

## 74LVT374 • 74LVTH374

### Low Voltage Octal D-Type Flip-Flop with 3-STATE Outputs

#### General Description

The LVT374 and LVTH374 are high-speed, low-power octal D-type flip-flops featuring separate D-type inputs for each flip-flop and 3-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ( $\overline{OE}$ ) are common to all flip-flops.

The LVTH374 data inputs include bushold, eliminating the need for external pull-up resistors to hold unused inputs.

These octal flip-flops are designed for low-voltage (3.3V)  $V_{CC}$  applications, but with the capability to provide a TTL interface to a 5V environment. The LVT374 and LVTH374 are fabricated with an advanced BiCMOS technology to achieve high speed operation similar to 5V ABT while maintaining low power dissipation.

#### Features

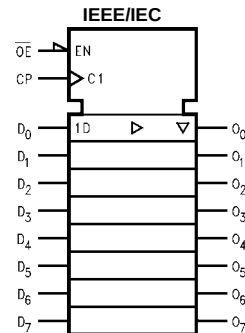
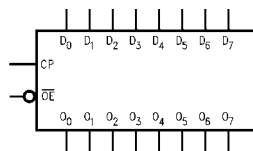
- Input and output interface capability to systems at 5V  $V_{CC}$
- Bus-Hold data inputs eliminate the need for external pull-up resistors to hold unused inputs (74LVTH374), also available without bushold feature (74LVT374).
- Live insertion/extraction permitted
- Power Up/Down high impedance provides glitch-free bus loading
- Outputs source/sink -32 mA/+64 mA
- Functionally compatible with the 74 series 374
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human-body model > 2000V
  - Machine model > 200V
  - Charged-device model > 1000V

#### Ordering Code:

| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| 74LVT374WM   | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74LVT374SJ   | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74LVT374MTC  | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74LVTH374WM  | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74LVTH374SJ  | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74LVTH374MTC | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

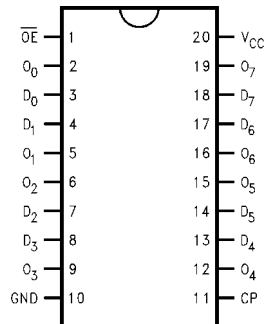
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

#### Logic Symbols



74LVT374 • 74LVTH374 Low Voltage Octal D-Type Flip-Flop with 3-STATE Outputs

## Connection Diagram



## Pin Descriptions

| Pin Names                      | Description                 |
|--------------------------------|-----------------------------|
| D <sub>0</sub> –D <sub>7</sub> | Data Inputs                 |
| CP                             | Clock Pulse Input           |
| $\overline{OE}$                | 3-STATE Output Enable Input |
| O <sub>0</sub> –O <sub>7</sub> | 3-STATE Outputs             |

## Truth Table

| Inputs         |    |                 | Outputs        |
|----------------|----|-----------------|----------------|
| D <sub>n</sub> | CP | $\overline{OE}$ | O <sub>n</sub> |
| H              | ↗  | L               | H              |
| L              | ↗  | L               | L              |
| X              | L  | L               | O <sub>0</sub> |
| X              | X  | H               | Z              |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Z = High Impedance

↗ = LOW-to-HIGH Transition

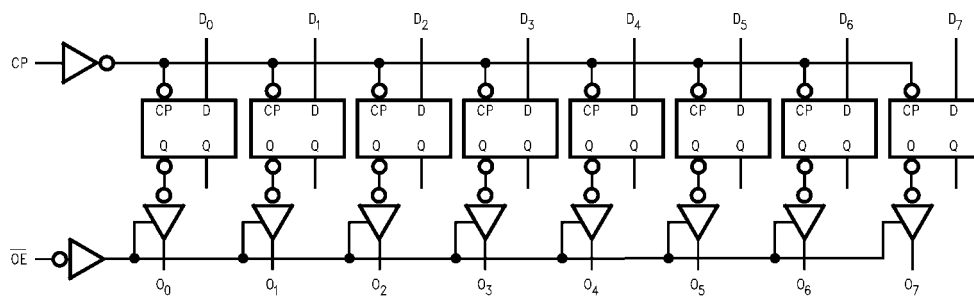
O<sub>0</sub> = Previous O<sub>0</sub> before HIGH-to-LOW of CP

## Functional Description

The LVT374 and LVTH374 consist of eight edge-triggered flip-flops with individual D-type inputs and 3-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP)

transition. With the Output Enable ( $\overline{OE}$ ) LOW, the contents of the eight flip-flops are available at the outputs. When the  $\overline{OE}$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

## 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.

**Absolute Maximum Ratings**(Note 1)

| Symbol    | Parameter                        | Value        | Conditions                           | Units |
|-----------|----------------------------------|--------------|--------------------------------------|-------|
| $V_{CC}$  | Supply Voltage                   | -0.5 to +4.6 |                                      | V     |
| $V_I$     | DC Input Voltage                 | -0.5 to +7.0 |                                      | V     |
| $V_O$     | DC Output Voltage                | -0.5 to +7.0 | Output in 3-STATE                    | V     |
|           |                                  | -0.5 to +7.0 | Output in HIGH or LOW State (Note 2) | V     |
| $I_{IK}$  | DC Input Diode Current           | -50          | $V_I < GND$                          | mA    |
| $I_{OK}$  | DC Output Diode Current          | -50          | $V_O < GND$                          | mA    |
| $I_O$     | DC Output Current                | 64           | $V_O > V_{CC}$ Output at HIGH State  | mA    |
|           |                                  | 128          | $V_O > V_{CC}$ Output at LOW State   |       |
| $I_{CC}$  | DC Supply Current per Supply Pin | ±64          |                                      | mA    |
| $I_{GND}$ | DC Ground Current per Ground Pin | ±128         |                                      | mA    |
| $T_{STG}$ | Storage Temperature              | -65 to +150  |                                      | °C    |

**Recommended Operating Conditions**

| Symbol              | Parameter                                               | Min | Max | Units |
|---------------------|---------------------------------------------------------|-----|-----|-------|
| $V_{CC}$            | Supply Voltage                                          | 2.7 | 3.6 | V     |
| $V_I$               | Input Voltage                                           | 0   | 5.5 | V     |
| $I_{OH}$            | HIGH-Level Output Current                               |     | -32 | mA    |
| $I_{OL}$            | LOW-Level Output Current                                |     | 64  | mA    |
| $T_A$               | Free-Air Operating Temperature                          | -40 | 85  | °C    |
| $\Delta t/\Delta V$ | Input Edge Rate, $V_{IN} = 0.8V-2.0V$ , $V_{CC} = 3.0V$ | 0   | 10  | ns/V  |

**Note 1:** Absolute Maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rated conditions is not implied.

**Note 2:**  $I_O$  Absolute Maximum Rating must be observed.

## DC Electrical Characteristics

| Symbol                           | Parameter                                           | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C |                 |      | Units | Conditions                                                                    |
|----------------------------------|-----------------------------------------------------|------------------------|---------------------------------|-----------------|------|-------|-------------------------------------------------------------------------------|
|                                  |                                                     |                        | Min                             | Typ<br>(Note 3) | Max  |       |                                                                               |
| V <sub>IK</sub>                  | Input Clamp Diode Voltage                           | 2.7                    |                                 |                 | -1.2 | V     | I <sub>I</sub> = -18 mA                                                       |
| V <sub>IH</sub>                  | Input HIGH Voltage                                  | 2.7-3.6                | 2.0                             |                 |      | V     | V <sub>O</sub> ≤ 0.1V or                                                      |
| V <sub>IL</sub>                  | Input LOW Voltage                                   | 2.7-3.6                |                                 |                 | 0.8  |       | V <sub>O</sub> ≥ V <sub>CC</sub> - 0.1V                                       |
| V <sub>OH</sub>                  | Output HIGH Voltage                                 | 2.7-3.6                | V <sub>CC</sub> - 0.2           |                 |      | V     | I <sub>OH</sub> = -100 μA                                                     |
|                                  |                                                     | 2.7                    | 2.4                             |                 |      | V     | I <sub>OH</sub> = -8 mA                                                       |
|                                  |                                                     | 3.0                    | 2.0                             |                 |      | V     | I <sub>OH</sub> = -32 mA                                                      |
| V <sub>OL</sub>                  | Output LOW Voltage                                  | 2.7                    |                                 |                 | 0.2  | V     | I <sub>OL</sub> = 100 μA                                                      |
|                                  |                                                     | 2.7                    |                                 |                 | 0.5  | V     | I <sub>OL</sub> = 24 mA                                                       |
|                                  |                                                     | 3.0                    |                                 |                 | 0.4  | V     | I <sub>OL</sub> = 16 mA                                                       |
|                                  |                                                     | 3.0                    |                                 |                 | 0.5  | V     | I <sub>OL</sub> = 32 mA                                                       |
|                                  |                                                     | 3.0                    |                                 |                 | 0.55 | V     | I <sub>OL</sub> = 64 mA                                                       |
| I <sub>I(HOLD)</sub><br>(Note 4) | Bushold Input Minimum Drive                         | 3.0                    | 75                              |                 |      | μA    | V <sub>I</sub> = 0.8V                                                         |
|                                  |                                                     |                        | -75                             |                 |      | μA    | V <sub>I</sub> = 2.0V                                                         |
| I <sub>I(OD)</sub><br>(Note 4)   | Bushold Input Over-Drive<br>Current to Change State | 3.0                    | 500                             |                 |      | μA    | (Note 5)                                                                      |
|                                  |                                                     |                        | -500                            |                 |      | μA    | (Note 6)                                                                      |
| I <sub>I</sub>                   | Input Current                                       | 3.6                    |                                 |                 | 10   | μA    | V <sub>I</sub> = 5.5V                                                         |
|                                  |                                                     | Control Pins           | 3.6                             |                 | ±1   | μA    | V <sub>I</sub> = 0V or V <sub>CC</sub>                                        |
|                                  |                                                     |                        |                                 |                 | -5   | μA    | V <sub>I</sub> = 0V                                                           |
|                                  |                                                     | Data Pins              | 3.6                             |                 | 1    | μA    | V <sub>I</sub> = V <sub>CC</sub>                                              |
| I <sub>OFF</sub>                 | Power Off Leakage Current                           | 0                      |                                 |                 | ±100 | μA    | 0V ≤ V <sub>I</sub> or V <sub>O</sub> ≤ 5.5V                                  |
| I <sub>PU/PD</sub>               | Power up/down 3-STATE<br>Output Current             | 0-1.5V                 |                                 |                 | ±100 | μA    | V <sub>O</sub> = 0.5V to 3.0V<br>V <sub>I</sub> = GND or V <sub>CC</sub>      |
| I <sub>OZL</sub>                 | 3-STATE Output Leakage Current                      | 3.6                    |                                 |                 | -5   | μA    | V <sub>O</sub> = 0.5V                                                         |
| I <sub>OZH</sub>                 | 3-STATE Output Leakage Current                      | 3.6                    |                                 |                 | 5    | μA    | V <sub>O</sub> = 3.0V                                                         |
| I <sub>OZH+</sub>                | 3-STATE Output Leakage Current                      | 3.6                    |                                 |                 | 10   | μA    | V <sub>CC</sub> < V <sub>O</sub> ≤ 5.5V                                       |
| I <sub>CCH</sub>                 | Power Supply Current                                | 3.6                    |                                 |                 | 0.19 | mA    | Outputs HIGH                                                                  |
| I <sub>CCL</sub>                 | Power Supply Current                                | 3.6                    |                                 |                 | 5    | mA    | Outputs LOW                                                                   |
| I <sub>CCZ</sub>                 | Power Supply Current                                | 3.6                    |                                 |                 | 0.19 | mA    | Outputs Disabled                                                              |
| I <sub>CCZ+</sub>                | Power Supply Current                                | 3.6                    |                                 |                 | 0.19 | mA    | V <sub>CC</sub> ≤ V <sub>O</sub> ≤ 5.5V,<br>Outputs Disabled                  |
| ΔI <sub>CC</sub>                 | Increase in Power Supply Current<br>(Note 7)        | 3.6                    |                                 |                 | 0.2  | mA    | One Input at V <sub>CC</sub> - 0.6V<br>Other Inputs at V <sub>CC</sub> or GND |

**Note 3:** All typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = 25°C.

**Note 4:** Applies to Bushold versions only (74LVTH374).

**Note 5:** An external driver must source at least the specified current to switch from LOW-to-HIGH.

**Note 6:** An external driver must sink at least the specified current to switch from HIGH-to-LOW.

**Note 7:** This is the increase in supply current for each input that is at the specified voltage level rather than V<sub>CC</sub> or GND.

## Dynamic Switching Characteristics (Note 8)

| Symbol           | Parameter                                    | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |      |     | Units | Conditions<br>C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω |
|------------------|----------------------------------------------|------------------------|-----------------------|------|-----|-------|-------------------------------------------------------------|
|                  |                                              |                        | Min                   | Typ  | Max |       |                                                             |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 3.3                    |                       | 0.8  |     | V     | (Note 9)                                                    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 3.3                    |                       | -0.8 |     | V     | (Note 9)                                                    |

**Note 8:** Characterized in SOIC package. Guaranteed parameter, but not tested.

**Note 9:** Max number of outputs defined as (n). n-1 data inputs are driven 0V to 3V. Output under test held LOW.

## AC Electrical Characteristics

| Symbol           | Parameter               | $T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$<br>$C_L = 50\text{ pF}, R_L = 500\Omega$ |                  |     |                        |     | Units |
|------------------|-------------------------|----------------------------------------------------------------------------------------------|------------------|-----|------------------------|-----|-------|
|                  |                         | $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$                                                       |                  |     | $V_{CC} = 2.7\text{V}$ |     |       |
|                  |                         | Min                                                                                          | Typ<br>(Note 10) | Max | Min                    | Max |       |
| $f_{\text{MAX}}$ | Maximum Clock Frequency | 160                                                                                          |                  |     | 160                    |     | MHz   |
| $t_{\text{PHL}}$ | Propagation Delay       | 1.8                                                                                          |                  | 4.9 | 1.8                    | 5.1 | ns    |
| $t_{\text{PLH}}$ | CP to $O_n$             | 1.8                                                                                          |                  | 4.8 | 1.8                    | 5.2 |       |
| $t_{\text{PZL}}$ | Output Enable Time      | 1.3                                                                                          |                  | 5.0 | 1.3                    | 5.8 | ns    |
| $t_{\text{PZH}}$ |                         | 1.6                                                                                          |                  | 4.7 | 1.6                    | 5.3 |       |
| $t_{\text{PLZ}}$ | Output Disable Time     | 1.9                                                                                          |                  | 4.6 | 1.9                    | 4.9 | ns    |
| $t_{\text{PHZ}}$ |                         | 2.0                                                                                          |                  | 4.7 | 2.0                    | 5.0 |       |
| $t_W$            | Pulse Width             | 3.0                                                                                          |                  |     | 3.0                    |     | ns    |
| $t_S$            | Setup Time              | 1.5                                                                                          |                  |     | 2.0                    |     | ns    |
| $t_H$            | Hold Time               | 0.8                                                                                          |                  |     | 0.0                    |     | ns    |

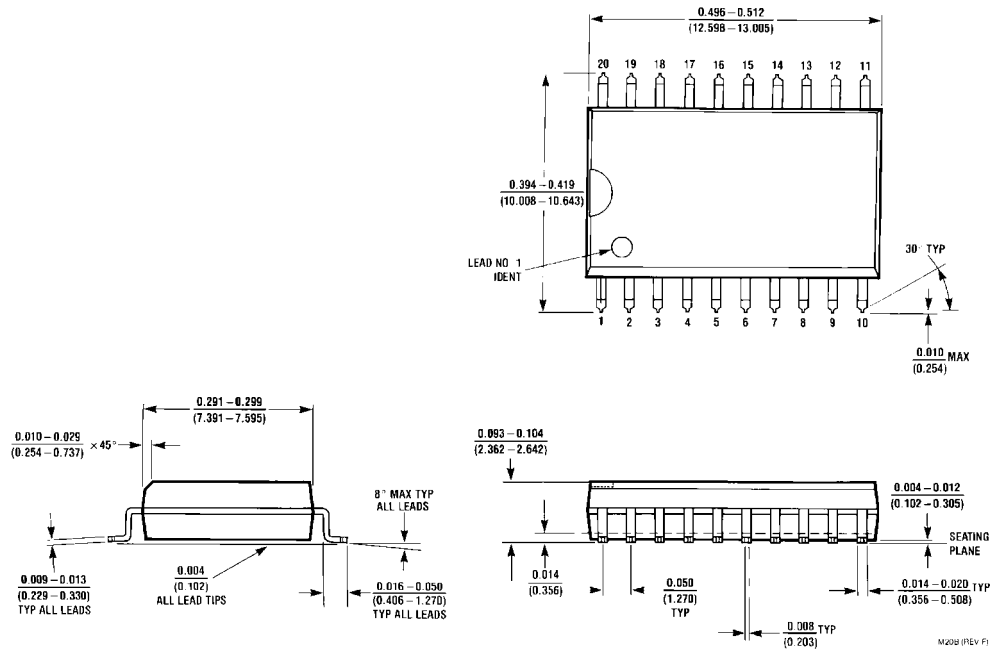
**Note 10:** All typical values are at  $V_{CC} = 3.3V$ ,  $T_A = 25^{\circ}\text{C}$ .

## Capacitance (Note 11)

| Symbol    | Parameter          | Conditions                               | Typical | Units |
|-----------|--------------------|------------------------------------------|---------|-------|
| $C_{IN}$  | Input Capacitance  | $V_{CC} = 0V$ , $V_I = 0V$ or $V_{CC}$   | 3       | pF    |
| $C_{OUT}$ | Output Capacitance | $V_{CC} = 3.0V$ , $V_O = 0V$ or $V_{CC}$ | 5       | pF    |

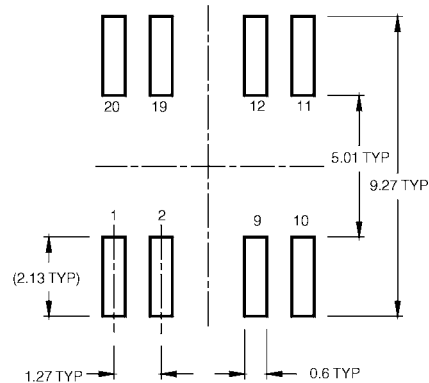
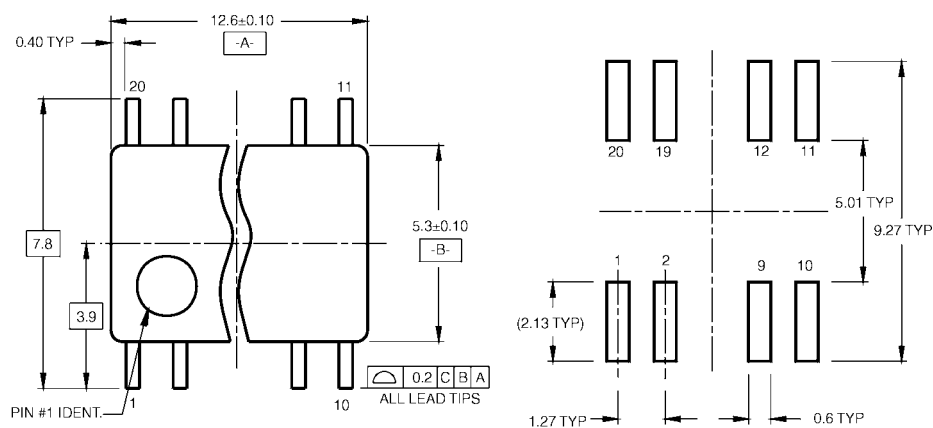
**Note 11:** Capacitance is measured at frequency  $f = 1 \text{ MHz}$ , per MIL-STD-883, Method 3012.

# Physical Dimensions inches (millimeters) unless otherwise noted

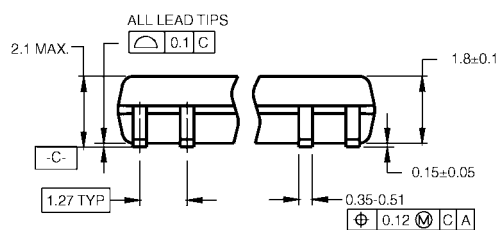


20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M20B

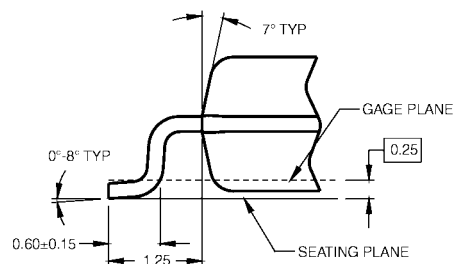
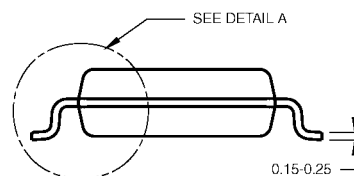
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**LAND PATTERN RECOMMENDATION**



DIMENSIONS ARE IN MILLIMETERS



**DETAIL A**

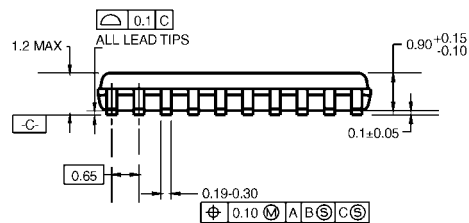
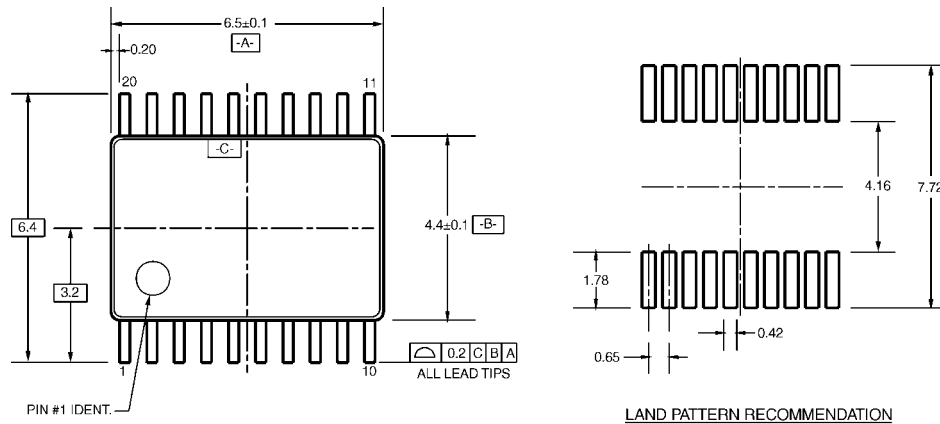
**NOTES:**

- CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DRevB1

**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M20D**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

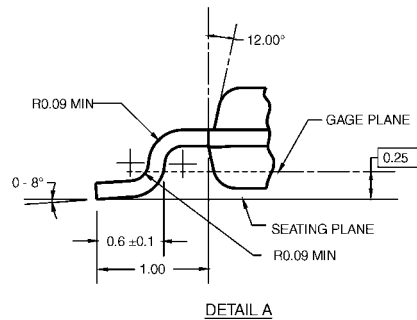


DIMENSIONS ARE IN MILLIMETERS

### NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20RevD1



20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC20

Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.

### LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
- A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

[www.fairchildsemi.com](http://www.fairchildsemi.com)