

# Octal D-Type Latch with 3-State Outputs

With 5 V-Tolerant Inputs

## MC74LVX573

The MC74LVX573 is an advanced high speed CMOS octal latch with 3-state outputs. The inputs tolerate voltages up to 5.5 V, allowing the interface of 5.0 V systems to 3.0 V systems.

This 8-bit D-type latch is controlled by a latch enable input and an output enable input. When the output enable input is high, the eight outputs are in a high impedance state.

### Features

- High Speed:  $t_{PD} = 6.4$  ns (Typ) at  $V_{CC} = 3.3$  V
- Low Power Dissipation:  $I_{CC} = 4$   $\mu$ A (Max) at  $T_A = 25$  °C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise:  $V_{OLP} = 0.8$  V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 100 mA
- ESD Performance: Human Body Model > 2000 V;
- These Devices are Pb-Free and are RoHS Compliant

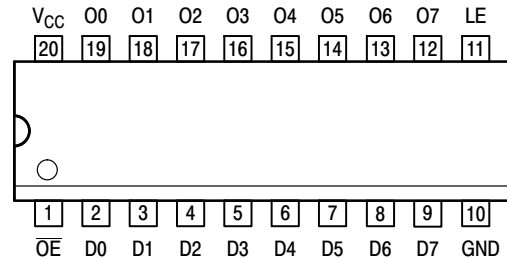


SOIC-20  
DW SUFFIX  
CASE 751D



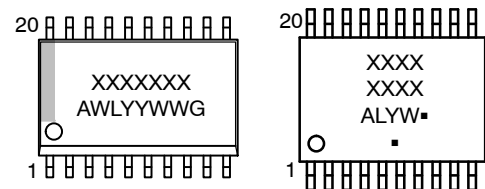
TSSOP-20  
DT SUFFIX  
CASE 948E

### PIN ASSIGNMENT



20-Lead (Top View)

### MARKING DIAGRAMS



SOIC-20

TSSOP-20

XXXXXXX = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
Y = Year  
WW, W = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

MC74LVX573

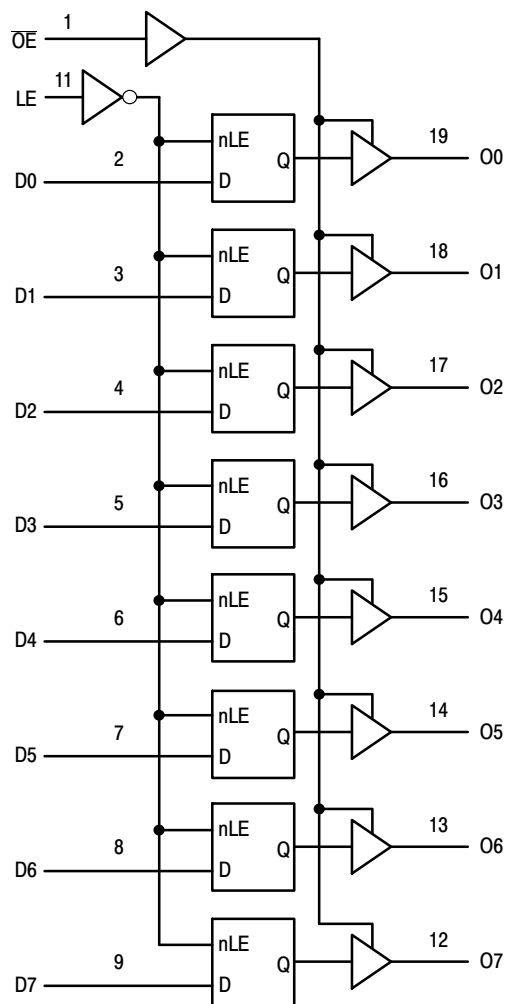


Figure 1. Logic Diagram

PIN NAMES

| Pins            | Function              |
|-----------------|-----------------------|
| $\overline{OE}$ | Output Enable Input   |
| LE              | Latch Enable Input    |
| D0–D7           | Data Inputs           |
| O0–O7           | 3-State Latch Outputs |

TRUTH TABLE

| INPUTS |    |    | OUTPUTS | OPERATING MODE                                 |
|--------|----|----|---------|------------------------------------------------|
| OE     | LE | Dn | On      |                                                |
| L      | H  | H  | H       | Transparent (Latch Disabled); Read Latch       |
| L      | H  | L  | L       |                                                |
| L      | L  | h  | H       | Latched (Latch Enabled) Read Latch             |
| L      | L  | l  | L       |                                                |
| L      | L  | X  | NC      | Hold; Read Latch                               |
| H      | L  | X  | Z       | Hold; Disabled Outputs                         |
| H      | H  | H  | Z       | Transparent (Latch Disabled); Disabled Outputs |
| H      | H  | L  | Z       |                                                |
| H      | L  | h  | Z       | Latched (Latch Enabled); Disabled Outputs      |
| H      | L  | l  | Z       |                                                |

H = High Voltage Level; h = High Voltage Level One Setup Time Prior to the Latch Enable High-to-Low Transition; L = Low Voltage Level; l = Low Voltage Level One Setup Time Prior to the Latch Enable High-to-Low Transition; NC = No Change, State Prior to the Latch Enable High-to-Low Transition; X = High or Low Voltage Level or Transitions are Acceptable; Z = High Impedance State; For I<sub>CC</sub> Reasons DO NOT FLOAT Inputs.

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## MAXIMUM RATINGS

| Symbol               | Parameter                                       |                        | Value                        | Unit |
|----------------------|-------------------------------------------------|------------------------|------------------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage                               |                        | −0.5 to +6.5                 | V    |
| V <sub>IN</sub>      | DC Input Voltage                                |                        | −0.5 to +6.5                 | V    |
| V <sub>OUT</sub>     | DC Output Voltage                               |                        | −0.5 to V <sub>CC</sub> +0.5 | V    |
| I <sub>IN</sub>      | DC Input Current, per Pin                       |                        | ±20                          | mA   |
| I <sub>OUT</sub>     | DC Output Current, Per Pin                      |                        | ±25                          | mA   |
| I <sub>CC</sub>      | DC Supply Current, V <sub>CC</sub> and GND Pins |                        | ±75                          | mA   |
| I <sub>IK</sub>      | Input Clamp Current                             |                        | −20                          | mA   |
| I <sub>OK</sub>      | Output Clamp Current                            |                        | ±20                          | mA   |
| T <sub>STG</sub>     | Storage Temperature Range                       |                        | −65 to +150                  | °C   |
| T <sub>L</sub>       | Lead Temperature, 1 mm from Case for 10 s       |                        | 260                          | °C   |
| T <sub>J</sub>       | Junction Temperature Under Bias                 |                        | +150                         | °C   |
| θ <sub>JA</sub>      | Thermal Resistance (Note 2)                     | SOIC-20W               | 96                           | °C/W |
|                      |                                                 | TSSOP-20               | 150                          |      |
| P <sub>D</sub>       | Power Dissipation in Still Air at 25 °C         | SOIC-20W               | 1302                         | mW   |
|                      |                                                 | TSSOP-20               | 833                          |      |
| MSL                  | Moisture Sensitivity                            | SOIC-20W               | Level 3                      | –    |
|                      |                                                 | All Other Packages     | Level 1                      |      |
| F <sub>R</sub>       | Flammability Rating                             | Oxygen Index: 28 to 34 | UL 94 V–0 @ 0.573 in         | –    |
| V <sub>ESD</sub>     | ESD Withstand Voltage (Note 3)                  | Human Body Model       | 2000                         | V    |
|                      |                                                 | Charged Device Model   | N/A                          |      |
| I <sub>LATCHUP</sub> | Latchup Performance (Note 4)                    |                        | ±100                         | mA   |

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. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                  | Min | Max             | Unit |
|---------------------------------|----------------------------|-----|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage          | 2.0 | 3.6             | V    |
| V <sub>IN</sub>                 | DC Input Voltage (Note 5)  | 0   | 5.5             | V    |
| V <sub>OUT</sub>                | DC Output Voltage (Note 5) | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature      | −40 | +85             | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Rate    | 0   | 100             | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

5. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                                                            | Test Conditions                                                                                   | V <sub>CC</sub><br>V | T <sub>A</sub> = 25 °C |                 |                    | T <sub>A</sub> = -40 to 85 °C |                    | Unit |
|-----------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------|------------------------|-----------------|--------------------|-------------------------------|--------------------|------|
|                 |                                                                                      |                                                                                                   |                      | Min                    | Typ             | Max                | Min                           | Max                |      |
| V <sub>IH</sub> | High-Level Input Voltage                                                             |                                                                                                   | 2.0<br>3.0<br>3.6    | 1.5<br>2.0<br>2.4      | –<br>–<br>–     | –<br>–<br>–        | 1.5<br>2.0<br>2.4             | –<br>–<br>–        | V    |
| V <sub>IL</sub> | Low-Level Input Voltage                                                              |                                                                                                   | 2.0<br>3.0<br>3.6    | –<br>–<br>–            | –<br>–<br>–     | 0.5<br>0.8<br>0.8  | –<br>–<br>–                   | 0.5<br>0.8<br>0.8  | V    |
| V <sub>OH</sub> | High-Level Output Voltage<br>(V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> ) | I <sub>OH</sub> = –50 µA<br>I <sub>OH</sub> = –50 µA<br>I <sub>OH</sub> = –4 mA                   | 2.0<br>3.0<br>3.0    | 1.9<br>2.9<br>2.58     | 2.0<br>3.0<br>– | –<br>–<br>–        | 1.9<br>2.9<br>2.48            | –<br>–<br>–        | V    |
| V <sub>OL</sub> | Low-Level Output Voltage<br>(V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> )  | I <sub>OL</sub> = 50 µA<br>I <sub>OL</sub> = 50 µA<br>I <sub>OL</sub> = 4 mA                      | 2.0<br>3.0<br>3.0    | –<br>–<br>–            | 0.0<br>0.0<br>– | 0.1<br>0.1<br>0.36 | –<br>–<br>–                   | 0.1<br>0.1<br>0.44 | V    |
| I <sub>in</sub> | Input Leakage Current                                                                | V <sub>in</sub> = 5.5 V or GND                                                                    | 3.6                  | –                      | –               | ±0.1               | –                             | ±1.0               | µA   |
| I <sub>OZ</sub> | Maximum 3-State Leakage Current                                                      | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND | 3.6<br>–             | –<br>–                 | –<br>–          | ±0.2<br>5          | –<br>–                        | ±2.5<br>–          | µA   |
| I <sub>CC</sub> | Quiescent Supply Current                                                             | V <sub>in</sub> = V <sub>CC</sub> or GND                                                          | 3.6                  | –                      | –               | 4.0                | –                             | 40.0               | µA   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                   | Parameter                         | Test Conditions                                                                                        | T <sub>A</sub> = 25 °C |             |              | T <sub>A</sub> = -40 to 85 °C |              | Unit |
|------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------|------------------------|-------------|--------------|-------------------------------|--------------|------|
|                                          |                                   |                                                                                                        | Min                    | Typ         | Max          | Min                           | Max          |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub>   | Propagation Delay<br>LE to O      | V <sub>CC</sub> = 2.7 V C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF                               | –<br>–                 | 8.2<br>10.7 | 15.6<br>19.1 | 1.0<br>1.0                    | 18.5<br>22.0 | ns   |
|                                          |                                   | V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF                         | –<br>–                 | 6.4<br>8.9  | 10.1<br>13.6 | 1.0<br>1.0                    | 12.0<br>15.5 |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub>   | Propagation Delay<br>D to O       | V <sub>CC</sub> = 2.7 V C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF                               | –<br>–                 | 7.6<br>10.1 | 14.5<br>18.0 | 1.0<br>1.0                    | 17.5<br>21.0 | ns   |
|                                          |                                   | V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF                         | –<br>–                 | 5.9<br>8.4  | 9.3<br>12.8  | 1.0<br>1.0                    | 11.0<br>14.5 |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub>   | Output Enable Time<br>OE to O     | V <sub>CC</sub> = 2.7 V C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF         | –<br>–                 | 7.8<br>10.3 | 15.0<br>18.5 | 1.0<br>1.0                    | 18.5<br>22.0 | ns   |
|                                          |                                   | V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF   | –<br>–                 | 6.1<br>8.6  | 9.7<br>13.2  | 1.0<br>1.0                    | 12.0<br>15.5 |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub>   | Output Disable Time<br>OE to O    | V <sub>CC</sub> = 2.7 V C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ                                | –                      | 12.1        | 19.1         | 1.0                           | 22.0         | ns   |
|                                          |                                   | V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ                          | –                      | 10.1        | 13.6         | 1.0                           | 15.5         |      |
| t <sub>OSSL</sub> ,<br>t <sub>OSLH</sub> | Output-to-Output Skew<br>(Note 6) | V <sub>CC</sub> = 2.7 V C <sub>L</sub> = 50 pF<br>V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 50 pF | –<br>–                 | –<br>–      | 1.5<br>1.5   | –<br>–                        | 1.5<br>1.5   | ns   |

6. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.



# MC74LVX573

## TIMING REQUIREMENTS

| Symbol            | Parameter                   | Test Conditions                                          | T <sub>A</sub> = 25 °C |            | T <sub>A</sub> = -40 to 85 °C | Unit |
|-------------------|-----------------------------|----------------------------------------------------------|------------------------|------------|-------------------------------|------|
|                   |                             |                                                          | Typ                    | Limit      | Limit                         |      |
| t <sub>w(h)</sub> | Minimum Pulse Width, LE     | V <sub>CC</sub> = 2.7 V<br>V <sub>CC</sub> = 3.3 ± 0.3 V |                        | 6.5<br>5.0 | 7.5<br>5.0                    | ns   |
| t <sub>su</sub>   | Minimum Setup Time, D to LE | V <sub>CC</sub> = 2.7 V<br>V <sub>CC</sub> = 3.3 ± 0.3 V |                        | 5.0<br>3.5 | 5.0<br>3.5                    | ns   |
| t <sub>h</sub>    | Minimum Hold Time, D to LE  | V <sub>CC</sub> = 2.7 V<br>V <sub>CC</sub> = 3.3 ± 0.3 V |                        | 1.5<br>1.5 | 1.5<br>1.5                    | ns   |

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                              | T <sub>A</sub> = 25 °C |     |     | T <sub>A</sub> = -40 to 85 °C |     | Unit |
|------------------|----------------------------------------|------------------------|-----|-----|-------------------------------|-----|------|
|                  |                                        | Min                    | Typ | Max | Min                           | Max |      |
| C <sub>in</sub>  | Input Capacitance                      | –                      | 4   | 10  | –                             | 10  | pF   |
| C <sub>out</sub> | Maximum 3-State Output Capacitance     | –                      | 6   | –   | –                             | –   | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance (Note 7) | –                      | 29  | –   | –                             | –   | pF   |

7. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>/8 (per latch). C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

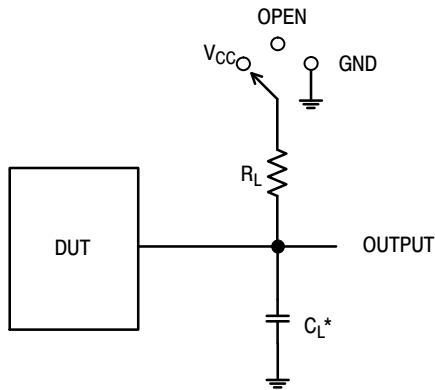
## NOISE CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns, C<sub>L</sub> = 50 pF, V<sub>CC</sub> = 3.3 V)

| Symbol           | Characteristic                               | T <sub>A</sub> = 25 °C |      | Unit |
|------------------|----------------------------------------------|------------------------|------|------|
|                  |                                              | Typ                    | Max  |      |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 0.5                    | 0.8  | V    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | –0.5                   | –0.8 | V    |
| V <sub>IHD</sub> | Minimum High Level Dynamic Input Voltage     | –                      | 2.0  | V    |
| V <sub>ILD</sub> | Maximum Low Level Dynamic Input Voltage      | –                      | 0.8  | V    |



# MC74LVX573

## TEST CIRCUITS



\*C<sub>L</sub> includes probe and jig capacitance  
Input  $t_R = t_F = 3 \text{ ns}$

| Test                | Switch Position | C <sub>L</sub>               | R <sub>L</sub> |
|---------------------|-----------------|------------------------------|----------------|
| $t_{PLH} / t_{PHL}$ | Open            | See AC Characteristics Table | 1 k $\Omega$   |
| $t_{PLZ} / t_{PZL}$ | V <sub>CC</sub> |                              |                |
| $t_{PHZ} / t_{PZH}$ | GND             |                              |                |

Figure 2. AC Test Circuit

## SWITCHING WAVEFORMS

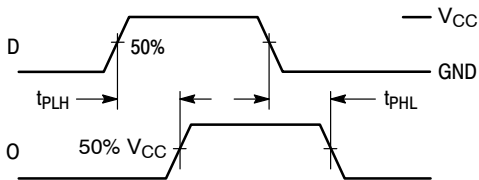


Figure 3.

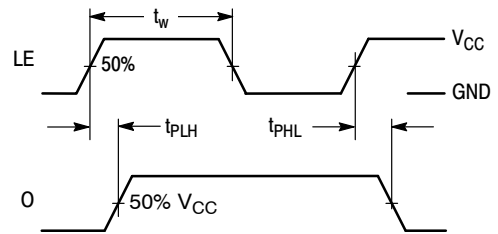


Figure 4.

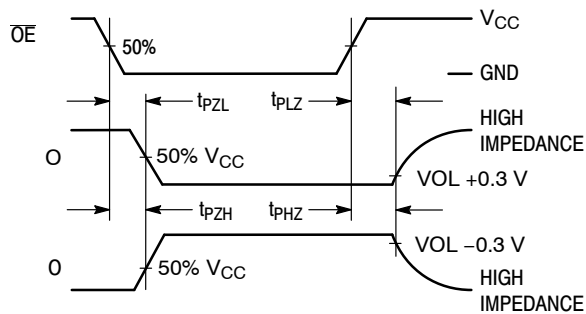


Figure 5.

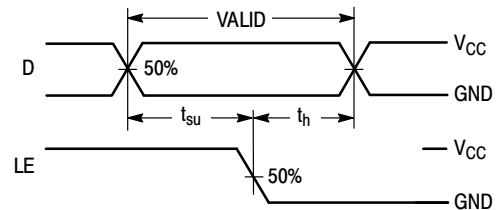


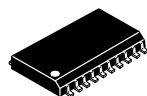
Figure 6.

## ORDERING INFORMATION

| Device          | Marking    | Package    | Shipping <sup>†</sup> |
|-----------------|------------|------------|-----------------------|
| MC74LVX573DWR2G | LVX573G    | SOIC-20 WB | 1000 / Tape & Reel    |
| MC74LVX573DTG   | LVX<br>573 | TSSOP-20   | 75 Units / Rail       |
| MC74LVX573DTR2G | LVX<br>573 | TSSOP-20   | 2500 / Tape & Reel    |

<sup>†</sup>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](#).

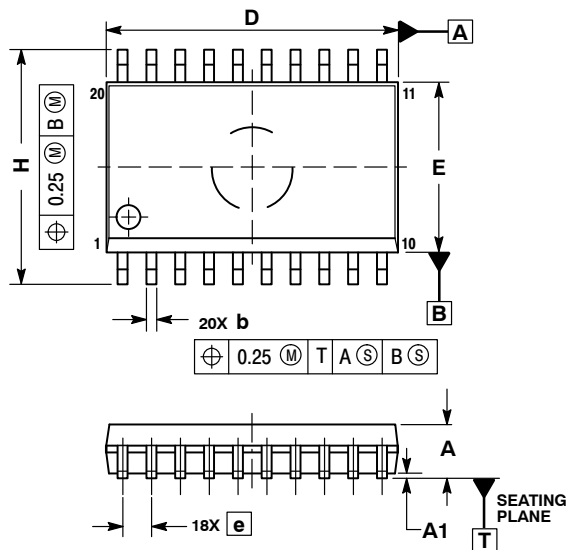




SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015

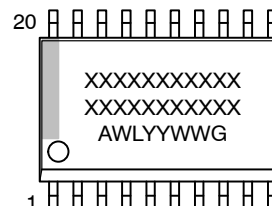


NOTES:

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

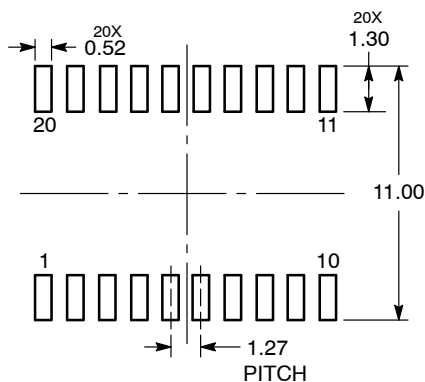
| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| b   | 0.35        | 0.49  |
| c   | 0.23        | 0.32  |
| D   | 12.65       | 12.95 |
| E   | 7.40        | 7.60  |
| e   | 1.27 BSC    |       |
| H   | 10.05       | 10.55 |
| h   | 0.25        | 0.75  |
| L   | 0.50        | 0.90  |
| θ   | 0°          | 7°    |

GENERIC  
MARKING DIAGRAM\*



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

RECOMMENDED  
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.

\*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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