

# Octal 3-State Noninverting Buffer/Line Driver/Line Receiver with LSTTL-Compatible Inputs

## High-Performance Silicon-Gate CMOS

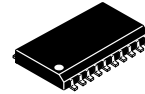
### MC74HCT241A

The MC74HCT241A is identical in pinout to the LS241. This device may be used as a level converter for interfacing TTL or NMOS outputs to High-Speed CMOS inputs. The HCT241A is an octal noninverting buffer/line driver/line receiver designed to be used with 3-state memory address drivers, clock drivers, and other bus-oriented systems. The device has non-inverted outputs and two output enables. Enable A is active-low and Enable B is active-high.

The HCT241A is similar in function to the HCT244. See also HCT240.

#### Features

- Output Drive Capability: 15 LSTTL Loads
- TTL/NMOS Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0  $\mu$ A
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 118 FETs or 29.5 Equivalent Gates
- Pb-Free Packages are Available\*

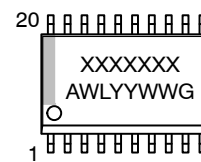


SOIC-20  
DW SUFFIX  
CASE 751D

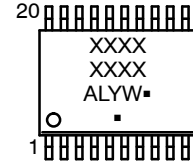


TSSOP-20  
DT SUFFIX  
CASE 948E

#### MARKING DIAGRAMS



SOIC-20



TSSOP-20

XXXXXXXX = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
YY, 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 on page 6 of this data sheet.

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

# MC74HCT241A

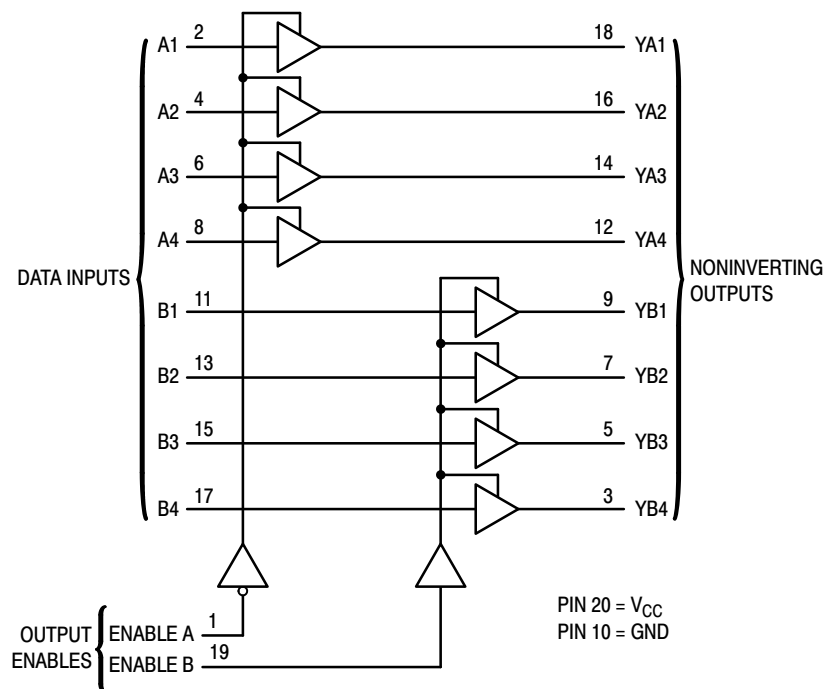


Figure 1. Logic Diagram

|          |    |    |                 |
|----------|----|----|-----------------|
| ENABLE A | 1  | 20 | V <sub>CC</sub> |
| A1       | 2  | 19 | ENABLE B        |
| YB4      | 3  | 18 | YA1             |
| A2       | 4  | 17 | B4              |
| YB3      | 5  | 16 | YA2             |
| A3       | 6  | 15 | B3              |
| YB2      | 7  | 14 | YA3             |
| A4       | 8  | 13 | B2              |
| YB1      | 9  | 12 | YA4             |
| GND      | 10 | 11 | B1              |

Figure 2. Pin Assignment

## FUNCTION TABLE

| Inputs   |   | Output |
|----------|---|--------|
| Enable A | A | YA     |
| L        | L | L      |
| L        | H | H      |
| H        | X | Z      |

| Inputs   |   | Output |
|----------|---|--------|
| Enable B | B | YB     |
| H        | L | L      |
| H        | H | H      |
| L        | X | Z      |

Z = high impedance

X = don't care

# MC74HCT241A

## 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 V <sub>CC</sub> +0.5              | V    |
| V <sub>OUT</sub> | DC Output Voltage                                                                               | −0.5 to V <sub>CC</sub> +0.5              | V    |
| I <sub>IN</sub>  | DC Input Diode Current, per Pin                                                                 | ±20                                       | mA   |
| I <sub>OUT</sub> | DC Input Diode Current, Per Pin                                                                 | ±35                                       | mA   |
| I <sub>CC</sub>  | DC Supply Current, V <sub>CC</sub> and GND Pins                                                 | ±75                                       | mA   |
| I <sub>IK</sub>  | Input Clamp Current (V <sub>IN</sub> < 0 or V <sub>IN</sub> > V <sub>CC</sub> )                 | ±20                                       | mA   |
| I <sub>OK</sub>  | Output Clamp Current (V <sub>OUT</sub> < 0 or V <sub>OUT</sub> > V <sub>CC</sub> )              | ±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 secs                                                    | 260                                       | °C   |
| T <sub>J</sub>   | Junction Temperature Under Bias                                                                 | +150                                      | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Note 1)<br><div>SOIC−20W<br/>WQFN20<br/>QFN20<br/>TSSOP−20</div>            | <div>96<br/>99<br/>111<br/>150</div>      | °C/W |
| P <sub>D</sub>   | Power Dissipation in Still Air at 25°C<br><div>SOIC−20W<br/>WQFN20<br/>QFN20<br/>TSSOP−20</div> | <div>1302<br/>1256<br/>1127<br/>833</div> | mW   |
| MSL              | Moisture Sensitivity<br><div>SOIC−20W<br/>All Other Packages</div>                              | <div>Level 3<br/>Level 1</div>            | –    |
| F <sub>R</sub>   | Flammability Rating<br>Oxygen Index: 28 to 34                                                   | UL 94 V−0 @ 0.125 in                      | –    |
| V <sub>ESD</sub> | ESD Withstand Voltage (Note 2)<br><div>Human Body Model<br/>Charged Device Model</div>          | <div>&gt; 2000<br/>&gt; 1000</div>        | V    |

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. Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
2. 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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                                            | Min | Max      | Unit |
|-------------------|------------------------------------------------------|-----|----------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 4.5 | 5.5      | V    |
| $V_{in}, V_{out}$ | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature, All Package Types             | -55 | +125     | °C   |
| $t_r, t_f$        | Input Rise and Fall Time                             | 0   | 500      | ns   |

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.

3. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                      | Test Conditions                                                                                                                     | V <sub>CC</sub><br>V | Guaranteed Limit |            |            | Unit |
|-----------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|------------|------------|------|
|                 |                                                |                                                                                                                                     |                      | -55 to 25°C      | ≤ 85°C     | ≤ 125°C    |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>out</sub>   ≤ 20 μA                                                  | 4.5<br>5.5           | 2<br>2           | 2<br>2     | 2<br>2     | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>out</sub>   ≤ 20 μA                                                  | 4.5<br>5.5           | 0.8<br>0.8       | 0.8<br>0.8 | 0.8<br>0.8 | V    |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5<br>5.5           | 4.4<br>5.4       | 4.4<br>5.4 | 4.4<br>5.4 | V    |
|                 |                                                | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 6 mA                                                  | 4.5                  | 3.98             | 3.84       | 3.7        |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5<br>5.5           | 0.1<br>0.1       | 0.1<br>0.1 | 0.1<br>0.1 | V    |
|                 |                                                | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 6 mA                                                  | 4.5                  | 0.26             | 0.33       | 0.4        |      |
| I <sub>in</sub> | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                                            | 5.5                  | ± 0.1            | ± 1.0      | ± 1.0      | μA   |
| I <sub>OZ</sub> | Maximum Three-State Leakage Current            | Output in High-Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND | 5.5                  | ± 0.5            | ± 5.0      | ± 10       | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0 μA                                                                 | 5.5                  | 4                | 40         | 160        | μA   |

|                  |                                     |                                                                                                                             |     |         |               |    |
|------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----|---------|---------------|----|
| ΔI <sub>CC</sub> | Additional Quiescent Supply Current | V <sub>in</sub> = 2.4 V, Any One Input<br>V <sub>in</sub> = V <sub>CC</sub> or GND, Other Inputs<br>I <sub>out</sub> = 0 μA | 5.5 | ≥ -55°C | 25°C to 125°C | mA |
|                  |                                     |                                                                                                                             |     | 2.9     | 2.4           |    |

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.

4. Total Supply Current = I<sub>CC</sub> + ΣΔI<sub>CC</sub>.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                 | Parameter                                                                 | Guaranteed Limit |        |         | Unit |
|----------------------------------------|---------------------------------------------------------------------------|------------------|--------|---------|------|
|                                        |                                                                           | -55 to 25°C      | ≤ 85°C | ≤ 125°C |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, A to YA or B to YB<br>(Figures 1 and 3)        | 23               | 29     | 35      | ns   |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to YA or YB<br>(Figures 2 and 4) | 30               | 38     | 45      | ns   |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to YA or YB<br>(Figures 2 and 4) | 26               | 33     | 39      | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 3)           | 12               | 15     | 18      | ns   |
| C <sub>in</sub>                        | Maximum Input Capacitance                                                 | 10               | 10     | 10      | pF   |
| C <sub>out</sub>                       | Maximum Three-State Output Capacitance (Output in High-Impedance State)   | 15               | 15     | 15      | pF   |

|                 |                                                     |                                         |    |
|-----------------|-----------------------------------------------------|-----------------------------------------|----|
| C <sub>PD</sub> | Power Dissipation Capacitance (Per Enabled Output)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|                 |                                                     | 55                                      |    |

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.

\*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 + I<sub>CC</sub> V<sub>CC</sub>.

# MC74HCT241A

## SWITCHING WAVEFORMS

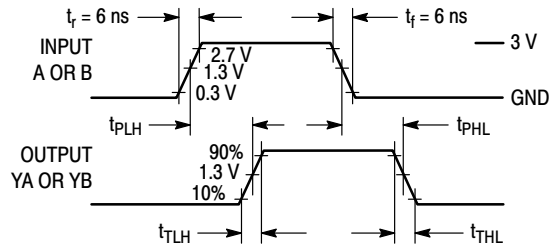


Figure 3.

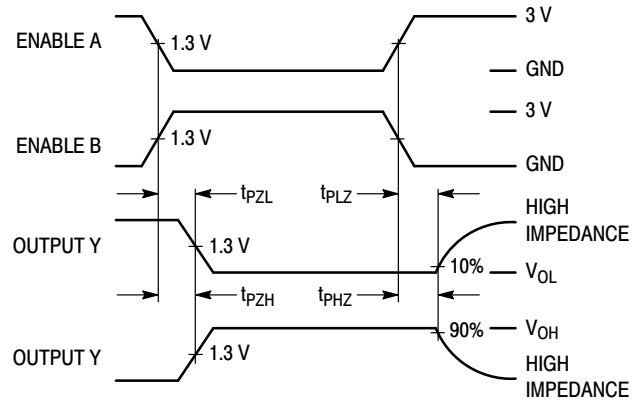
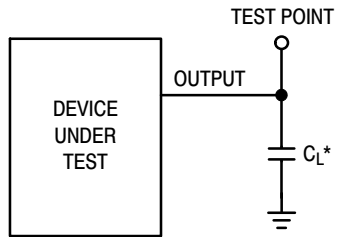
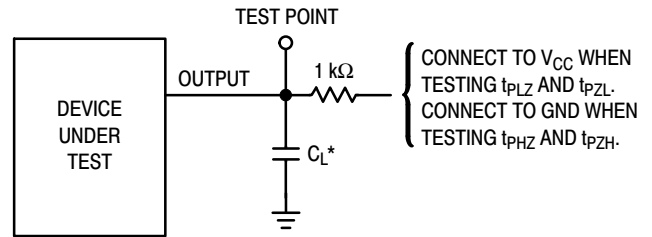


Figure 4.



\*Includes all probe and jig capacitance

Figure 5. Test Circuit



\*Includes all probe and jig capacitance

Figure 6. Test Circuit

# MC74HCT241A

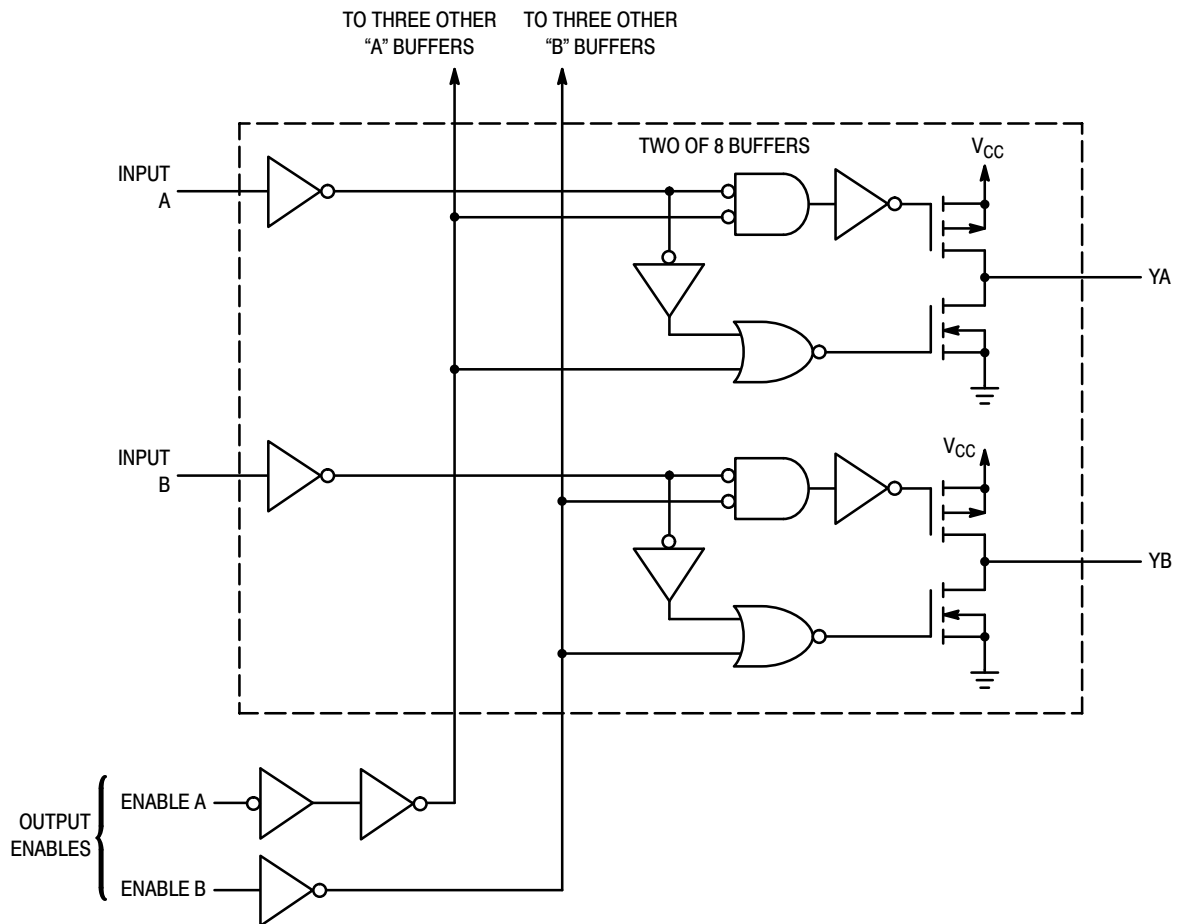


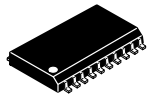
Figure 7. Logic Detail

## ORDERING INFORMATION

| Device           | Marking     | Package      | Shipping <sup>†</sup> |
|------------------|-------------|--------------|-----------------------|
| MC74HCT241ADWR2G | HCT241A     | SOIC-20 Wide | 1000 / Tape & Reel    |
| MC74HCT241ADTG   | HCT<br>241A | TSSOP-20     | 75 Units / Rail       |
| MC74HCT241ADTR2G | HCT<br>241A | 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.

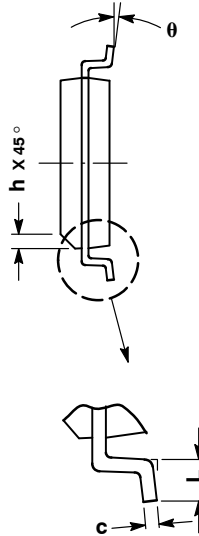
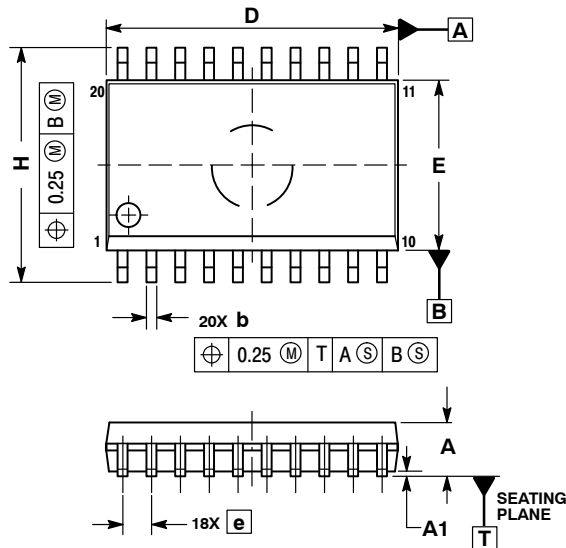
\*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.



SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015

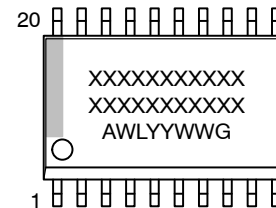


NOTES:

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.

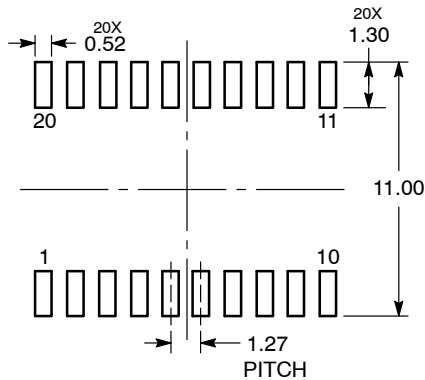
| DIM      | MILLIMETERS |       |
|----------|-------------|-------|
|          | MIN         | MAX   |
| A        | 2.35        | 2.65  |
| A1       | 0.10        | 0.25  |
| b        | 0.35        | 0.49  |
| c        | 0.23        | 0.32  |
| D        | 12.65       | 12.95 |
| E        | 7.40   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