Dual and single low noise op amp

NE5533/5533A/ NE/SA/SE5534/5534A

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.

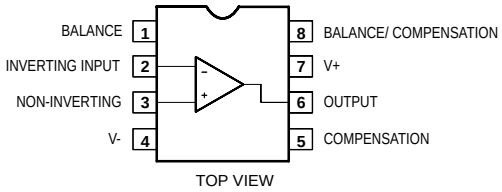
FEATURES

- Small-signal bandwidth: 10MHz
- Output drive capability: 600Ω, $10V_{RMS}$ at VS=±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

NE/SA/SE5534/5534A

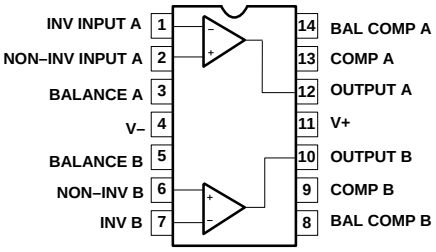
D, FE, N Packages



TOP VIEW

NE5533/5533A

N Package



TOP VIEW

APPLICATIONS

- Audio equipment
- Instrumentation and control circuits
- Telephone channel amplifiers
- Medical equipment

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
14-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5533N	0405B
14-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5533AN	0405B
8-Pin Plastic Small Outline (SO) package	0 to +70°C	NE5534D	0174C
8-Pin Hermetic Ceramic Dual In-Line Package (CERDIP)	0 to +70°C	NE5534FE	
8-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5534N	0404B
8-Pin Plastic Small Outline (SO) package	0 to +70°C	NE5534AD	0174C
8-Pin Hermetic Ceramic Dual In-Line Package (CERDIP)	0 to +70°C	NE5534AF	
8-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5534AN	0404B
8-Pin Plastic Dual In-Line Package (DIP)	-40°C to +85°C	SA5534N	0404B
8-Pin Plastic Small Outline (SO) package	-40°C to +85°C	SA5534AD	0174C
8-Pin Plastic Dual In-Line Package (DIP)	-55°C to +125°C	SE5534N	0404B
8-Pin Hermetic Ceramic Dual In-Line Package (CERDIP)	-55°C to +125°C	SE5534AF	
8-Pin Plastic Dual In-Line Package (DIP)	-55°C to +125°C	SE5534AN	0404B
8-Pin Plastic Dual In-Line Package (DIP)	-40°C to +85°C	SA5534AN	0404B

ABSOLUTE MAXIMUM RATINGS

SYMBOL	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		
	SE	-55 to +125	°C
	SA	-40 to +85	°C
	NE	0 to +70	°C
T_{STG}	Storage temperature range	-65 to +150	°C
T_J	Junction temperature	150	°C
P_D	Power dissipation at 25°C[2]		
	16D Pkg	1350	mW
	16N Pkg	1500	mW
	8D Pkg	750	mW
	8FE Pkg	800	mW
	8N Pkg	1150	mW
	Output short-circuit duration[3]	Indefinite	
T_{SOLD}	Lead soldering temperature (10sec max)	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 resistance:
   8-pin ceramic DIP 150°C/W
   8-pin plastic DIP 105°C/W
   8-pin plastic SO 160°C/W
   16-pin plastic DIP 80°C/W
   16-pin plastic SO 90°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, 3]

SYMBOL	PARAMETER	TEST CONDITIONS	SE5534/5534A			NE5533/5533A NE/SA5534/5534A			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 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	µV/V
A_{VOL}	Large-signal voltage gain	R_L≥600Ω, V_O=±10V	50	100		25	100		V/mV
		Over temperature	25			15			V/mV
V_{OUT}	Output swing	R_L≥600Ω	±12	±13		±12	±13		V
		Over temperature	±10	±12		±10	±12		V
		R_L≥600Ω, V_S=±18V	±15	±16		±15	±16		V
		R_L≥2kΩ	±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
3. For SA5534/5534A, T_{MIN} = -40°C, T_{MAX} = +125°C

AC ELECTRICAL CHARACTERISTICS

T_A=25°C, V_S=±15V, unless otherwise specified.

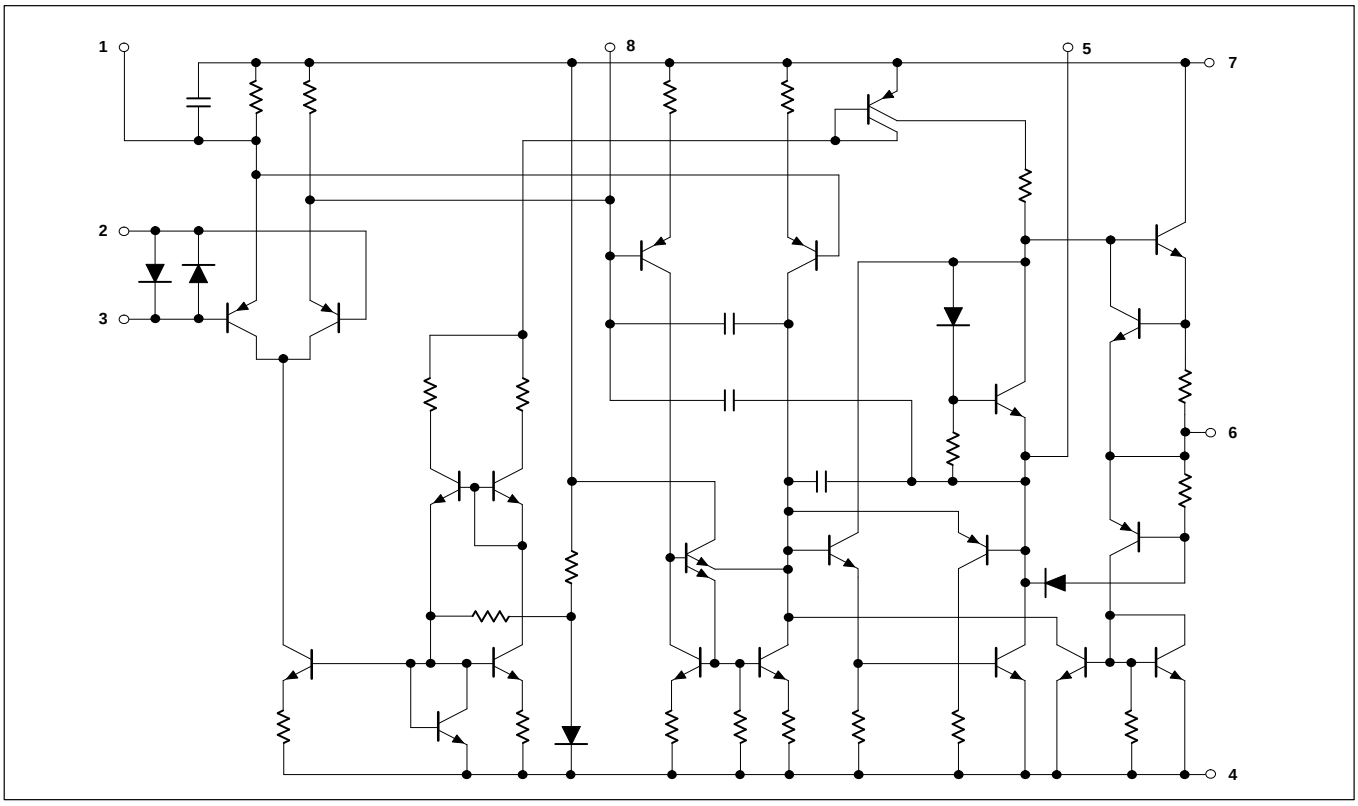
SYMBOL	PARAMETER	TEST CONDITIONS	SE5534/5534A			NE5533/5533A NE/SA5534/5534A			UNIT
			Min	Typ	Max	Min	Typ	Max	
R_{OUT}	Output resistance	A_V=30dB closed-loop f=10kHz, R_L=600Ω, C_C=22pF		0.3			0.3		Ω
	Transient response	Voltage-follower, V_{IN}=50mV R_L=600Ω, C_C=22pF, C_L=100pF							
t_R	Rise time			20			20		ns
	Overshoot			20			20		%
	Transient response	V_{IN}=50mV, R_L=600Ω C_C=47pF, C_L=500pF							
t_R	Rise time			50			50		ns
	Overshoot			35			35		%
A_V	Gain	f=10kHz, C_C=0		6			6		V/mV
		f=10kHz, C_C=22pF		2.2			2.2		V/mV
GBW	Gain bandwidth product	C_C=22pF, C_L=100pF		10			10		MHz
SR	Slew rate	C_C=0		13			13		V/µs
		C_C=22pF		6			6		V/µs
	Power bandwidth	V_{OUT}=±10V, C_C=0		200			200		kHz
		V_{OUT}=±10V, C_C=22pF		95			95		kHz
		V_{OUT}=±14V, R_L=600Ω C_C=22pF, V_{CC}=±18V		70			70		kHz

ELECTRICAL CHARACTERISTICS

T_A=25°C, V_S = 15V, unless otherwise specified.

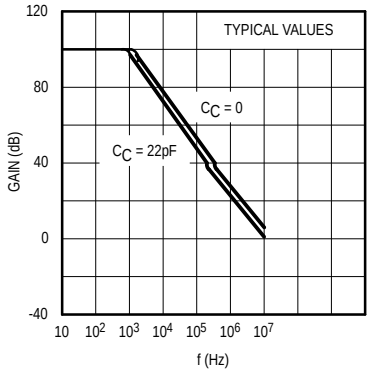
SYMBOL	PARAMETER	TEST CONDITIONS	5533/5534			5533A/5534A			UNIT
			Min	Typ	Max	Min	Typ	Max	
V_{NOISE}	Input noise voltage	f_O=30Hz		7			5.5	7	nV/√Hz
		f_O=1kHz		4			3.5	4.5	nV/√Hz
I_{NOISE}	Input noise current	f_O=30Hz		2.5			1.5		pA/√Hz
		f_O=1kHz		0.6			0.4		pA/√Hz
	Broadband noise figure	f=10Hz-20kHz, R_S=5kΩ					0.9		dB
	Channel separation	f=1kHz, R_S=5kΩ		110			110		dB

EQUIVALENT SCHEMATIC

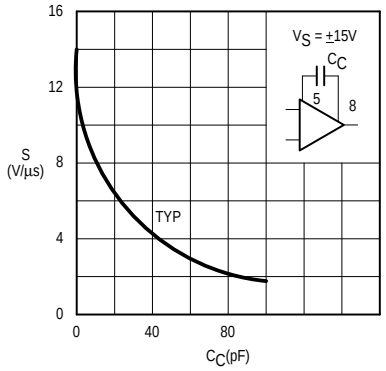


TYPICAL PERFORMANCE CHARACTERISTICS

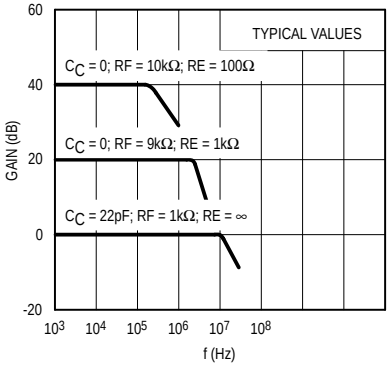
Open-Loop Frequency Response



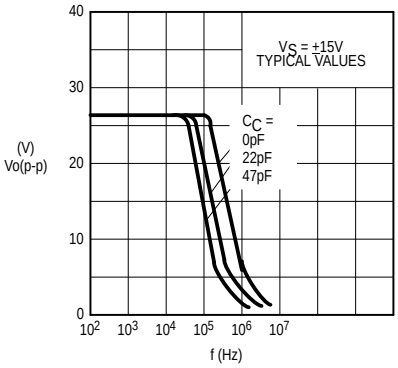
Slew Rate as a Function of Compensation Capacitance



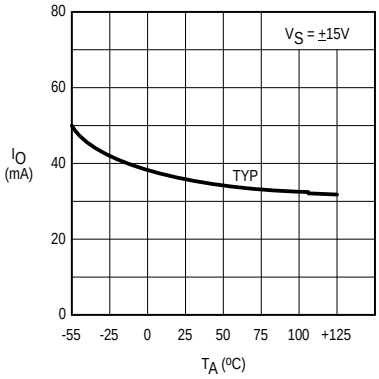
Closed-Loop Frequency Response



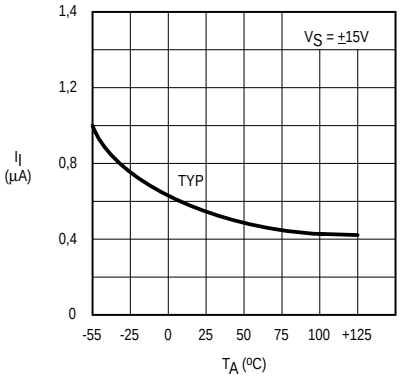
Large-Signal Frequency Response



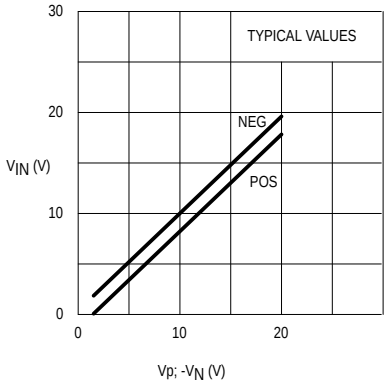
Output Short-Circuit Current



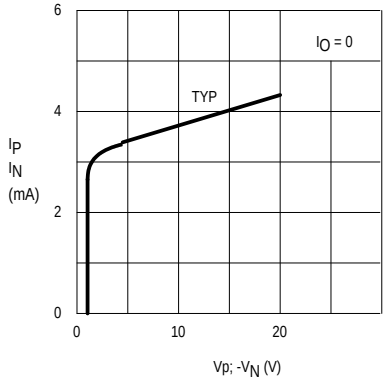
Input Bias Current



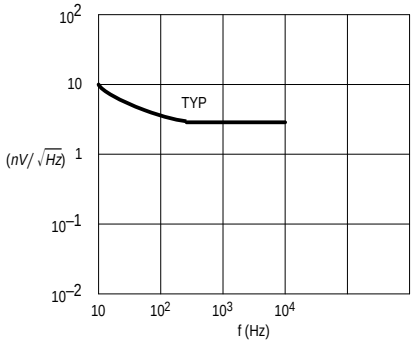
Input Commom-Mode Voltage Range



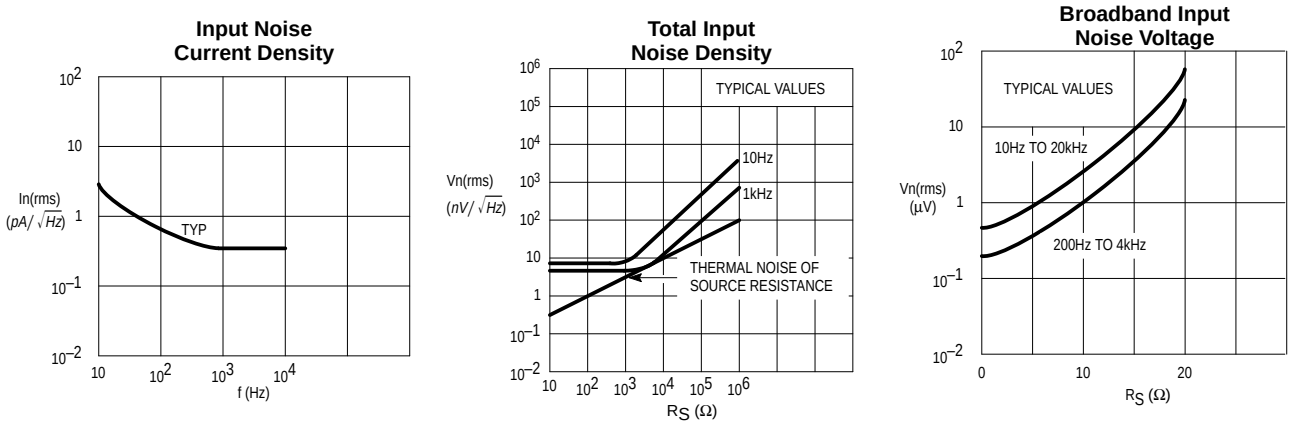
Supply Current per Op Amp



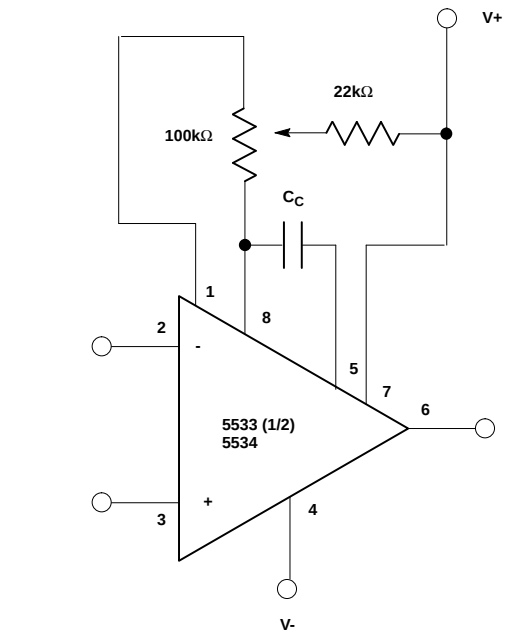
Input Noise Voltage Density



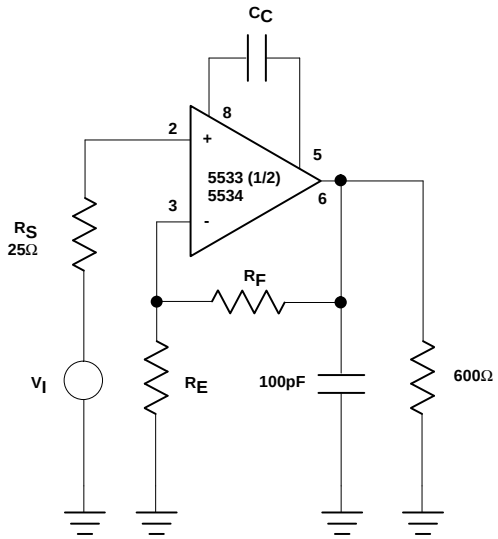
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



TEST LOAD CIRCUITS



Frequency Compensation and Offset Voltage Adjustment Circuit



Closed-Loop Frequency Response

NOISE TEST BLOCK DIAGRAM