Low-noise operational amplifiers 5534/5534A

FEATURES

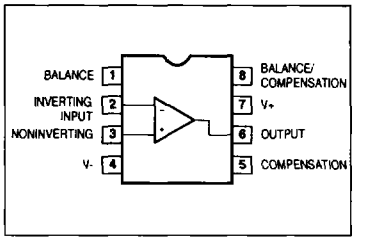
- Small-signal bandwidth: 10MHz
- Output drive capability: 600Ω, $10V_{RMS}$ at $V_S = \pm 18V$
- Input noise voltage: $4nV/\sqrt{Hz}$
- DC voltage gain: 100000
- AC voltage gain: 6000 at 10kHz
- Power bandwidth: 200kHz
- Slew rate: 13V/μs
- Large supply voltage range: ±3 to ±20V

DESCRIPTION

The 5534 is a high-performance low-noise operational amplifier. Compared to other operational amplifiers, such as TL083, it shows better noise performance, improved output drive capability and considerably higher small-signal and power bandwidths.

The op amps are internally compensated for again 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 5534A version be used which has guaranteed noise specifications.

PIN CONFIGURATION



ORDERING INFORMATION

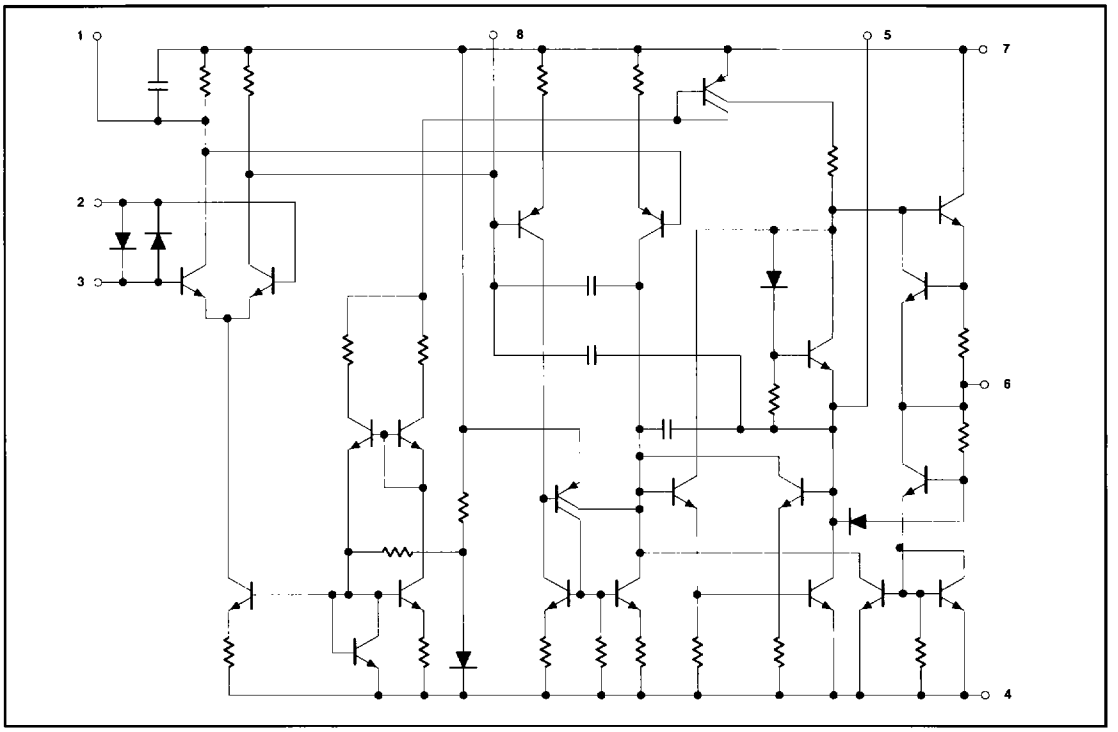
DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
8-Pin Ceramic DIP	5534/BPA	GDIP-T8
8-Pin Ceramic DIP	5534A/BPA	GDIP-T8

* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING[2]	UNIT
V_S	Supply voltage	±22	V
V_{IN}	Input voltage	±V supply	V
V_{DIFF}	Differential input voltage[1]	±0.5	V
T_{stg}	Storage temperature range	-65 to +150	°C
T_J	Junction temperature	150	°C
t_{PD}	Power dissipation at 25 °C	800	mW

EQUIVALENT SCHEMATIC



DC ELECTRICAL CHARACTERISTICS

$V_S = \pm$ 15V, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	T_{amb} = +25°C			T_{amb} = -55°C, +125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage			0.5	2.0			3	mV
I_{IO}	Input offset current			10	200			500	nA
I_{IB}	Input bias current			400	800			1500	nA
V_{ICR}	Common mode voltage range		±12	±13		±12			V
CMRR	Input mode rejection ratio	R_S = 10kΩ	80	100		70			dB
PSRR	Power supply rejection ratio			10	50			100	μV/V
A_V	Large signal voltage gain	$R_L \geq 600\Omega$, $V_O = \pm 10V$	50	100		25			V/mV
V_O	Output voltage swing	$R_L \geq 600\Omega$,	±12	±13		±10			V
		$R_L \geq 600\Omega$, $V_S = \pm 18V$	±15	+16					V
		$R_L \geq 2k\Omega$, $V_S = \pm 15V$	±13	±13.5		±12			V
R_i	Input resistance[3]		50	100					kΩ
I_{SC}	Output short-circuit current			38					mA
I_{CC}	Supply current			4	6.5			9	mA

AC ELECTRICAL CHARACTERISTICS

$V_S = \pm 15V$, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	$T_{amb} = +25^5C$			$T_{amb} = -55^5C, +125^5C$			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					Ω
	Transient response	Voltage follower,							
t_r	Rise time	R_L = 600Ω, C_C = 22pF,		20					ns
OS	Overshoot	C_L = 100pF, V_I = 50mV		20					%
	Transient response								
t_r	Rise time	V_{IN} = 50mv, R_L = 600Ω		50					ns
OS	Overshoot	C_C = 47pF, C_L = 500pF		35					%
AC	Gain	f = 10kHz, C_C = 0 f = 10kHz, C_C = 22pF		6 2.2					V/mV V/mV
GBW	Gain bandwidth product	C_C = 22pF, C_L - 100pF		10					mHz
SR	Slew rate[3]	C_C = 0 C_C = 22pF	4	13 6					VμS V/mus
PBW	Power bandwidth	$V_{OUT} = \pm 10V$, C_C = 0 $V_{OUT} = \pm 10V$, C_C = 22pF $V_{OUT} = \pm 14V$, R_L = 600Ω C_C = 22pF, $V_{CC} = \pm 18V$		200 95 70					kHz kHz kHz

ELECTRICAL CHARACTERISTICS

$T_{amb} = 25^5C$, $V_S \pm 15V$, unless otherwise specified.

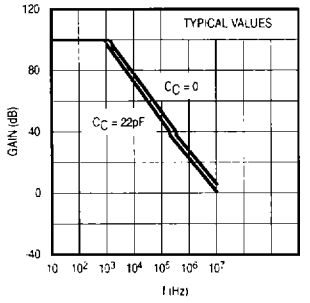
SYMBOL	PARAMETER	CONDITIONS	5533/5534			5533A/5534A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
E_N	Input noise voltage	f_O = 30Hz		7			5.5	7	nV/$\sqrt{Hz}$
		f_O = 1kHz		4			3.5	4.5	nV/$\sqrt{Hz}$
I_N	Input noise current	f_O = 30Hz		2.5			1.5		pA/$\sqrt{Hz}$
		f_O = 1kHz		0.6			0.4		pA/$\sqrt{Hz}$
BB_N	Broadband noise figure	f = 10Hz - 20kHz, R_S = 5kΩ					0.9		dB
CS	Channel separation	f = 1kHz, R_S = 5kΩ		110			110		dB

NOTES:

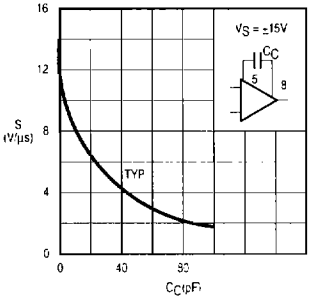
1. Diodes protect the inputs against over-voltage. Therefore, unless current-limiting resistors are used, large currents will flow if the different input voltage exceeds 0.6V. Maximum current should be limited to ± 10mA.
2. Operations beyond the limits of this table may impair the useful life of the device.
3. This parameter is guaranteed, but not tested.

TYPICAL PERFORMANCE CHARACTERISTICS

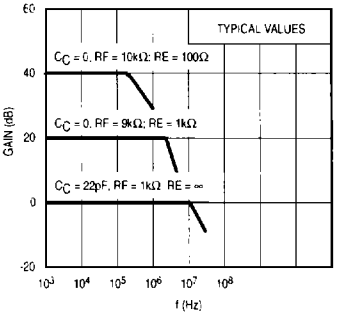
Open-Loop Frequency Response



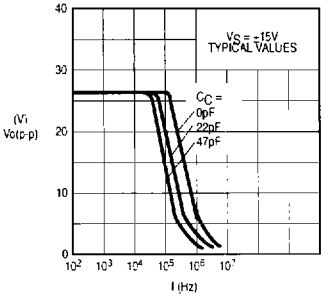
Slew Rate as a Function of Compensation Capacitance



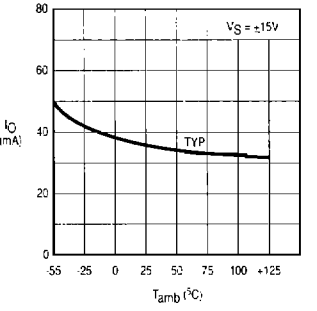
Closed-Loop Frequency Response



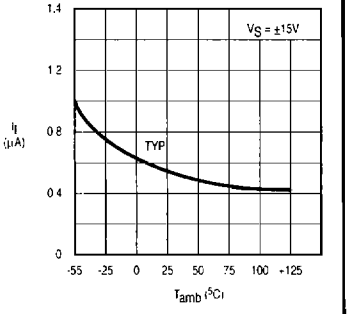
Large-Signal Frequency Response



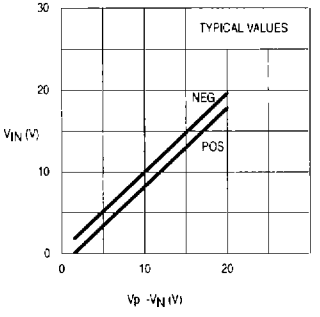
Output Short-Circuit Current



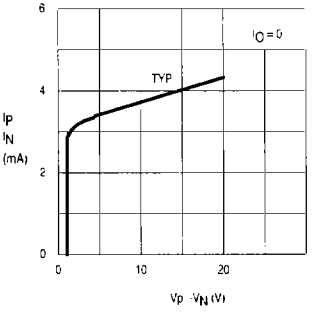
Input Bias Current



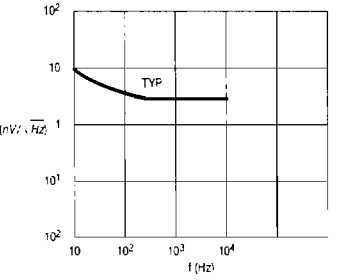
Input Commom-Mode Voltage Range



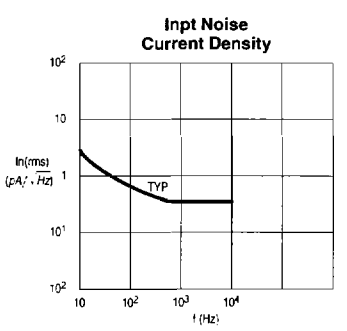
Supply Current per Op Amp

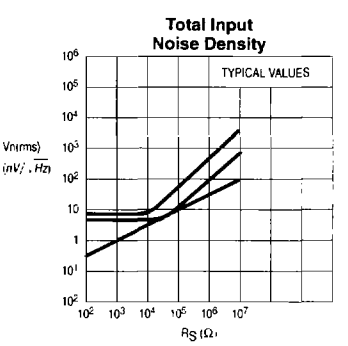


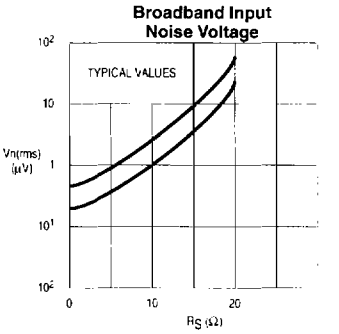
Input Noise Voltage Density



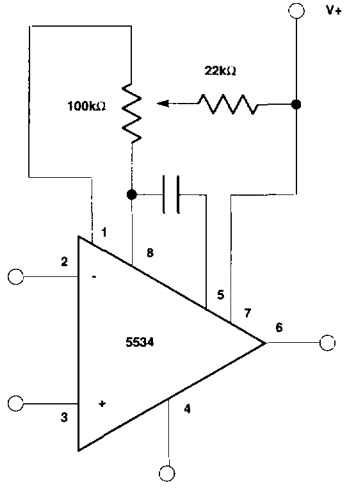
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



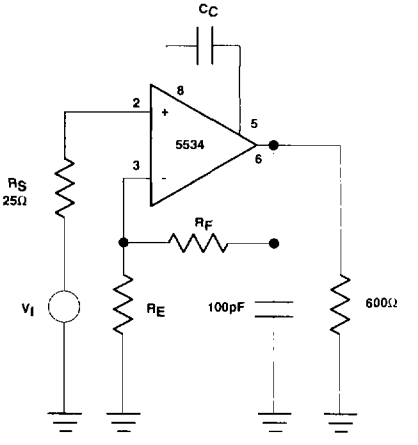




TEST LOAD CIRCUITS



Frequency Compensation and Offset Voltage Adjustment Circuit



Closed-Loop Frequency Response

NOISE TEST BLOCK DIAGRAM