

SSI2162

FATKEYS™ DUAL VOLTAGE CONTROLLED AMPLIFIER

The SSI2162 is a versatile VCA building block for high-performance audio applications. Two independent channels provide voltage control of current-mode inputs and outputs for a gain range from +20dB to -100dB, with control provided by a ground-referenced -33mV/dB constant.

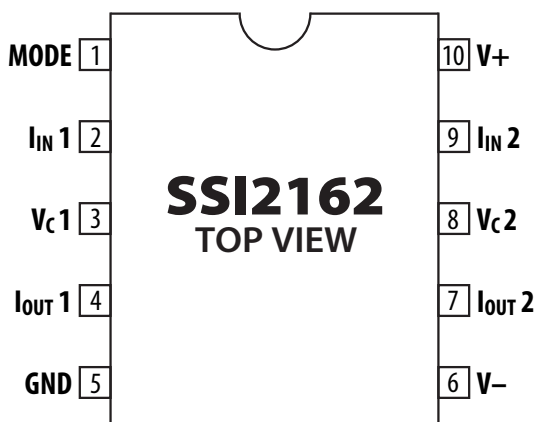
The device offers considerable flexibility for a wide range of design goals and applications. A unique mode control allows selection of Class A, Class AB, or in-between using a single resistor. In addition, improved current handling allows use of lower value input resistors for reduced output noise without loss of headroom. Both channels can be parallel-connected for further noise improvement. Finally, SSI2162 VCA channels can be used as high-quality OTA building blocks for a variety of applications such as voltage controlled filters, exponential generators, and antilog converters.

The SSI2162 will operate on supplies as low as +8V for battery-powered devices such as guitar pedals, or up to $\pm 18V$ in systems where maximum headroom is desired.

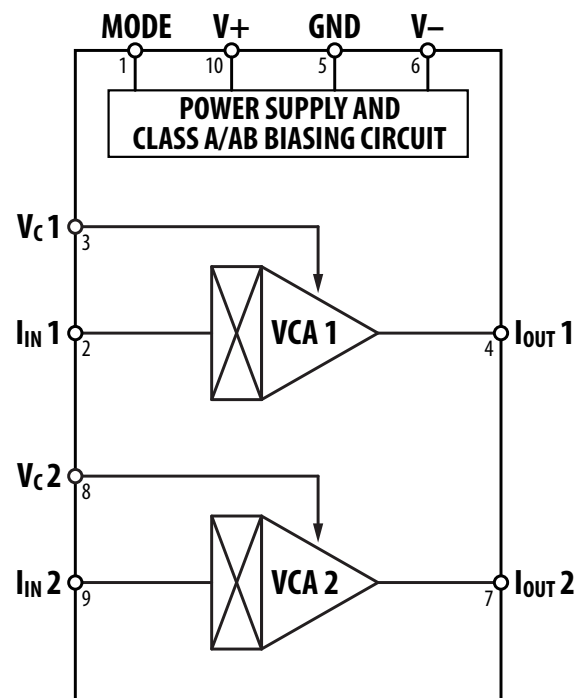
The SSI2162 is part of a family of affordable high-performance VCA's from Sound Semiconductor. The SSI2164 offers four VCA's in a compact SOP package with lowest cost-per VCA, and the single-channel SSI2161 provides lowest noise.

FEATURES

- Two High-Performance VCA's in a Single Package
- Pin-Selectable Class A or AB Operation
- 3dB Lower Noise than SSI2164
- 123dB Dynamic Range (Class AB)
- Low Distortion – Typical 0.025% (Class A)
- Large Gain Range: -100dB to +20dB
- Ultra-Compact 10-Lead SSOP Package
- $\pm 4V$ to $\pm 18V$ Operation
- No External Trimming
- Low Control Feedthrough – Typically -60dB



PIN CONNECTIONS
10-LEAD SSOP



**FUNCTIONAL BLOCK
DIAGRAM**

SPECIFICATIONS ($V_S = \pm 15V$, $V_{IN} = 0.775V_{RMS}$, $f = 1kHz$, $A_V = 0dB$, Class AB, $T_A = 25^\circ C$; using Figure 1 circuit without diode)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|--|--------|---|---------|------------|----------|-----------------|
| POWER SUPPLY | | | | | | |
| Supply Voltage Range | V_S | | ± 4 | | ± 18 | V |
| Supply Current | I_S | Class AB, $V_C = GND$ | | ± 6 | ± 8 | mA |
| Supply Current | I_S | Class A, $V_C = GND$, $I_M = 1mA$ | | ± 8.0 | | mA |
| Power Supply Rejection Ratio | PSRR | 60Hz | | 90 | | dB |
| CONTROL PORTS | | | | | | |
| Input Impedance | | | 4.5 | 5 | 5.5 | k Ω |
| Gain Constant | | After 60 seconds of operation | | -33 | | mV/dB |
| Gain Constant Temp. Coefficient | | | | -3300 | | ppm/ $^\circ C$ |
| Control Feedthrough | | $A_V = 0dB$ to $-40dB$ | | -60 | | dB |
| Gain Accuracy | | $A_V = 0dB$ | | ± 0.30 | | dB |
| | | $A_V = +20dB$ | | ± 0.55 | | dB |
| | | $A_V = -20dB$ | | ± 0.55 | | 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 | | | | 1.9 | | mA _P |
| SIGNAL OUTPUTS | | | | | | |
| Output Offset Current | | $V_{IN} = GND$ | | ± 150 | | nA |
| Output Compliance | | | | ± 100 | | mV |
| PERFORMANCE | | | | | | |
| Output Noise ($I_M = 1mA$) | | Class AB (20Hz - 20kHz, unweighted) | | | | |
| | | $R_{IN/OUT} = 15k\Omega$ | | -96 | | dBu |
| | | $R_{IN/OUT} = 10k\Omega$ | | -99 | | dBu |
| | | $R_{IN/OUT} = 7.5k\Omega$ | | -101 | | dBu |
| | | $R_{IN/OUT} = 3.74k\Omega$ | | -105 | | dBu |
| | | Class A (20Hz - 20kHz, unweighted) ¹ | | | | |
| | | $R_{IN/OUT} = 15k\Omega$ | | -84 | | dBu |
| | | $R_{IN/OUT} = 10k\Omega$ | | -88 | | dBu |
| | | $R_{IN/OUT} = 7.5k\Omega$ | | -90 | | dBu |
| | | $R_{IN/OUT} = 3.74k\Omega$ | | -96 | | dBu |
| Headroom | HR | 1% THD | | +22 | | dBu |
| Total Harmonic Distortion ($I_M = 1mA$) | THD | Class AB (80kHz BW) | | | | |
| | | $A_V = 0dB$ | | 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 | | $\mu A/\mu s$ |

ABSOLUTE MAXIMUM RATINGS

| | |
|--|---------------------------------|
| Supply Voltage | $\pm 20V$ |
| Storage Temperature Range | $-65^\circ C$ to $+150^\circ C$ |
| Operating Temperature Range | $-40^\circ C$ to $+85^\circ C$ |
| Lead Temperature (Soldering, 10 sec) | $260^\circ C$ |
| Mode Current (I_M ; Pin 1 to Pin 10 via R_M) | 2.0mA |
| Control Pin Voltage (Pins 3, 8) | V- to V+ |

ORDERING INFORMATION

| Part Number | Package Type/Container | Quantity |
|--------------|-------------------------------|----------|
| SSI2162SS-TU | 10-Lead SSOP* - Tube | 100 |
| SSI2162SS-RT | 10-Lead SSOP* - Tape and Reel | 4000 |

*SSI Package ID "PSSL10"

 Mechanical drawing available at www.soundsemiconductor.com

Features and specifications are subject to change without notice. While Sound Semiconductor strives to provide accurate and reliable information, no responsibility is assumed for use of its products, infringement of intellectual property, or other rights of third parties as a result of such use.

PIN DESCRIPTIONS ("x" refers to one of the two channels)

| 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, 9 | I _{IN} x | Ground-referenced current inputs; each requires RC network. |
| 3, 8 | V _C x | Ground-referenced control port with a -33mV-per-dB constant. |
| 4, 7 | I _{OUT} x | Ground-referenced current output. |
| 5 | GND | Connect to analog signal ground with short, low inductance trace. |
| 6 | V- | Negative supply. Recommend 100nF local decoupling capacitor placed as close to package as possible with a low inductance trace to ground. |
| 10 | V+ | Positive supply. Recommend 100nF local decoupling capacitor placed as close to package as possible with a low inductance trace to ground. |

USING THE SSI2162

The SSI2162 is a two-channel voltage controlled amplifier with a control range from +20dB to -100dB. Each VCA is an independent current-in, current-out device with a separate exponential voltage control port. Only the mode control affects both channels; otherwise designers have great latitude on use of each channel for a given application. 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. A resistor converts the input voltage to an input current, and a 110Ω resistor in series with a 2200pF capacitor connected to ground ensures stable operation. The SSI2162 is quite tolerant of RC network selection, but 110Ω/2200pF has been proven to work well over a wide range of R_{IN} values.

A 10kΩ value for R_{IN} is recommended for most applications, but can range from 3.75kΩ to 100kΩ – lower values will produce the best noise performance at some cost in distortion.

Maximum input current handling is approximately 2mA peak. This input current "headroom" is only likely to be a consideration when using R_{IN} values of 10kΩ and below with supplies of ±12V and higher. In such cases, one may want to design the signal chain for a maximum input current of 1.8mA to allow adequate headroom.

An optional series-connected 22μF capacitor is recommended for improved control feedthrough.

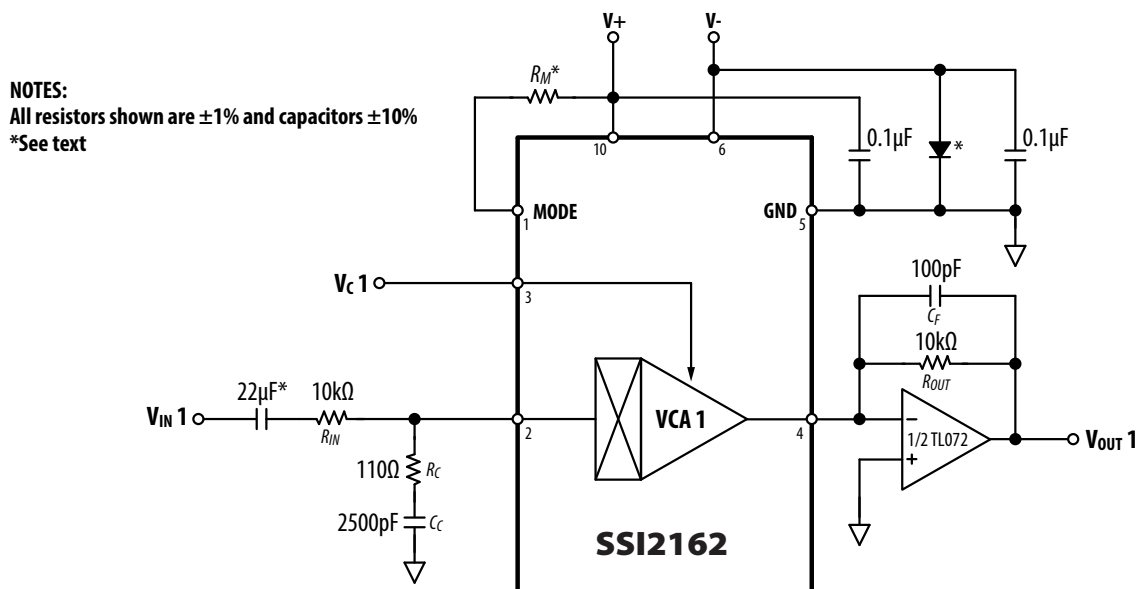


Figure 1: Typical Application Circuit