



### FEATURES

- Very Low Input Noise Voltage .....  $3.5\text{nV}/\sqrt{\text{Hz}}$  Typ
- Wide Small-Signal Bandwidth .....  $10\text{MHz}$  Typ
- High Current Drive Capability  
( $10\text{V}_{\text{RMS}}$  into  $600\Omega$  @  $V_S = \pm 18\text{V}$ )
- High Slew Rate .....  $13\text{V}/\mu\text{s}$  Typ
- Wide Power Bandwidth .....  $200\text{kHz}$  Typ
- High Open-Loop Gain .....  $200\text{V}/\text{mV}$  Typ
- Extended Industrial  
Temperature Range .....  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$
- Direct Replacement for Industry Standard 5534AN

### APPLICATIONS

- High Quality Audio Amplifiers
- Telephone Channel Amplifiers
- Active Filter Designs
- Microphone Preamplifiers
- Audio Line Drivers
- Low-Level Signal Detection
- Servo Control Systems

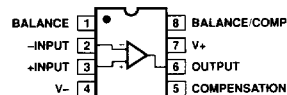
### GENERAL DESCRIPTION

The SSM-2134 is a high performance low noise operational amplifier which offers exceptionally low voltage noise of  $3.5\text{nV}/\sqrt{\text{Hz}}$ , outstanding output drive capability, and very high small-signal and power bandwidth. This makes the SSM-2134 an ideal choice for use in high quality and professional audio equipment, instrumentation, and control circuits.

The SSM-2134 is internally compensated for  $A_v \geq 3$ . However, the frequency response can be optimized with an external compensation capacitor to enable the SSM-2134 to operate at unity-gain or drive large capacitive loads.

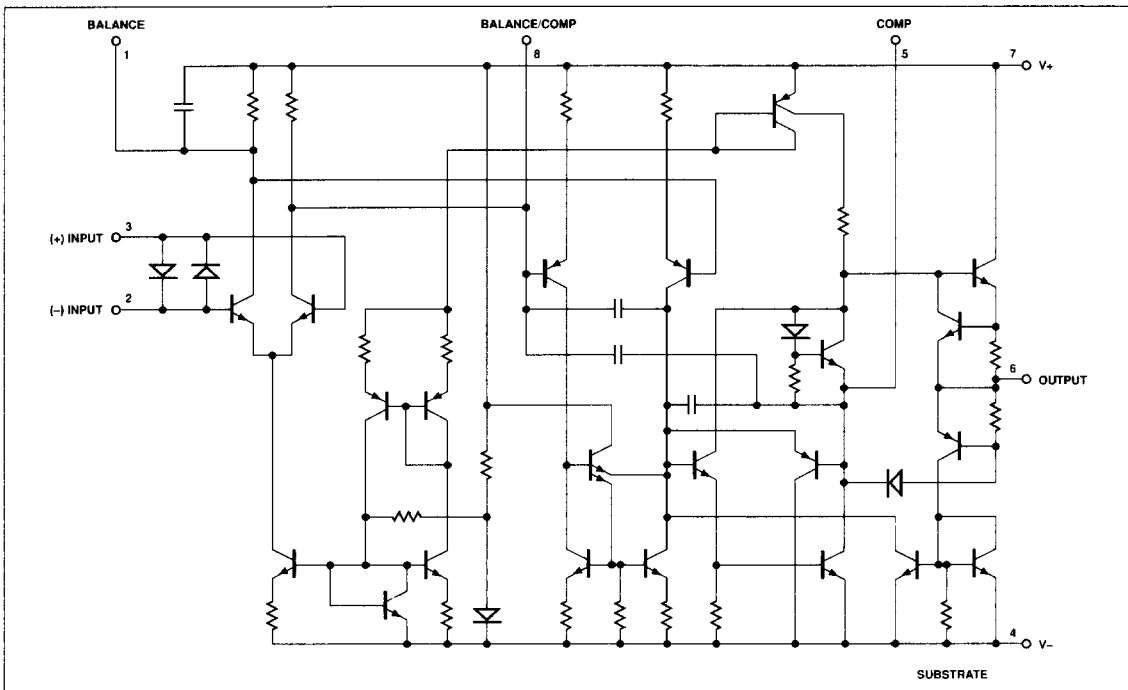
The SSM-2134 is offered in an 8-pin plastic DIP and its performance and characteristics are guaranteed over the extended industrial temperature range of  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

### PIN CONNECTIONS



**8-PIN  
EPOXY DIP  
(P-Suffix)**

### SIMPLIFIED SCHEMATIC



# SSM-2134

## ORDERING INFORMATION

PACKAGE	OPERATING TEMPERATURE RANGE
SSM2134P 8-Pin Plastic	-40°C to +85°C

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±22V
Differential Input Voltage (Note 1)	±0.5V
Input Voltage (Note 2)	±22V

Power Dissipation	300mW
Derate Above +24°C	2.5mW/°C
Short-Circuit Duration (Note 3)	Indefinite
Operating Temperature Range	-40°C to +85°C
Storage Temperature	-60°C to +150°C

### NOTES:

- The SSM-2134's inputs are protected by diodes. Current limiting resistors are not used in order to achieve low noise. If differential input voltage exceeds ±0.6V, the input current should be limited to 10mA.
- For supply voltages less than ±22V, the absolute maximum input voltage is equal to the supply voltage.
- Output may be shorted to ground at  $V_S = \pm 15V$ ,  $T_A = +25^\circ C$ . Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

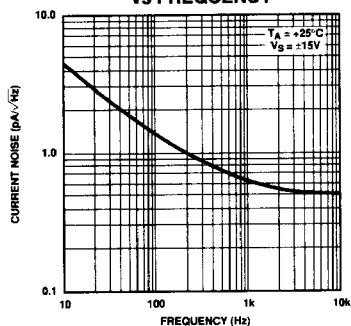
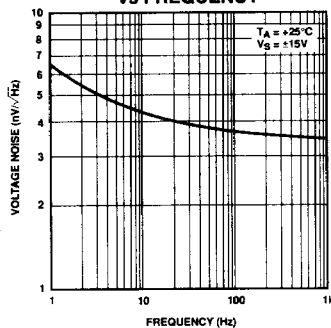
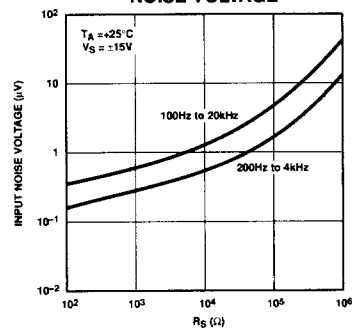
## ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$ and $T_A = +25^\circ C$ , unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	SSM-2134P			UNITS
			MIN	TYP	MAX	
Input Offset Voltage	$V_{OS}$	$-40^\circ C \leq T_A \leq +85^\circ C$	—	0.3 0.4	2 3	mV
Input Offset Current	$I_{OS}$	$-40^\circ C \leq T_A \leq +85^\circ C$	—	15 25	300 400	nA
Input Bias Current	$I_B$	$-40^\circ C \leq T_A \leq +85^\circ C$	—	350 500	1500 2000	nA
Large-Signal Voltage Gain	$A_{VO}$	$R_L \geq 600\Omega$ , $V_O = \pm 10V$	25	200	—	V/mV
		$R_L \geq 600\Omega$ , $V_O = \pm 10V$ $-40^\circ C \leq T_A \leq +85^\circ C$	15	150	—	
Supply Current	$I_{SV}$	No Load	—	4.5	6.5	mA
Output Voltage Swing	$V_O$	$V_S = \pm 15V$ , $R_L \geq 600\Omega$	±12	±13	—	V
		$V_S = \pm 18V$ , $R_L \geq 600\Omega$	±15	±16	—	
Output Short-Circuit Current	$I_{SC}$	(Note 1)	—	65	—	mA
Input Resistance-Differential-Mode	$R_{IN}$	(Note 2)	30	100	—	kΩ
Input Voltage Range	IVR		±12	±13	—	V
Common-Mode Rejection	CMR	$V_{CM} = \pm 12V$	70	114	—	dB
Power Supply Rejection Ratio	PSRR		—	6	100	μV/V
Rise Time	$t_r$	$R_L \geq 600\Omega$ , $C_C = 22pF$	—	20	—	ns
Overshoot	OS	$C_L = 100pF$	—	20	—	%
AC Gain		$C_C = 0$ , $f_O = 10kHz$	—	6	—	V/mV
		$C_C = 22pF$ , $f_O = 10kHz$	—	2.2	—	
Unity-Gain Bandwidth	GBW	$C_C = 22pF$ , $C_L = 100 pF$	—	10	—	MHz
Slew Rate	SR	$C_C = 0$	—	13	—	V/μs
		$C_C = 22pF$	—	6	—	
Full Power Bandwidth	$BW_P$	$V_O = \pm 10V$ , $C_C = 22pF$	—	95	—	kHz
		$C_C = 0$	—	200	—	
Input Noise Voltage Density	$e_n$	$f_O = 30Hz$	—	5.5	7.0	nV/√Hz
		$f_O = 1kHz$	—	3.5	4.5	
Input Noise Current Density	$i_n$	$f_O = 30Hz$	—	2.5	—	pA/√Hz
		$f_O = 1kHz$	—	0.6	—	
Broadband Noise Figure	$F_N$	$R_S = 5k\Omega$ , $f = 10Hz$ to $20kHz$	—	0.7	—	dB
Total Harmonic Distortion	THD	$V_{IN} = 3V_{RMS}$ , $A_V = +1000$ , $R_L = 2k\Omega$	—	0.025	—	%

### NOTES:

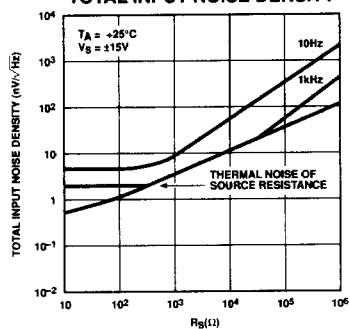
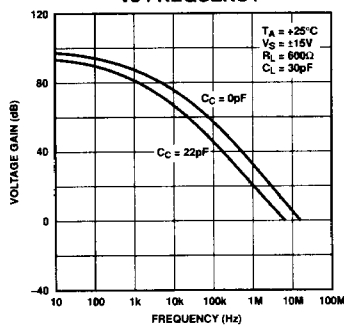
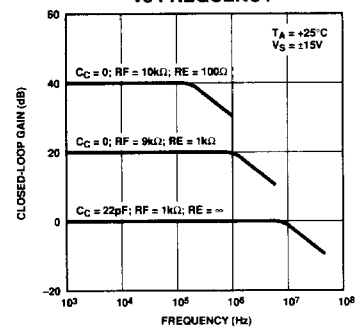
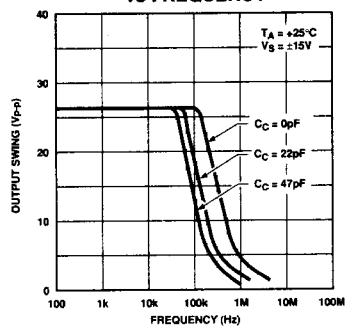
- Output may be shorted to ground at  $V_S = \pm 15V$ ,  $T_A = +25^\circ C$ . Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.
- Guaranteed by design.

Specifications subject to change. Consult latest data sheet.

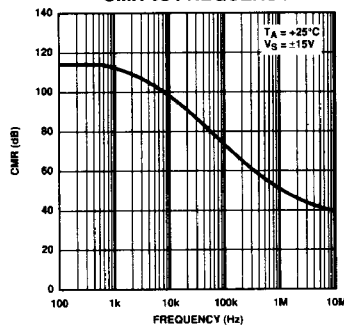
TYPICAL PERFORMANCE CHARACTERISTICS *Continued*CURRENT NOISE DENSITY  
vs FREQUENCYVOLTAGE NOISE DENSITY  
vs FREQUENCYBROADBAND INPUT  
NOISE VOLTAGE

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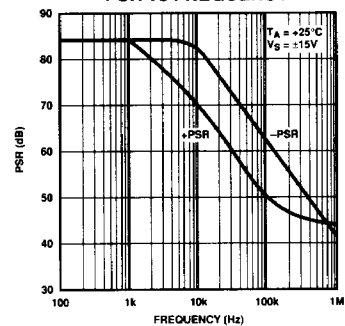
TOTAL INPUT NOISE DENSITY

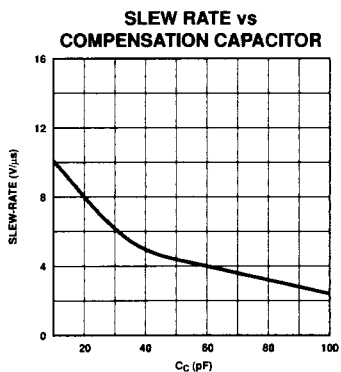
OPEN-LOOP GAIN  
vs FREQUENCYCLOSED-LOOP GAIN  
vs FREQUENCYOUTPUT VOLTAGE SWING  
vs FREQUENCY

CMR vs FREQUENCY

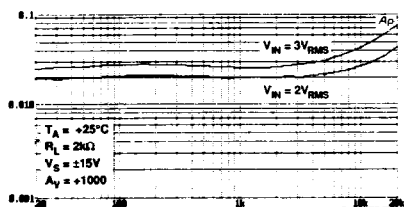


PSR vs FREQUENCY

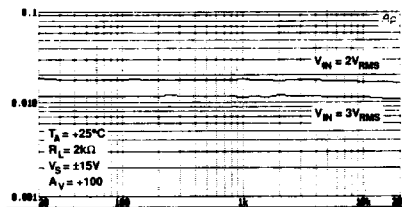




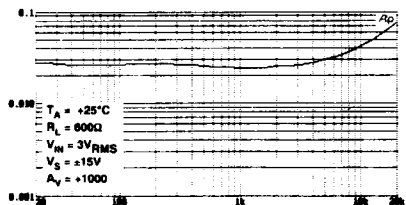
TOTAL HARMONIC DISTORTION vs FREQUENCY



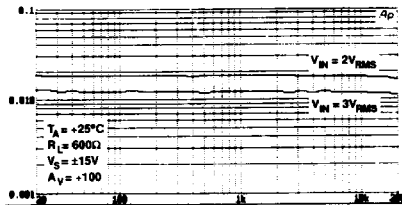
TOTAL HARMONIC DISTORTION vs FREQUENCY



TOTAL HARMONIC DISTORTION vs FREQUENCY

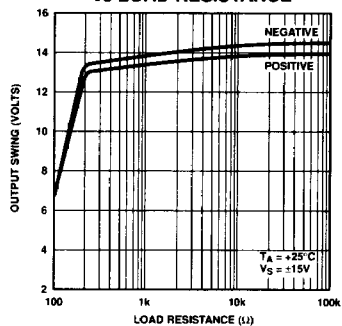
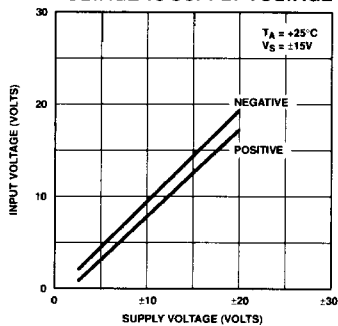
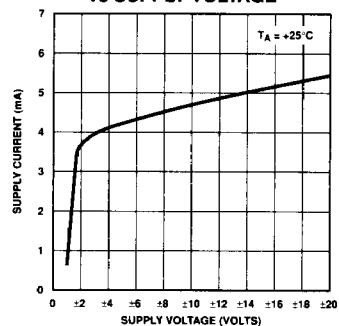
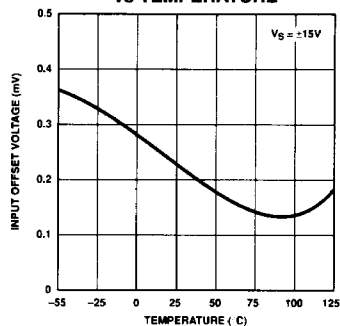
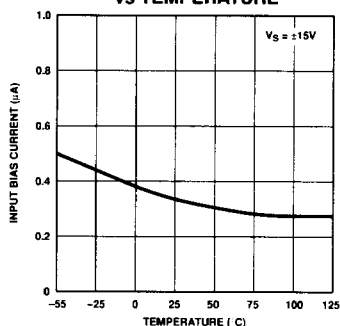


TOTAL HARMONIC DISTORTION vs FREQUENCY

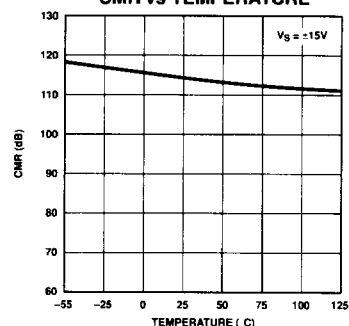


TYPICAL PERFORMANCE CHARACTERISTICS *Continued*

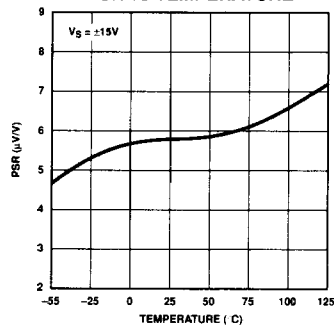
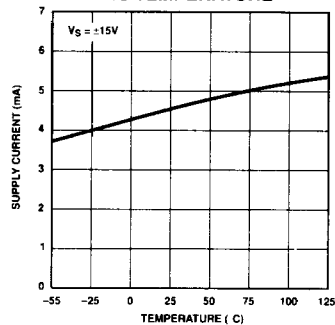
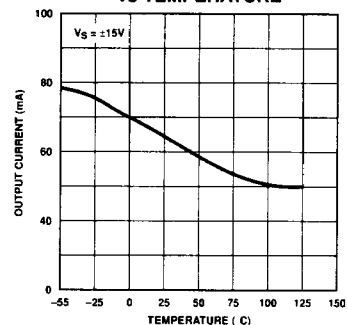
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OUTPUT VOLTAGE SWING  
vs LOAD RESISTANCEINPUT COMMON-MODE  
VOLTAGE vs SUPPLY VOLTAGESUPPLY CURRENT  
vs SUPPLY VOLTAGEINPUT OFFSET VOLTAGE  
vs TEMPERATUREINPUT BIAS CURRENT  
vs TEMPERATURE

CMR vs TEMPERATURE

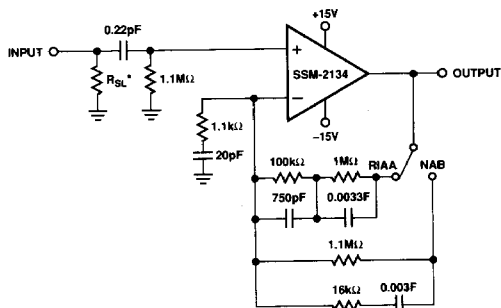


PSR vs TEMPERATURE

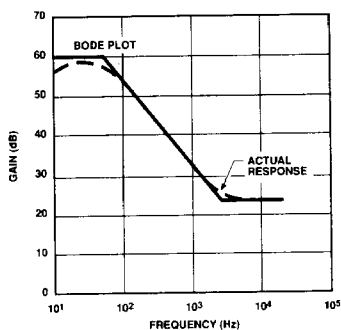
SUPPLY CURRENT  
vs TEMPERATURESHORT-CIRCUIT CURRENT  
vs TEMPERATURE

## APPLICATIONS INFORMATION

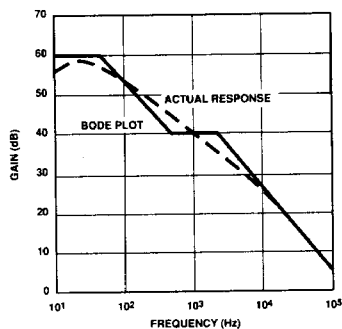
## PREAMPLIFIER-RIAA/NAB COMPENSATION



\*SELECT TO PROVIDE SPECIFIED TRANSDUCER LOADING  
OUTPUT NOISE 0.8mV<sub>RMS</sub> (WITH INPUT SHORTED)



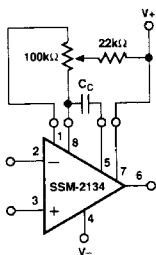
BODE PLOT OF RIAA EQUALIZATION AND THE RESPONSE REALIZED IN AN ACTUAL CIRCUIT USING THE SSM-2134



BODE PLOT OF NAB EQUALIZATION AND THE RESPONSE REALIZED IN THE ACTUAL CIRCUIT USING THE SSM-2134

## TEST CIRCUIT

## FREQUENCY COMPENSATION AND OFFSET VOLTAGE ADJUSTMENT CIRCUIT



## CLOSED-LOOP FREQUENCY RESPONSE

