

# NE521

## High-Speed Dual-Differential Comparator/Sense Amp

### Features

- TTL-Compatible Strokes and Outputs
- Large Common-Mode Input Voltage Range
- Operates from Standard Supply Voltages
- Pb-Free Packages are Available

### Applications

- MOS Memory Sense Amp
- A-to-D Conversion
- High-Speed Line Receiver

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage Positive Negative	V <sub>+</sub> V <sub>-</sub>	+7.0 -7.0	V
Differential Input Voltage	V <sub>IDR</sub>	±6.0	V
Input Voltage Common Mode Stroke/Gate	V <sub>IN</sub>	±5.0 +5.25	V
Maximum Power Dissipation (Note 1) T <sub>A</sub> = 25°C (Still-Air)	P <sub>D</sub>	1420 1040	mW
Thermal Resistance, Junction-to-Ambient N Package D Package	R <sub>θJA</sub>	100 145	°C/W
Operating Temperature Range	T <sub>A</sub>	0 to 70	°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	°C
Operating Junction Temperature	T <sub>J</sub>	150	°C
Lead Soldering Temperature (10 sec max)	T <sub>slid</sub>	+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. Derate above 25°C at the following rates:

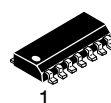
N package at 10 mW/°C  
D package at 6.9 mW/°C.



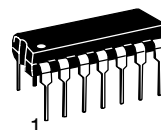
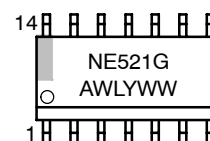
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<http://onsemi.com>

### MARKING DIAGRAMS



SOIC-14  
D SUFFIX  
CASE 751A



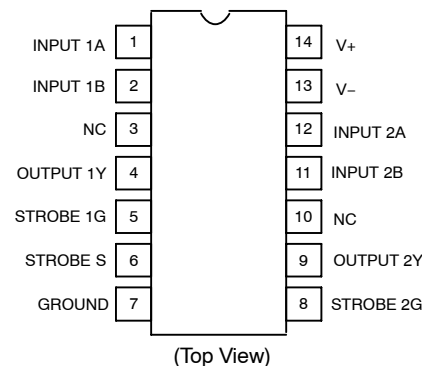
PDIP-14  
N SUFFIX  
CASE 646



A = Assembly Location  
WL = Wafer Lot  
Y, YY = Year  
WW = Work Week  
G = Pb-Free Package

### PIN CONNECTIONS

#### D, N Packages



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

## LOGIC FUNCTION TABLE

$V_{ID} (A^+, B)$	Strobe S	Strobe G	Output (Y)
$V_{ID} \leq -V_{OS}$	H	H	L
$-V_{OS} < V_{ID} < V_{OS}$	H	H	Undefined
$V_{ID} \geq V_{OS}$	H	H	H
X	L	X	H
X	X	L	H

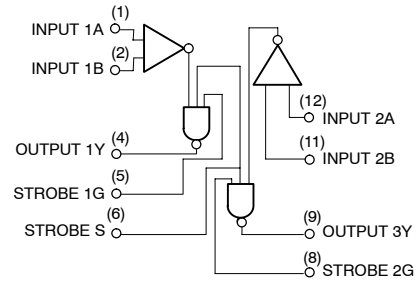


Figure 1. Block Diagram

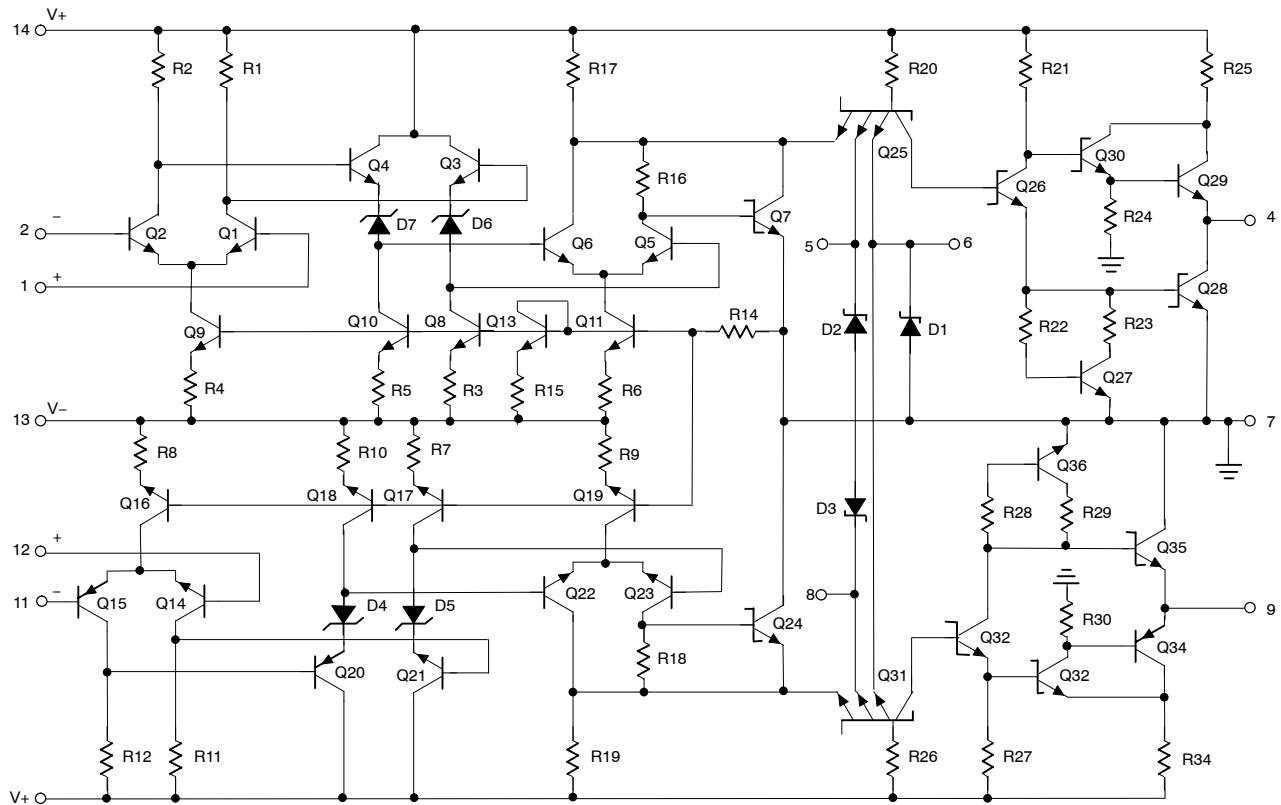


Figure 2. Equivalent Schematic

# NE521

## DC ELECTRICAL CHARACTERISTICS ( $V_+ = +5.0\text{ V}$ ; $V_- = -5.0\text{ V}$ , $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Test Conditions	Symbol	Limits			Unit
			Min	Typ	Max	
Input Offset Voltage At $25^\circ\text{C}$ Overtemperature Range	$V_+ = +4.75\text{ V}$ ; $V_- = -4.75\text{ V}$	$V_{OS}$	– –	6.0 –	7.5 10	mV
Input Bias Current At $25^\circ\text{C}$ Overtemperature Range	$V_+ = +5.25\text{ V}$ ; $V_- = -5.25\text{ V}$	$I_{BIAS}$	– –	7.5 –	20 40	$\mu\text{A}$
Input Offset Current At $25^\circ\text{C}$ Overtemperature Range	$V_+ = +5.25\text{ V}$ ; $V_- = -5.25\text{ V}$	$I_{OS}$	– –	1.0 –	5.0 12	$\mu\text{A}$
Common-Mode Voltage Range	$V_+ = +4.75\text{ V}$ ; $V_- = -4.75\text{ V}$	$V_{CM}$	–3.0	–	+3.0	V
Input Current High	$V_+ = +5.25\text{ V}$ ; $V_- = -5.25\text{ V}$ $V_{IH} = 2.7\text{ V}$ 1G or 2G Strobe Common Strobe S	$I_{IH}$	– –	– –	50 100	$\mu\text{A}$
Input Current Low	$V_{IL} = 0.5\text{ V}$ 1G or 2G Strobe Common Strobe S	$I_{IL}$	– –	– –	–2.0 –4.0	mA
Output Voltage High  Low	$V_{I(S)} = 2.0\text{ V}$ $V_+ = +4.75\text{ V}$ ; $V_- = -4.75\text{ V}$ ; $I_{LOAD} = -1.0\text{ mA}$ $V_+ = +5.25\text{ V}$ ; $V_- = -5.25\text{ V}$ ; $I_{LOAD} = 20\text{ mA}$	$V_{OH}$  $V_{OL}$	2.7	3.4	0.5	V
Supply Voltage Positive Negative	–	$V_+$ $V_-$	4.75 –4.75	5.0 –5.0	5.25 –5.25	V
Supply Current Positive Negative	$V_+ = +5.25\text{ V}$ ; $V_- = -5.25\text{ V}$ ; $T_A = 25^\circ\text{C}$	$I_{CC+}$ $I_{CC-}$	– –	27 –15	35 –28	mA
Short-Circuit Output Current	–	$I_{SC}$	–40	–	–100	mA

## AC ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ ; $R_L = 280\ \Omega$ ; $C_L = 15\text{ pF}$ , $V_+ = 5.0\text{ V}$ ; $V_- = 5.0\text{ V}$ , guaranteed by characterization)

Characteristic	From Input	To Output	Symbol	Limits			Unit
				Min	Typ	Max	
Large-Signal Switching Speed							
Propagation Delay Low to High (Note 2)	Amp	Output	t <sub>PLH(D)</sub>	–	9.6	12	ns
High to Low (Note 2)	Amp	Output	t <sub>PHL(D)</sub>	–	8.2	9.0	
Low to High (Note 3)	Strobe	Output	t <sub>PLH(S)</sub>	–	4.8	10	
High to Low (Note 3)	Strobe	Output	t <sub>PHL(S)</sub>	–	3.9	6.0	
Max. Operating Frequency	–	–	f <sub>MAX</sub>	40	55	–	MHz

2. Response time measured from 0 V point of  $\pm 100\text{ mV}_{P-P}$  10 MHz square wave to the 1.5 V point of the output.

3. Response time measured from 1.5 V point of input to 1.5 V point of the output.

## TYPICAL PERFORMANCE CHARACTERISTICS

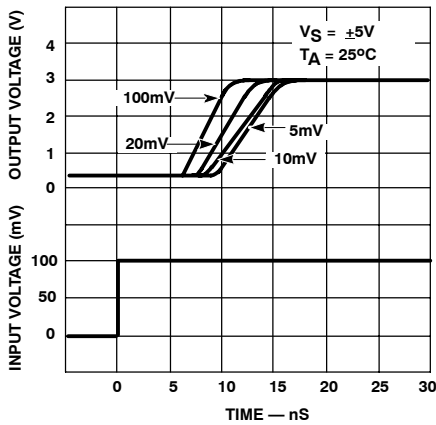


Figure 3. Response Time for Various Input Overdrives

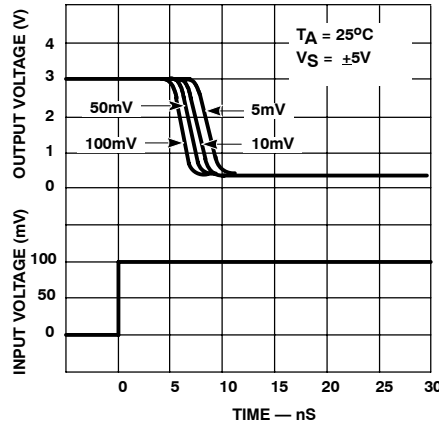


Figure 4. Response Time for Various Input Overdrives

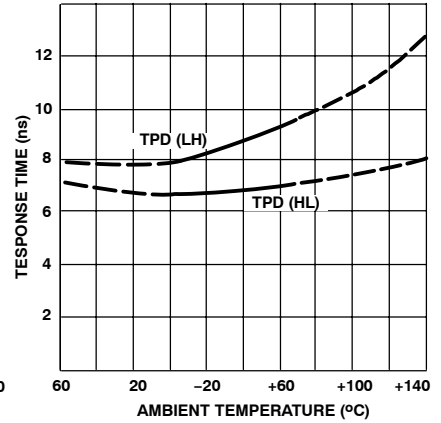


Figure 5. Response Time vs. Temperature

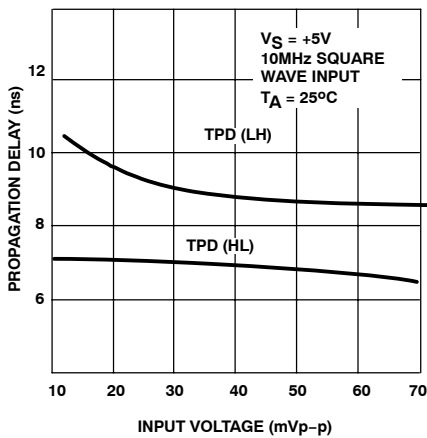


Figure 6. Propagation Delay for Various Input Voltages

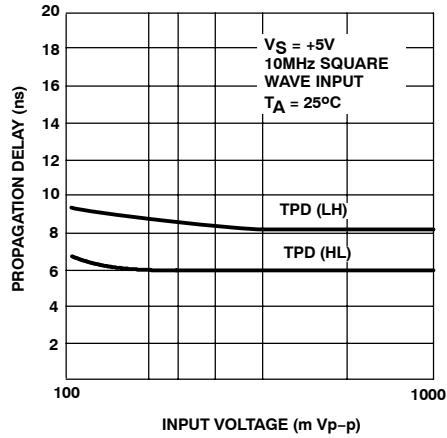


Figure 7. Propagation Delay for Various Input Voltages

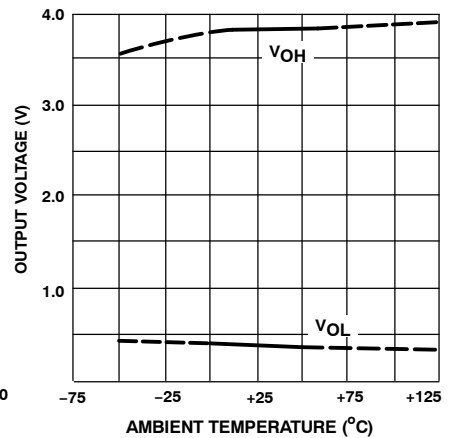


Figure 8. Output Voltage vs. Ambient Temperature

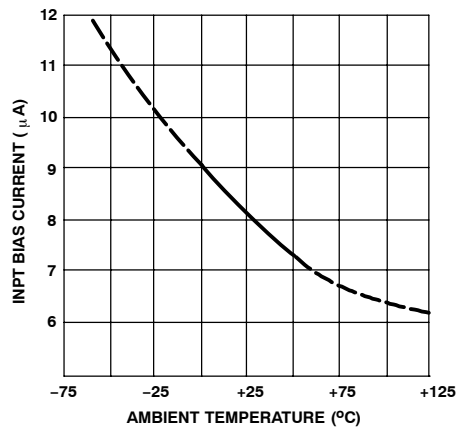


Figure 9. Input Bias Current vs. Ambient Temperature

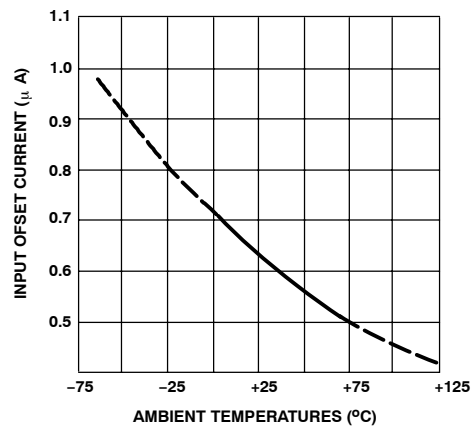


Figure 10. Input Offset Current vs. Ambient Temperature

## NE521

### ORDERING INFORMATION

Device	Temperature Range	Package	Shipping†
NE521D	0 to +70°C	SOIC-14	55 Units/Rail
NE521DG		SOIC-14 (Pb-Free)	
NE521DR2		SOIC-14	2500/Tape & Reel
NE521DR2G		SOIC-14 (Pb-Free)	
NE521N		PDIP-14	25 Units/Rail
NE521NG		PDIP-14 (Pb-Free)	

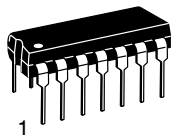
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE

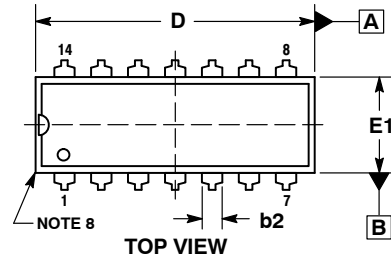
## PACKAGE DIMENSIONS

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ON



SCALE 1:1

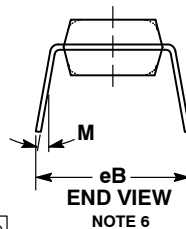
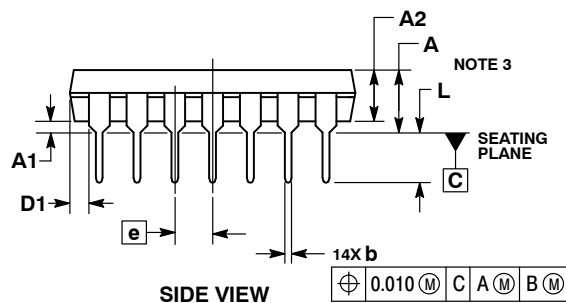
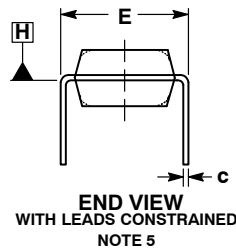


PDIP-14  
CASE 646-06  
ISSUE S

DATE 22 APR 2015

### 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 eB 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).



DIM	INCHES		MILLIMETERS	
	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	0.735	0.775	18.67	19.69
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°

### GENERIC MARKING DIAGRAM\*



XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking.  
Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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PDIP-14  
CASE 646-06  
ISSUE S

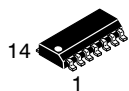
DATE 22 APR 2015

STYLE 1: PIN 1. COLLECTOR 2. BASE 3. EMITTER 4. NO CONNECTION 5. EMITTER 6. BASE 7. COLLECTOR 8. COLLECTOR 9. BASE 10. EMITTER 11. NO CONNECTION 12. EMITTER 13. BASE 14. COLLECTOR	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. DRAIN 2. SOURCE 3. GATE 4. NO CONNECTION 5. GATE 6. SOURCE 7. DRAIN 8. DRAIN 9. SOURCE 10. GATE 11. NO CONNECTION 12. GATE 13. SOURCE 14. DRAIN
STYLE 5: PIN 1. GATE 2. DRAIN 3. SOURCE 4. NO CONNECTION 5. SOURCE 6. DRAIN 7. GATE 8. GATE 9. DRAIN 10. SOURCE 11. NO CONNECTION 12. SOURCE 13. DRAIN 14. GATE	STYLE 6: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. NO CONNECTION 7. ANODE/CATHODE 8. ANODE/CATHODE 9. ANODE/CATHODE 10. NO CONNECTION 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 7: PIN 1. NO CONNECTION 2. ANODE 3. ANODE 4. NO CONNECTION 5. ANODE 6. NO CONNECTION 7. ANODE 8. ANODE 9. ANODE 10. NO CONNECTION 11. ANODE 12. ANODE 13. NO CONNECTION 14. COMMON CATHODE	STYLE 8: PIN 1. NO CONNECTION 2. CATHODE 3. CATHODE 4. NO CONNECTION 5. CATHODE 6. NO CONNECTION 7. CATHODE 8. CATHODE 9. CATHODE 10. NO CONNECTION 11. CATHODE 12. CATHODE 13. NO CONNECTION 14. COMMON ANODE
STYLE 9: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. ANODE/CATHODE 7. COMMON ANODE 8. COMMON ANODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. NO CONNECTION 12. ANODE/CATHODE 13. ANODE/CATHODE 14. COMMON CATHODE	STYLE 10: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. NO CONNECTION 7. COMMON ANODE 8. COMMON CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 11: PIN 1. CATHODE 2. CATHODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE 7. CATHODE 8. ANODE 9. ANODE 10. ANODE 11. ANODE 12. ANODE 13. ANODE 14. ANODE	STYLE 12: PIN 1. COMMON CATHODE 2. COMMON ANODE 3. ANODE/CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. COMMON ANODE 7. COMMON CATHODE 8. ANODE/CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. ANODE/CATHODE 12. ANODE/CATHODE 13. ANODE/CATHODE 14. ANODE/CATHODE

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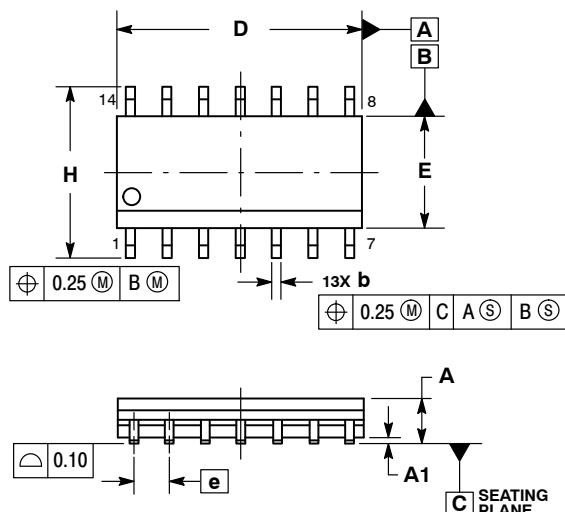
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

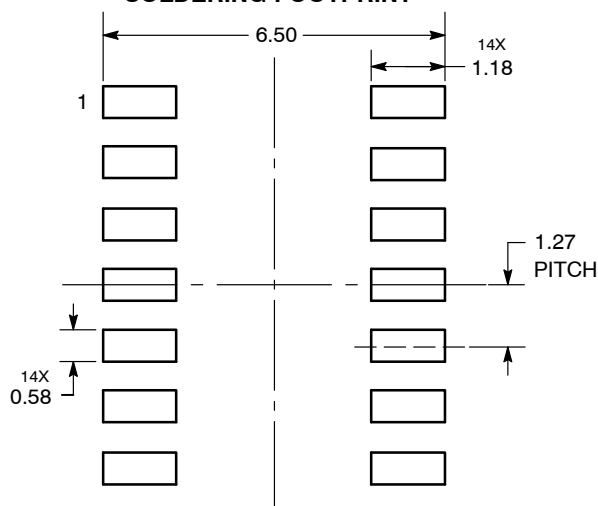


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
M	0°	7°	0°	7°

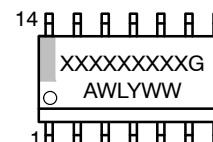
## SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

## GENERIC MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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SOIC-14  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

STYLE 1:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. NO CONNECTION  
5. ANODE/CATHODE  
6. NO CONNECTION  
7. ANODE/CATHODE  
8. ANODE/CATHODE  
9. ANODE/CATHODE  
10. NO CONNECTION  
11. ANODE/CATHODE  
12. ANODE/CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

STYLE 2:  
CANCELLED

STYLE 3:  
PIN 1. NO CONNECTION  
2. ANODE  
3. ANODE  
4. NO CONNECTION  
5. ANODE  
6. NO CONNECTION  
7. ANODE  
8. ANODE  
9. ANODE  
10. NO CONNECTION  
11. ANODE  
12. ANODE  
13. NO CONNECTION  
14. COMMON CATHODE

STYLE 4:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. CATHODE  
4. NO CONNECTION  
5. CATHODE  
6. NO CONNECTION  
7. CATHODE  
8. CATHODE  
9. CATHODE  
10. NO CONNECTION  
11. CATHODE  
12. CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

STYLE 5:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. ANODE/CATHODE  
5. ANODE/CATHODE  
6. NO CONNECTION  
7. COMMON ANODE  
8. COMMON CATHODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. ANODE/CATHODE  
12. ANODE/CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

STYLE 6:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE  
4. CATHODE  
5. CATHODE  
6. CATHODE  
7. CATHODE  
8. ANODE  
9. ANODE  
10. ANODE  
11. ANODE  
12. ANODE  
13. ANODE  
14. ANODE

STYLE 7:  
PIN 1. ANODE/CATHODE  
2. COMMON ANODE  
3. COMMON CATHODE  
4. ANODE/CATHODE  
5. ANODE/CATHODE  
6. ANODE/CATHODE  
7. ANODE/CATHODE  
8. ANODE/CATHODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. COMMON CATHODE  
12. COMMON ANODE  
13. ANODE/CATHODE  
14. ANODE/CATHODE

STYLE 8:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. NO CONNECTION  
5. ANODE/CATHODE  
6. ANODE/CATHODE  
7. COMMON ANODE  
8. COMMON ANODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. NO CONNECTION  
12. ANODE/CATHODE  
13. ANODE/CATHODE  
14. COMMON CATHODE

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