

# 74LVT374, 74LVTH374

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

### 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  $-32\text{mA}/+64\text{mA}$
- Functionally compatible with the 74 series 374
- Latch-up performance exceeds 500mA
- ESD performance:
  - Human-body model > 2000V
  - Machine model > 200V
  - Charged-device model > 1000V

### 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.

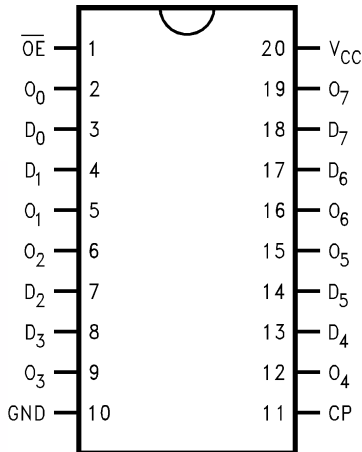
### Ordering Information

| 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 number.

 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram



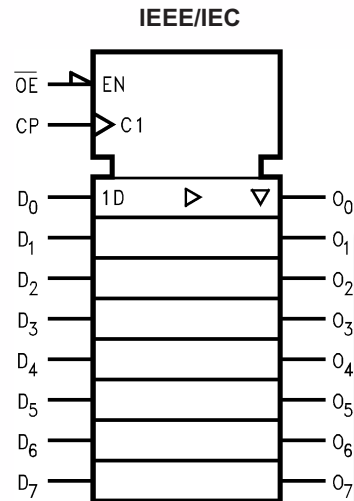
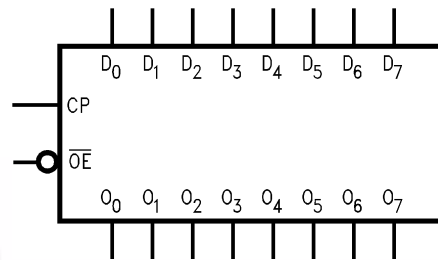
### Pin Description

| 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             |

### 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 Symbols



### 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>o</sub> |
| X              | X  | H               | Z              |

H = HIGH Voltage Level

L = LOW Voltage Level

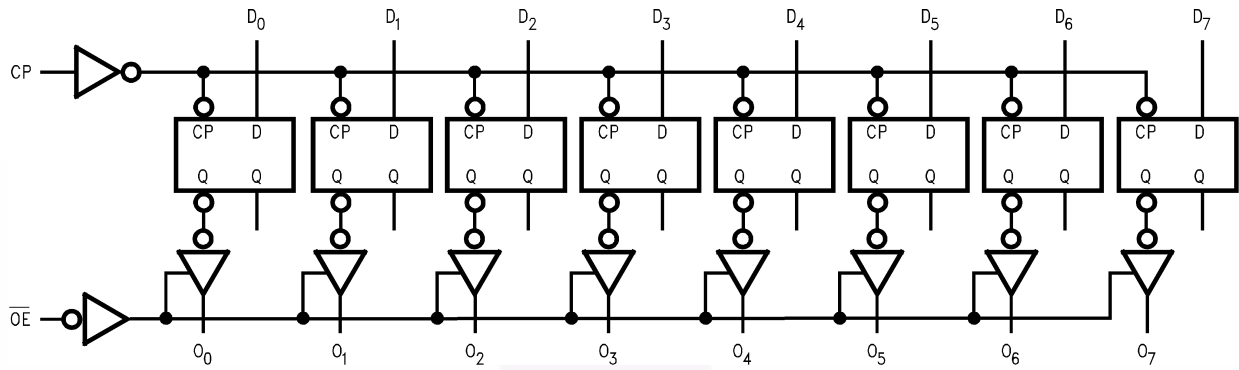
X = Immaterial

Z = High Impedance

↗ = LOW-to-HIGH Transition

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

**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

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol    | Parameter   | Rating          |
|-----------|---|-----------------|
| $V_{CC}$  | Supply Voltage  | -0.5V to +4.6V  |
| $V_I$     | DC Input Voltage  | -0.5V to +7.0V  |
| $V_O$     | DC Output Voltage<br>Output in 3-STATE                    | -0.5V to +7.0V  |
|           | Output in HIGH or LOW State <sup>(1)</sup>                | -0.5V to +7.0V  |
| $I_{IK}$  | DC Input Diode Current, $V_I < GND$                       | -50mA           |
| $I_{OK}$  | DC Output Diode Current, $V_O < GND$                      | -50mA           |
| $I_O$     | DC Output Current, $V_O > V_{CC}$<br>Output at HIGH State | 64mA            |
|           | Output at LOW State                                       | 128mA           |
| $I_{CC}$  | DC Supply Current per Supply Pin                          | ±64mA           |
| $I_{GND}$ | DC Ground Current per Ground Pin                          | ±128mA          |
| $T_{STG}$ | Storage Temperature                                       | -65°C to +150°C |

### Note:

- $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| 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  |

## DC Electrical Characteristics

| Symbol                              | Parameter  | V <sub>CC</sub> (V) | Conditions   | T <sub>A</sub> = -40°C to +85°C        |                                  |      | Units |    |
|-------------------------------------|--|---------------------|--|--|----------------------------------|------|-------|----|
|                                     |  |                     |  | Min.                                   | Typ. <sup>(2)</sup>              | Max. |       |    |
| V <sub>IK</sub>                     | Input Clamp Diode Voltage                        | 2.7                 | I <sub>I</sub> = -18mA   |  |                                  | -1.2 | V     |    |
| V <sub>IH</sub>                     | Input HIGH Voltage                               | 2.7-3.6             | V <sub>O</sub> ≤ 0.1V or   | 2.0                                    |                                  |      | V     |    |
| V <sub>IL</sub>                     | Input LOW Voltage                                | 2.7-3.6             | V <sub>O</sub> ≥ V <sub>CC</sub> - 0.1V  |  |                                  | 0.8  | V     |    |
| V <sub>OH</sub>                     | Output HIGH Voltage                              | 2.7-3.6             | I <sub>OH</sub> = -100μA   | V <sub>CC</sub> -0.2                   |                                  |      | V     |    |
|                                     |  | 2.7                 | I <sub>OH</sub> = -8mA   | 2.4                                    |                                  |      |       |    |
|                                     |  | 3.0                 | I <sub>OH</sub> = -32mA  | 2.0                                    |                                  |      |       |    |
| V <sub>OL</sub>                     | Output LOW Voltage                               | 2.7                 | I <sub>OL</sub> = 100μA  |  |                                  | 0.2  | V     |    |
|                                     |  |                     | I <sub>OL</sub> = 24mA   |  |                                  | 0.5  |       |    |
|                                     |  | 3.0                 | I <sub>OL</sub> = 16mA   |  |                                  | 0.4  |       |    |
|                                     |  |                     | I <sub>OL</sub> = 32mA   |  |                                  | 0.5  |       |    |
|                                     |  |                     | I <sub>OL</sub> = 64mA   |  |                                  | 0.55 |       |    |
| I <sub>I(HOLD)</sub> <sup>(3)</sup> | Bushold Input Minimum Drive                      | 3.0                 | V <sub>I</sub> = 0.8V  | 75                                     |                                  |      | μA    |    |
|                                     |  |                     | V <sub>I</sub> = 2.0V  | -75                                    |                                  |      |       |    |
| I <sub>I(OD)</sub> <sup>(3)</sup>   | Bushold Input Over-Drive Current to Change State | 3.0                 | <sup>(4)</sup>   | 500                                    |                                  |      | μA    |    |
|                                     |  |                     | <sup>(5)</sup>   | -500                                   |                                  |      |       |    |
| I <sub>I</sub>                      | Input Current                                    | 3.6                 | V <sub>I</sub> = 5.5V  |  |                                  | 10   | μA    |    |
|                                     |  | Control Pins        | 3.6  | V <sub>I</sub> = 0V or V <sub>CC</sub> |                                  |      |       | ±1 |
|                                     |  |                     | Data Pins  | 3.6                                    | V <sub>I</sub> = 0V              |      |       |    |
|                                     |  |                     |  |  | V <sub>I</sub> = V <sub>CC</sub> |      |       |    |
| I <sub>OFF</sub>                    | Power Off Leakage Current                        | 0                   | 0V ≤ V <sub>I</sub> or V <sub>O</sub> ≤ 5.5V                                   |  |                                  | ±100 | μA    |    |
| I <sub>PU/PD</sub>                  | Power up/down 3-STATE Output Current             | 0-1.5V              | V <sub>O</sub> = 0.5V to 3.0V,<br>V <sub>I</sub> = GND or V <sub>CC</sub>      |  |                                  | ±100 | μA    |    |
| I <sub>OZL</sub>                    | 3-STATE Output Leakage Current                   | 3.6                 | V <sub>O</sub> = 0.5V  |  |                                  | -5   | μA    |    |
| I <sub>OZH</sub>                    | 3-STATE Output Leakage Current                   | 3.6                 | V <sub>O</sub> = 3.0V  |  |                                  | 5    | μA    |    |
| I <sub>OZH+</sub>                   | 3-STATE Output Leakage Current                   | 3.6                 | V <sub>CC</sub> < V <sub>O</sub> ≤ 5.5V  |  |                                  | 10   | μA    |    |
| I <sub>CCH</sub>                    | Power Supply Current                             | 3.6                 | Outputs HIGH   |  |                                  | 0.19 | mA    |    |
| I <sub>CCL</sub>                    | Power Supply Current                             | 3.6                 | Outputs LOW  |  |                                  | 5    | mA    |    |
| I <sub>CCZ</sub>                    | Power Supply Current                             | 3.6                 | Outputs Disabled   |  |                                  | 0.19 | mA    |    |
| I <sub>CCZ+</sub>                   | Power Supply Current                             | 3.6                 | V <sub>CC</sub> ≤ V <sub>O</sub> ≤ 5.5V,<br>Outputs Disabled                   |  |                                  | 0.19 | mA    |    |
| ΔI <sub>CC</sub>                    | Increase in Power Supply Current <sup>(6)</sup>  | 3.6                 | One Input at V <sub>CC</sub> - 0.6V,<br>Other Inputs at V <sub>CC</sub> or GND |  |                                  | 0.2  | mA    |    |

**Notes:**

- All typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = 25°C.
- Applies to bushold versions only (74LVTH374).
- An external driver must source at least the specified current to switch from LOW-to-HIGH.
- An external driver must sink at least the specified current to switch from HIGH-to-LOW.
- 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<sup>(7)</sup>**

| Symbol           | Parameter                                    | V <sub>CC</sub> (V) | Conditions<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω | T <sub>A</sub> = 25°C |      |      | Units |
|------------------|--|---------------------|--|-----------------------|------|------|-------|
|                  |  |                     |  | Min.                  | Typ. | Max. |       |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 3.3                 | <sup>(8)</sup>   |                       | 0.8  |      | V     |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 3.3                 | <sup>(8)</sup>   |                       | -0.8 |      | V     |

**Notes:**

7. Characterized in SOIC package. Guaranteed parameter, but not tested.  
 8. 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 <sub>A</sub> = -40°C to +85°C,<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω |                     |      |                        |      | Units |
|------------------|---|--|---------------------|------|------------------------|------|-------|
|                  |   | V <sub>CC</sub> = 3.3V ± 0.3V  |                     |      | V <sub>CC</sub> = 2.7V |      |       |
|                  |   | Min.   | Typ. <sup>(9)</sup> | Max. | Min.                   | Max. |       |
| f <sub>MAX</sub> | Maximum Clock Frequency                 | 160  |                     |      | 160                    |      | MHz   |
| t <sub>PHL</sub> | Propagation Delay, CP to O <sub>n</sub> | 1.8  |                     | 4.9  | 1.8                    | 5.1  | ns    |
| t <sub>PLH</sub> |   | 1.8  |                     | 4.8  | 1.8                    | 5.2  |       |
| t <sub>PZL</sub> | Output Enable Time                      | 1.3  |                     | 5.0  | 1.3                    | 5.8  | ns    |
| t <sub>PZH</sub> |   | 1.6  |                     | 4.7  | 1.6                    | 5.3  |       |
| t <sub>PLZ</sub> | Output Disable Time                     | 1.9  |                     | 4.6  | 1.9                    | 4.9  | ns    |
| t <sub>PHZ</sub> |   | 2.0  |                     | 4.7  | 2.0                    | 5.0  |       |
| t <sub>W</sub>   | Pulse Width                             | 3.0  |                     |      | 3.0                    |      | ns    |
| t <sub>S</sub>   | Setup Time                              | 1.5  |                     |      | 2.0                    |      | ns    |
| t <sub>H</sub>   | Hold Time                               | 0.8  |                     |      | 0.0                    |      | ns    |

**Note:**

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

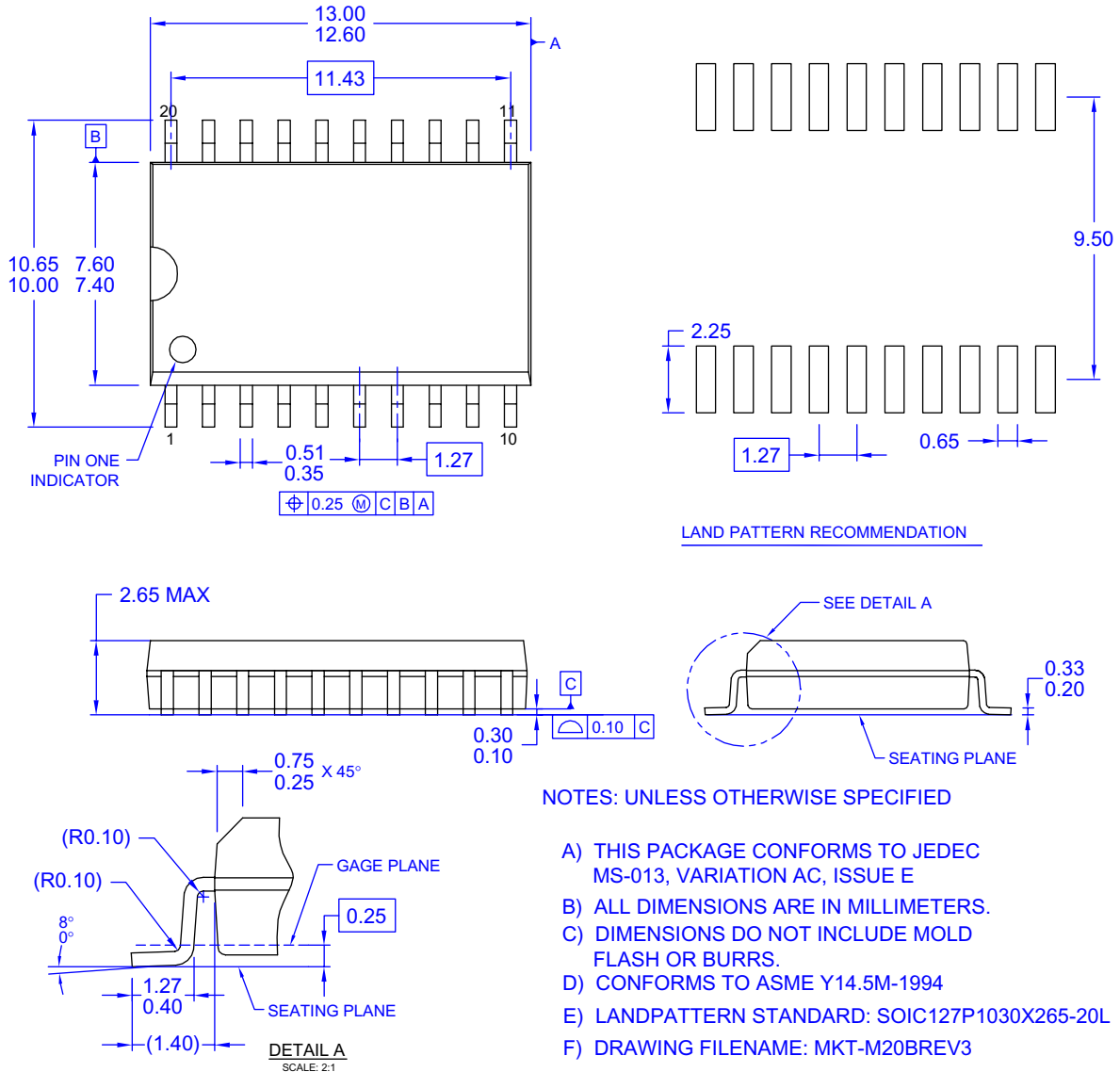
**Capacitance<sup>(10)</sup>**

| Symbol           | Parameter          | Conditions   | Typical | Units |
|------------------|--------------------|--|---------|-------|
| C <sub>IN</sub>  | Input Capacitance  | V <sub>CC</sub> = 0V, V <sub>I</sub> = 0V or V <sub>CC</sub>   | 3       | pF    |
| C <sub>OUT</sub> | Output Capacitance | V <sub>CC</sub> = 3.0V, V <sub>O</sub> = 0V or V <sub>CC</sub> | 5       | pF    |

**Note:**

10. Capacitance is measured at frequency f = 1MHz, per MIL-STD-883, Method 3012.

## Physical Dimensions



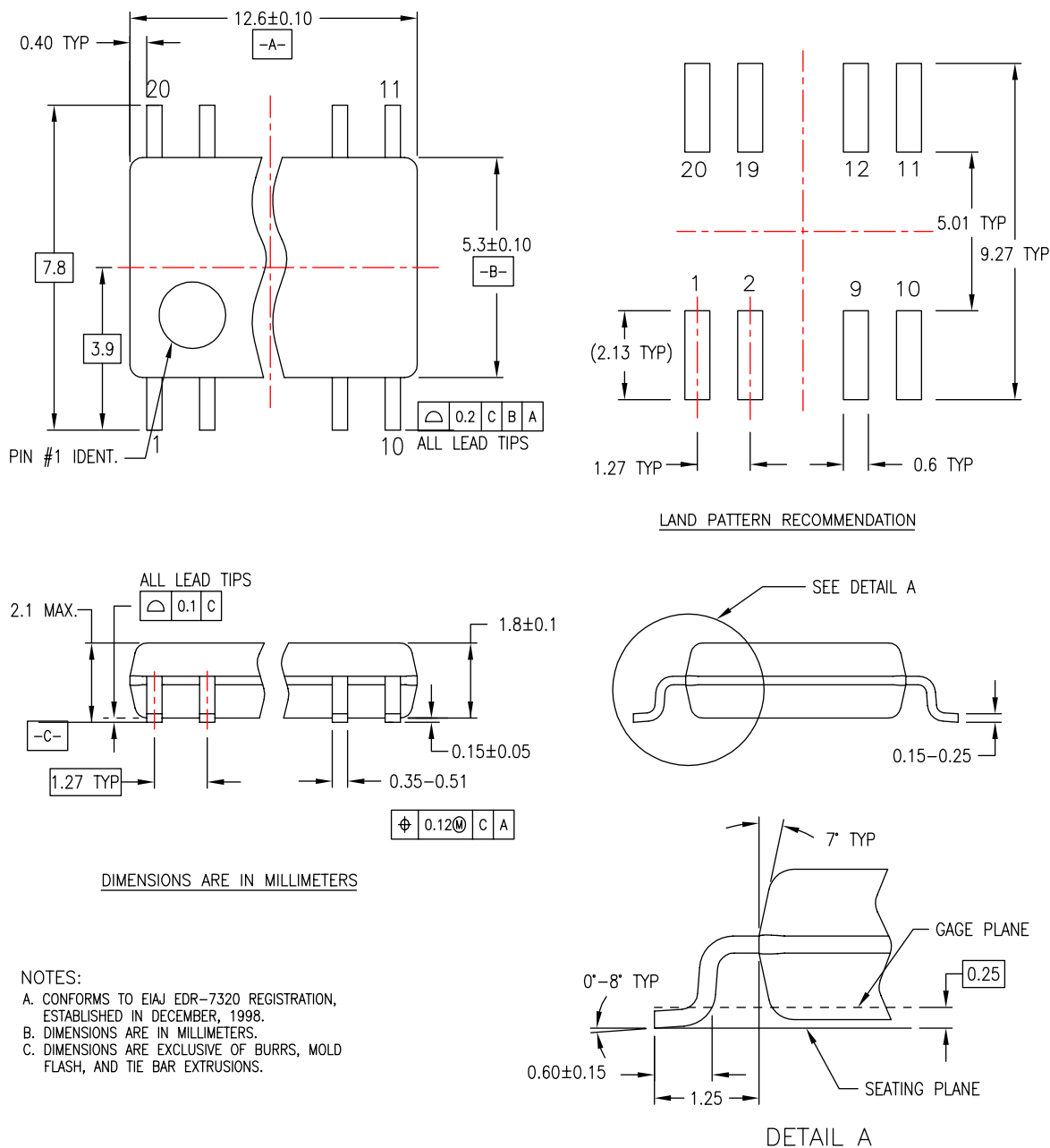
**Figure 1. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide**

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**Physical Dimensions (Continued)**



M20DREVC

**Figure 2. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

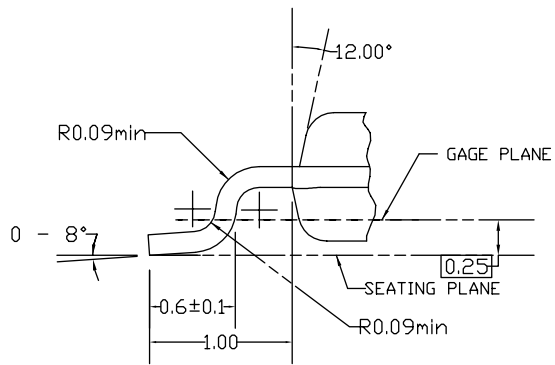
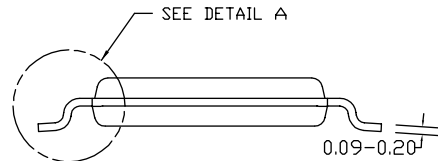
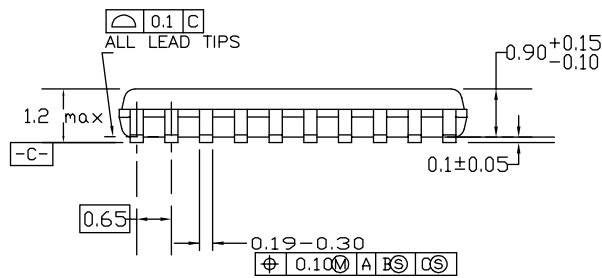
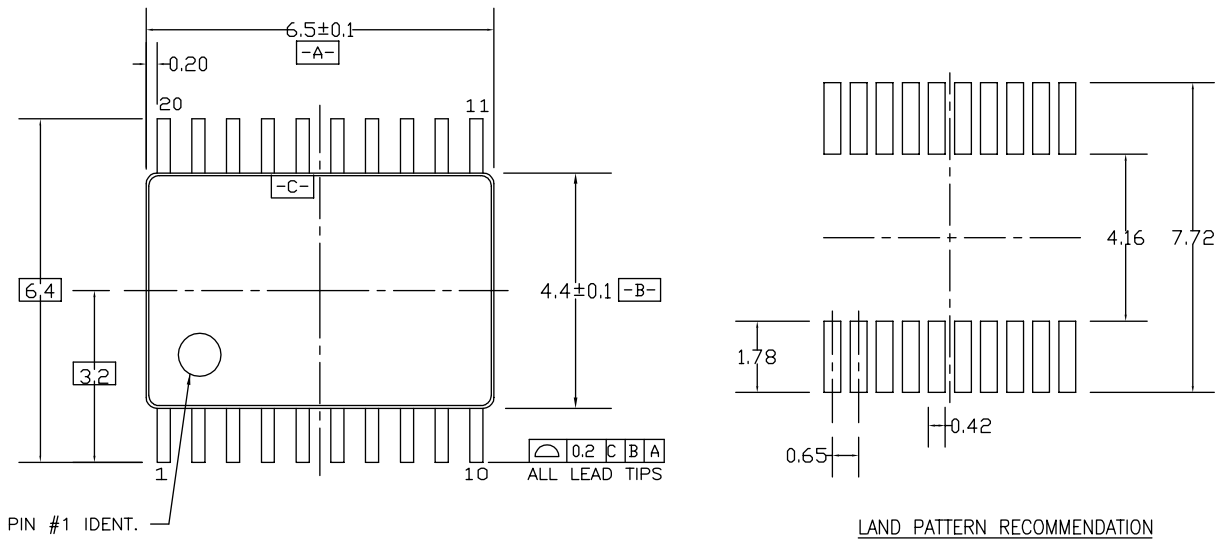
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Physical Dimensions (Continued)



DIMENSIONS ARE IN MILLIMETERS

NOTES:

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

MTC20REV D1

Figure 3. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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| FlashWriter <sup>®</sup> *  | OPTOPLANAR <sup>®</sup>                      | SuperSOT <sup>™</sup> 6                | Ultra FRFET <sup>™</sup>         |
|   |  | SuperSOT <sup>™</sup> 8                | UniFET <sup>™</sup>              |
|   |  |  | VCX <sup>™</sup>                 |

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