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.

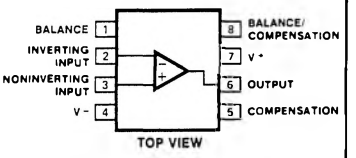
This makes the devices especially suitable for application in high quality and professional audio equipment, in instrumentation and control circuits and telephone channel amplifiers. The op amps are internally compensated for gain equal to, or higher than, three. The frequency response can be optimized 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/μs**
- **Large supply voltage range: ±3 to ±20V**

PIN CONFIGURATIONS

D,FE,N PACKAGE

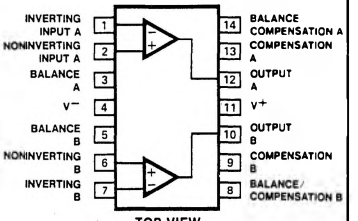


TOP VIEW

ORDER NUMBERS

SE/NE5534N,FE *NE5534AD SE/NE5534AN,FE
SA5534A NE5534D SA5534AN

N PACKAGE



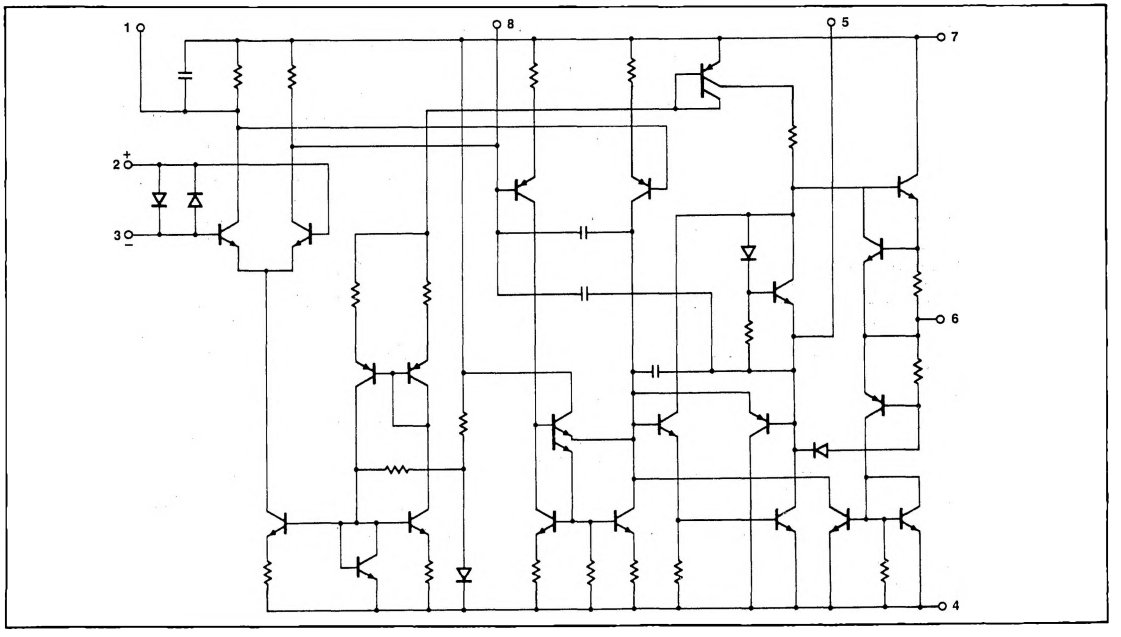
TOP VIEW

ORDER NUMBERS

NE5533N
NE5533AN

*NOTE:
This device may not be symbolled 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	± 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

1. 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 ±10mA.
2. 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
3. Output may be shorted to ground at V_S = ±15V, T_A = 25°C. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

DC ELECTRICAL CHARACTERISTICS T_A = 25°C, V_S = ± 15V 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
		Over temperature			3			5	mV
$\Delta V_{OS}/\Delta T$				5			5		µV/°C
I_{OS}	Offset current			10	200		20	300	nA
		Over temperature			500			400	nA
$\Delta I_{OS}/\Delta T$				200			200		pA/°C
I_B	Input current			400	800		500	1500	nA
		Over temperature			1500			2000	nA
$\Delta I_B/\Delta T$				5			5		nA/°C
I_{CC}	Supply current			4	6.5		4	8	mA
	Per op amp	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	µV/V
A_{VOL}	Large signal voltage gain	$R_L \geq 600\Omega$, V_O = ± 10V	50	100		25	100		V/mV
		Over temperature	25			15			V/mV
V_{OUT}	Output swing	$R_L \geq 600\Omega$	± 12	± 13		± 12	± 13		V
	5534 only	Over temperature	± 10	± 12		± 10	± 12		V
		$R_L \geq 600\Omega$, V_S = ± 18V	± 15	± 16		± 15	± 16		V
		$R_L \geq 2k\Omega$	± 13	± 13.5		± 13	± 13.5		V
		Over Temperature	± 12	± 12.5		± 12	± 12.5		V
R_{IN}	Input resistance		50	100		30	100		kΩ
I_{SC}	Output short circuit current			38			38		mA

NOTES

1. For NE5533/5533A/5534/5534A, T_{MIN} = 0°C, T_{MAX} = 70°C
2. For SE5534/5534A, T_{MIN} = − 55°C, T_{MAX} = + 125°C

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

AC ELECTRICAL CHARACTERISTICS $T_A = 25°C$, $V_S = \pm 15V$ 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 = 30dB closed loop f = 10kHz, $R_L = 600\Omega$, $C_C = 22pF$		0.3			0.3		Ω
Transient response	Voltage follower, V_{IN} = 50mV $R_L = 600\Omega$, $C_C = 22pF$, $C_L = 100pF$							
T_R Rise time			20			20		ns
Overshoot			20			20		%
Transient response	V_{IN} = 50mv, $R_L = 600\Omega$ $C_C = 47pF$, $C_L = 500pF$							
T_R Rise time			50			50		ns
Overshoot			35			35		%
AC Gain	f = 10kHz, C_C = 0		6			6		V/mV
	f = 10kHz, $C_C = 22pF$		2.2			2.2		V/mV
Gain bandwidth product	$C_C = 22pF$, $C_L = 100pF$		10			10		mHz
Slew rate	C_C = 0		13			13		V/μS
	$C_C = 22pF$		6			6		V/μS
Power bandwidth	$V_{OUT} = \pm 10V$, C_C = 0		200			200		kHz
	$V_{OUT} = \pm 10V$, $C_C = 22pF$		95			95		kHz
	$V_{OUT} = \pm 14V$, $R_L = 600\Omega$ $C_C = 22pF$, $V_{CC} = \pm 18V$		70			70		kHz

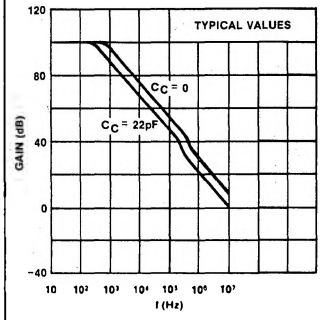
ELECTRICAL CHARACTERISTICS $T_A = 25°C$, $V_S = \pm 15V$ unless otherwise specified.

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

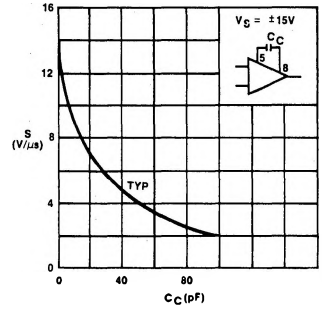
SINGLE AND DUAL LOW NOISE OP AMP NE5533/5533A/SA/SE/NE5534/5534A

TYPICAL PERFORMANCE CHARACTERISTICS

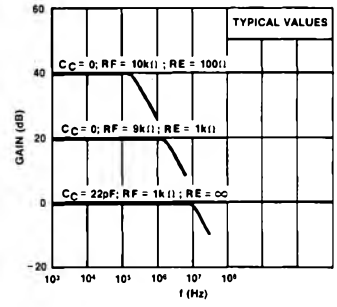
OPEN LOOP FREQUENCY RESPONSE



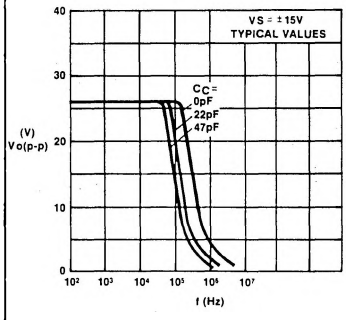
SLEW-RATE AS A FUNCTION OF COMPENSATION CAPACITANCE



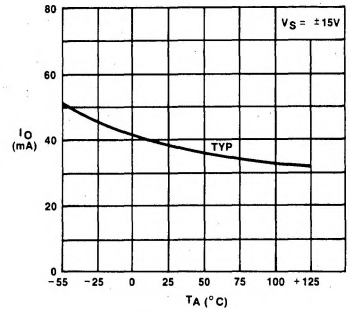
CLOSED LOOP FREQUENCY RESPONSE



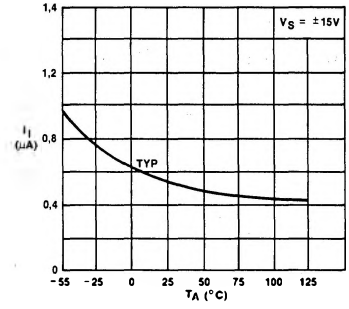
LARGE-SIGNAL FREQUENCY RESPONSE



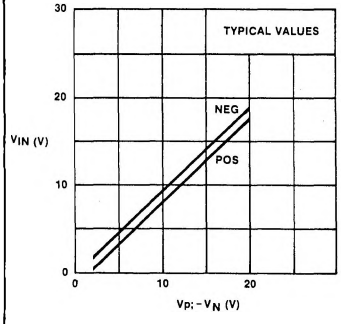
OUTPUT SHORT-CIRCUIT CURRENT



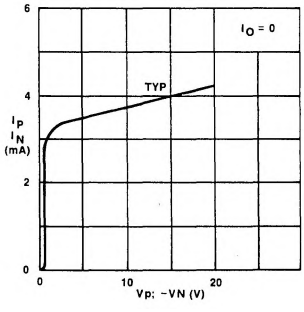
INPUT BIAS CURRENT



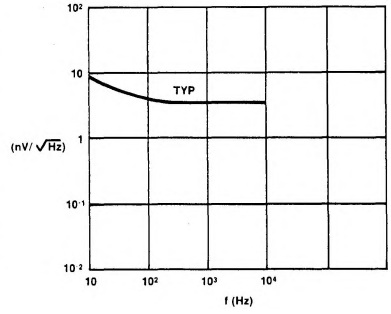
INPUT COMMON MODE VOLTAGE RANGE



SUPPLY CURRENT PER OP AMP



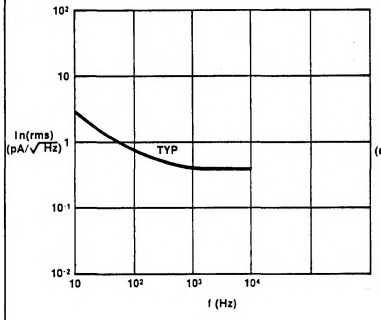
INPUT NOISE VOLTAGE DENSITY



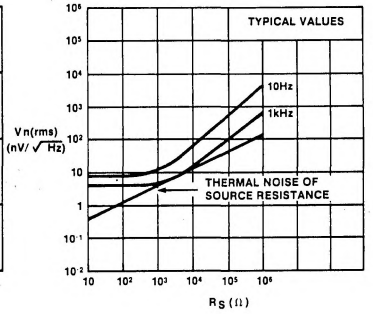
SINGLE AND DUAL LOW NOISE OP AMP NE5533/5533A/SA/SE/NE5534/5534A

TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

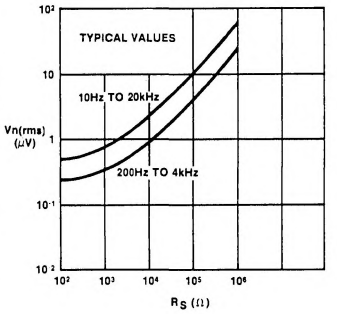
INPUT NOISE CURRENT DENSITY



TOTAL INPUT NOISE DENSITY

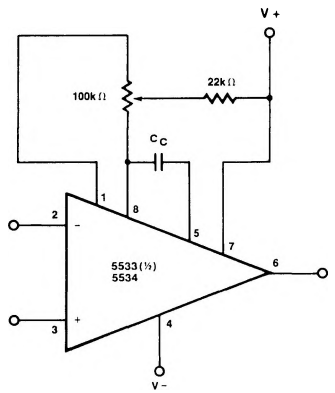


BROADBAND INPUT NOISE VOLTAGE

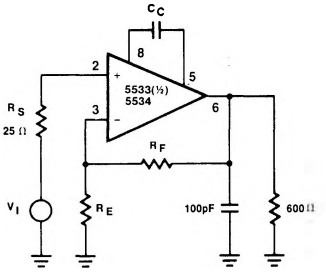


TEST LOAD CIRCUITS

FREQUENCY COMPENSATION AND OFFSET VOLTAGE ADJUSTMENT CIRCUIT

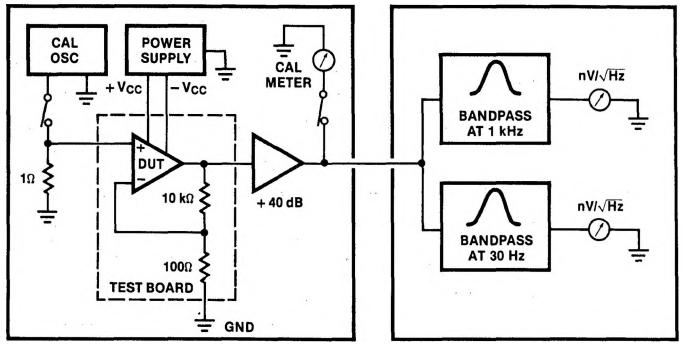


CLOSED LOOP FREQUENCY RESPONSE



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

NOISE TEST BLOCK DIAGRAM



*For additional information, consult the Applications Section.