

SINGLE AND DUAL LOW NOISE OP AMP NE5533/5533A/SA/SE/NE5534/5534A

DESCRIPTION

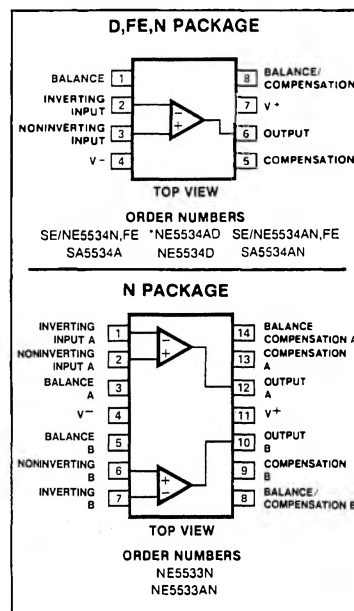
The 5533/5534 are dual and single high-performance low noise operational amplifiers. Compared to other operational amplifiers, such as TL083, they show better noise performance, improved output drive capability and considerably higher small-signal and power bandwidths.

This makes the devices especially suitable for application in high quality and professional audio equipment, in instrumentation and control circuits and telephone channel amplifiers. The op amps are internally compensated for gain equal to, or higher than, three. The frequency response can be optimized with an external compensation capacitor for various applications (unity gain amplifier, capacitive load, slew-rate, low overshoot, etc.) If very low noise is of prime importance, it is recommended that the 5533A/5534A version be used which has guaranteed noise specifications.

FEATURES

- Small-signal bandwidth: 10MHz
- Output drive capability: 600Ω , 10V (rms) at $V_s = \pm 18V$
- Input noise voltage: $4nV/\sqrt{Hz}$
- DC voltage gain: 100000
- AC voltage gain: 6000 at 10kHz
- Power bandwidth: 200kHz
- Slew-rate: $13V/\mu s$
- Large supply voltage range: ± 3 to $\pm 20V$

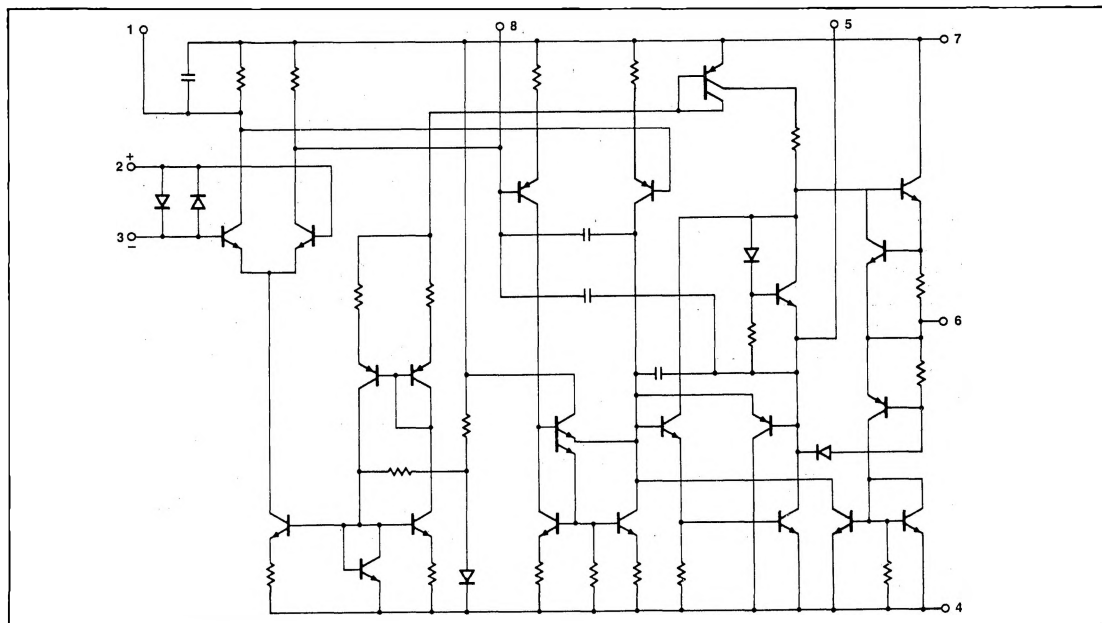
PIN CONFIGURATIONS



*NOTE:

This device may not be symbolized in standard format.

EQUIVALENT SCHEMATIC



SINGLE AND DUAL LOW NOISE OP AMP NE5533/5533A/SA/SE/NE5534/5534A

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
V_S Supply voltage	± 22	V
V_{IN} Input voltage	$\pm V$ supply	V
V_{DIFF} Differential input voltage ¹	± 0.5	V
T_A Operating temperature range		
SE5534/5534A	-55 to +125	°C
NE5533/5533A/5534/5534A	0 to +70	°C
T_{STG} Storage temperature	-65 to +150	°C
T_J Junction temperature	150	°C
P_D Power dissipation at 25°C ²		
5533N, 5534N, 5534FE	800	mW
Output short circuit duration ³	Indefinite	
Lead temperature (soldering, 10 sec)	300	°C

NOTES

- Diodes protect the inputs against over-voltage. Therefore, unless current-limiting resistors are used, large currents will flow if the differential input voltage exceeds 0.6V. Maximum current should be limited to ± 10 mA.
- For operation at elevated temperature, derate packages based on the following junction-to-ambient thermal resistances:
 - 8-pin ceramic (FE) 140°C/W
 - 14-pin ceramic (F) 110°C/W
 - 8-pin plastic (N) 162°C/W
 - 14-pin plastic (N) 150°C/W
- Output may be shorted to ground at $V_S = \pm 15$ V, $T_A = 25^\circ\text{C}$. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

DC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_S = \pm 15$ V unless otherwise specified.^{1,2}

PARAMETER	TEST CONDITIONS	SE5534/5534A			NE5533/5533A 5534/5534A			UNIT
		Min	Typ	Max	Min	Typ	Max	
V_{OS} Offset voltage			0.5	2		0.5	4	mV
$\Delta V_{OS}/\Delta T$	Over temperature		5	3		5	5	mV $\mu\text{V}/^\circ\text{C}$
I_{OS} Offset current			10	200		20	300	nA
$\Delta I_{OS}/\Delta T$	Over temperature		200	500		200	400	nA $\text{pA}/^\circ\text{C}$
I_B Input current			400	800		500	1500	nA
$\Delta I_B/\Delta T$	Over temperature		5	1500		5	2000	nA $\text{nA}/^\circ\text{C}$
I_{CC} Supply current Per op amp			4	6.5		4	8	mA
	Over temperature			9			10	mA
V_{CM} Common mode input range		± 12	± 13		± 12	± 13		V
CMRR Common mode rejection ratio		80	100		70	100		dB
PSRR Power supply rejection ratio			10	50		10	100	$\mu\text{V}/\text{V}$
A_{VOL} Large signal voltage gain	$R_L \geq 600\Omega$, $V_O = \pm 10$ V Over temperature	50	100		25	100		V/mV V/mV
V_{OUT} Output swing 5534 only	$R_L \geq 600\Omega$ Over temperature $R_L \geq 600\Omega$, $V_S = \pm 18$ V $R_L \geq 2\text{k}\Omega$ Over Temperature	± 12 ± 10 ± 15 ± 13 ± 12	± 13 ± 12 ± 16 ± 13.5 ± 12.5		± 12 ± 10 ± 15 ± 13 ± 12	± 13 ± 12 ± 16 ± 13.5 ± 12.5		V V V V V
R_{IN} Input resistance		50	100		30	100		k Ω
I_{SC} Output short circuit current			38			38		mA

NOTES

- For NE5533/5533A/5534/5534A, $T_{MIN} = 0^\circ\text{C}$, $T_{MAX} = 70^\circ\text{C}$
- For SE5534/5534A, $T_{MIN} = -55^\circ\text{C}$, $T_{MAX} = +125^\circ\text{C}$

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AC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{V}$ unless otherwise specified.

PARAMETER	TEST CONDITIONS	SE5534/5534A			NE5533/5533A 5534/5534A			UNIT
		Min	Typ	Max	Min	Typ	Max	
R_{OUT} Output resistance	$A_V = 30\text{dB}$ closed loop $f = 10\text{kHz}$, $R_L = 600\Omega$, $C_C = 22\text{pF}$		0.3			0.3		Ω
Transient response	Voltage follower, $V_{IN} = 50\text{mV}$ $R_L = 600\Omega$, $C_C = 22\text{pF}$, $C_L = 100\text{pF}$							
T_R Rise time			20			20		ns
Overshoot			20			20		%
Transient response	$V_{IN} = 50\text{mV}$, $R_L = 600\Omega$ $C_C = 47\text{pF}$, $C_L = 500\text{pF}$							
T_R Rise time			50			50		ns
Overshoot			35			35		%
AC Gain	$f = 10\text{kHz}$, $C_C = 0$ $f = 10\text{kHz}$, $C_C = 22\text{pF}$		6 2.2			6 2.2		V/mV V/mV
Gain bandwidth product	$C_C = 22\text{pF}$, $C_L = 100\text{pF}$		10			10		mHz
Slew rate	$C_C = 0$ $C_C = 22\text{pF}$		13 6			13 6		V/ μS V/ μS
Power bandwidth	$V_{OUT} = \pm 10\text{V}$, $C_C = 0$ $V_{OUT} = \pm 10\text{V}$, $C_C = 22\text{pF}$ $V_{OUT} = \pm 14\text{V}$, $R_L = 600\Omega$ $C_C = 22\text{pF}$, $V_{CC} = \pm 18\text{V}$		200 95 70			200 95 70		kHz kHz kHz

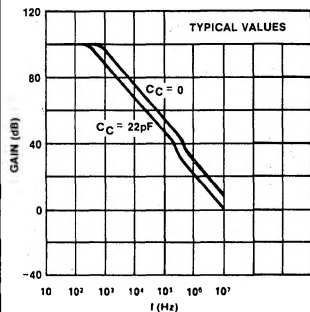
ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{V}$ unless otherwise specified.

PARAMETER	TEST CONDITIONS	5533/5534			5533A/5534A			UNIT
		Min	Typ	Max	Min	Typ	Max	
Input noise voltage	$f_o = 30\text{Hz}$ $f_o = 1\text{kHz}$		7 4			5.5 3.5	7 4.5	nV/ $\sqrt{\text{Hz}}$ nV/ $\sqrt{\text{Hz}}$
Input noise current	$f_o = 30\text{Hz}$ $f_o = 1\text{kHz}$		2.5 0.6			1.5 0.4		pA/ $\sqrt{\text{Hz}}$ pA/ $\sqrt{\text{Hz}}$
Broadband noise figure	$f = 10\text{Hz} - 20\text{kHz}$, $R_S = 5\text{k}\Omega$					0.9		dB
Channel separation	$f = 1\text{kHz}$, $R_S = 5\text{k}\Omega$		110			110		dB

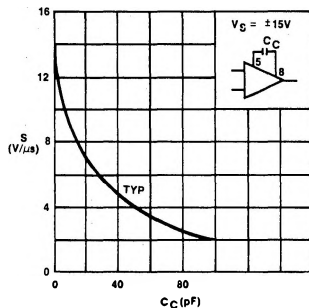
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TYPICAL PERFORMANCE CHARACTERISTICS

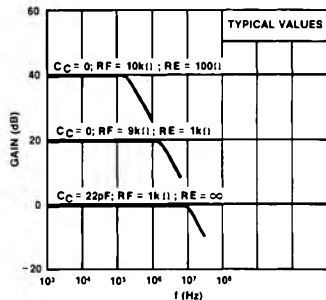
OPEN LOOP FREQUENCY RESPONSE



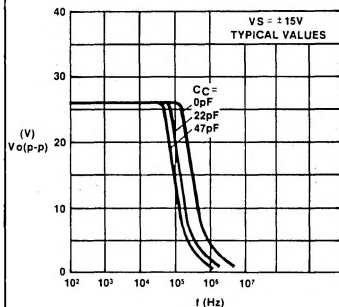
SLEW-RATE AS A FUNCTION OF COMPENSATION CAPACITANCE



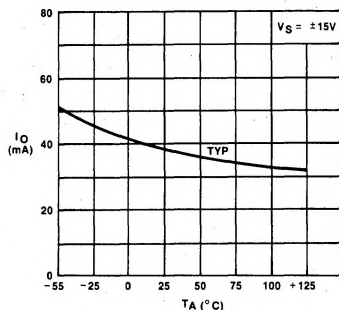
CLOSED LOOP FREQUENCY RESPONSE



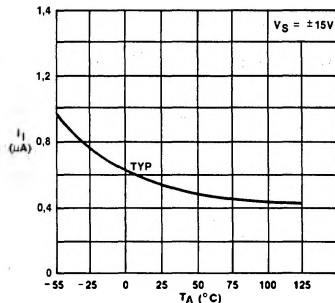
LARGE-SIGNAL FREQUENCY RESPONSE



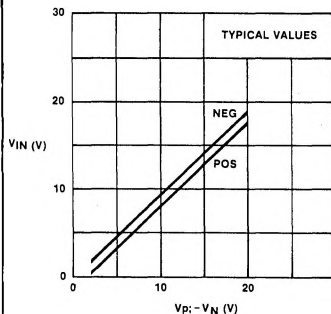
OUTPUT SHORT-CIRCUIT CURRENT



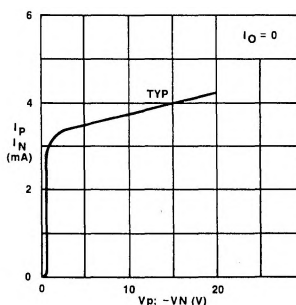
INPUT BIAS CURRENT



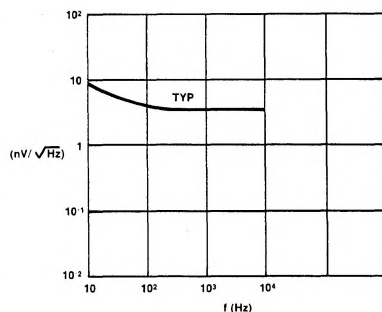
INPUT COMMON MODE VOLTAGE RANGE



SUPPLY CURRENT PER OP AMP

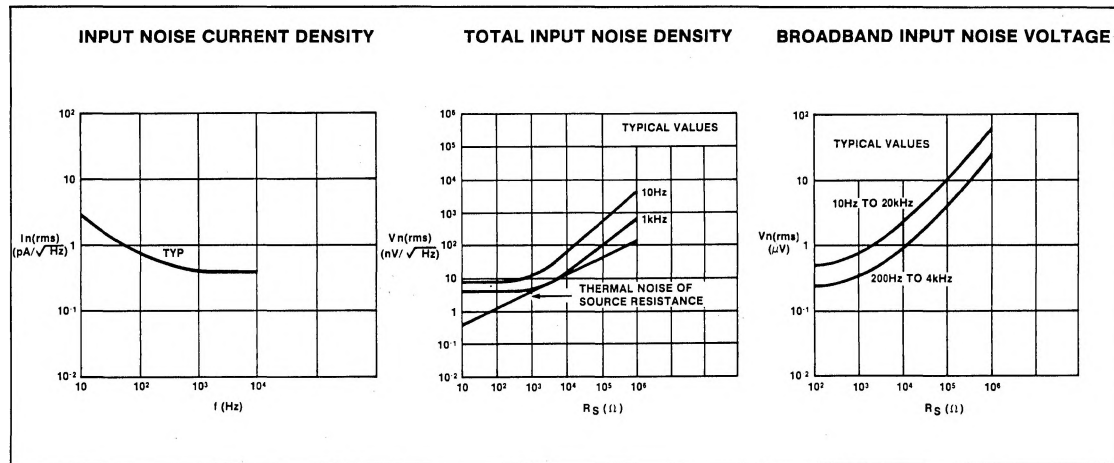


INPUT NOISE VOLTAGE DENSITY

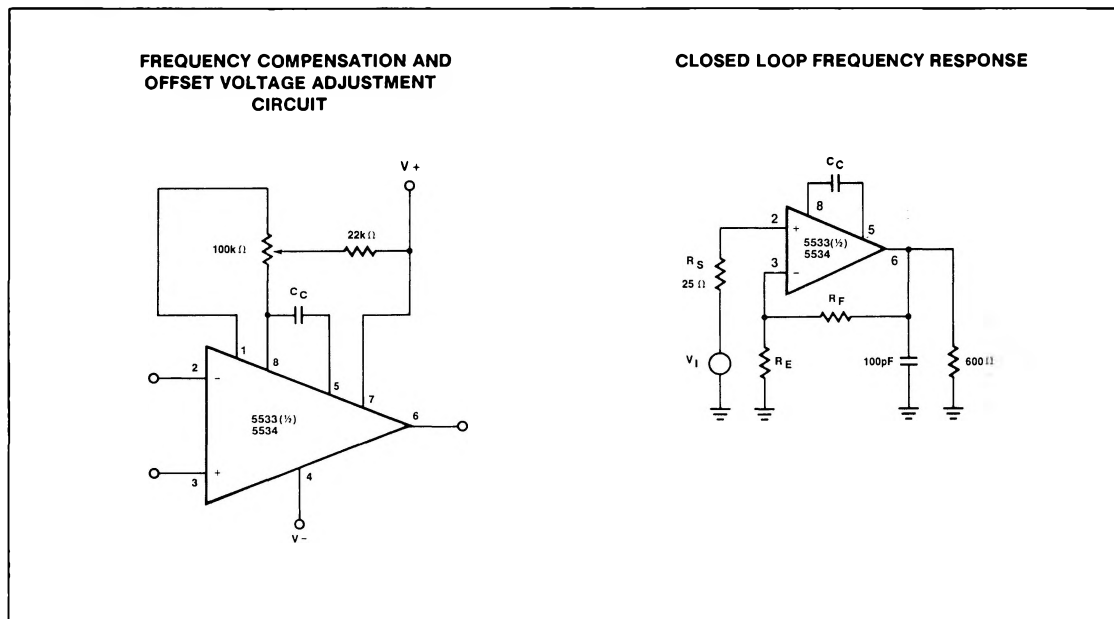


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TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

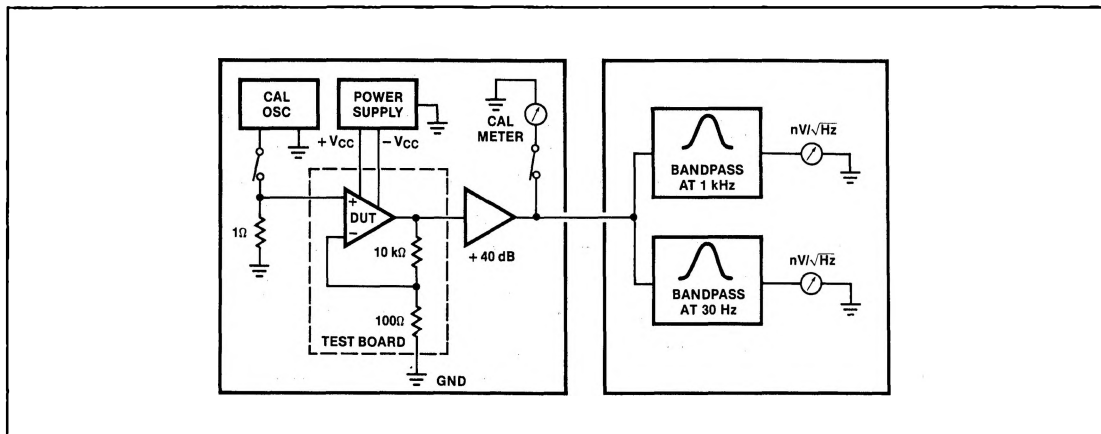


TEST LOAD CIRCUITS



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NOISE TEST BLOCK DIAGRAM



*For additional information, consult the Applications Section.