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Low Voltage Microphone Preamplifier with Variable Compression & Noise Gating

FEATURES

- Complete Microphone Conditioner in a 10-Pin Package
- Single +3 V Operation
- Low Shutdown Current < 50 μ A
- Preset Noise Gate Threshold
- Settable Compression Ratio
- Automatic Limiting Feature Prevents ADC Overload
- Adjustable Release Time
- Low Noise and Distortion
- Low Distortion: 0.2% THD + N
- 20 kHz Bandwidth (61 dB)

APPLICATIONS

- Desktop, Portable or Palmtop Computers
- Telephone Conferencing
- Communication Headsets
- 2-Way Communications
- Surveillance Systems
- Karaoke and DJ Mixers

GENERAL DESCRIPTION

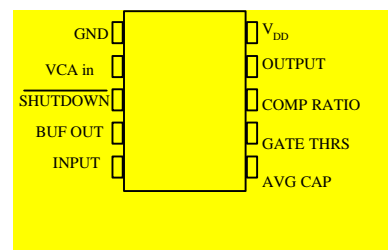
The SSM2167 is a complete and flexible solution for conditioning microphone inputs in personal electronics and computer audio systems. It is also excellent for improving vocal clarity in communications and public address systems. A low noise voltage controlled amplifier (VCA) provides a gain that is 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 10:1 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 background 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 SSM2167 easy to integrate in a wide variety of microphone conditioning applications.

The SSM2167 is available in two versions, with different amounts of fixed gain. The SSM2167-1 has 18 dB of fixed gain, and the SSM2167-2 features only 8 dB of fixed gain.

The device is available in 10-pin MSOP package, and guaranteed for operation over the extended industrial temperature range of -40°C to $+85^{\circ}\text{C}$.

PIN CONFIGURATION 10-Lead MSOP (RM Suffix)



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ELECTRICAL SPECIFICATIONS

($V_S=+3V$, $f=1\text{ kHz}$, $R_L=100\text{ k}\Omega$, $R_{COMP}=0\Omega$, $T_A=+25^\circ\text{C}$, $V_{in}=100\text{ mV rms}$, $R_{GATE}=2\text{ k}\Omega$ unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|-----------------------------------|-----------|---|-----|------|-----|------------------------|
| AUDIO SIGNAL PATH | | | | | | |
| Voltage Noise Density | e_n | 10:1 Compression | | 20 | | nV/ $\sqrt{\text{Hz}}$ |
| Noise | | 20 kHz Bandwidth, $V_{in} = \text{GND}$ | | -70 | | dBV |
| Total Harmonic Distortion + Noise | THD+N | $V_{in} = -20\text{ dBu}$ | | | | |
| SSM2167-2 | | | | .25 | | % |
| SSM2167-1 | | | | .25 | | % |
| Input Impedance | ZIN | | | 100 | | k Ω |
| Output Impedance | ZOUT | | | 75 | | Ω |
| Load Drive | | Minimum Resistive Load | | 5 | | k Ω |
| | | Maximum Capacitive Load | | 2 | | nF |
| Input Voltage Range | | (TBD) % THD | | TBD | | mV rms |
| Output Voltage Range | | (TBD) % THD | | | | mV rms |
| SSM2167-1 | | | | TBD | | |
| SSM2167-2 | | | | TBD | | |
| Gain Bandwidth Product | | 1:1 Compression | | | | |
| SSM2167-1 | | VCA G = 18 dB | | | | MHz |
| SSM2167-2 | | VCA G = 8 dB | | 30 | | MHz |
| CONTROL SECTION | | | | | | |
| VCA Dynamic Gain Range | | | | 40 | | dB |
| VCA Fixed Gain | | | | | | |
| SSM2167-1 | | | | 18 | | dB |
| SSM2167-2 | | | | 8 | | dB |
| Compression Ratio, Min | | | | 1:1 | | |
| Compression Ratio, Max | | See Figure for Rcomp | | 10:1 | | |
| Rotation Point | SSM2167-1 | | | 63 | | mV RMS |
| 1 | SSM2167-2 | | | 100 | | mV RMS |
| Noise Gate Range | | Maximum Threshold | | -40 | | dBV |
| POWER SUPPLY | | | | | | |
| Supply Voltage | V_{SY} | | 2.5 | | 5.5 | V |
| Supply Current | I_{SY} | | | 5 | | mA |
| DC Output Voltage | | | | 1 | | V |
| Power Supply Rejection Ratio | PSRR | $V_{SY} = +2.5\text{V to }+6\text{V}$ | | 50 | | dB |
| SHUTDOWN | | | | | | |

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Supply Current

ISY | Pin 3 = GND

50

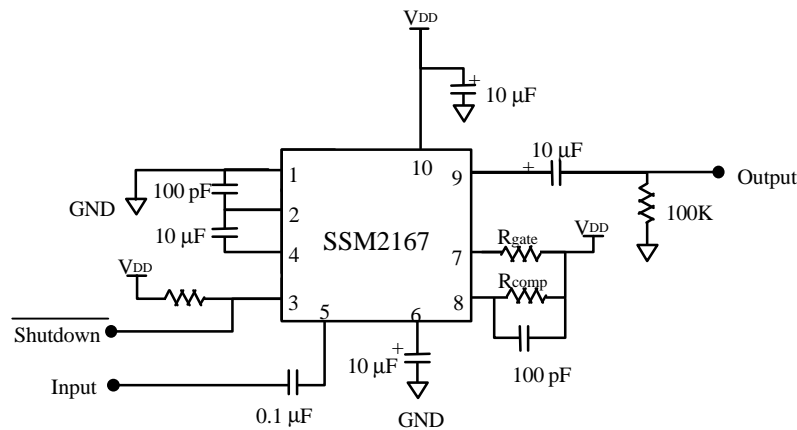
μA

Application Information

The SSM2167 is available in two versions, noted as "SSM2167-1" and "SSM2167-2".

The SSM2167-1 features 18 dB of fixed gain and is appropriate for applications that require a line level output as well as replacing existing microphone preamplifiers. For applications which require a microphone level output the SSM2167-2 features only 8 dB of fixed gain. The SSM2167-2 is ideal for enhancing the performance of an existing system that does not usually use a microphone preamplifier.

Typical Application Circuit



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Setting the Compression Ratio and Noise Gate.

The Compression Ratio can be varied from 1:1 to 10:1 according to the table below.

| Compression Ratio | Value of R_{comp} |
|-------------------|----------------------|
| 1:1 | 0 ohms (short to V+) |
| 2:1 | 15k |
| 3:1 | 35k |
| 5:1 | 75k |
| 10:1 | 175k |

Shorting the resistor to the positive rail can disable the Compression function, however if a compression resistor will be used, we recommend using a value greater than 5 k Ω . If lower than 5 k Ω is used, the device may interpret this as a short, 0 ohms.

Setting the Compression Ratio and Noise Gate. (Cont.)

The Noise gate can be varied from -40 dBV to -55dBV, according to the table below.

| Noise gate | Value of R_{gate} |
|------------|----------------------|
| -40dBV | 0 ohms (short to V+) |
| -48dBV | 1k |
| -54dBV | 2k |
| -55dBV | 3k |

Note: 0dBV=1Vrms, so -40dBV is 10mV input signal. We do not recommend more than 5k for the Rgate resistor as the noise floor of the SSM2167 prevents the noise gate from being lowered further without causing problems.

ABSOLUTE MAXIMUM RATINGS¹

Supply Voltage.....6V
 Input VoltageTBD
 Operating Temperature Range.....-40°C to +85°C
 Junction Temperature..... +150°C
 Lead Temperature Range (Soldering, 10 Sec)..... +300°C

| Package Type | Θ_{JA1} | Θ_{JC} | Units |
|-------------------|----------------|---------------|-------|
| 10 Lead MSOP (RM) | 180 | 35 | °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 listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ORDERING GUIDE

| Model | Temperature Range | Package Description | Package Options |
|------------------|-------------------|------------------------------------|-----------------|
| SSM2167-1RM-Reel | -40°C to +85°C | 10-Lead Micro Small Outline (MSOP) | RM-10 |
| SSM2167-2RM-Reel | -40°C to +85°C | 10-Lead Micro Small Outline (MSOP) | RM-10 |

CAUTION

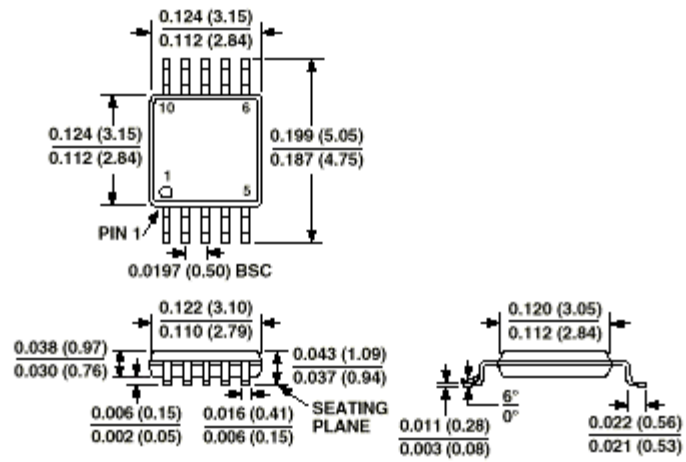
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this device features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



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