

# NLSV4T240E

## 4-Bit Dual-Supply Inverting Level Translator

The NLSV4T240E is a 4-bit configurable dual-supply voltage level translator. The input  $A_n$  and output  $B_n$  ports are designed to track two different power supply rails,  $V_{CCA}$  and  $V_{CCB}$  respectively. Both supply rails are configurable from 0.9 V to 4.5 V allowing universal low-voltage translation from the input  $A_n$  to the output  $B_n$  port.

The NLSV4T240E is similar to the NLSV4T240; however, it has enhanced power-off characteristics.

### Features

- Wide  $V_{CCA}$  and  $V_{CCB}$  Operating Range: 0.9 V to 4.5 V
- High-Speed w/ Balanced Propagation Delay
- Inputs and Outputs have OVT Protection to 4.5 V
- Non-preferential  $V_{CCA}$  and  $V_{CCB}$  Sequencing
- Outputs at 3-State until Active  $V_{CC}$  is Reached
- Power-Off Protection
- Outputs Switch to 3-State with  $V_{CCB}$  at GND
- Ultra-Small Packaging: 1.7 mm x 2.0 mm UQFN12
- This is a Pb-Free Device

### Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

### Important Information

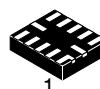
- ESD Protection for All Pins:  
HBM (Human Body Model) > 6000 V  
MM (Machine Model) > 300 V



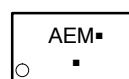
**ON Semiconductor®**

<http://onsemi.com>

### MARKING DIAGRAMS

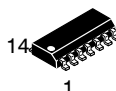


**UQFN12**  
**MU SUFFIX**  
**CASE 523AE**

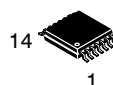
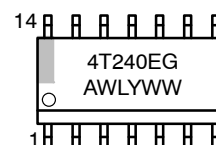


AE = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

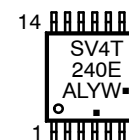
(Note: Microdot may be in either location)



**SOIC-14**  
**D SUFFIX**  
**CASE 751A**



**TSSOP-14**  
**DT SUFFIX**  
**CASE 948G**



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week  
G or ▪ = Pb-Free Package  
(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device          | Package              | Shipping†           |
|-----------------|----------------------|---------------------|
| NLSV4T240EMUTAG | UQFN12<br>(Pb-Free)  | 3000/Tape &<br>Reel |
| NLSV4T240EDR2G  | SO-14<br>(Pb-Free)   | 2500/Tape &<br>Reel |
| NLSV4T240EDTR2G | TSSOP14<br>(Pb-Free) | 2500/Tape &<br>Reel |

†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.

NLSV4T240E

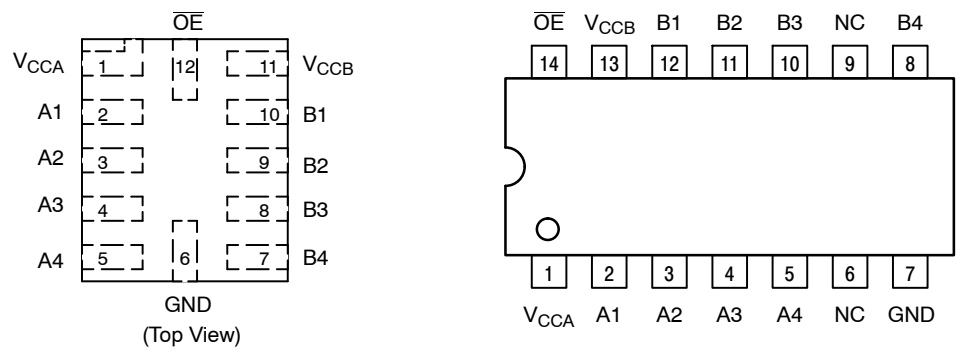


Figure 1. Pin Assignments

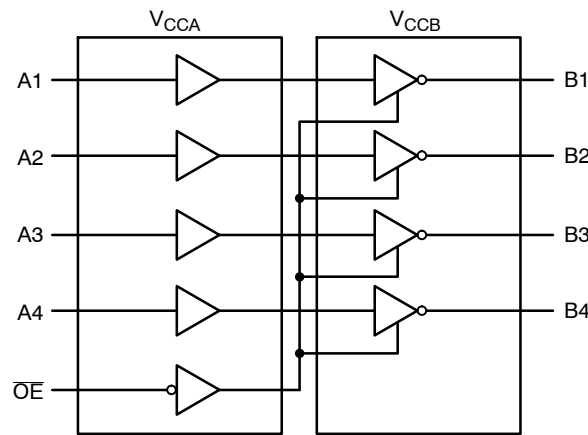


Figure 2. Logic Diagram

PIN ASSIGNMENT

| Pin            | Function                    |
|----------------|-----------------------------|
| VCCA           | Input Port DC Power Supply  |
| VCCB           | Output Port DC Power Supply |
| GND            | Ground                      |
| A <sub>n</sub> | Input Port                  |
| B <sub>n</sub> | Output Port                 |
| OE             | Output Enable               |

TRUTH TABLE

| Inputs |                | Outputs        |
|--------|----------------|----------------|
| OE     | A <sub>n</sub> | B <sub>n</sub> |
| L      | L              | H              |
| L      | H              | L              |
| H      | X              | 3-State        |

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## MAXIMUM RATINGS

| Symbol             | Rating                               | Value        | Condition               | Unit |
|--------------------|--------------------------------------|--------------|-------------------------|------|
| $V_{CCA}, V_{CCB}$ | DC Supply Voltage                    | -0.5 to +5.5 |                         | V    |
| $V_I$              | DC Input Voltage $A_n$               | -0.5 to +5.5 |                         | V    |
| $V_C$              | Control Input $\overline{OE}$        | -0.5 to +5.5 |                         | V    |
| $V_O$              | DC Output Voltage (Power Down) $B_n$ | -0.5 to +5.5 | $V_{CCA} = V_{CCB} = 0$ | V    |
|                    | (Active Mode) $B_n$                  | -0.5 to +5.5 |                         | V    |
|                    | (Tri-State Mode) $B_n$               | -0.5 to +5.5 |                         | V    |
| $I_{IK}$           | DC Input Diode Current               | -20          | $V_I < GND$             | mA   |
| $I_{OK}$           | DC Output Diode Current              | -50          | $V_O < GND$             | mA   |
| $I_O$              | DC Output Source/Sink Current        | $\pm 50$     |                         | mA   |
| $I_{CCA}, I_{CCB}$ | DC Supply Current Per Supply Pin     | $\pm 100$    |                         | mA   |
| $I_{GND}$          | DC Ground Current per Ground Pin     | $\pm 100$    |                         | mA   |
| $T_{STG}$          | Storage Temperature                  | -65 to +150  |                         | °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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                | Parameter                                                                                                         | Min | Max       | Unit |
|-----------------------|-------------------------------------------------------------------------------------------------------------------|-----|-----------|------|
| $V_{CCA}, V_{CCB}$    | Positive DC Supply Voltage                                                                                        | 0.9 | 4.5       | V    |
| $V_I$                 | Bus Input Voltage                                                                                                 | GND | 4.5       | V    |
| $V_C$                 | Control Input $\overline{OE}$                                                                                     | GND | 4.5       | V    |
| $V_{IO}$              | Bus Output Voltage (Power Down Mode) $B_n$                                                                        | GND | 4.5       | V    |
|                       | (Active Mode) $B_n$                                                                                               | GND | $V_{CCB}$ | V    |
|                       | (Tri-State Mode) $B_n$                                                                                            | GND | 4.5       | V    |
| $T_A$                 | Operating Temperature Range                                                                                       | -40 | +85       | °C   |
| $\Delta t / \Delta V$ | Input Transition Rise or Rate<br>$V_I$ , from 30% to 70% of $V_{CC}$ ; $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | 0   | 10        | nS   |

## DC ELECTRICAL CHARACTERISTICS

| Symbol   | Parameter                                      | Test Conditions | $V_{CCA}$ (V) | $V_{CCB}$ (V) | -40°C to +85°C   |                  | Unit |
|----------|------------------------------------------------|-----------------|---------------|---------------|------------------|------------------|------|
|          |                                                |                 |               |               | Min              | Max              |      |
| $V_{IH}$ | Input HIGH Voltage<br>( $A_n, \overline{OE}$ ) |                 | 3.6 – 4.5     | 0.9 – 4.5     | 2.7              | –                | V    |
|          |                                                |                 | 2.7 – 3.6     |               | 2.0              | –                |      |
|          |                                                |                 | 2.3 – 2.7     |               | 1.7              | –                |      |
|          |                                                |                 | 1.4 – 2.3     |               | $0.75 * V_{CCA}$ | –                |      |
|          |                                                |                 | 0.9 – 1.4     |               | $0.9 * V_{CCA}$  | –                |      |
| $V_{IL}$ | Input LOW Voltage<br>( $A_n, \overline{OE}$ )  |                 | 3.6 – 4.5     | 0.9 – 4.5     | –                | 0.8              | V    |
|          |                                                |                 | 2.7 – 3.6     |               | –                | 0.8              |      |
|          |                                                |                 | 2.3 – 2.7     |               | –                | 0.7              |      |
|          |                                                |                 | 1.4 – 2.3     |               | –                | $0.35 * V_{CCA}$ |      |
|          |                                                |                 | 0.9 – 1.4     |               | –                | $0.1 * V_{CCA}$  |      |

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## DC ELECTRICAL CHARACTERISTICS

| Symbol                              | Parameter                                                                                | Test Conditions                                                                                      | V <sub>CCA</sub> (V) | V <sub>CCB</sub> (V) | -40°C to +85°C          |            | Unit |
|-------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------|----------------------|-------------------------|------------|------|
|                                     |                                                                                          |                                                                                                      |                      |                      | Min                     | Max        |      |
| V <sub>OH</sub>                     | Output HIGH Voltage                                                                      | I <sub>OH</sub> = -100 µA; V <sub>I</sub> = V <sub>IH</sub>                                          | 0.9 – 4.5            | 0.9 – 4.5            | V <sub>CCB</sub> – 0.2  | –          | V    |
|                                     |                                                                                          | I <sub>OH</sub> = -0.5 mA; V <sub>I</sub> = V <sub>IH</sub>                                          | 0.9                  | 0.9                  | 0.75 * V <sub>CCB</sub> | –          |      |
|                                     |                                                                                          | I <sub>OH</sub> = -2 mA; V <sub>I</sub> = V <sub>IH</sub>                                            | 1.4                  | 1.4                  | 1.05                    | –          |      |
|                                     |                                                                                          | I <sub>OH</sub> = -6 mA; V <sub>I</sub> = V <sub>IH</sub>                                            | 1.65                 | 1.65                 | 1.25                    | –          |      |
|                                     |                                                                                          |                                                                                                      | 2.3                  | 2.3                  | 2.0                     | –          |      |
|                                     |                                                                                          | I <sub>OH</sub> = -12 mA; V <sub>I</sub> = V <sub>IH</sub>                                           | 2.3                  | 2.3                  | 1.8                     | –          |      |
|                                     |                                                                                          |                                                                                                      | 2.7                  | 2.7                  | 2.2                     | –          |      |
|                                     |                                                                                          | I <sub>OH</sub> = -18 mA; V <sub>I</sub> = V <sub>IH</sub>                                           | 2.3                  | 2.3                  | 1.7                     | –          |      |
|                                     |                                                                                          |                                                                                                      | 3.0                  | 3.0                  | 2.4                     | –          |      |
|                                     |                                                                                          | I <sub>OH</sub> = -24 mA; V <sub>I</sub> = V <sub>IH</sub>                                           | 3.0                  | 3.0                  | 2.2                     | –          |      |
| V <sub>OL</sub>                     | Output LOW Voltage                                                                       | I <sub>OL</sub> = 100 µA; V <sub>I</sub> = V <sub>IL</sub>                                           | 0.9 – 4.5            | 0.9 – 4.5            | –                       | 0.2        | V    |
|                                     |                                                                                          | I <sub>OL</sub> = 0.5 mA; V <sub>I</sub> = V <sub>IH</sub>                                           | 1.1                  | 1.1                  | –                       | 0.3        |      |
|                                     |                                                                                          | I <sub>OL</sub> = 2 mA; V <sub>I</sub> = V <sub>IH</sub>                                             | 1.4                  | 1.4                  | –                       | 0.35       |      |
|                                     |                                                                                          | I <sub>OL</sub> = 6 mA; V <sub>I</sub> = V <sub>IL</sub>                                             | 1.65                 | 1.65                 | –                       | 0.3        |      |
|                                     |                                                                                          | I <sub>OL</sub> = 12 mA; V <sub>I</sub> = V <sub>IL</sub>                                            | 2.3                  | 2.3                  | –                       | 0.4        |      |
|                                     |                                                                                          |                                                                                                      | 2.7                  | 2.7                  | –                       | 0.4        |      |
|                                     |                                                                                          | I <sub>OL</sub> = 18 mA; V <sub>I</sub> = V <sub>IL</sub>                                            | 2.3                  | 2.3                  | –                       | 0.6        |      |
|                                     |                                                                                          |                                                                                                      | 3.0                  | 3.0                  | –                       | 0.4        |      |
|                                     |                                                                                          | I <sub>OL</sub> = 24 mA; V <sub>I</sub> = V <sub>IL</sub>                                            | 3.0                  | 3.0                  | –                       | 0.55       |      |
| I <sub>I</sub>                      | Input Leakage Current                                                                    | V <sub>I</sub> = V <sub>CCA</sub> or GND                                                             | 0.9 – 4.5            | 0.9 – 4.5            | -1.0                    | 1.0        | µA   |
| I <sub>OFF</sub>                    | Power-Off Leakage Current                                                                | $\overline{OE} = 0$ V                                                                                | 0<br>0.9 – 4.5       | 0.9 – 4.5<br>0       | -1.0<br>-1.0            | 1.0<br>1.0 | µA   |
| I <sub>CCA</sub>                    | Quiescent Supply Current                                                                 | V <sub>I</sub> = V <sub>CCA</sub> or GND;<br>I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub> | 0.9 – 4.5            | 0.9 – 4.5            | –                       | 2.0        | µA   |
| I <sub>CCB</sub>                    | Quiescent Supply Current                                                                 | V <sub>I</sub> = V <sub>CCA</sub> or GND;<br>I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub> | 0.9 – 4.5            | 0.9 – 4.5            | –                       | 2.0        | µA   |
| I <sub>CCA</sub> + I <sub>CCB</sub> | Quiescent Supply Current                                                                 | V <sub>I</sub> = V <sub>CCA</sub> or GND;<br>I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub> | 0.9 – 4.5            | 0.9 – 4.5            | –                       | 4.0        | µA   |
| ΔI <sub>CCA</sub>                   | Increase in I <sub>CC</sub> per Input Voltage, Other Inputs at V <sub>CCA</sub> or GND   | V <sub>I</sub> = V <sub>CCA</sub> – 0.6 V;<br>V <sub>I</sub> = V <sub>CCA</sub> or GND               | 4.5<br>3.6           | 4.5<br>3.6           | –                       | 10<br>5.0  | µA   |
| ΔI <sub>CCB</sub>                   | Increase in I <sub>CC</sub> per Input Voltage, Other Inputs at V <sub>CCA</sub> or GND   | V <sub>I</sub> = V <sub>CCA</sub> – 0.6 V;<br>V <sub>I</sub> = V <sub>CCA</sub> or GND               | 4.5<br>3.6           | 4.5<br>3.6           | –                       | 10<br>5.0  | µA   |
| I <sub>OZ</sub>                     | I/O Tri-State Output Leakage Current (T <sub>A</sub> = 25°C, $\overline{OE} = V_{CCA}$ ) | V <sub>O</sub> = 0 V                                                                                 | 4.5                  | 4.5                  | –                       | 1.0        | µA   |
|                                     |                                                                                          | V <sub>O</sub> = 4.5 V                                                                               | 4.5                  | 4.5                  | –                       | 10         |      |
|                                     |                                                                                          | V <sub>O</sub> = 0 to 4.5 V                                                                          | 2.5                  | 3.5                  | –                       | 105        |      |
|                                     |                                                                                          |                                                                                                      | 3.0                  | 3.75                 | –                       | 110        |      |
|                                     |                                                                                          |                                                                                                      | 3.3                  | 3.0                  | –                       | 75         |      |
|                                     |                                                                                          |                                                                                                      | 3.75                 | 1.5                  | –                       | 10         |      |

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## TOTAL STATIC POWER CONSUMPTION ( $I_{CCA} + I_{CCB}$ )

| V <sub>CCA</sub> (V) | -40°C to +85°C       |       |     |       |     |       |     |       |     |       | Unit |
|----------------------|----------------------|-------|-----|-------|-----|-------|-----|-------|-----|-------|------|
|                      | V <sub>CCB</sub> (V) |       |     |       |     |       |     |       |     |       |      |
|                      | 4.5                  |       | 3.3 |       | 2.8 |       | 1.8 |       | 0.9 |       |      |
|                      | Min                  | Max   | Min | Max   | Min | Max   | Min | Max   | Min | Max   |      |
| 4.5                  |                      | 2     |     | 2     |     | 2     |     | 2     |     | < 1.5 | μA   |
| 3.3                  |                      | 2     |     | 2     |     | 2     |     | 2     |     | < 1.5 | μA   |
| 2.8                  |                      | < 2   |     | < 1   |     | < 1   |     | < 0.5 |     | < 0.5 | μA   |
| 1.8                  |                      | < 1   |     | < 1   |     | < 0.5 |     | < 0.5 |     | < 0.5 | μA   |
| 0.9                  |                      | < 0.5 |     | < 0.5 |     | < 0.5 |     | < 0.5 |     | < 0.5 | μA   |

NOTE: Connect ground before applying supply voltage  $V_{CCA}$  or  $V_{CCB}$ . This device is designed with the feature that the power-up sequence of  $V_{CCA}$  and  $V_{CCB}$  will not damage the IC.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                               | Parameter                                              | V <sub>CCA</sub> (V) | -40°C to +85°C       |      |     |      |     |      |     |      |     |      | Unit |
|------------------------------------------------------|--------------------------------------------------------|----------------------|----------------------|------|-----|------|-----|------|-----|------|-----|------|------|
|                                                      |                                                        |                      | V <sub>CCB</sub> (V) |      |     |      |     |      |     |      |     |      |      |
|                                                      |                                                        |                      | 4.5                  |      | 3.3 |      | 2.8 |      | 1.8 |      | 1.5 |      |      |
|                                                      |                                                        |                      | Min                  | Max  | Min | Max  | Min | Max  | Min | Max  | Min | Max  |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub><br>(Note 1)   | Propagation Delay,<br>A <sub>n</sub> to B <sub>n</sub> | 4.5                  |                      | 3.0  |     | 3.2  |     | 3.4  |     | 3.7  |     | 4.0  | nS   |
|                                                      |                                                        | 3.6                  |                      | 3.3  |     | 3.5  |     | 3.7  |     | 4.0  |     | 4.3  |      |
|                                                      |                                                        | 2.8                  |                      | 3.5  |     | 3.7  |     | 3.9  |     | 4.2  |     | 4.5  |      |
|                                                      |                                                        | 1.8                  |                      | 3.8  |     | 4.0  |     | 4.2  |     | 4.5  |     | 4.8  |      |
|                                                      |                                                        | 1.5                  |                      | 4.1  |     | 4.3  |     | 4.5  |     | 4.8  |     | 5.0  |      |
| t <sub>PZH</sub> ,<br>t <sub>PZL</sub><br>(Note 1)   | Output Enable,<br>OE to B <sub>n</sub>                 | 4.5                  |                      | 4.4  |     | 4.8  |     | 5.2  |     | 5.7  |     | 6.2  | nS   |
|                                                      |                                                        | 3.3                  |                      | 4.7  |     | 5.1  |     | 5.5  |     | 6.0  |     | 6.5  |      |
|                                                      |                                                        | 2.8                  |                      | 4.9  |     | 5.3  |     | 5.7  |     | 6.2  |     | 6.7  |      |
|                                                      |                                                        | 1.8                  |                      | 5.2  |     | 5.6  |     | 6.0  |     | 6.5  |     | 7.0  |      |
|                                                      |                                                        | 1.5                  |                      | 5.5  |     | 5.9  |     | 6.3  |     | 6.8  |     | 7.3  |      |
| t <sub>PHZ</sub> ,<br>t <sub>PLZ</sub><br>(Note 1)   | Output Disable,<br>OE to B <sub>n</sub>                | 4.5                  |                      | 4.4  |     | 4.8  |     | 5.2  |     | 5.7  |     | 6.2  | nS   |
|                                                      |                                                        | 3.3                  |                      | 4.7  |     | 5.1  |     | 5.5  |     | 6.0  |     | 6.5  |      |
|                                                      |                                                        | 2.8                  |                      | 4.9  |     | 5.3  |     | 5.7  |     | 6.2  |     | 6.7  |      |
|                                                      |                                                        | 1.8                  |                      | 5.2  |     | 5.6  |     | 6.0  |     | 6.5  |     | 7.0  |      |
|                                                      |                                                        | 1.5                  |                      | 5.5  |     | 5.9  |     | 6.3  |     | 6.8  |     | 7.3  |      |
| t <sub>OSHL</sub> ,<br>t <sub>OSLH</sub><br>(Note 1) | Output to Output Skew,<br>Data to Out-put              | 4.1                  |                      | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 | nS   |
|                                                      |                                                        | 3.6                  |                      | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |      |
|                                                      |                                                        | 2.8                  |                      | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |      |
|                                                      |                                                        | 1.8                  |                      | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |      |
|                                                      |                                                        | 1.2                  |                      | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |     | 0.15 |      |

1. Propagation delays defined per Figures 3 and 4.

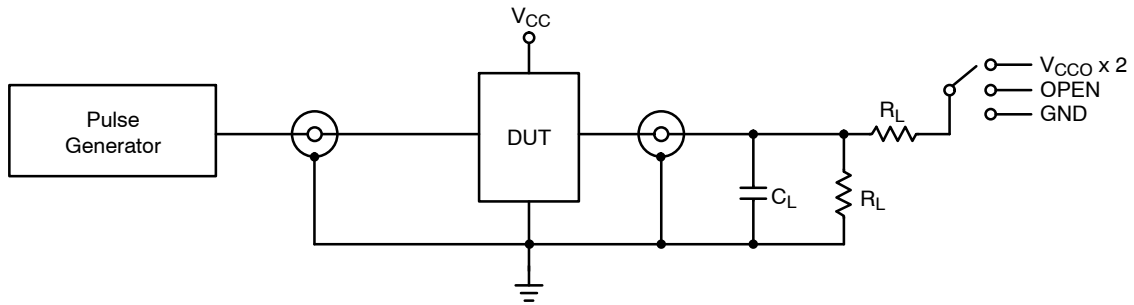
## CAPACITANCE

| Symbol    | Parameter                     | Test Conditions                                                      | Typ (Note 2) | Unit |
|-----------|-------------------------------|----------------------------------------------------------------------|--------------|------|
| $C_{IN}$  | Control Pin Input Capacitance | $V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$              | 3.5          | pF   |
| $C_{I/O}$ | I/O Pin Input Capacitance     | $V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$              | 5.0          | pF   |
| $C_{PD}$  | Power Dissipation Capacitance | $V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA}$ , $f = 10$ MHz | 20           | pF   |

2. Typical values are at  $T_A = +25^\circ\text{C}$ .

3.  $C_{PD}$  is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from:  
 $I_{CC(\text{operating})} \cong C_{PD} \times V_{CC} \times f_{IN} \times N_{SW}$  where  $I_{CC} = I_{CCA} + I_{CCB}$  and  $N_{SW}$  = total number of outputs switching.

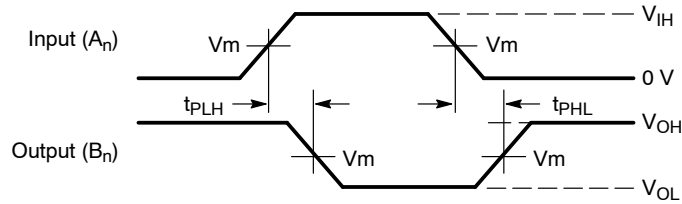
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**Figure 3. AC (Propagation Delay) Test Circuit**

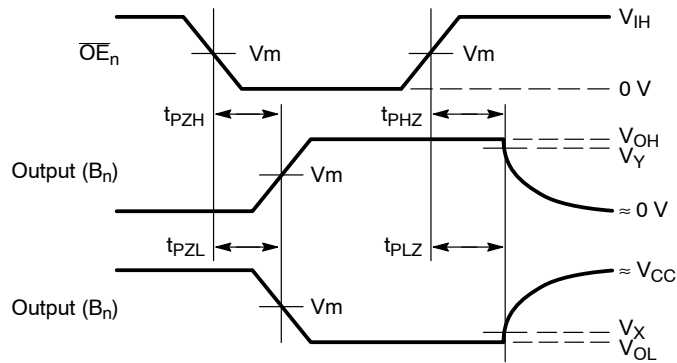
| Test                  | Switch             |
|-----------------------|--------------------|
| $t_{PLH}$ , $t_{PHL}$ | OPEN               |
| $t_{PLZ}$ , $t_{PZL}$ | $V_{CCO} \times 2$ |
| $t_{PHZ}$ , $t_{PZH}$ | GND                |

$C_L = 15 \text{ pF}$  or equivalent (includes probe and jig capacitance)  
 $R_L = 2 \text{ k}\Omega$  or equivalent  
 $Z_{OUT}$  of pulse generator =  $50 \Omega$



**Waveform 1 – Propagation Delays**

$t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$



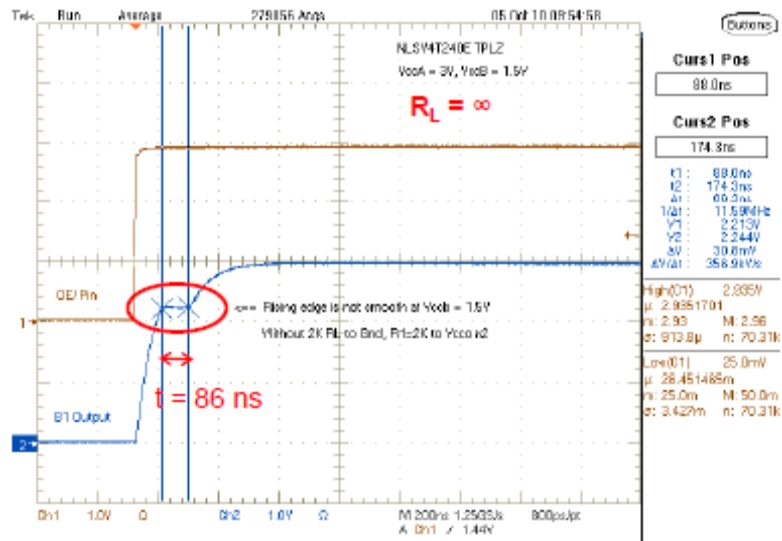
**Waveform 2 – Output Enable and Disable Times**

$t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$

**Figure 4. AC (Propagation Delay) Test Circuit Waveforms**

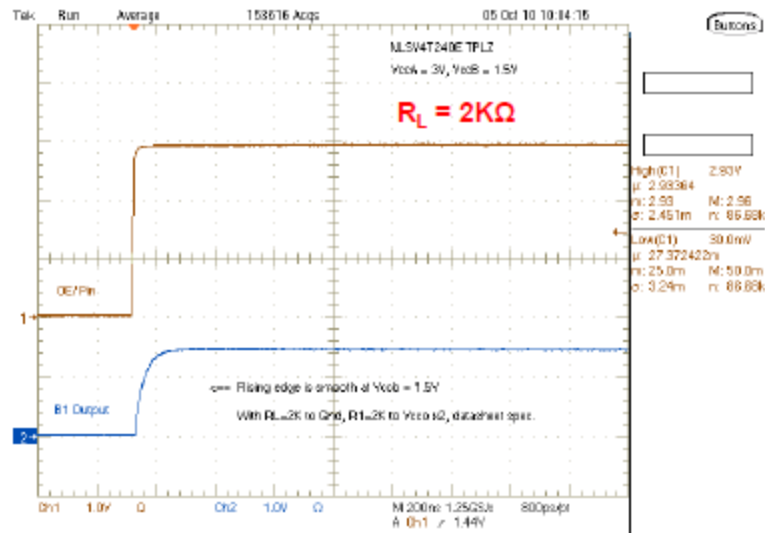
| Symbol   | $V_{CC}$            |                     |                     |                     |                     |
|----------|---------------------|---------------------|---------------------|---------------------|---------------------|
|          | 3.0 V – 4.5 V       | 2.3 V – 2.7 V       | 1.65 V – 1.95 V     | 1.4 V – 1.6 V       | 0.9 V – 1.3 V       |
| $V_{mA}$ | $V_{CCA}/2$         | $V_{CCA}/2$         | $V_{CCA}/2$         | $V_{CCA}/2$         | $V_{CCA}/2$         |
| $V_{mB}$ | $V_{CCB}/2$         | $V_{CCB}/2$         | $V_{CCB}/2$         | $V_{CCB}/2$         | $V_{CCB}/2$         |
| $V_X$    | $V_{OL} \times 0.1$ | $V_{OL} \times 0.1$ | $V_{OL} \times 0.1$ | $V_{OL} \times 0.1$ | $V_{OL} \times 0.1$ |
| $V_Y$    | $V_{OH} \times 0.9$ | $V_{OH} \times 0.9$ | $V_{OH} \times 0.9$ | $V_{OH} \times 0.9$ | $V_{OH} \times 0.9$ |

APPLICATIONS INFORMATION



( $C_L = 50 \text{ pF}$ ,  $R_L = 2 \text{ k}\Omega$ ,  $R_{\text{pull-up}} = 50 \text{ k}\Omega$ , test circuit shown in Figure 3)

Figure 5. Typical Tri-State Output



( $C_L = 50 \text{ pF}$ ,  $R_L = \infty$ ,  $R_{\text{pull-up}} = 2 \text{ k}\Omega$ , test circuit shown in Figure 3)

Figure 6. Typical Tri-State Output

Typical tri-state output waveforms of the NLSX4T240E are shown in Figures 5 and 6. The shape of the output waveform during a tri-state condition corresponding to the disable time ( $t_{PHZ}$ ,  $t_{PLZ}$ ) depends on the configuration of the pull-up circuit. Figure 5 shows a smooth monotonically increasing exponentially waveform because a  $2 \text{ k}\Omega$  resistance is connected between the output and ground.

Figure 6 shows that the output may have a ‘shelf’ or a short duration where the slope of the waveform is equal to zero if no load resistance is connected to ground. The NLSX4T240E was created from the NLSV4T240 to minimize the ‘shelf’ of the waveform during the disable time.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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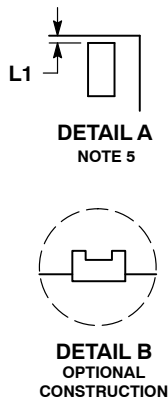
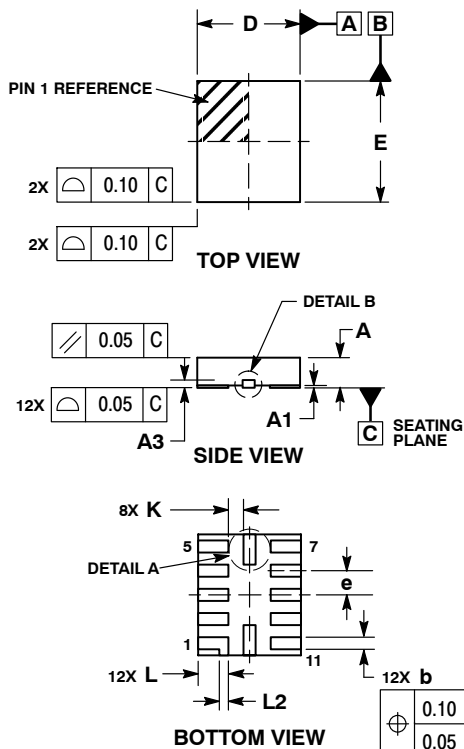
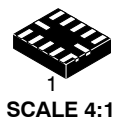


### UQFN12 1.7x2.0, 0.4P

#### CASE 523AE-01

#### ISSUE A

DATE 11 JUN 2007

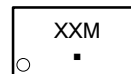


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE. FLASH 0.03 MAX ON BOTTOM SURFACE OF TERMINALS.
5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR TERMINALS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.45        | 0.55 |
| A1  | 0.00        | 0.05 |
| A3  | 0.127 REF   |      |
| b   | 0.15        | 0.25 |
| D   | 1.70 BSC    |      |
| E   | 2.00 BSC    |      |
| e   | 0.40 BSC    |      |
| K   | 0.20        | ---- |
| L   | 0.45        | 0.55 |
| L1  | 0.00        | 0.03 |
| L2  | 0.15 REF    |      |

#### GENERIC MARKING DIAGRAM\*

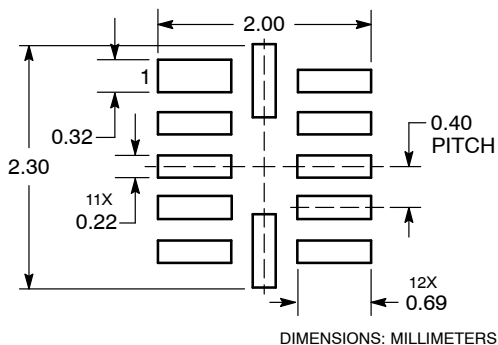


- XX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*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.

#### MOUNTING FOOTPRINT

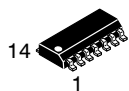
#### SOLDERMASK DEFINED



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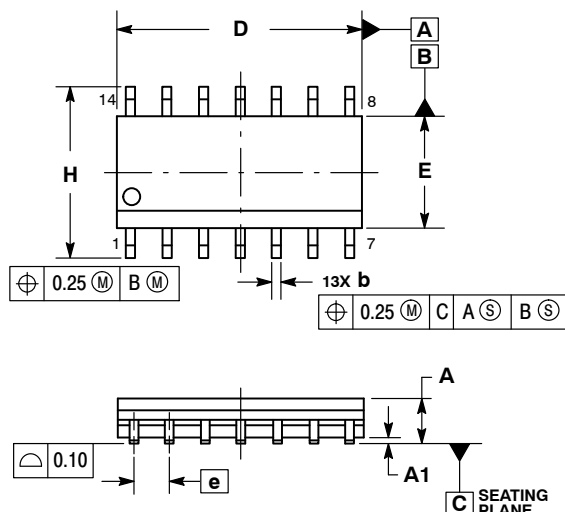
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

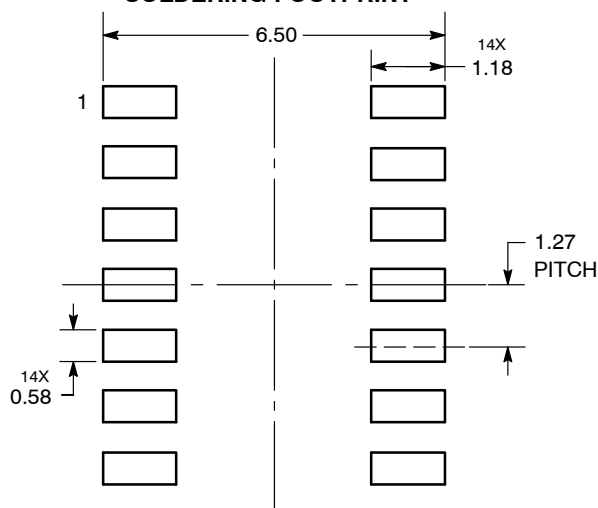


## NOTES:

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°    |

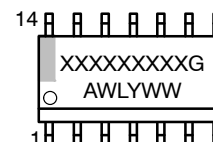
## SOLDERING FOOTPRINT\*



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.

STYLES ON PAGE 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

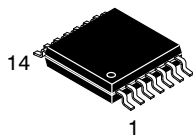
STYLE 7:  
PIN 1. ANODE/CATHODE  
2. COMMON ANODE  
3. COMMON CATHODE  
4. ANODE/CATHODE  
5. ANODE/CATHODE  
6. ANODE/CATHODE  
7. ANODE/CATHODE  
8. ANODE/CATHODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. COMMON CATHODE  
12. COMMON ANODE  
13. ANODE/CATHODE  
14. ANODE/CATHODE

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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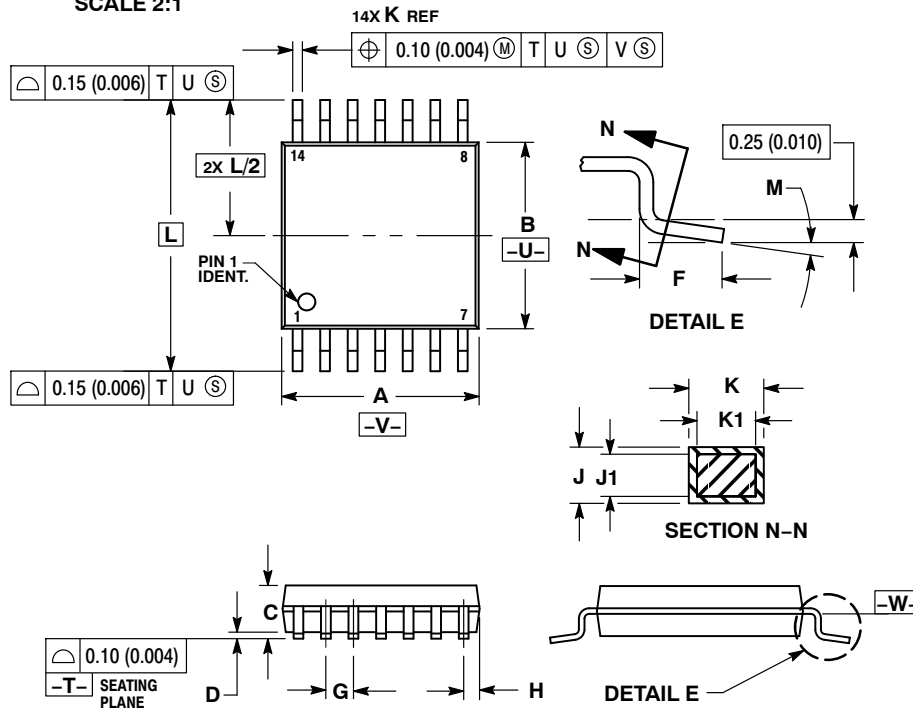
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**TSSOP-14 WB**  
CASE 948G  
ISSUE C

DATE 17 FEB 2016

SCALE 2:1

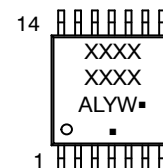


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.50        | 0.60 | 0.020     | 0.024 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

## GENERIC MARKING DIAGRAM\*

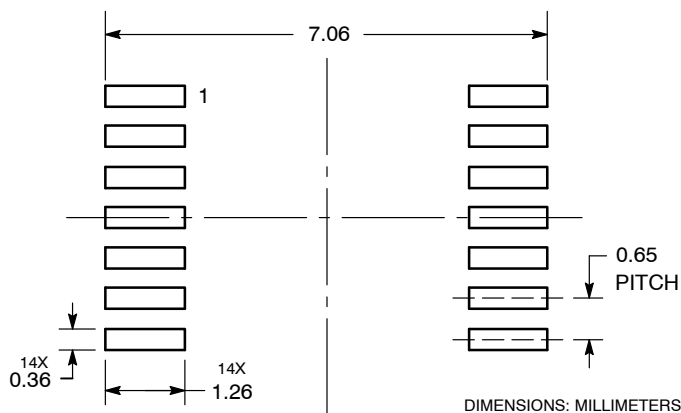


- A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*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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DESCRIPTION: TSSOP-14 WB

PAGE 1 OF 1

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