supply Rejection Ratio	PSRR	60Hz		90		dB
CONTROL PORTS						
Input Impedance			9	10	11	kΩ
Gain Constant		After 60 seconds of operation		–33		mV/dB
Gain Constant Temp. Coefficient				–3300		ppm/°C
Control Feedthrough		A_V = 0dB to –40dB		–60		dB
Gain Accuracy		A_V = 0dB		+0.30		dB
		A_V = +20dB		-0.20		dB
		A_V = –20dB		+0.20		dB
Channel-to-Channel Gain Matching		A_V = 0dB		0.07		dB
		A_V = –40dB		0.24		dB
Maximum Attenuation				–100		dB
Maximum Gain				+20		dB
SIGNAL INPUTS						
Input Bias Current	I_B			±10		nA
Input Current Handling				1		mA_P
SIGNAL OUTPUTS						
Output Offset Current		V_{IN} = GND		±150		nA
Output Compliance				±100		mV
PERFORMANCE						
Output Noise		Class AB *(20Hz -20kHz, unweighted)*				
([1]I_M = <1mA)		$R_{IN/OUT}$ = 30kΩ		–93		dBu
		$R_{IN/OUT}$ = 20kΩ		–96		dBu
		$R_{IN/OUT}$ = 15kΩ		–98		dBu
		$R_{IN/OUT}$ = 7.5kΩ		–101		dBu
		Class A *(20Hz -20kHz, unweighted)*[1]				
		$R_{IN/OUT}$ = 30kΩ		–81		dBu
		$R_{IN/OUT}$ = 20kΩ		–84		dBu
		$R_{IN/OUT}$ = 15kΩ		–87		dBu
		$R_{IN/OUT}$ = 7.5kΩ		–92.5		dBu
Headroom	HR	1% THD		+22		dBu
Total Harmonic Distortion	THD	Class AB (*80kHz BW)*				
([1]I_M = <1mA)		A_V = 0dB		0.05		%
		A_V = 0dB, V_{IN} = –17dBu		0.025		%
		A_V = +20dB		0.20		%
		A_V = –20dB		0.045		%
		Class A (*80kHz BW)*[1]				
		A_V = 0dB		0.025		%
		A_V = 0dB, V_{IN} = –5dBu		0.015		%
		A_V = +20dB		0.17		%
		A_V = –20dB		0.025		%
Channel Separation				–110		dB
Unity Gain Bandwidth		C_F = 10pF		500		kHz
Slew Rate	SR	C_F = 10pF		700		µA/µs

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±20V
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-40°C to +85°C
Lead Temperature (Soldering, 10 sec)	260°C
Mode Current (I_M; Pin 1 to Pin 16 via R_M)	2.0mA
Control Pin Voltage (Pins 3, 6, 11, 14)	V- to V+

ORDERING INFORMATION

Part Number	Package Type/Container	Quantity
SSI2160S-TU	8-Lead SOP* - Tube	xx
SSI2160S-RT	8-Lead SOP* - Tape and Reel	xx

*SSI Package ID "**PSL8**", compliant with JEDEC MS-012-AA
Mechanical drawing available at www.soundsemiconductor.com

PIN DESCRIPTIONS

Pin(s)	Name	Description
1	MODE	Current into this pin sets VCA core to operate as Class A (lowest THD), AB (lowest noise), or inbetween, set by external resistor. Leave open for Class AB operation.
2	I_{IN}	Ground-referenced current input; requires RC network.
3	V_C	Ground-referenced control port with a –33mV-per-dB constant.
4	GND	Connect to analog signal ground with short, low inductance trace.
5	V–	Negative supply. Recommend 100nF local decoupling capacitor placed as close to package as possible with a low inductance trace to ground.
6	NC	Leave this pin unconnected.
7	I_{OUT}	Ground-referenced current ouput.
8	V+	Positive supply. Recommend 100nF local decoupling capacitor placed as close to package as possible with a low inductance trace to ground.

USING THE SSI2160

The SSI2160 is a single-channel voltage controlled amplifier with a control range from +20dB to –100dB. The VCA is a current-in, current-out device with a separate voltage control port. Basic operation is described below; see the "Principles of Operation" section for further details on inner workings of the device and an application section that follows.

Signal Inputs

Figure 1 shows the basic application circuit for one channel. Resistor R_{IN} converts the input voltage to an current, and a 221Ω resistor in series with a 1200pF capacitor connected to ground ensures stable operation. The SSI2164 is quite tolerant of RC network selection, but 221Ω/1200pF has been proven to work well over a wide range of R_{IN} values.

A 20kΩ value for R_{IN} is recommended for most applications, but can range from 7.5kΩ to 100kΩ – lower values will produce the best noise performance at some cost in distortion and headroom.

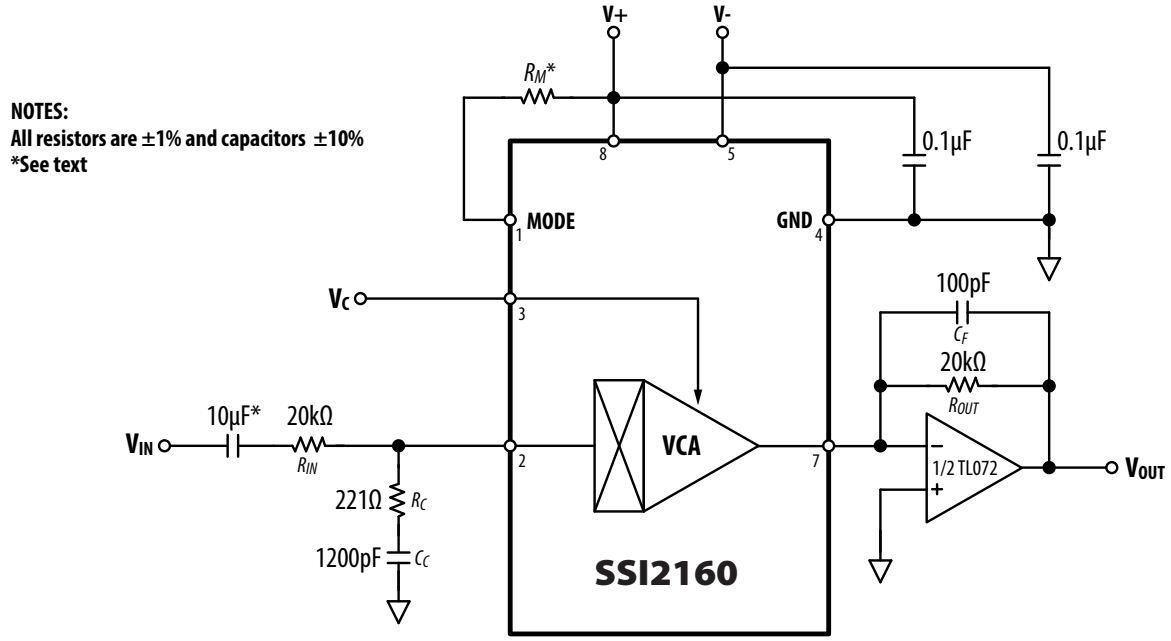

Figure 1: Typical Application Circuit