# High-Speed Dual-Differential Comparator/Sense Amp

# NE521

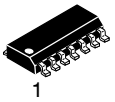
### Features

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

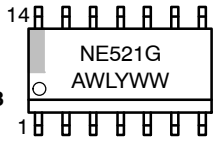
### Applications

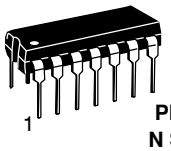
- MOS Memory Sense Amp
- A-to-D Conversion
- High-Speed Line Receiver

### MARKING DIAGRAMS



SOIC−14
D SUFFIX
CASE 751A−03



PDIP−14
N SUFFIX
CASE 646−06




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

### MAXIMUM RATINGS

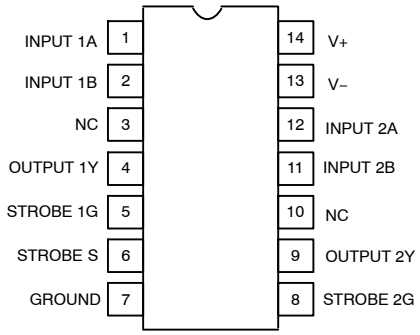
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltage<br>Positive<br>Negative | <br>V+<br>V− | <br>+7.0<br>−7.0 | V |
| Differential Input Voltage | $V_{IDR}$ | ±6.0 | V |
| Input Voltage<br>Common Mode<br>Strobe/Gate | $V_{IN}$ | <br>±5.0<br>+5.25 | V |
| Maximum Power Dissipation (Note 1)<br>$T_A$ = 25°C (Still−Air)<br>N Package<br>D Package | $P_D$ | <br><br>1420<br>1040 | mW |
| Thermal Resistance, Junction−to−Ambient<br>N Package<br>D Package | $R_{\theta JA}$ | <br>100<br>145 | °C/W |
| Operating Temperature Range | $T_A$ | 0 to 70 | °C |
| Storage Temperature Range | $T_{stg}$ | −65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | 150 | °C |
| Lead Soldering Temperature (10 sec max) | $T_{sld}$ | +230 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Derate above 25°C at the following rates:
   N package at 10 mW/°C
   D package at 6.9 mW/°C.

### PIN CONNECTIONS

**D, N Packages**




(Top View)

### ORDERING INFORMATION

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

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## 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 |

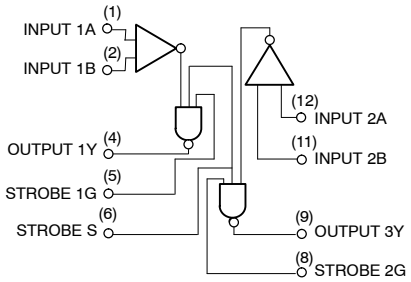



**Figure 1. Block Diagram**

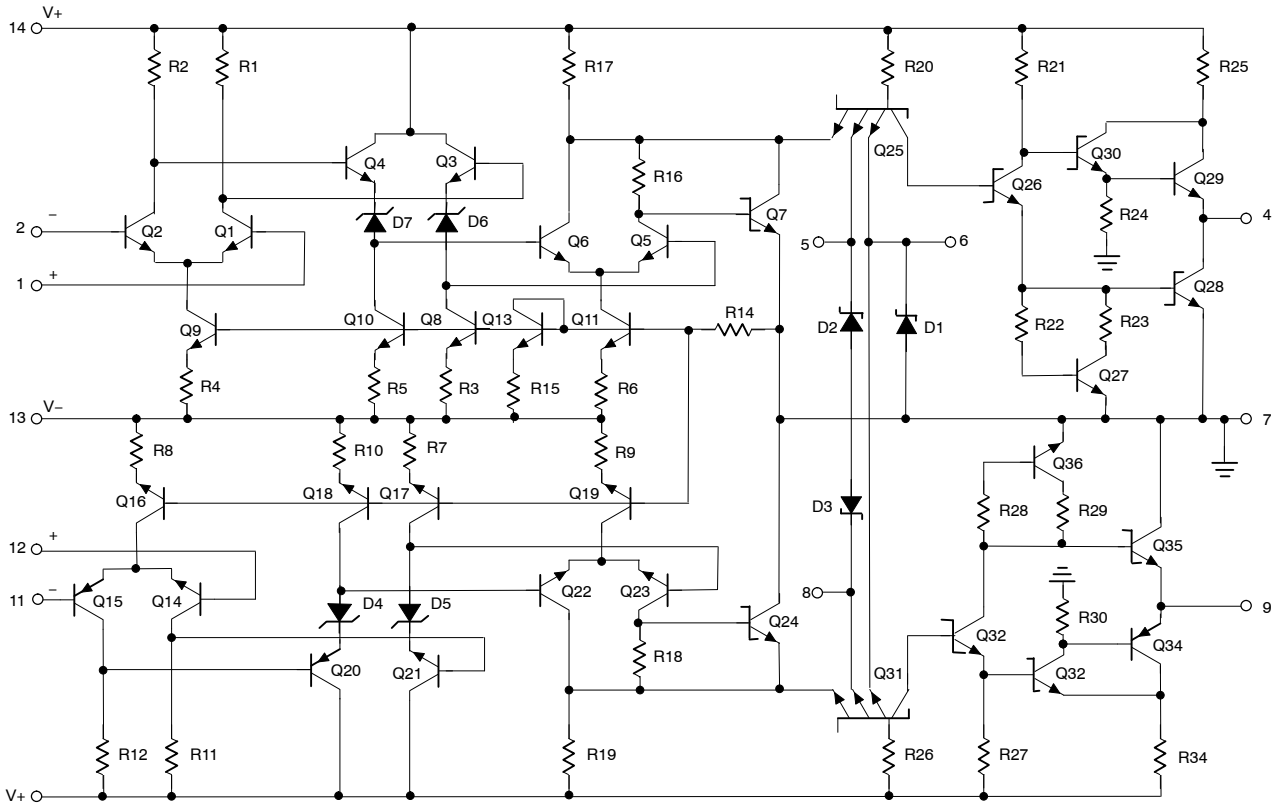



**Figure 2. Equivalent Schematic**



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**DC ELECTRICAL CHARACTERISTICS** ($V+ = +5.0$ V; $V- = -5.0$ V, $T_A = 0°C$ to $+70°C$, unless otherwise noted.)

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

**AC ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C; $R_L$ = 280 Ω; $C_L$ = 15 pF, V+ = 5.0 V; V– = 5.0 V, guaranteed by characterization)

| Characteristic | From Input | To Output | Symbol | Limits | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| **Large–Signal Switching Speed** | | | | | | | |
| Propagation Delay | | | | | | | ns |
| Low to High (Note 2) | Amp | Output | $t_{PLH(D)}$ | – | 9.6 | 12 | |
| High to Low (Note 2) | Amp | Output | $t_{PHL(D)}$ | – | 8.2 | 9.0 | |
| Low to High (Note 3) | Strobe | Output | $t_{PLH(S)}$ | – | 4.8 | 10 | |
| High to Low (Note 3) | Strobe | Output | $t_{PHL(S)}$ | – | 3.9 | 6.0 | |
| Max. Operating Frequency | – | – | $f_{MAX}$ | 40 | 55 | – | MHz |

2. Response time measured from 0 V point of ±100 $mV_{P-P}$ 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.


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## TYPICAL PERFORMANCE CHARACTERISTICS

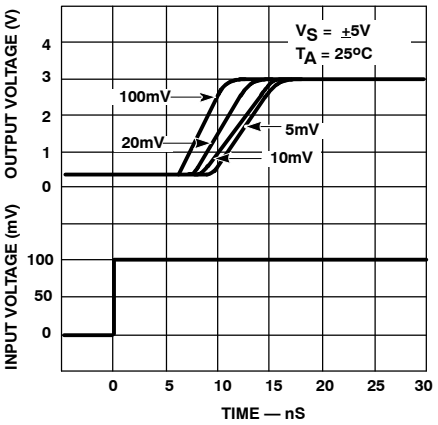



Figure 3. Response Time for Various Input Overdrives

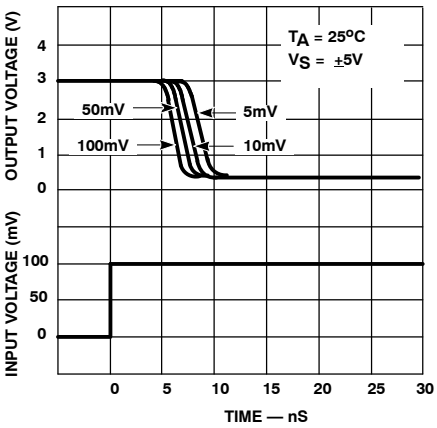



Figure 4. Response Time for Various Input Overdrives

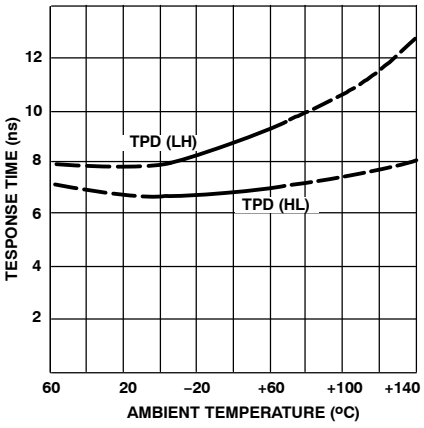



Figure 5. Response Time vs. Temperature

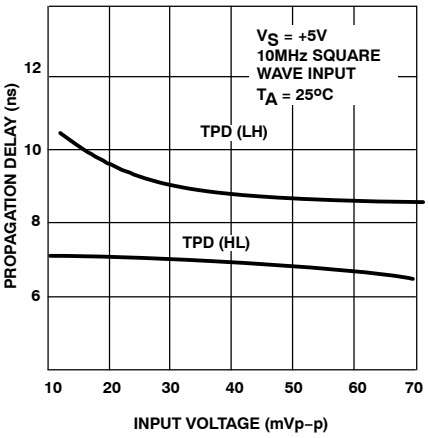



Figure 6. Propagation Delay for Various Input Voltages

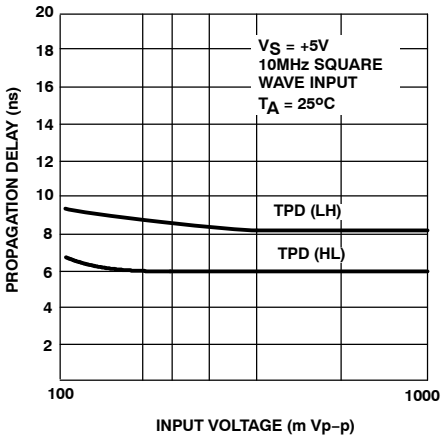



Figure 7. Propagation Delay for Various Input Voltages

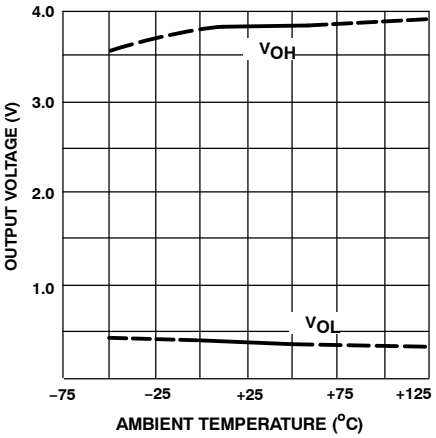



Figure 8. Output Voltage vs. Ambient Temperature

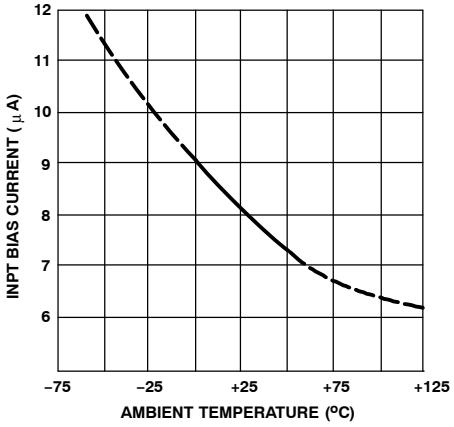



Figure 9. Input Bias Current vs. Ambient Temperature

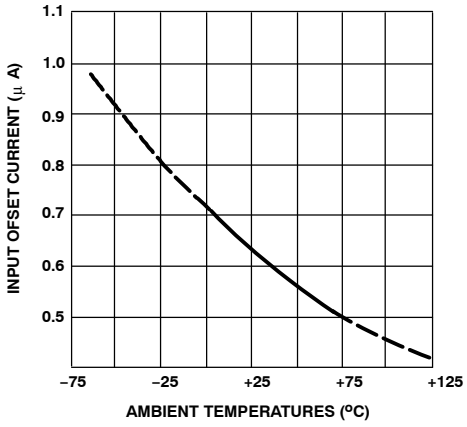



Figure 10. Input Offset Current vs. Ambient Temperature



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## ORDERING INFORMATION

| Device | Temperature Range | Package | Shipping† |
|---|---|---|---|
| NE521DR2G | 0 to +70°C | SOIC−14 (Pb−Free) | 2500/Tape & Reel |

**DISCONTINUED** (Note 4)

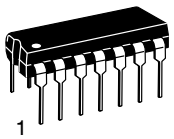
| | | | |
|---|---|---|---|
| NE521D | 0 to +70°C | SOIC−14 | 55 Units/Rail |
| NE521DG | | SOIC−14 (Pb−Free) | |
| NE521DR2 | | SOIC−14 | 2500/Tape & Reel |
| NE521N | 0 to +70°C | PDIP−14 | 25 Units/Rail |
| NE521NG | | PDIP−14 (Pb−Free) | |

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

4. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.



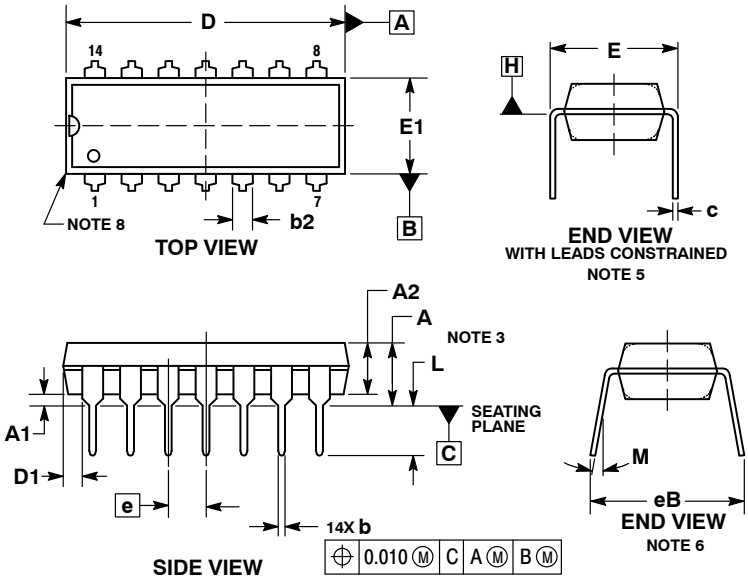
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**PDIP−14**
CASE 646−06
ISSUE S

DATE 22 APR 2015

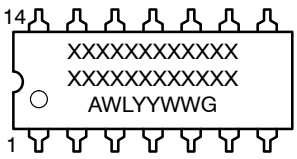
SCALE 1:1




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).

| | 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 | 0.735 | 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. Some products may not follow the Generic Marking.

**STYLES ON PAGE 2**



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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

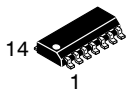
STYLE 11:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. ANODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE

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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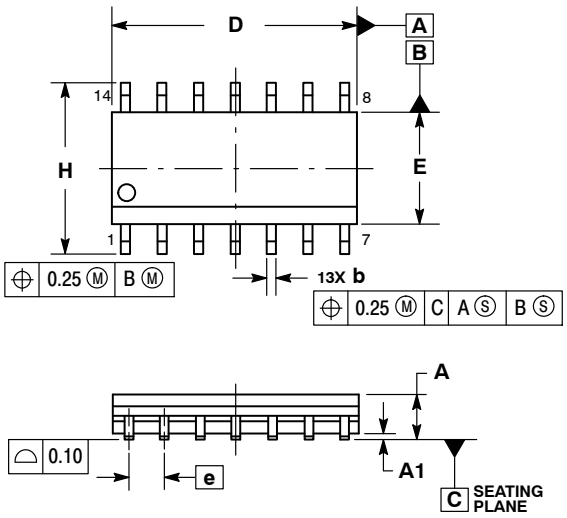
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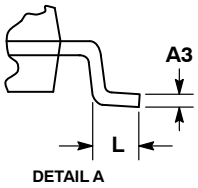


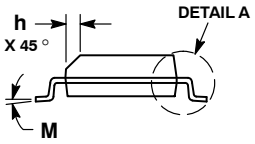

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**SOIC−14 NB**
CASE 751A−03
ISSUE L

DATE 03 FEB 2016



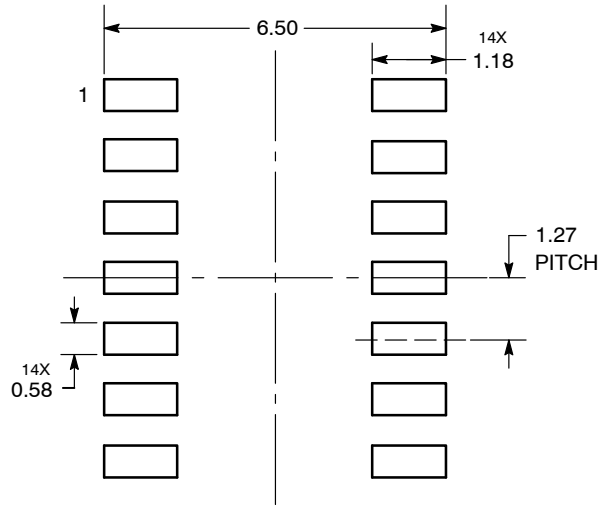




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM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

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 ° |

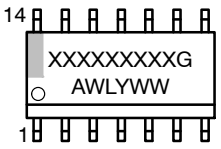
## SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

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

## GENERIC MARKING DIAGRAM*




XXXXX = 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.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
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| **DESCRIPTION:** | **SOIC−14 NB** | | **PAGE 1 OF 2** |

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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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