ON Semiconductor

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NE5532, SA5532, SE5532, NE5532A, SE5532A

Internally Compensated Dual Low Noise Operational Amplifier

The 5532 is a dual high-performance low noise operational amplifier. Compared to most of the standard operational amplifiers, such as the 1458, it shows better noise performance, improved output drive capability and considerably higher small-signal and power bandwidths.

This makes the device especially suitable for application in high-quality and professional audio equipment, instrumentation and control circuits, and telephone channel amplifiers. The op amp is internally compensated for gains equal to one. If very low noise is of prime importance, it is recommended that the 5532A version be used because it has guaranteed noise voltage specifications.

Features

- Small-Signal Bandwidth: 10 MHz
- Output Drive Capability: 600 Ω, 10 V_{RMS}
- Input Noise Voltage: 5.0 $nV/\sqrt{Hz}$ (Typical)
- DC Voltage Gain: 50000
- AC Voltage Gain: 2200 at 10 kHz
- Power Bandwidth: 140 kHz
- Slew Rate: 9.0 V/μs
- Large Supply Voltage Range: ±3.0 to ±20 V
- Compensated for Unity Gain
- Pb−Free Packages are Available

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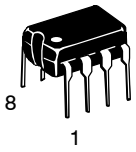
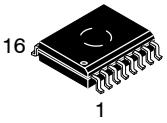
SOIC−8
D SUFFIX
CASE 751



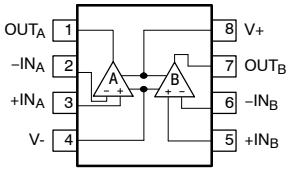
PDIP−8
N SUFFIX
CASE 626



SOIC−16 WB
D SUFFIX
CASE 751G

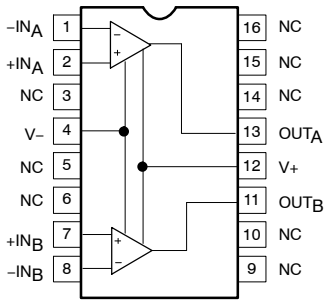
PIN CONNECTIONS

N, D8 Packages



Top View

D Package*



Top View

*SOL and non-standard pinout.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 6 of this data sheet.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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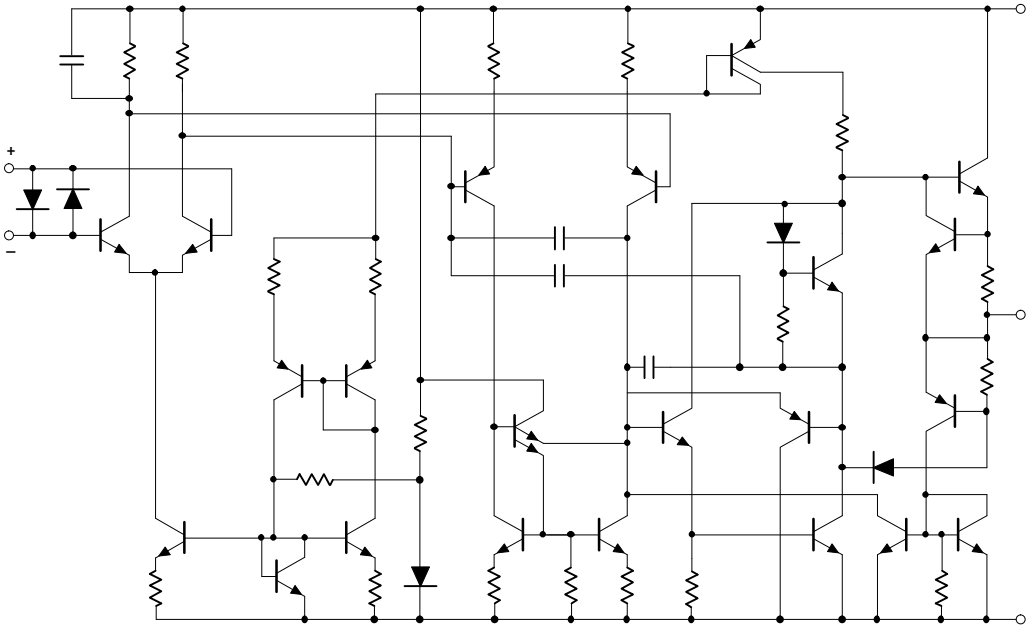


Figure 1. Equivalent Schematic (Each Amplifier)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_S	±22	V
Input Voltage	V_{IN}	$\pm V_{SUPPLY}$	V
Differential Input Voltage (Note 1)	V_{DIFF}	±0.5	V
Operating Temperature Range NE5532/A SA5532 SE5532/A	T_{amb}	 0 to 70 −40 to +85 −55 to +125	°C
Storage Temperature	T_{stg}	−65 to +150	°C
Junction Temperature	T_j	150	°C
Maximum Power Dissipation, T_{amb} = 25°C (Still-Air) 8 D8 Package 8 N Package 16 D Packagee	P_D	 780 1200 1200	mW
Thermal Resistance, Junction−to−Ambient 8 D8 Package 8 N Package 16 D Packagee	$R_{\theta JA}$	 182 130 140	°C/W
Lead Soldering Temperature (10 sec max)	T_{sld}	230	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Diodes protect the inputs against overvoltage. 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.

DC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.) (Notes 2, 3 and 4)

Characteristic	Symbol	Test Conditions	SE5532/A			NE5532/A, SA5532			Unit
			Min	Typ	Max	Min	Typ	Max	
Offset Voltage	V_{OS}	–	–	0.5	2.0	–	0.5	4.0	mV
	–	Overtemperature	–	–	3.0	–	–	5.0	mV
	$\Delta V_{OS}/\Delta T$	–	–	5.0	–	–	5.0	–	μV/°C
Offset Current	I_{OS}	–	–	–	100	–	10	150	nA
	–	Overtemperature	–	–	200	–	–	200	nA
	$\Delta I_{OS}/\Delta T$	–	–	200	–	–	200	–	pA/°C
Input Current	I_B	–	–	300	500	–	300	800	nA
	–	Overtemperature	–	–	700	–	–	1000	nA
	$\Delta I_B/\Delta T$	–	–	5.0	–	–	5.0	–	nA/°C
Supply Current	I_{CC}	–	–	8.0	10.5	–	8.0	16	mA
	–	Overtemperature	–	–	13	–	–	–	
Common-Mode Input Range	V_{CM}	–	±12	±13	–	±12	±13	–	V
Common-Mode Rejection Ratio	CMRR	–	80	100	–	70	100	–	dB
Power Supply Rejection Ratio	PSRR	–	–	10	50	–	10	100	μV/V
Large-Signal Voltage Gain	A_{VOL}	$R_L \geq$ 2.0 kΩ; V_O = ±10 V	50	100	–	25	100	–	V/mV
		Overtemperature	25	–	–	15	–	–	
		$R_L \geq$ 600 Ω; V_O = ±10 V	40	50	–	15	50	–	
		Overtemperature	20	–	–	10	–	–	
Output Swing	V_{OUT}	$R_L \geq$ 600 Ω	±12	±13	–	±12	±13	–	V
		Overtemperature	±10	±12	–	±10	±12	–	
		$R_L \geq$ 600 Ω; V_S = ±18 V	±15	±16	–	±15	±16	–	
		Overtemperature	±12	±14	–	±12	±14	–	
		$R_L \geq$ 2.0 kΩ	±13	±13.5	–	±13	±13.5	–	
		Overtemperature	±12	±12.5	–	±10	±12.5	–	
Input Resistance	R_{IN}	–	30	300	–	30	300	–	kΩ
Output Short Circuit Current	I_{SC}	–	10	38	60	10	38	60	mA

2. Diodes protect the inputs against overvoltage. 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.
3. For operation at elevated temperature, derate packages based on the package thermal resistance.
4. 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.

AC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.)

Characteristic	Symbol	Test Conditions	NE/SE5532/A, SA5532			Unit
			Min	Typ	Max	
Output Resistance	R_{OUT}	A_V = 30 dB Closed-loop f = 10 kHz, R_L = 600 Ω	–	0.3	–	Ω
Overshoot	–	Voltage-Follower V_{IN} = 100 mV_{P-P} C_L = 100 pF; R_L = 600 Ω	–	10	–	%
Gain	A_V	f = 10 kHz	–	2.2	–	V/mV
Gain Bandwidth Product	GBW	C_L = 100 pF; R_L = 600 Ω	–	10	–	MHz
Slew Rate	SR	–	–	9.0	–	V/μs
Power Bandwidth	–	V_{OUT} = ±10 V V_{OUT} = ±14 V; R_L = 600 Ω V_{CC} = ±18 V	– –	140 100	– –	kHz

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.)

Characteristic	Symbol	Test Conditions	NE/SE5532			NE/SA/SE5532A			Unit
			Min	Typ	Max	Min	Typ	Max	
Input Noise Voltage	V_{NOISE}	f_O = 30 Hz	–	8.0	–	–	8.0	12	nV/√Hz
		f_O = 1.0 kHz	–	5.0	–	–	5.0	6.0	
Input Noise Current	I_{NOISE}	f_O = 30 Hz	–	2.7	–	–	2.7	–	pA/√Hz
		f_O = 1.0 kHz	–	0.7	–	–	0.7	–	
Channel Separation	–	f = 1.0 kHz; R_S = 5.0 kΩ	–	110	–	–	110	–	dB

TYPICAL PERFORMANCE CHARACTERISTICS

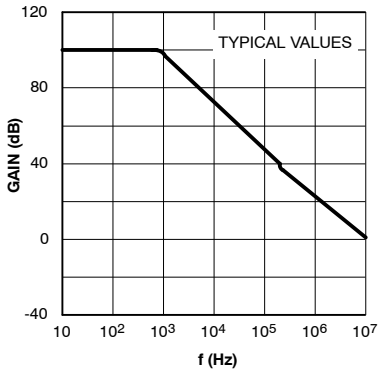


Figure 2. Open-Loop Frequency Response

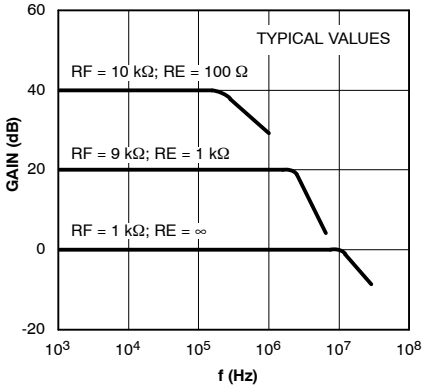


Figure 3. Closed-Loop Frequency Response

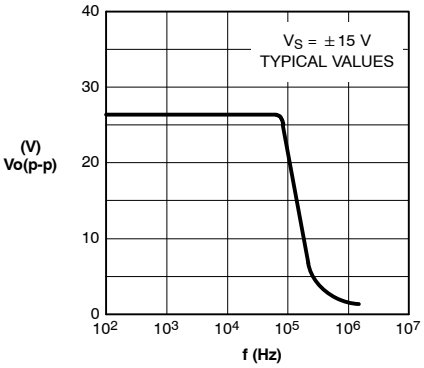


Figure 4. Large−Signal Frequency Response

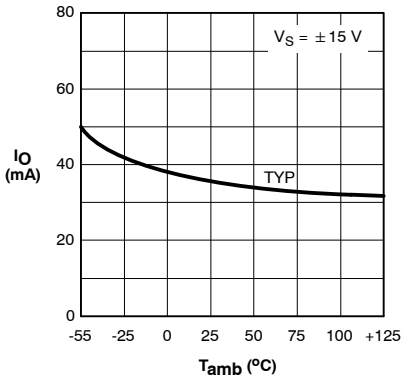


Figure 5. Output Short−Circuit Current

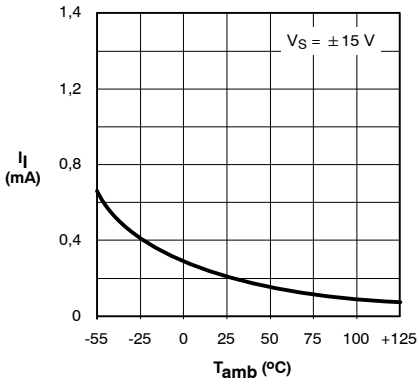


Figure 6. Input Bias Current

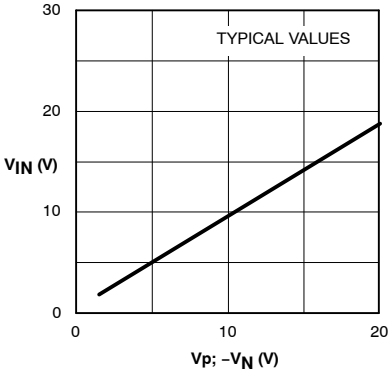


Figure 7. Input Common−Mode Voltage Range

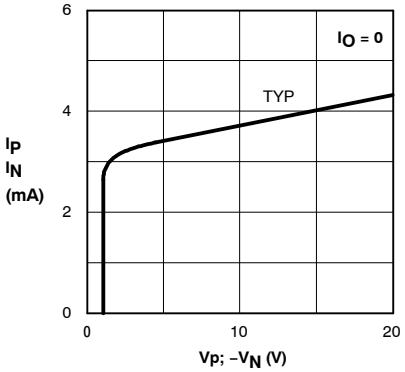


Figure 8. Supply Current

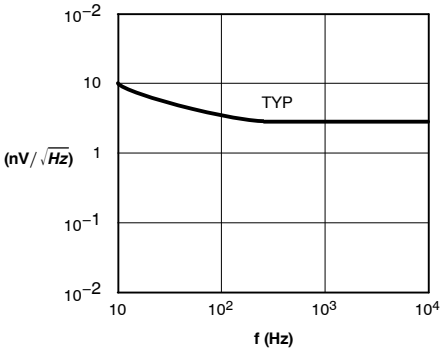
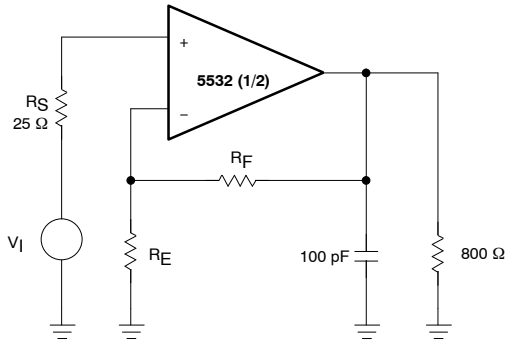
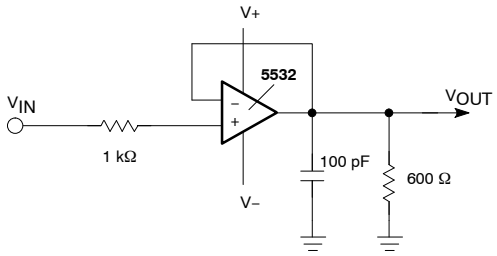


Figure 9. Input Noise Voltage Density



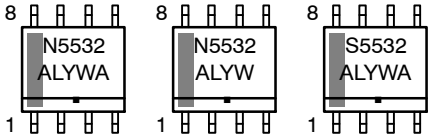
Closed-Loop Frequency Response



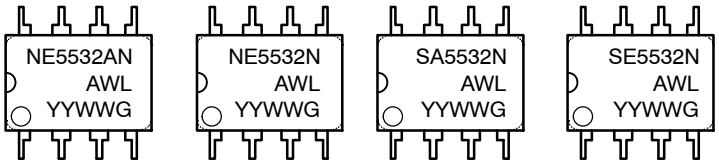
Voltage-Follower

Figure 10. Test Circuits

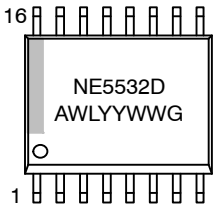
MARKING DIAGRAMS



SOIC−8
D SUFFIX
CASE 751



PDIP−8
N SUFFIX
CASE 626



SOIC−16 WB
D SUFFIX
CASE 751G

A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G or ▪ = Pb−Free Packagee

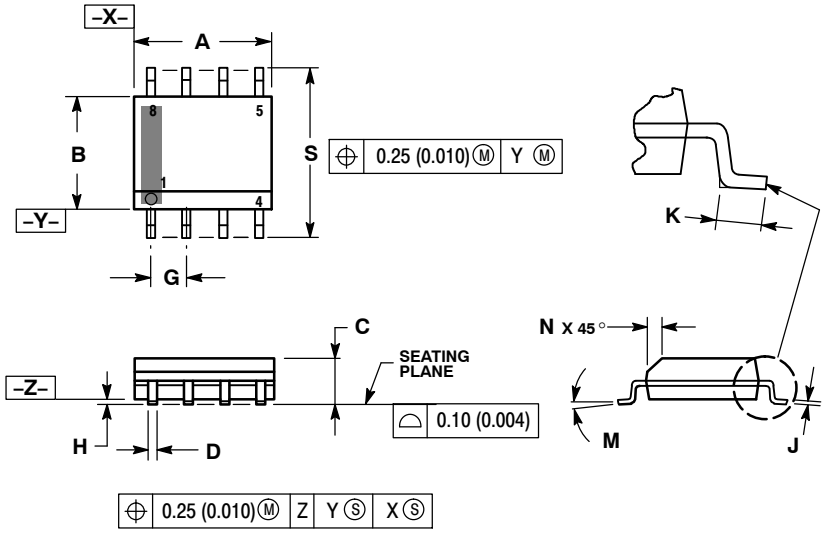
ORDERING INFORMATION

Device	Description	Temperature Range	Shipping†
NE5532AD8	8−Pin Plastic Small Outline (SO−8) Package	0 to 70°C	98 Units / Rail
NE5532AD8G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		98 Units / Rail
NE5532AD8R2	8−Pin Plastic Small Outline (SO−8) Package		2500 / Tape & Reel
NE5532AD8R2G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		2500 / Tape & Reel
NE5532AN	8−Pin Plastic Dual In−Line Package (PDIP−8)		50 Units / Rail
NE5532ANG	8−Pin Plastic Dual In−Line Package (PDIP−8) (Pb−Free)		50 Units / Rail
NE5532D	16−Pin Plastic Small Outline (SO−16 WB) Package		47 Units / Rail
NE5532DG	16−Pin Plastic Small Outline (SO−16 WB) Package (Pb−Free)		47 Units / Rail
NE5532DR2	16−Pin Plastic Small Outline (SO−16 WB) Package		1000 Tape & Reel
NE5532DR2G	16−Pin Plastic Small Outline (SO−16 WB) Package (Pb−Free)		1000 Tape & Reel
NE5532D8	8−Pin Plastic Small Outline (SO−8) Package		98 Units / Rail
NE5532D8G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		98 Units / Rail
NE5532D8R2	8−Pin Plastic Small Outline (SO−8) Package		2500 / Tape & Reel
NE5532D8R2G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		2500 / Tape & Reel
NE5532N	8−Pin Plastic Dual In−Line Package (PDIP−8)		50 Units / Rail
NE5532NG	8−Pin Plastic Dual In−Line Package (PDIP−8) (Pb−Free)		50 Units / Rail
SA5532N	8−Pin Plastic Dual In−Line Package (PDIP−8)	−40 to +85°C	50 Units / Rail
SA5532NG	8−Pin Plastic Dual In−Line Package (PDIP−8) (Pb−Free)		50 Units / Rail
SE5532AD8	8−Pin Plastic Small Outline (SO−8) Package	−55 to +125°C	98 Units / Rail
SE5532AD8G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		98 Units / Rail
SE5532AD8R2	8−Pin Plastic Small Outline (SO−8) Package		2500 / Tape & Reel
SE5532AD8R2G	8−Pin Plastic Small Outline (SO−8) Package (Pb−Free)		2500 / Tape & Reel
SE5532N	8−Pin Plastic Dual In−Line Package (PDIP−8)		50 Units / Rail
SE5532NG	8−Pin Plastic Dual In−Line Package (PDIP−8) (Pb−Free)		50 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

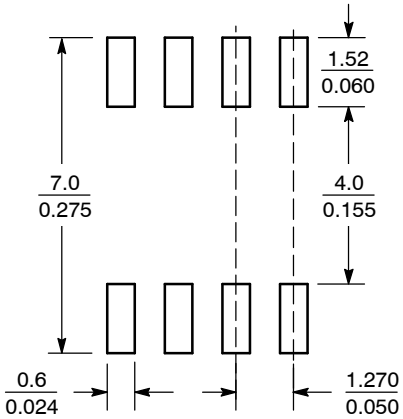
SOIC−8 NB
CASE 751−07
ISSUE AK



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*

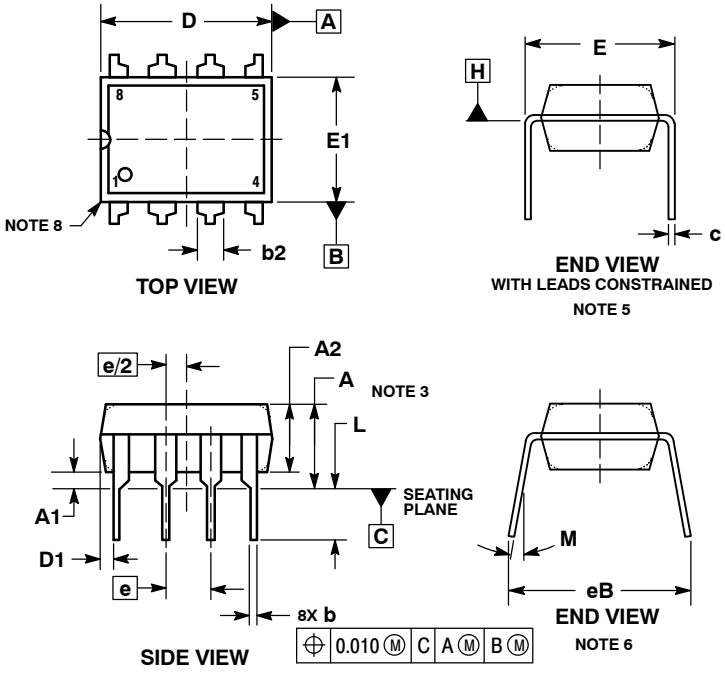


SCALE 6:1 (mm / inches)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

8−Pin Plastic Dual In−Line Package (PDIP−8)
N SUFFIX
CASE 626−05
ISSUE N

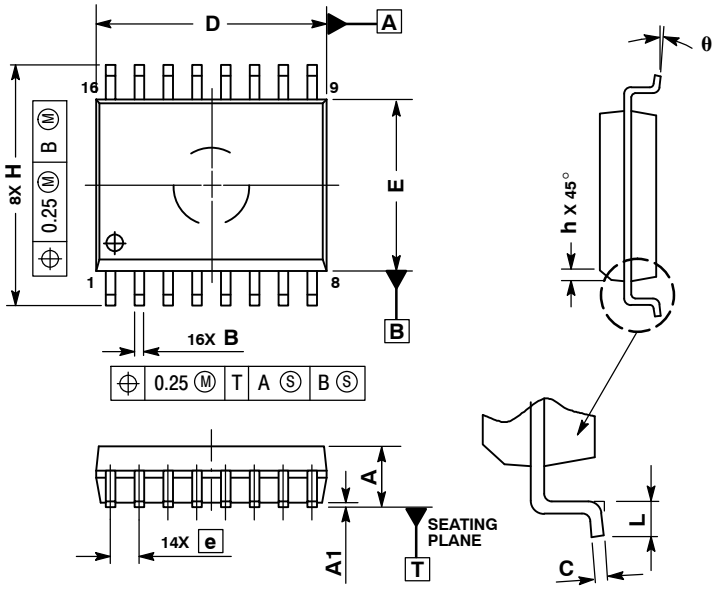


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS−3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION E3 IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	----	0.210	---	5.33
A1	0.015	----	0.38	---
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP		1.52 TYP	
C	0.008	0.014	0.20	0.36
D	0.355	0.400	9.02	10.16
D1	0.005	----	0.13	---
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC		2.54 BSC	
eB	----	0.430	---	10.92
L	0.115	0.150	2.92	3.81
M	----	10°	---	10°

PACKAGE DIMENSIONS

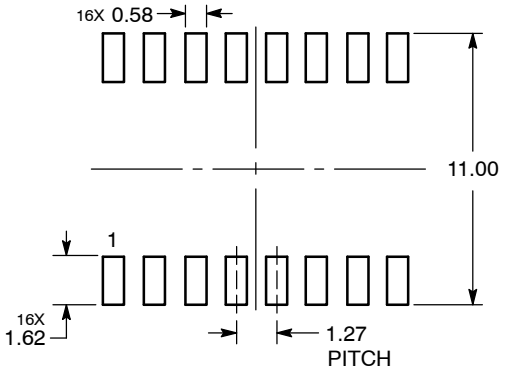
SOIC−16 WB
D SUFFIX
CASE 751G−03
ISSUE D



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INLCUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	10.15	10.45
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
q	0 °	7 °

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

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