



*Audio Silicon
Specialists™*

SSM-2134

LOW NOISE AUDIO
OPERATIONAL AMPLIFIER

Precision Monolithics Inc.

FEATURES

- Very Low Input Noise Voltage $3.5\text{nV}/\sqrt{\text{Hz}}$ Typ
- Wide Small-Signal Bandwidth 10MHz Typ
- High Current Drive Capability
(10V_{RMS} Into 600Ω @ $V_S = \pm 18\text{V}$)
- High Slew Rate $13\text{V}/\mu\text{s}$ Typ
- Wide Power Bandwidth 200kHz Typ
- High Open-Loop Gain $200\text{V}/\text{mV}$ Typ
- Extended Industrial
Temperature Range -40°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

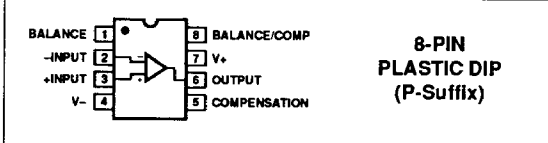
GENERAL DESCRIPTION

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.

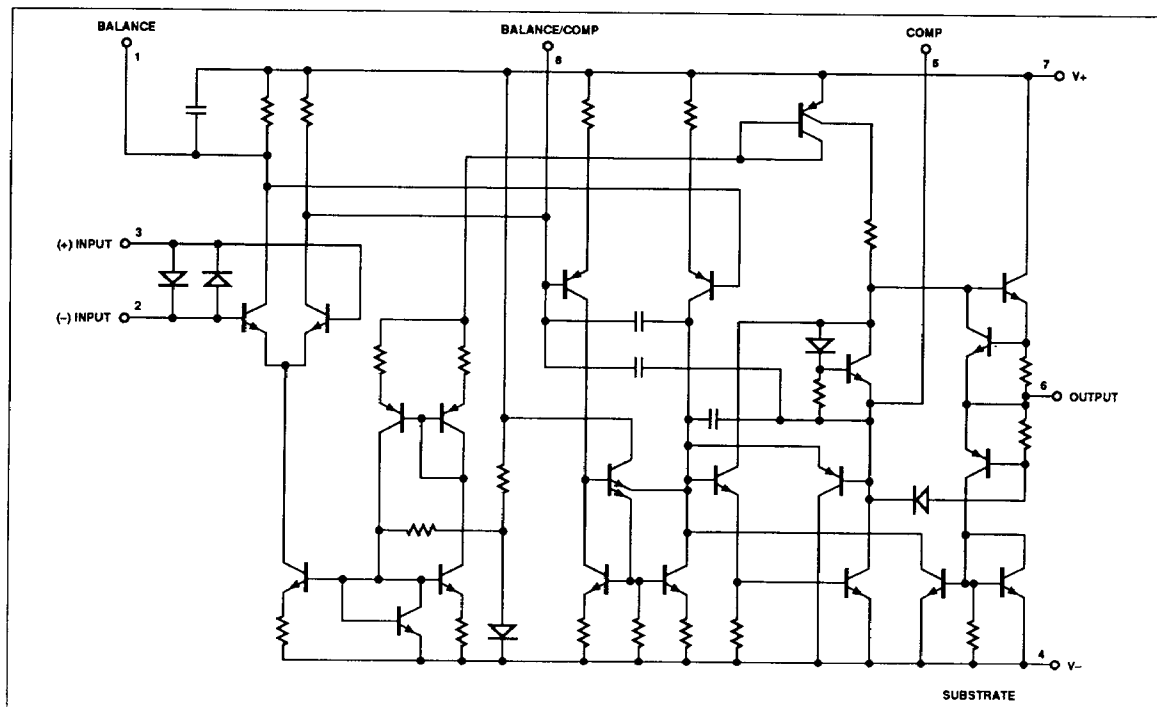
The SSM-2134 is internally compensated for $A_v \geq 3$. However, the frequency response can be optimized with an external compensation capacitor to enable the SSM-2134 to operate at unity-gain or drive large capacitive loads.

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°C to $+85^\circ\text{C}$.

PIN CONNECTIONS



SIMPLIFIED SCHEMATIC



ORDERING INFORMATION

PACKAGE	OPERATING TEMPERATURE RANGE
PLASTIC 8-PIN	
SSM2134P	XIND*

*XIND = -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:

1. 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.
2. For supply voltages less than ±22V, the absolute maximum input voltage is equal to the supply voltage.
3. 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.

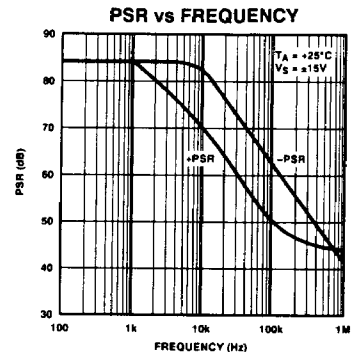
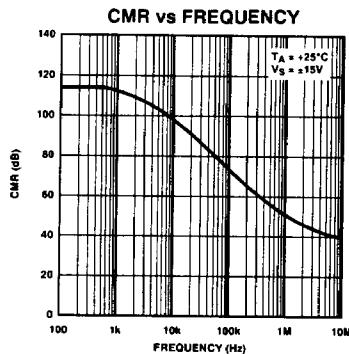
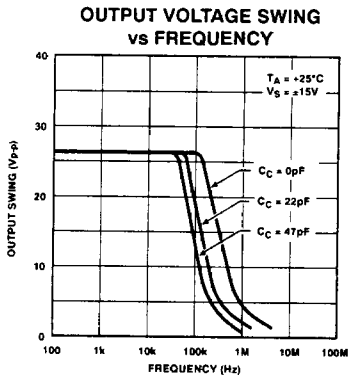
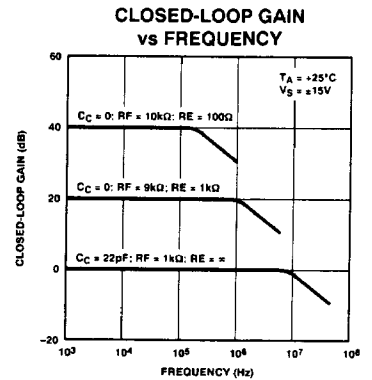
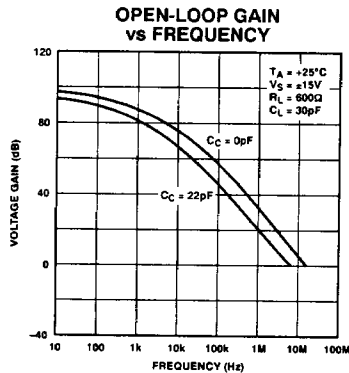
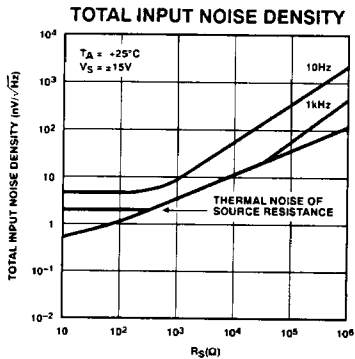
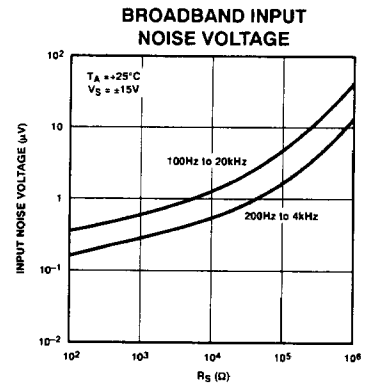
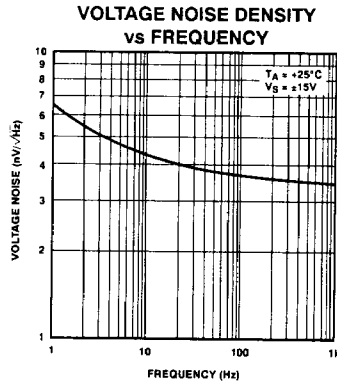
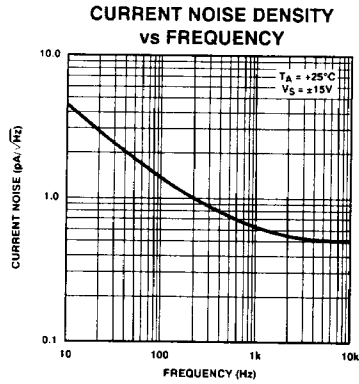
PARAMETER	SYMBOL	CONDITIONS	SSM-2134P			UNITS
			MIN	TYP	MAX	
Input Offset Voltage	V_{OS}	$-40^\circ C \leq T_A \leq +85^\circ C$	-	0.3 0.4	2 3	mV
Input Offset Current	I_{OS}	$-40^\circ C \leq T_A \leq +85^\circ C$	-	15 25	300 400	nA
Input Bias Current	I_B	$-40^\circ C \leq T_A \leq +85^\circ C$	-	350 500	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_{SY}	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)	-	60	-	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	-	%

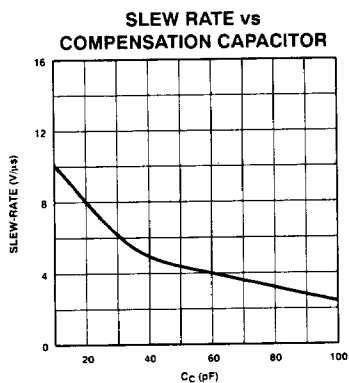
NOTES:

1. 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.
2. Guaranteed by design.

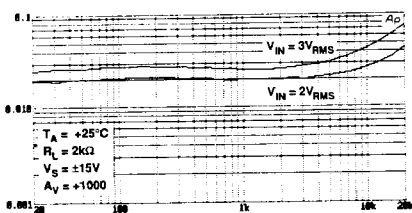
Specifications subject to change. Consult latest data sheet.

TYPICAL PERFORMANCE CHARACTERISTICS

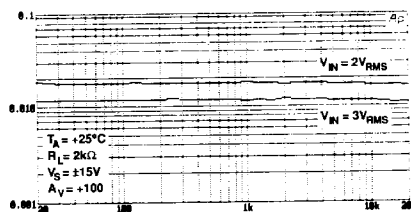


TYPICAL PERFORMANCE CHARACTERISTICS *Continued*

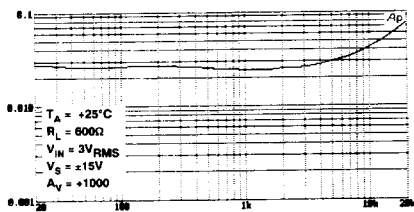
TOTAL HARMONIC DISTORTION vs FREQUENCY



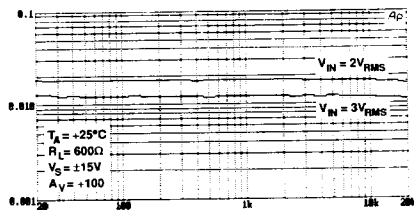
TOTAL HARMONIC DISTORTION vs FREQUENCY

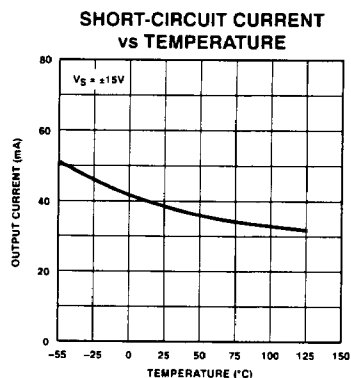
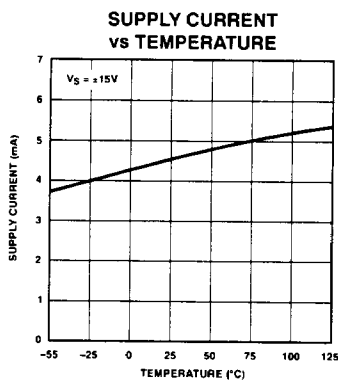
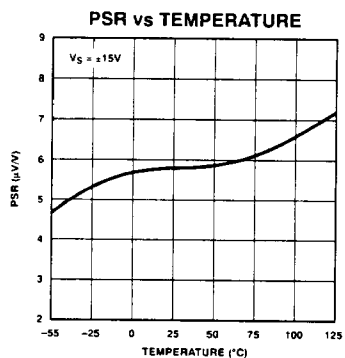
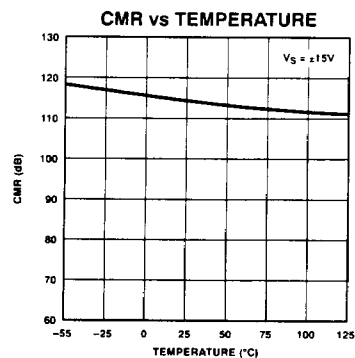
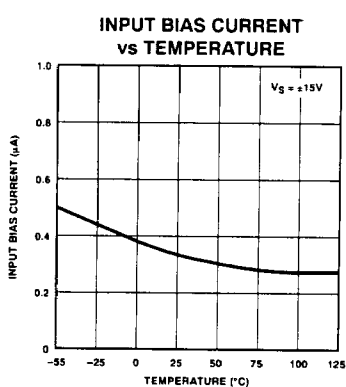
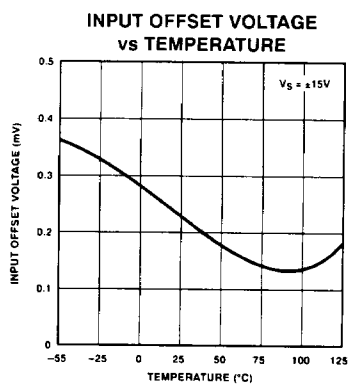
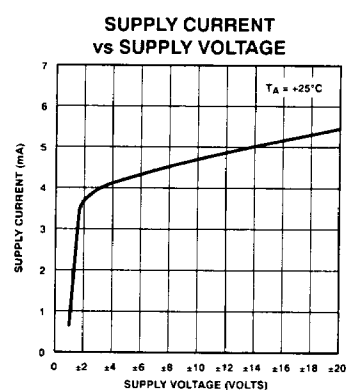
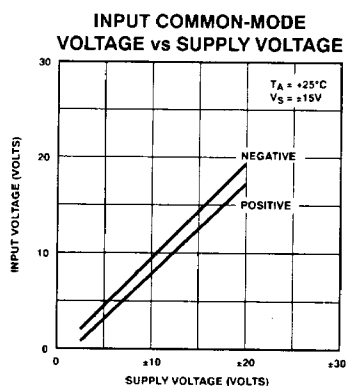
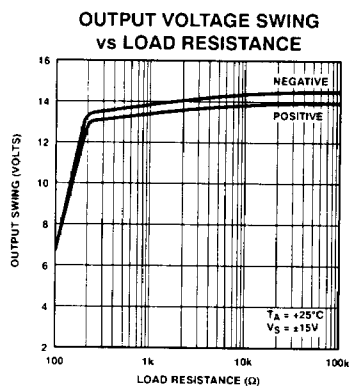


TOTAL HARMONIC DISTORTION vs FREQUENCY



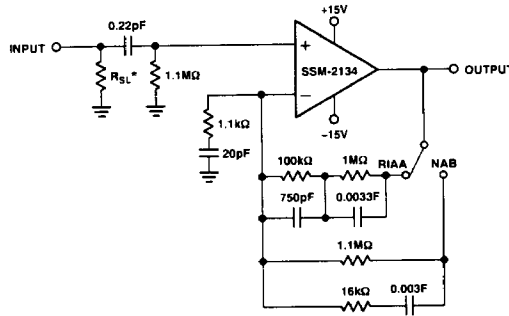
TOTAL HARMONIC DISTORTION vs FREQUENCY



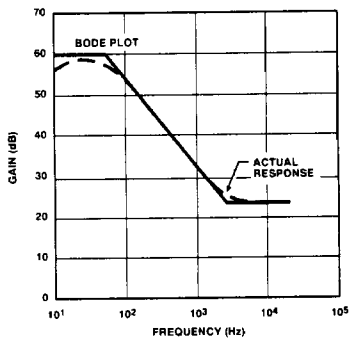
TYPICAL PERFORMANCE CHARACTERISTICS *Continued*


APPLICATIONS INFORMATION

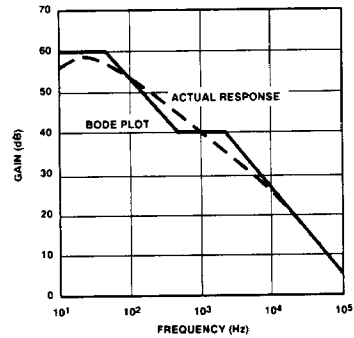
PREAMPLIFIER-RIAA/NAB COMPENSATION



*SELECT TO PROVIDE SPECIFIED TRANSDUCER LOADING
OUTPUT NOISE $0.8\text{mV}_{\text{RMS}}$ (WITH INPUT SHORTED)



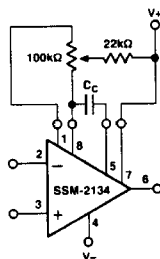
BODE PLOT OF RIAA EQUALIZATION AND THE RESPONSE REALIZED IN AN ACTUAL CIRCUIT USING THE SSM-2134



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

