Microphone Preamplifier with Variable Compression and Noise Gating

SSM2165*

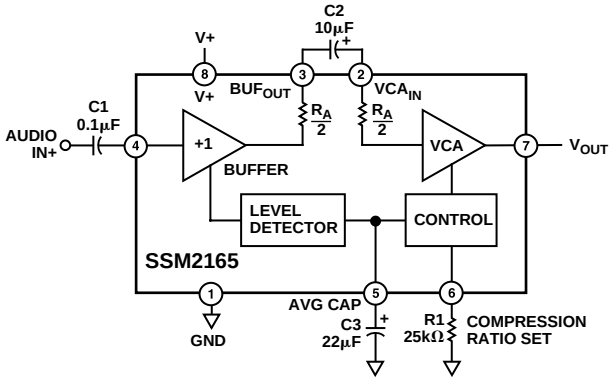
FEATURES

Complete Microphone Conditioner in an 8-Lead Package
Single 5 V Operation
Preset Noise Gate Threshold
Compression Ratio Set by External Resistor
Automatic Limiting Feature Prevents ADC Overload
Adjustable Release Time
Low Noise and Distortion
20 kHz Bandwidth (±1 dB)
Low Cost

APPLICATIONS

Microphone Preamplifier/Processor
Computer Sound Cards
Public Address/Paging Systems
Communication Headsets
Telephone Conferencing
Guitar Sustain Effects Generator
Computerized Voice Recognition
Surveillance Systems
Karaoke and DJ Mixers

FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The SSM2165 is a complete and flexible solution for conditioning microphone inputs in computer audio systems. It is also excellent for improving vocal clarity in communications and public address systems. A low noise voltage controlled amplifier (VCA) provides a gain that is dynamically adjusted by a control loop to maintain a set compression characteristic. The compression ratio is set by a single resistor and can be varied from 1:1 to over 15:1 relative to the fixed rotation point. Signals above the rotation point are limited to prevent overload and to eliminate "popping." A downward expander (noise gate) prevents amplification of noise or hum. This results in optimized signal levels prior to digitization, thereby eliminating the need for additional gain or attenuation in the digital domain that could add noise or impair accuracy of speech recognition algorithms. The flexibility of setting the compression ratio and the time constant of the level detector, coupled with two values of rotation point, make the SSM2165 easy to integrate in a wide variety of microphone conditioning applications.

The SSM2165 is an ideal companion product for audio codecs used in computer systems, such as the AD1845 and AD1847. The device is available in 8-lead SOIC and P-DIP packages, and guaranteed for operation over the extended industrial temperature range of –40°C to +85°C. As shown in Figure 1a, the SSM2165-1 has a rotation point of –25.7 dBu (40 mV)[1], a VCA gain of 18 dB, and gives –7.7 dBu (320 mV) before limiting. As shown in Figure 1b, the SSM2165-2 has a rotation point of –17.8 dBu (100 mV), a VCA gain of 8 dB and gives –9.8 dBu (250 mV) before limiting. Both have a noise gate threshold of –64 dBu (500 µV), below which downward expansion reduces the gain with a ratio of approximately 1:3. That is, a –3 dB reduction of output signal occurs with a –1 dB reduction of input signal. For applications requiring adjustable noise gate threshold, VCA gain up to 18 dB, and adjustable rotation point, please refer to the SSM2166.

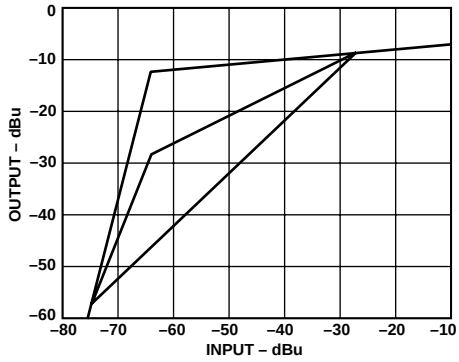


Figure 1a. SSM2165-1 Compression and Gating Characteristics

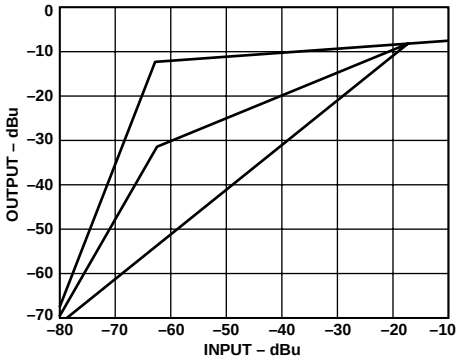


Figure 1b. SSM2165-2 Compression and Gating Characteristics

*Patents pending.

[1]All signals are in rms volts or dBu (0 dBu = 0.775 V rms).

REV. B

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 **www.analog.com**
Fax: 781/326-8703

SSM2165–SPECIFICATIONS (V+ = 5 V, f = 1 kHz, R_L = 100 kΩ, R_{COMP} = 0 Ω, T_A = 25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
AUDIO SIGNAL PATH						
Voltage Noise Density	e_n	15:1 Compression, V_{IN} = GND		17		nV/√Hz[2]
Noise		20 kHz Bandwidth, V_{IN} = GND		–109		dBu[1]
Total Harmonic Distortion	THD+N					
SSM2165-1		2nd and 3rd Harmonics, V_{IN} = –30 dBu		0.2	0.5	%
SSM2165-2		2nd and 3rd Harmonics, V_{IN} = –20 dBu		0.2	0.5	%
		22 kHz Low-Pass Filter				
Input Impedance	Z_{IN}			180		kΩ
Output Impedance	Z_{OUT}			75		Ω
Load Drive		Resistive	5			kΩ
		Capacitive			2	nF
Input Voltage Range		1% THD		1		V rms
Output Voltage Range		1% THD		1.4		V rms
Gain Bandwidth Product		1:1 Compression				
SSM2165-1		VCA G = 18 dB		300		kHz
SSM2165-2		VCA G = 8 dB		100		kHz
CONTROL SECTION						
VCA Dynamic Gain Range				40		dB
VCA Fixed Gain						
SSM2165-1				18		dB
SSM2165-2				8		dB
Rotation Point						
SSM2165-1				40		mV rms
SSM2165-2				100		mV rms
Compression Ratio, Min				1:1		
Compression Ratio, Max				15:1		
Control Feedthrough		15:1 Compression		±5		mV
POWER SUPPLY						
Supply Voltage Range	V_S		4.5		5.5	V
Supply Current	I_{SY}			7.5	10	mA
Quiescent Output Voltage Level				2.2		V
Power Supply Rejection Ratio[2]	PSRR			50		dB

NOTES
[1]0 dBu = 0.775 V rms.
[2]Referred to input.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage . . . . . 10 V
Audio Input Voltage . . . . . Supply Voltage
Operating Temperature Range . . . . . –40°C to +85°C
Storage Temperature Range . . . . . –65°C to +150°C
Junction Temperature (T_J) . . . . . 150°C
Lead Temperature (Soldering, 60 sec) . . . . . 300°C

ESD RATINGS

883 (Human Body) Model . . . . . 2.0 kV

THERMAL CHARACTERISTICS

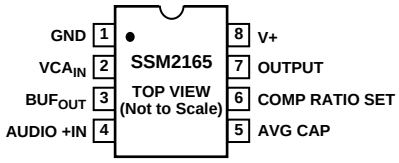
Thermal Resistance
8-Lead Plastic DIP
θ_{JA} . . . . . 103°C/W
θ_{JC} . . . . . 43°C/W
8-Lead SOIC
θ_{JA} . . . . . 158°C/W
θ_{JC} . . . . . 43°C/W

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Options
SSM2165-1P*	–40°C to +85°C	Plastic DIP	N-8
SSM2165-1S	–40°C to +85°C	Narrow SOIC	SO-8
SSM2165-2S	–40°C to +85°C	Narrow SOIC	SO-8

*Not for new design, obsolete April 2002.

PIN CONFIGURATION



PIN FUNCTION DESCRIPTIONS

Pin #	Mnemonic	Function
1	GND	Ground
2	VCA_{IN}	VCA Input Pin. A typical connection is a 1 µF–10 µF capacitor from the buffer output pin (Pin 3) to this pin.
3	BUF_{OUT}	Input Buffer Amplifier Output Pin. Must not be loaded by capacitance to ground.
4	AUDIO +IN	Input Audio Signal. The input signal should be ac-coupled (0.1 µF typical) into this pin.
5	AVG CAP	Detector Averaging Capacitor. A capacitor, 2.2 µF–22 µF, to ground from this pin is the averaging capacitor for the detector circuit.
6	COMP RATIO SET	Compression Ratio Set Pin. A resistor to ground from this pin sets the compression ratio as shown in TPC 1.
7	OUTPUT	Output Signal.
8	V+	Positive Supply, 5 V Nominal.

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 SSM2165 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.