DATA SHEET

NE/SA/SE5534/5534A

Single low noise operational amplifier

Product data
Supersedes data of 1994 Aug 31
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Single low noise operational amplifier NE/SA/SE5534/5534A

DESCRIPTION

The NE/SA/SE5534/5534A are 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.)

PIN CONFIGURATIONS

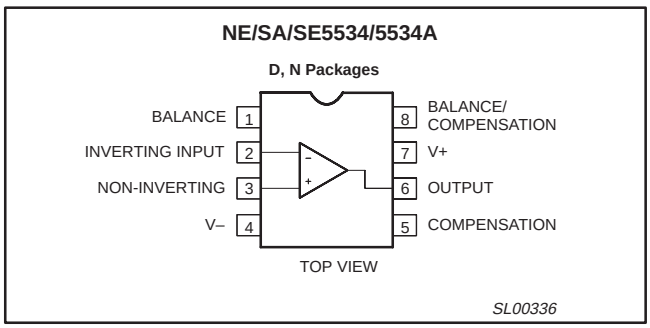


Figure 1. Pin Configuration

FEATURES

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

APPLICATIONS

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

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
8-Pin Plastic Small Outline (SO) package	0 °C to +70 °C	NE5534D	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	NE5534N	SOT97-1
8-Pin Plastic Small Outline (SO) package	0 °C to +70 °C	NE5534AD	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	NE5534AN	SOT97-1
8-Pin Plastic Dual In-Line Package (DIP)	–40 °C to +85 °C	SA5534N	SOT97-1
8-Pin Plastic Small Outline (SO) package	–40 °C to +85 °C	SA5534AD	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	–40 °C to +85 °C	SA5534AN	SOT97-1
8-Pin Plastic Dual In-Line Package (DIP)	–55 °C to +125 °C	SE5534N	SOT97-1
8-Pin Plastic Dual In-Line Package (DIP)	–55 °C to +125 °C	SE5534AN	SOT97-1

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_{amb}	Operating temperature range NE SA SE	 0 to +70 –40 to +85 –55 to +125	 °C °C °C
T_{stg}	Storage temperature range	–65 to +150	°C
T_j	Junction temperature	150	°C
P_D	Power dissipation at 25 °C [2] SO8 package DIP8 package	 750 1150	 mW mW
	Output short-circuit duration[3]	Indefinite	
T_{sld}	Lead soldering temperature (10 sec max)	230	°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 0.6 V. Maximum current should be limited to ±10 mA.
2. For operation at elevated temperature, derate packages based on the following junction-to-ambient thermal resistance:
   8-pin plastic DIP 105 °C/W
   8-pin plastic SO 160 °C/W
3. Output may be shorted to ground at V_S = ±15 V, T_{amb} = 25 °C. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

DC ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C; V_S = ±15 V, unless otherwise specified. [1, 2, 3]

SYMBOL	PARAMETER	TEST CONDITIONS	NE/SA5534/5534A			SE5534/5534A			UNIT
			Min	Typ	Max	Min	Typ	Max	
V_{OS}	Offset voltage			0.5	4		0.5	2	mV
		Over temperature			5			3	mV
$\Delta V_{OS}/\Delta T$				5			5		µV/°C
I_{OS}	Offset current			20	300		10	200	nA
		Over temperature			400			500	nA
$\Delta I_{OS}/\Delta T$				200			200		pA/°C
I_B	Input current			500	1500		400	800	nA
		Over temperature			2000			1500	nA
$\Delta I_B/\Delta T$				5			5		nA/°C
I_{CC}	Supply current per op amp			4	8		4	6.5	mA
		Over temperature			10			9	mA
V_{CM}	Common mode input range		±12	±13		±12	±13		V
CMRR	Common mode rejection ratio		70	100		80	100		dB
PSRR	Power supply rejection ratio			10	100		10	50	µV/V
A_{VOL}	Large-signal voltage gain	$R_L \geq 600\ \Omega$, V_O = ±10 V	25	100		50	100		V/mV
		Over temperature	15			25			V/mV
V_{OUT}	Output swing	$R_L \geq 600\ \Omega$	±12	±13		±12	±13		V
		Over temperature	±10	±12		±10	±12		V
		$R_L \geq 600\ \Omega$; V_S = ±18 V	±15	±16		±15	±16		V
		$R_L \geq 2\ k\Omega$	±13	±13.5		±13	±13.5		V
		Over temperature	±12	±12.5		±12	±12.5		V
R_{IN}	Input resistance		30	100		50	100		kΩ
I_{SC}	Output short circuit current			38			38		mA

NOTES:
1. For NE5534/5534A, T_{MIN} = 0 °C, T_{MAX} = 70 °C
2. For SA5534/5534A, T_{MIN} = –40 °C, T_{MAX} = +85 °C
3. For SE5534/5534A, T_{MIN} = –55 °C, T_{MAX} = +125 °C

AC ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, V_S = ±15 V, unless otherwise specified.

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

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, V_S = 15 V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	NE/SA/SE5534			NE/SA/SE5534A			UNIT
			Min	Typ	Max	Min	Typ	Max	
V_{NOISE}	Input noise voltage	f_O = 30 Hz f_O = 1 kHz		7 4			5.5 3.5	7 4.5	nV/√Hz nV/√Hz
I_{NOISE}	Input noise current	f_O = 30 Hz f_O = 1 kHz		2.5 0.6			1.5 0.4		pA/√Hz pA/√Hz
	Broadband noise figure	f = 10 Hz to 20 kHz; R_S = 5 kΩ					0.9		dB
	Channel separation	f = 1 kHz; R_S = 5 kΩ		110			110		dB

EQUIVALENT SCHEMATIC

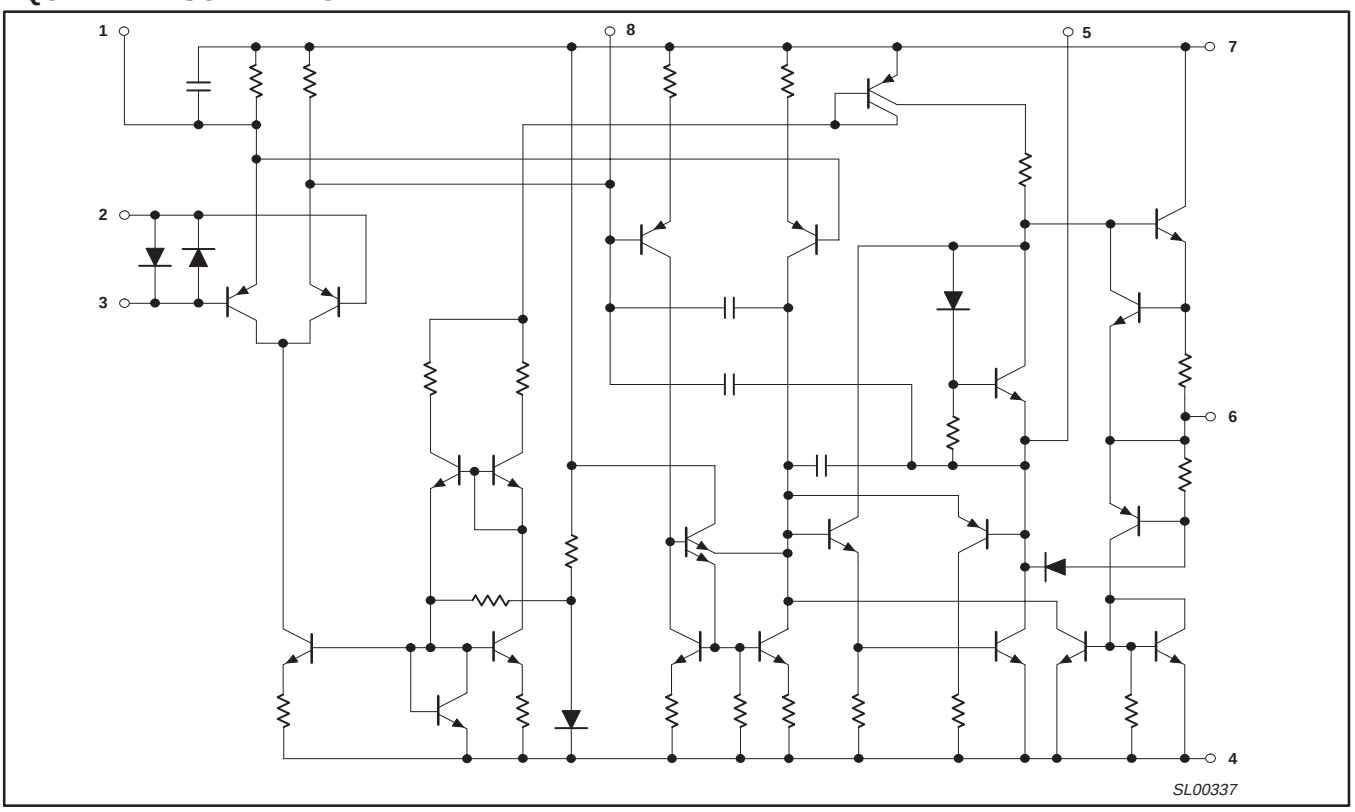


Figure 2. Equivalent Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

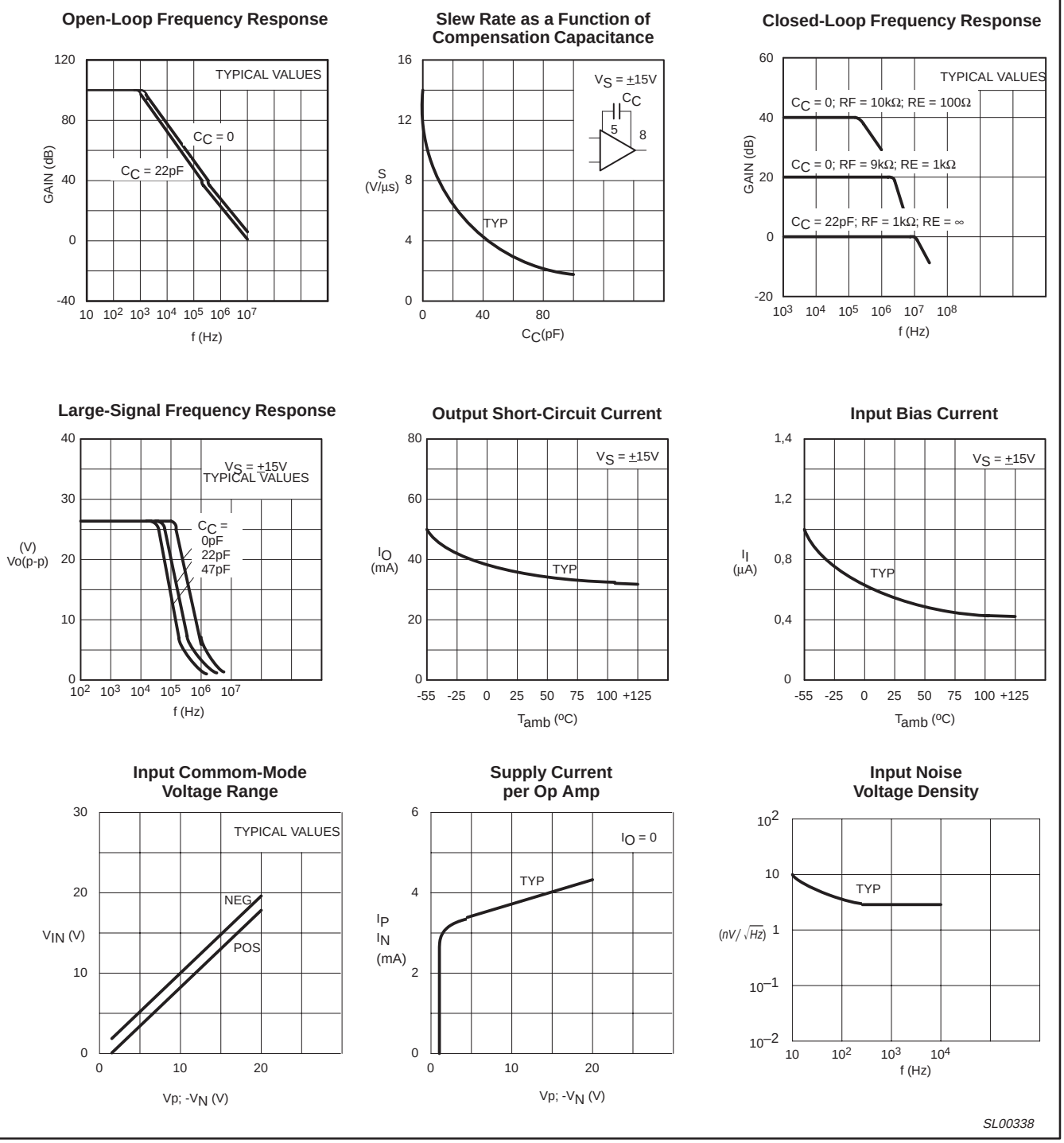


Figure 3. Typical Performance Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

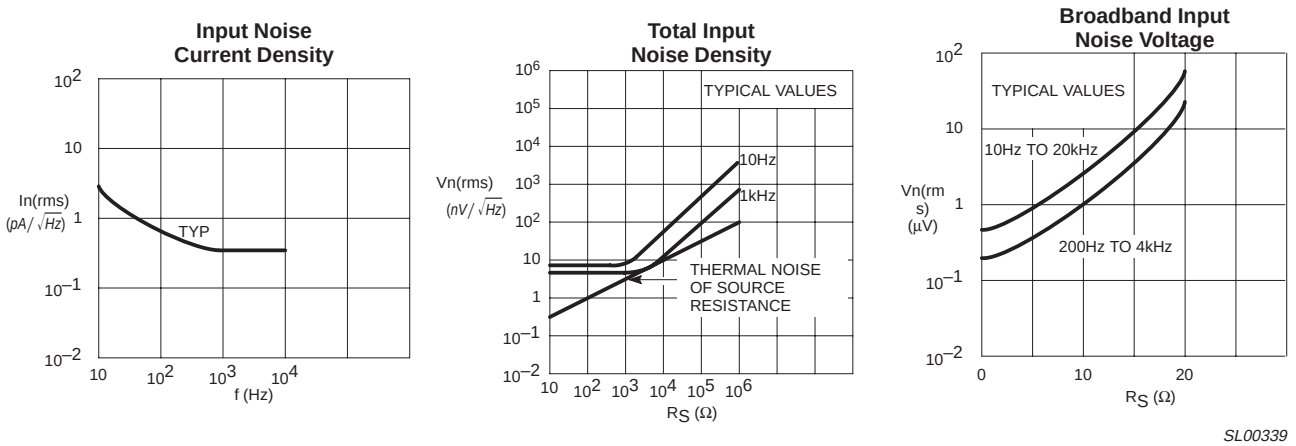


Figure 4. Typical Performance Characteristics (cont.)

TEST LOAD CIRCUITS

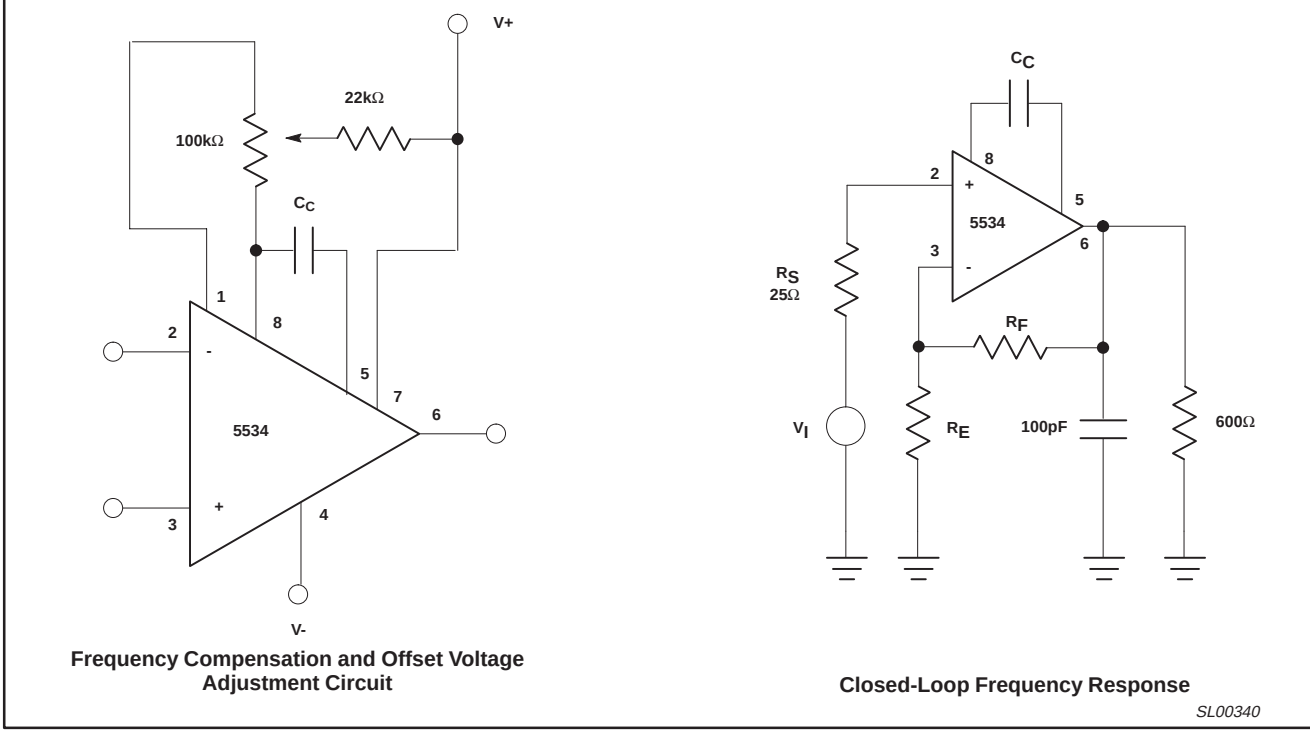


Figure 5. Test Load Circuits

NOISE TEST BLOCK DIAGRAM

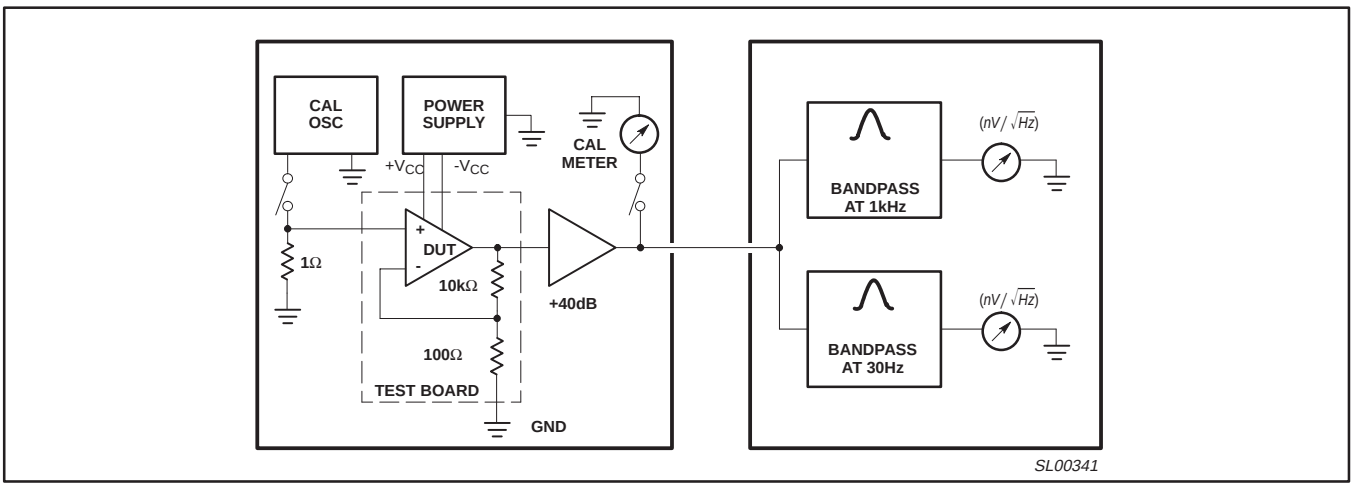
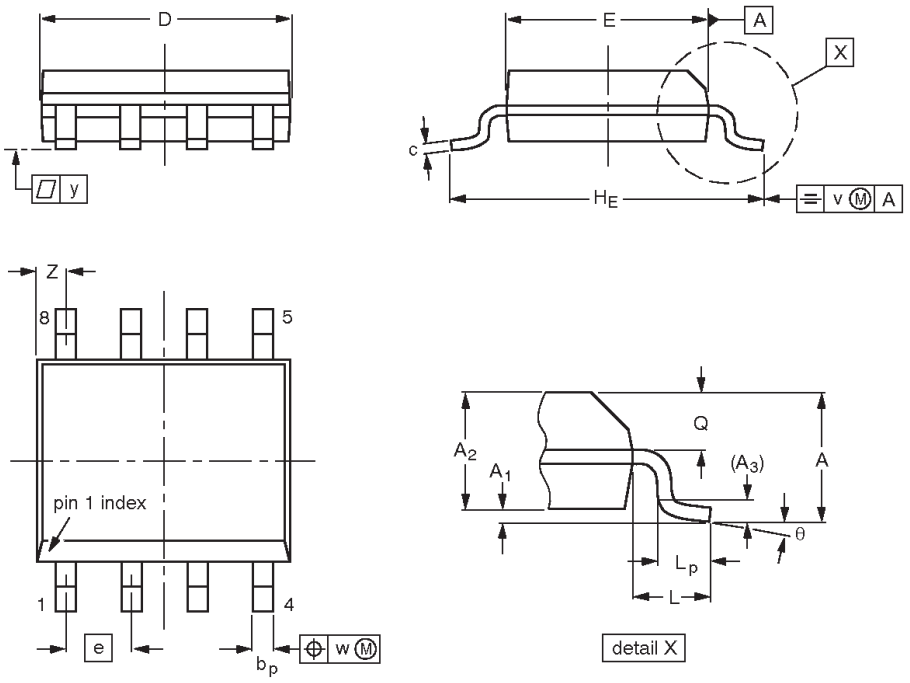
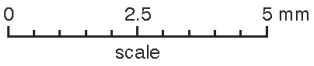


Figure 6. Noise Test Block Diagram

SO8: plastic small outline package; 8 leads; body width 3.9 mm **SOT96-1**





DIMENSIONS (inch dimensions are derived from the original mm dimensions)

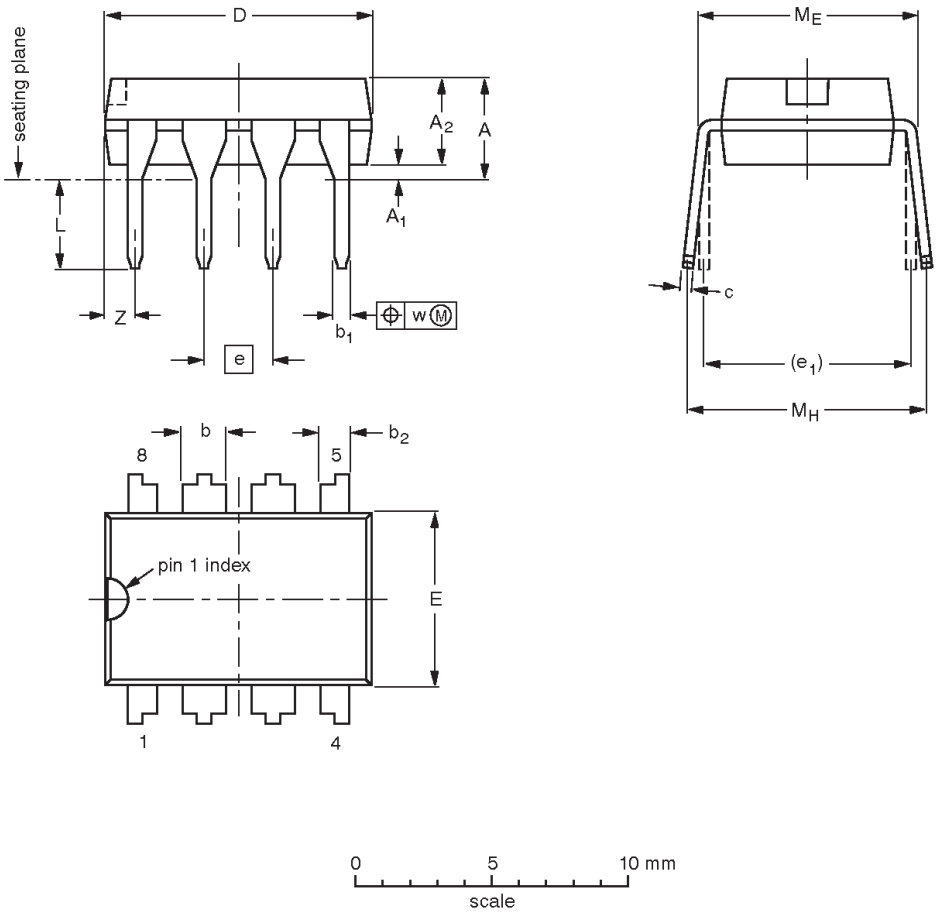
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT96-1	076E03	MS-012				~~97-05-22~~ 99-12-27

DIP8: plastic dual in-line package; 8 leads (300 mil) **SOT97-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.14	0.53 0.38	1.07 0.89	0.36 0.23	9.8 9.2	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	1.15
inches	0.17	0.020	0.13	0.068 0.045	0.021 0.015	0.042 0.035	0.014 0.009	0.39 0.36	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.045

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT97-1	050G01	MO-001	SC-504-8			~~95-02-04~~ 99-12-27

NOTES

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Data sheet status[1]	Product status[2]	Definitions
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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