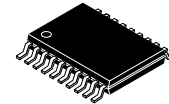


# Octal D-Type Latch with 3-STATE Outputs

## 74VHC573



TSSOP20, 4.4x6.5  
CASE 948AQ

### General Description

The VHC573 is an advanced high speed CMOS octal latch with 3-STATE output fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. This 8-bit D-type latch is controlled by a latch enable input (LE) and an Output Enable input ( $\overline{OE}$ ). When the  $\overline{OE}$  input is HIGH, the eight outputs are in a high impedance state.

An input protection circuit ensures that 0 V to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

- High Speed:  $t_{PD} = 5.0$  ns (Typ) at  $V_{CC} = 5$  V
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min)
- Power Down Protection is Provided on All Inputs
- Low Noise:  $V_{OLP} = 0.6$  V (Typ)
- Low Power Dissipation:  $I_{CC} = 4$   $\mu$ A (Max) @  $T_A = 25$  °C
- Pin and Function Compatible with 74HC573
- This is a Pb-Free Device

### Logic Symbol

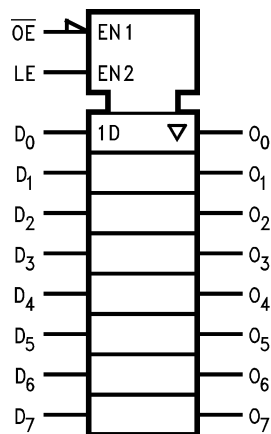
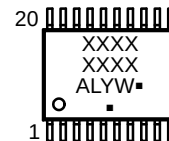


Figure 1. Logic Symbol

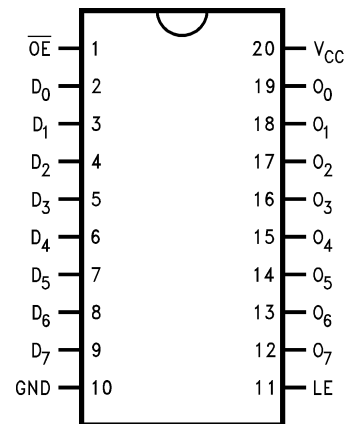
### MARKING DIAGRAM



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

(Note: Microdot may be in either location)

### CONNECTION DIAGRAM



### PIN DESCRIPTION

| Pin Names       | Description                 |
|-----------------|-----------------------------|
| $D_0$ – $D_7$   | Data Inputs                 |
| LE              | Latch Enable Input          |
| $\overline{OE}$ | 3-STATE Output Enable Input |
| $O_0$ – $O_7$   | 3-STATE Outputs             |

### ORDERING INFORMATION

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

## TRUTH TABLE

| Inputs          |    |   | Outputs |
|-----------------|----|---|---------|
| $\overline{OE}$ | LE | D | $O_n$   |
| L               | H  | H | H       |
| L               | H  | L | L       |
| L               | L  | X | $O_0$   |
| H               | X  | X | Z       |

H = HIGH Voltage Level

L = LOW Voltage Level

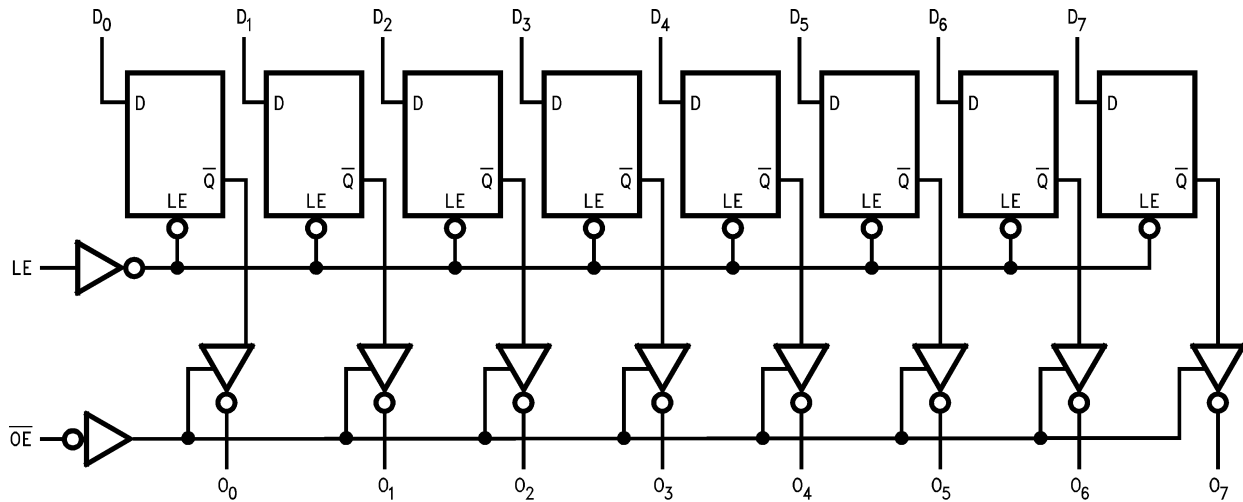
X = Immaterial

Z = High Impedance

## Functional Description

The VHC573 contains eight D-type latches with 3-STATE output buffers. When the Latch Enable (LE) input is HIGH, data on the  $D_n$  inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW the latches store the information that was present on the D inputs, a setup time preceding the HIGH-to-LOW transition of LE. The 3-STATE buffers are controlled by the Output Enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the buffers are enabled. When  $\overline{OE}$  is HIGH the buffers are in the high impedance mode, but, this does not interfere with entering new data into the latches.

## Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 2. Logic Diagram

## 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                                |                        | ±20                           | mA   |
| I <sub>OUT</sub> | DC Output Current                               |                        | ±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 Seconds |                        | 260                           | °C   |
| T <sub>J</sub>   | Junction Temperature under Bias                 |                        | +150                          | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Note 2)                     |                        | 150                           | °C/W |
| P <sub>D</sub>   | Power Dissipation in Still Air at 25 °C         |                        | 833                           | mW   |
| MSL              | Moisture Sensitivity                            |                        | 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                           |      |

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 76 mm-by-114 mm, 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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                  |                                  | Min | Max             | Unit |
|---------------------------------|----------------------------|----------------------------------|-----|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage          |                                  | 2.0 | 5.5             | V    |
| V <sub>IN</sub>                 | DC Input Voltage (Note 4)  |                                  | 0   | 5.5             | V    |
| V <sub>OUT</sub>                | DC Output Voltage (Note 4) |                                  | 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    | V <sub>CC</sub> = 3.0 V to 3.6 V | 0   | 100             | ns/V |
|                                 |                            | V <sub>CC</sub> = 4.5 V to 5.5 V | 0   | 20              |      |

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.

4. 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.

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                        | Conditions                                                                                       |                          | V <sub>CC</sub> (V) | T <sub>A</sub> = 25 °C |     |                       | T <sub>A</sub> = -40 °C to +85 °C |                       | Unit |
|-----------------|----------------------------------|--------------------------------------------------------------------------------------------------|--------------------------|---------------------|------------------------|-----|-----------------------|-----------------------------------|-----------------------|------|
|                 |                                  |                                                                                                  |                          |                     | Min                    | Typ | Max                   | Min                               | Max                   |      |
| V <sub>IH</sub> | HIGH Level Input Voltage         |                                                                                                  |                          | 2.0                 | 1.50                   | –   | –                     | 1.50                              | –                     | V    |
|                 |                                  |                                                                                                  |                          | 3.0–5.5             | 0.7 × V <sub>CC</sub>  | –   | –                     | 0.7 × V <sub>CC</sub>             | –                     |      |
| V <sub>IL</sub> | LOW Level Input Voltage          |                                                                                                  |                          | 2.0                 | –                      | –   | 0.50                  | –                                 | 0.50                  | V    |
|                 |                                  |                                                                                                  |                          | 3.0–5.5             | –                      | –   | 0.3 × V <sub>CC</sub> | –                                 | 0.3 × V <sub>CC</sub> |      |
| V <sub>OH</sub> | HIGH Level Output Voltage        | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                             | I <sub>OH</sub> = –50 μA | 2.0                 | 1.9                    | 2.0 | –                     | 1.9                               | –                     | V    |
|                 |                                  |                                                                                                  |                          | 3.0                 | 2.9                    | 3.0 | –                     | 2.9                               | –                     |      |
|                 |                                  |                                                                                                  |                          | 4.5                 | 4.4                    | 4.5 | –                     | 4.4                               | –                     |      |
|                 |                                  |                                                                                                  | I <sub>OH</sub> = –4 mA  | 3.0                 | 2.58                   | –   | –                     | 2.48                              | –                     |      |
|                 |                                  |                                                                                                  | I <sub>OH</sub> = –8 mA  | 4.5                 | 3.94                   | –   | –                     | 3.80                              | –                     |      |
| V <sub>OL</sub> | LOW Level Output Voltage         | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                             | I <sub>OL</sub> = 50 μA  | 2.0                 | –                      | 0.0 | 0.1                   | –                                 | 0.1                   | V    |
|                 |                                  |                                                                                                  |                          | 3.0                 | –                      | 0.0 | 0.1                   | –                                 | 0.1                   |      |
|                 |                                  |                                                                                                  |                          | 4.5                 | –                      | 0.0 | 0.1                   | –                                 | 0.1                   |      |
|                 |                                  |                                                                                                  | I <sub>OL</sub> = 4 mA   | 3.0                 | –                      | –   | 0.36                  | –                                 | 0.44                  |      |
|                 |                                  |                                                                                                  | I <sub>OL</sub> = 8 mA   | 4.5                 | –                      | –   | 0.36                  | –                                 | 0.44                  |      |
| I <sub>OZ</sub> | 3-STATE Output Off-State Current | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = V <sub>CC</sub> or GND |                          | 5.5                 | –                      | –   | ±0.25                 | –                                 | ±2.5                  | μA   |
| I <sub>IN</sub> | Input Leakage Current            | V <sub>IN</sub> = 5.5 V or GND                                                                   |                          | 0–5.5               | –                      | –   | ±0.1                  | –                                 | ±1.0                  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current         | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                         |                          | 5.5                 | –                      | –   | 4.0                   | –                                 | 40.0                  | μA   |

## NOISE CHARACTERISTICS

| Symbol                       | Parameter                                    | Conditions             | V <sub>CC</sub> (V) | T <sub>A</sub> = 25 °C |        | Unit |
|------------------------------|----------------------------------------------|------------------------|---------------------|------------------------|--------|------|
|                              |                                              |                        |                     | Typ                    | Limits |      |
| V <sub>OLP</sub><br>(Note 5) | Quiet Output Maximum Dynamic V <sub>OL</sub> | C <sub>L</sub> = 50 pF | 5.0                 | 0.9                    | 1.2    | V    |
| V <sub>OLV</sub><br>(Note 5) | Quiet Output Minimum Dynamic V <sub>OL</sub> | C <sub>L</sub> = 50 pF | 5.0                 | –0.8                   | –1.0   | V    |
| V <sub>IHD</sub><br>(Note 5) | Minimum HIGH Level Dynamic Input Voltage     | C <sub>L</sub> = 50 pF | 5.0                 | –                      | 3.5    | V    |
| V <sub>ILD</sub><br>(Note 5) | Maximum LOW Level Dynamic Input Voltage      | C <sub>L</sub> = 50 pF | 5.0                 | –                      | 1.5    | V    |

5. Parameter guaranteed by design.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                | Parameter                                      | Conditions              |                        | V <sub>CC</sub> (V) | T <sub>A</sub> = 25 °C |      |      | T <sub>A</sub> = −40 °C to +85 °C |      | Unit |
|---------------------------------------|------------------------------------------------|-------------------------|------------------------|---------------------|------------------------|------|------|-----------------------------------|------|------|
|                                       |                                                |                         |                        |                     | Min                    | Typ  | Max  | Min                               | Max  |      |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time (LE to O <sub>n</sub> ) |                         | C <sub>L</sub> = 15 pF | 3.3 ±0.3            | –                      | 7.6  | 11.9 | 1.0                               | 14.0 | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 10.1 | 15.4 | 1.0                               | 17.5 |      |
|                                       |                                                |                         | C <sub>L</sub> = 15 pF | 5.0 ±0.5            | –                      | 5.0  | 7.7  | 1.0                               | 9.0  | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 6.5  | 9.7  | 1.0                               | 11.0 |      |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time (D–O <sub>n</sub> )     |                         | C <sub>L</sub> = 15 pF | 3.3 ±0.3            | –                      | 7.0  | 11.0 | 1.0                               | 13.0 | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 9.5  | 14.5 | 1.0                               | 16.5 |      |
|                                       |                                                |                         | C <sub>L</sub> = 15 pF | 5.0 ±0.5            | –                      | 4.5  | 6.8  | 1.0                               | 8.0  | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 6.0  | 8.8  | 1.0                               | 10.0 |      |
| t <sub>PZL</sub> , t <sub>PZH</sub>   | 3–STATE Output Enable Time                     | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 15 pF | 3.3 ±0.3            | –                      | 7.3  | 11.5 | 1.0                               | 13.5 | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 9.8  | 15.0 | 1.0                               | 17.0 |      |
|                                       |                                                |                         | C <sub>L</sub> = 15 pF | 5.0 ±0.5            | –                      | 5.2  | 7.7  | 1.0                               | 9.0  | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF |                     | –                      | 6.7  | 9.7  | 1.0                               | 11.0 |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>   | 3–STATE Output Disable Time                    | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 50 pF | 3.3 ±0.3            | –                      | 10.7 | 14.5 | 1.0                               | 16.5 | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF | 5.0 ±0.5            | –                      | 6.7  | 9.7  | 1.0                               | 11.0 |      |
| t <sub>OSLH</sub> , t <sub>OSHL</sub> | Output to Output Skew                          | (Note 6)                | C <sub>L</sub> = 50 pF | 3.3 ±0.3            | –                      | –    | 1.5  | –                                 | 1.5  | ns   |
|                                       |                                                |                         | C <sub>L</sub> = 50 pF | 5.0 ±0.5            | –                      | –    | 1.0  | –                                 | 1.0  |      |
| C <sub>IN</sub>                       | Input Capacitance                              | V <sub>CC</sub> = Open  |                        |                     | –                      | 4    | 10   | –                                 | 10   | pF   |
| C <sub>OUT</sub>                      | Output Capacitance                             | V <sub>CC</sub> = 5.0 V |                        |                     | –                      | 6    | –    | –                                 | –    | pF   |
| C <sub>PD</sub>                       | Power Dissipation Capacitance                  | (Note 7)                |                        |                     | –                      | 29   | –    | –                                 | –    | pF   |

6. Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLH</sub> max – t<sub>PLH</sub> min|; t<sub>OSHL</sub> = |t<sub>PHL</sub> max – t<sub>PHL</sub> min|

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</sub> (Opr.) = C<sub>PD</sub> · V<sub>CC</sub> · f<sub>IN</sub> + I<sub>CC</sub> / 8 (per Latch). The total C<sub>PD</sub> when n pcs. of the Latch operates can be calculated by the equation: C<sub>PD</sub> (total) = 21 + 8n.

## AC OPERATING REQUIREMENTS

| Symbol                                 | Parameter                | V <sub>CC</sub> (V) | T <sub>A</sub> = 25 °C |     |     | T <sub>A</sub> = -40 °C to +85 °C |     | Unit |
|----------------------------------------|--------------------------|---------------------|------------------------|-----|-----|-----------------------------------|-----|------|
|                                        |                          |                     | Min                    | Typ | Max | Min                               | Max |      |
| t <sub>W</sub> (H), t <sub>W</sub> (L) | Minimum Pulse Width (LE) | 3.3 ±0.3            | 5.0                    | –   | –   | 5.0                               | –   | ns   |
|                                        |                          | 5.0 ±0.5            | 5.0                    | –   | –   | 5.0                               | –   |      |
| t <sub>S</sub>                         | Minimum Setup Time       | 3.3 ±0.3            | 3.5                    | –   | –   | 3.5                               | –   | ns   |
|                                        |                          | 5.0 ±0.5            | 3.5                    | –   | –   | 3.5                               | –   |      |
| t <sub>H</sub>                         | Minimum Hold Time        | 3.3 ±0.3            | 1.5                    | –   | –   | 1.5                               | –   | ns   |
|                                        |                          | 5.0 ±0.5            | 1.5                    | –   | –   | 1.5                               | –   |      |

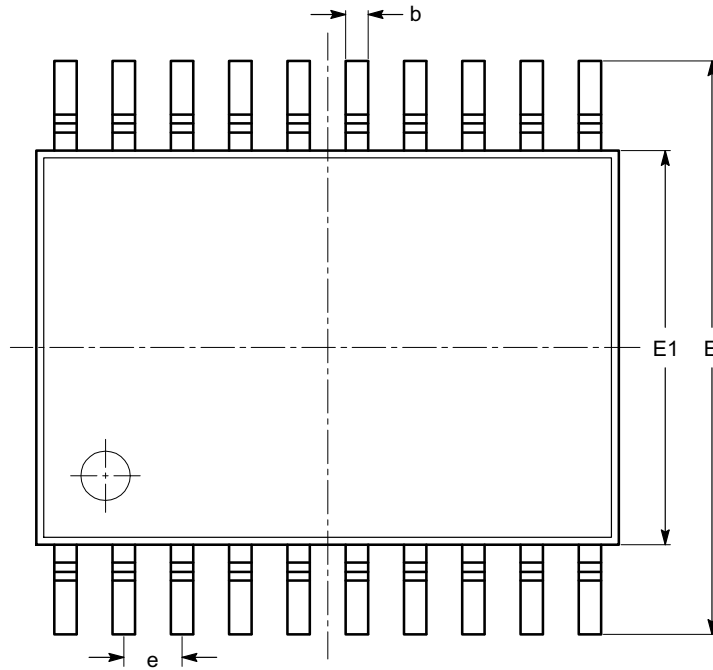
## ORDERING INFORMATION

| Device       | Marking    | Package              | Shipping <sup>†</sup>    |
|--------------|------------|----------------------|--------------------------|
| 74VHC573MTC  | VHC<br>573 | TSSOP20<br>(Pb-Free) | 75 Units / Tube          |
| 74VHC573MTCX | VHC<br>573 | TSSOP20<br>(Pb-Free) | 2500 Units / 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.

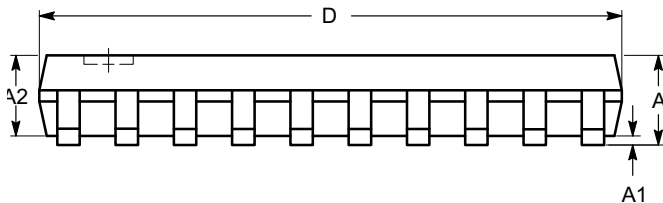
**TSSOP20, 4.4x6.5**  
CASE 948AQ  
ISSUE A

DATE 19 MAR 2009

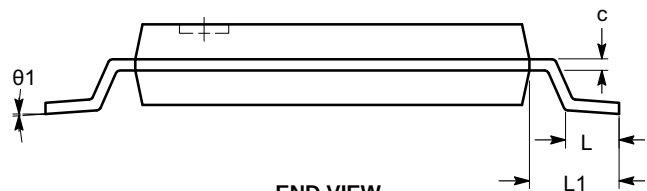


TOP VIEW

| SYMBOL | MIN      | NOM  | MAX  |
|--------|----------|------|------|
| A      |          |      | 1.20 |
| A1     | 0.05     |      | 0.15 |
| A2     | 0.80     |      | 1.05 |
| b      | 0.19     |      | 0.30 |
| c      | 0.09     |      | 0.20 |
| D      | 6.40     | 6.50 | 6.60 |
| E      | 6.30     | 6.40 | 6.50 |
| E1     | 4.30     | 4.40 | 4.50 |
| e      | 0.65 BSC |      |      |
| L      | 0.45     | 0.60 | 0.75 |
| L1     | 1.00 REF |      |      |
| θ      | 0°       |      | 8°   |



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-153.

|                         |                         |                                                                                                                                                                                     |
|-------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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