

# 74HC373

## Octal 3-State Non-Inverting Transparent Latch

### High-Performance Silicon-Gate CMOS

The 74HC373 is identical in pinout to the LS373. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

These latches appear transparent to data (i.e., the outputs change asynchronously) when Latch Enable is high. When Latch Enable goes low, data meeting the setup and hold time becomes latched.

The Output Enable input does not affect the state of the latches, but when Output Enable is high, all device outputs are forced to the high-impedance state. Thus, data may be latched even when the outputs are not enabled.

The HC373A is identical in function to the HC573A which has the data inputs on the opposite side of the package from the outputs to facilitate PC board layout.

The HC373A is the non-inverting version of the HC533A.

#### Features

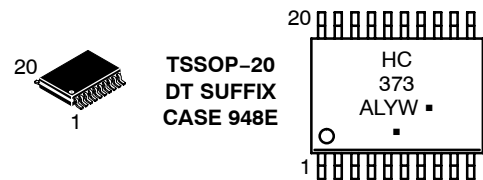
- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the JEDEC Standard No. 7.0 A Requirements
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 186 FETs or 46.5 Equivalent Gates
- This is a Pb-Free Device



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#### MARKING DIAGRAM



HC373 = Specific Device Code

A = Assembly Location

L = Wafer Lot

Y = Year

W = Work Week

▪ = Pb-Free Package

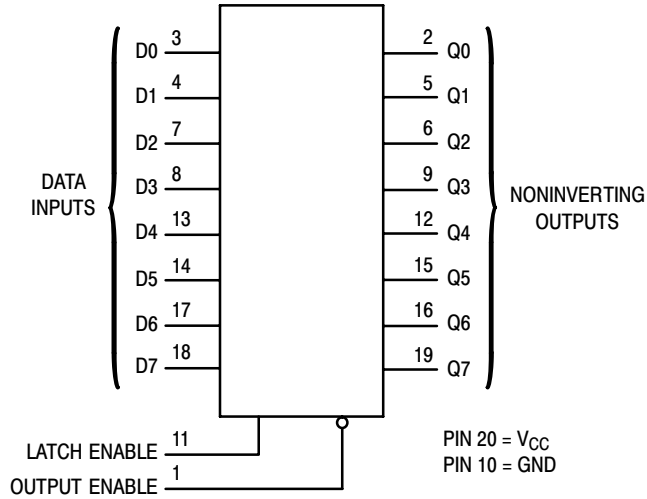
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

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## LOGIC DIAGRAM



## PIN ASSIGNMENT

|               |     |    |                 |
|---------------|-----|----|-----------------|
| OUTPUT ENABLE | 1 ● | 20 | V <sub>CC</sub> |
| Q0            | 2   | 19 | Q7              |
| D0            | 3   | 18 | D7              |
| D1            | 4   | 17 | D6              |
| Q1            | 5   | 16 | Q6              |
| Q2            | 6   | 15 | Q5              |
| D2            | 7   | 14 | D5              |
| D3            | 8   | 13 | D4              |
| Q3            | 9   | 12 | Q4              |
| GND           | 10  | 11 | LATCH ENABLE    |

## FUNCTION TABLE

| Inputs        |              |   | Output    |
|---------------|--------------|---|-----------|
| Output Enable | Latch Enable | D | Q         |
| L             | H            | H | H         |
| L             | H            | L | L         |
| L             | L            | X | No Change |
| H             | X            | X | Z         |

X = Don't Care

Z = High Impedance

| Design Criteria                 | Value  | Units |
|---------------------------------|--------|-------|
| Internal Gate Count*            | 46.5   | ea    |
| Internal Gate Propagation Delay | 1.5    | ns    |
| Internal Gate Power Dissipation | 5.0    | μW    |
| Speed Power Product             | 0.0075 | pJ    |

\*Equivalent to a two-input NAND gate.

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## MAXIMUM RATINGS

| Symbol    | Parameter                                                       | Value                   | Unit |
|-----------|-----------------------------------------------------------------|-------------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)                           | - 0.5 to + 7.0          | V    |
| $V_{in}$  | DC Input Voltage (Referenced to GND)                            | - 0.5 to $V_{CC} + 0.5$ | V    |
| $V_{out}$ | DC Output Voltage (Referenced to GND)                           | - 0.5 to $V_{CC} + 0.5$ | V    |
| $I_{in}$  | DC Input Current, per Pin                                       | $\pm 20$                | mA   |
| $I_{out}$ | DC Output Current, per Pin                                      | $\pm 35$                | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                        | $\pm 75$                | mA   |
| $P_D$     | Power Dissipation in Still Air, TSSOP Package†                  | 450                     | mW   |
| $T_{stg}$ | Storage Temperature                                             | - 65 to + 150           | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds (TSSOP Package) | 260                     | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

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.

†Derating — TSSOP Package: - 6.1 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                                            | Min  | Max      | Unit |
|-------------------|------------------------------------------------------|------|----------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 2.0  | 6.0      | 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 (Figure 1)                  |      |          | ns   |
|                   | $V_{CC} = 2.0 \text{ V}$                             | 0    | 1000     |      |
|                   | $V_{CC} = 4.5 \text{ V}$                             | 0    | 500      |      |
|                   | $V_{CC} = 6.0 \text{ V}$                             | 0    | 400      |      |

## ORDERING INFORMATION

| Device       | Package   | Shipping†         |
|--------------|-----------|-------------------|
| 74HC373DTR2G | TSSOP-20* | 2500 Units / Reel |

†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.

\*This package is inherently Pb-Free.

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## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| 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> = V <sub>CC</sub> - 0.1 V<br> I <sub>out</sub>   ≤ 20 μA                                                           | 2.0                    | 1.5              | 1.5     | 1.5      | V    |
|                 |                                                |                                                                                                                                     | 3.0                    | 2.1              | 2.1     | 2.1      |      |
|                 |                                                |                                                                                                                                     | 4.5                    | 3.15             | 3.15    | 3.15     |      |
|                 |                                                |                                                                                                                                     | 6.0                    | 4.2              | 4.2     | 4.2      |      |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1 V<br> I <sub>out</sub>   ≤ 20 μA                                                                             | 2.0                    | 0.5              | 0.5     | 0.5      | V    |
|                 |                                                |                                                                                                                                     | 3.0                    | 0.9              | 0.9     | 0.9      |      |
|                 |                                                |                                                                                                                                     | 4.5                    | 1.35             | 1.35    | 1.35     |      |
|                 |                                                |                                                                                                                                     | 6.0                    | 1.8              | 1.8     | 1.8      |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 20 μA                                                                    | 2.0                    | 1.9              | 1.9     | 1.9      | V    |
|                 |                                                |                                                                                                                                     | 4.5                    | 4.4              | 4.4     | 4.4      |      |
|                 |                                                |                                                                                                                                     | 6.0                    | 5.9              | 5.9     | 5.9      |      |
|                 |                                                | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 2.4 mA<br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA   | 3.0                    | 2.48             | 2.34    | 2.2      |      |
|                 |                                                |                                                                                                                                     | 4.5                    | 3.98             | 3.84    | 3.7      |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                                    | 2.0                    | 0.1              | 0.1     | 0.1      | V    |
|                 |                                                |                                                                                                                                     | 4.5                    | 0.1              | 0.1     | 0.1      |      |
|                 |                                                |                                                                                                                                     | 6.0                    | 0.1              | 0.1     | 0.1      |      |
|                 |                                                | V <sub>in</sub> = V <sub>IL</sub><br> I <sub>out</sub>   ≤ 2.4 mA<br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA   | 3.0                    | 0.26             | 0.33    | 0.4      |      |
| 4.5             | 0.26                                           |                                                                                                                                     | 0.33                   | 0.4              |         |          |      |
| 6.0             | 0.26                                           |                                                                                                                                     | 0.33                   | 0.4              |         |          |      |
| I <sub>in</sub> | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                                            | 6.0                    | ±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 | 6.0                    | ±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                                                                 | 6.0                    | 4.0              | 40      | 40       | μA   |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

| Symbol                               | Parameter                                                                  | V <sub>CC</sub><br>(V) | Guaranteed Limit |        |         | Unit |
|--------------------------------------|----------------------------------------------------------------------------|------------------------|------------------|--------|---------|------|
|                                      |                                                                            |                        | - 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Maximum Propagation Delay, Input D to Q<br>(Figures 1 and 5)               | 2.0                    | 125              | 155    | 190     | ns   |
|                                      |                                                                            | 3.0                    | 80               | 110    | 130     |      |
|                                      |                                                                            | 4.5                    | 25               | 31     | 38      |      |
|                                      |                                                                            | 6.0                    | 21               | 26     | 32      |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Maximum Propagation Delay, Latch Enable to Q<br>(Figures 2 and 5)          | 2.0                    | 140              | 175    | 210     | ns   |
|                                      |                                                                            | 3.0                    | 90               | 120    | 140     |      |
|                                      |                                                                            | 4.5                    | 28               | 35     | 42      |      |
|                                      |                                                                            | 6.0                    | 24               | 30     | 36      |      |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Q<br>(Figures 3 and 6)         | 2.0                    | 150              | 190    | 225     | ns   |
|                                      |                                                                            | 3.0                    | 100              | 125    | 150     |      |
|                                      |                                                                            | 4.5                    | 30               | 38     | 45      |      |
|                                      |                                                                            | 6.0                    | 26               | 33     | 38      |      |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Q<br>(Figures 3 and 6)         | 2.0                    | 150              | 190    | 225     | ns   |
|                                      |                                                                            | 3.0                    | 100              | 125    | 150     |      |
|                                      |                                                                            | 4.5                    | 30               | 38     | 45      |      |
|                                      |                                                                            | 6.0                    | 26               | 33     | 38      |      |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 5)            | 2.0                    | 60               | 75     | 90      | ns   |
|                                      |                                                                            | 3.0                    | 23               | 27     | 32      |      |
|                                      |                                                                            | 4.5                    | 12               | 15     | 18      |      |
|                                      |                                                                            | 6.0                    | 10               | 13     | 15      |      |
| C <sub>in</sub>                      | Maximum Input Capacitance                                                  |                        | 10               | 10     | 10      | pF   |
| C <sub>out</sub>                     | Maximum Three-State Output Capacitance<br>(Output in High-Impedance State) |                        | 15               | 15     | 15      | pF   |

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Enabled Output)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |    |
|-----------------|-----------------------------------------------------|-----------------------------------------|----|
|                 |                                                     | 36                                      | pF |
|                 |                                                     |                                         |    |

\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ . For load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## TIMING REQUIREMENTS ( $C_L = 50$ pF, Input $t_r = t_f = 6.0$ ns)

| Symbol     | Parameter                                   | Figure | $V_{CC}$<br>(V)          | Guaranteed Limit         |                           |                          |                           |                          |                           | Unit |    |
|------------|---------------------------------------------|--------|--------------------------|--------------------------|---------------------------|--------------------------|---------------------------|--------------------------|---------------------------|------|----|
|            |                                             |        |                          | - 55 to 25 °C            |                           | ≤ 85 °C                  |                           | ≤ 125 °C                 |                           |      |    |
|            |                                             |        |                          | Min                      | Max                       | Min                      | Max                       | Min                      | Max                       |      |    |
| $t_{su}$   | Minimum Setup Time, Input D to Latch Enable | 4      | 2.0<br>3.0<br>4.5<br>6.0 | 25<br>20<br>5.0<br>5.0   |                           | 30<br>25<br>6.0<br>6.0   |                           | 40<br>30<br>8.0<br>7.0   |                           | ns   |    |
| $t_h$      | Minimum Hold Time, Latch Enable to Input D  | 4      | 2.0<br>3.0<br>4.5<br>6.0 | 5.0<br>5.0<br>5.0<br>5.0 |                           | 5.0<br>5.0<br>5.0<br>5.0 |                           | 5.0<br>5.0<br>5.0<br>5.0 |                           | ns   |    |
| $t_w$      | Minimum Pulse Width, Latch Enable           | 2      | 2.0<br>3.0<br>4.5<br>6.0 | 60<br>23<br>12<br>10     |                           | 75<br>27<br>15<br>13     |                           | 90<br>32<br>18<br>15     |                           | ns   |    |
| $t_r, t_f$ | Maximum Input Rise and Fall Times           | 1      | 2.0<br>3.0<br>4.5<br>6.0 |                          | 1000<br>800<br>500<br>400 |                          | 1000<br>800<br>500<br>400 |                          | 1000<br>800<br>500<br>400 |      | ns |

## SWITCHING WAVEFORMS

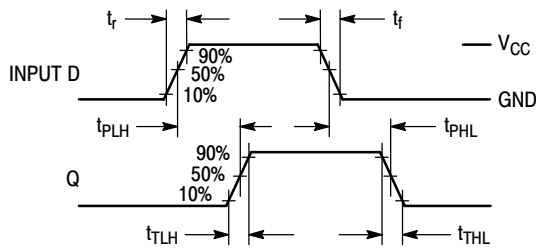


Figure 1.

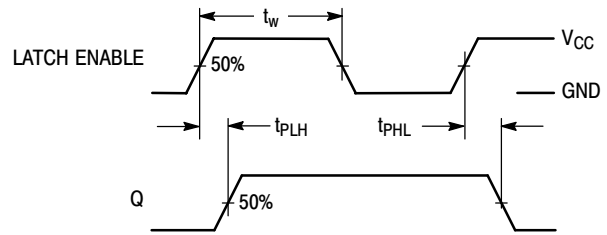


Figure 2.

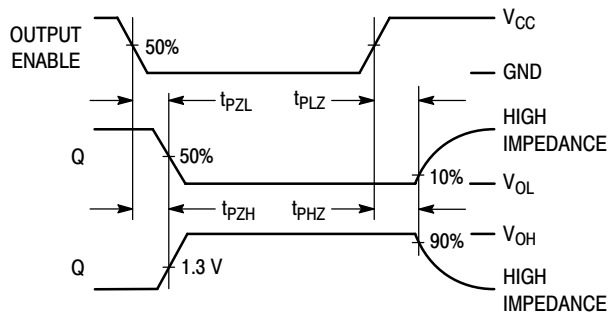


Figure 3.

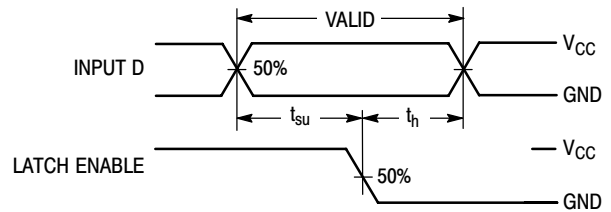
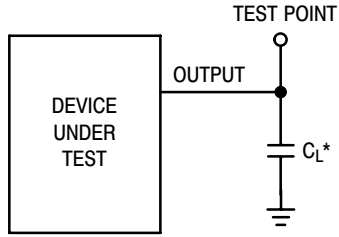


Figure 4.

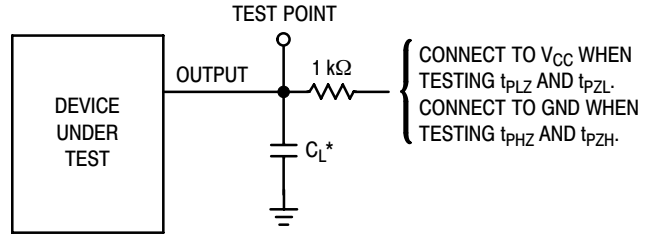
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## TEST CIRCUITS



\*Includes all probe and jig capacitance

Figure 5.



\*Includes all probe and jig capacitance

Figure 6.

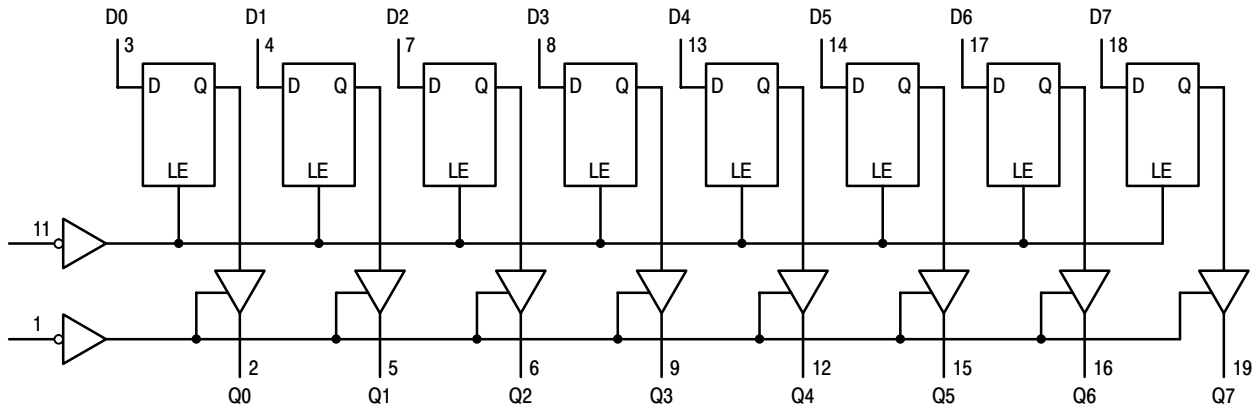
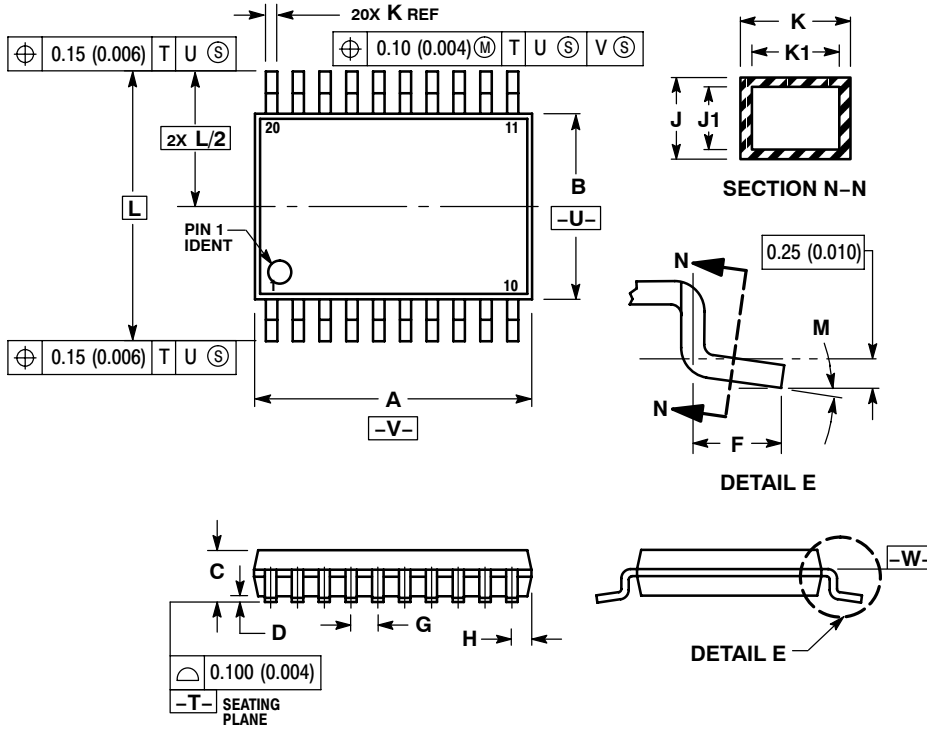


Figure 7. EXPANDED LOGIC DIAGRAM

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## PACKAGE DIMENSIONS

TSSOP-20  
CASE 948E-02  
ISSUE C

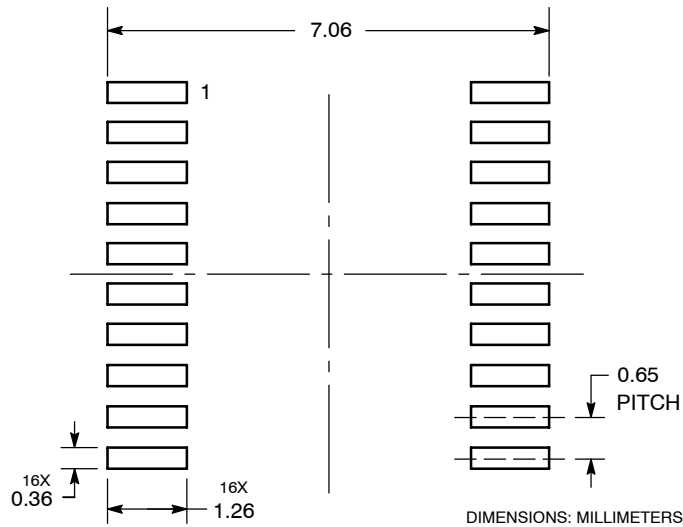


NOTES:

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   | 6.40        | 6.60 | 0.252     | 0.260 |
| 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   | 0.27        | 0.37 | 0.011     | 0.015 |
| 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°    |

### SOLDERING FOOTPRINT\*



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



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