

## 74VHC273 Octal D-Type Flip-Flop

### General Description

The VHC273 is an advanced high speed CMOS Octal D-type flip-flop 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.

The register has a common buffered Clock (CP) which is fully edge-triggered. The state of each D input, one setup time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's Q output. The Master Reset ( $\overline{MR}$ ) input will clear all flip-flops simultaneously. All outputs will be forced LOW independently of Clock or Data inputs by a LOW voltage level on the  $\overline{MR}$  input.

An input protection circuit insures that 0V to 7V can be applied to the inputs pins without regard to the supply volt-

age. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

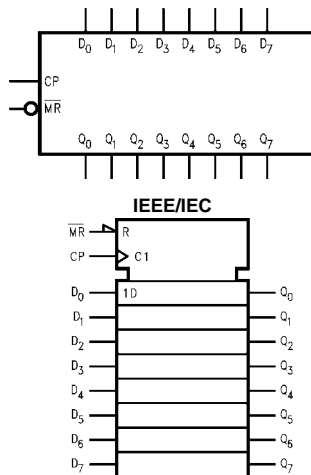
- High Speed:  $f_{MAX} = 165$  MHz (typ) at  $V_{CC} = 5$  V
- Low power dissipation:  $I_{CC} = 4$   $\mu$ A (max) at  $T_A = 25^\circ$ C
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)
- Power down protection is provided on all inputs
- Low noise:  $V_{OLP} = 0.9$  V (max)
- Pin and function compatible with 74HC273

### Ordering Code:

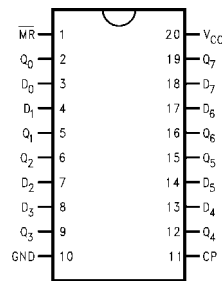
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74VHC273M    | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide   |
| 74VHC273SJ   | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74VHC273MTC  | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74VHC273N    | N20A           | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide       |

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbols



### Connection Diagram



### Pin Descriptions

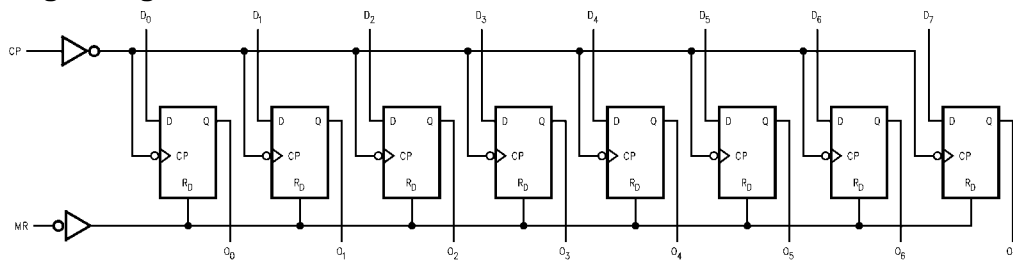
| Pin Names       | Description       |
|-----------------|-------------------|
| $D_0$ - $D_7$   | Data Inputs       |
| $\overline{MR}$ | Master Reset      |
| CP              | Clock Pulse Input |
| $Q_0$ - $Q_7$   | Data Outputs      |

### Function Table

| Operating Mode | Inputs          |    |       | Outputs |
|----------------|-----------------|----|-------|---------|
|                | $\overline{MR}$ | CP | $D_n$ | $Q_n$   |
| Reset (Clear)  | L               | X  | X     | L       |
| Load '1'       | H               | ↗  | H     | H       |
| Load '0'       | H               | ↘  | L     | L       |

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 ↗ = LOW-to-HIGH Transition

### 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)

|   |                          |
|---|--------------------------|
| Supply Voltage ( $V_{CC}$ )                           | -0.5V to +7.0V           |
| DC Input Voltage ( $V_{IN}$ )                         | -0.5V to +7.0V           |
| DC Output Voltage ( $V_{OUT}$ )                       | -0.5V to $V_{CC} + 0.5V$ |
| Input Diode Current ( $I_{IK}$ )                      | -20 mA                   |
| Output Diode Current ( $I_{OK}$ )                     | $\pm 20$ mA              |
| DC Output Current ( $I_{OUT}$ )                       | $\pm 25$ mA              |
| DC $V_{CC}$ /GND Current ( $I_{CC}$ )                 | $\pm 75$ mA              |
| Storage Temperature ( $T_{STG}$ )                     | -65°C to +150°C          |
| Lead Temperature ( $T_L$ )<br>(Soldering, 10 seconds) | 260°C                    |

**Recommended Operating Conditions** (Note 2)

|   |                   |
|---|-------------------|
| Supply Voltage ( $V_{CC}$ )             | 2.0V to +5.5V     |
| Input Voltage ( $V_{IN}$ )              | 0V to +5.5V       |
| Output Voltage ( $V_{OUT}$ )            | 0V to $V_{CC}$    |
| Operating Temperature ( $T_{OPR}$ )     | -40°C to +85°C    |
| Input Rise and Fall Time ( $t_r, t_f$ ) |                   |
| $V_{CC} = 3.3V \pm 0.3V$                | 0 ns/V ~ 100 ns/V |
| $V_{CC} = 5.0V \pm 0.5V$                | 0 ns/V ~ 20 ns/V  |

**Note 1:** Absolute Maximum Ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside databook specifications.

**Note 2:** Unused inputs must be held HIGH or LOW. They may not float.

**DC Electrical Characteristics**

| Symbol   | Parameter                 | $V_{CC}$<br>(V)  | $T_A = 25^\circ\text{C}$ |      |                      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |           | Units         | Conditions                       |  |
|----------|---------------------------|------------------|--------------------------|------|----------------------|---|-----------|---------------|----------------------------------|--|
|          |                           |                  | Min                      | Typ  | Max                  | Min   | Max       |               |                                  |  |
| $V_{IH}$ | HIGH Level Input Voltage  | 2.0<br>3.0 – 5.5 | 1.50<br>$0.7 V_{CC}$     |      |                      | 1.50<br>$0.7 V_{CC}$                            |           | V             |                                  |  |
| $V_{IL}$ | LOW Level Input Voltage   | 2.0<br>3.0 – 5.5 |                          |      | 0.50<br>$0.3 V_{CC}$ | 0.50<br>$0.3 V_{CC}$                            |           | V             |                                  |  |
| $V_{OH}$ | HIGH Level Output Voltage | 2.0              | 1.9                      | 2.0  |                      | 1.9   |           | V             | $V_{IN} = V_{IH}$<br>or $V_{IL}$ | $I_{OH} = -50 \mu\text{A}$                           |
|          |                           | 3.0              | 2.9                      | 3.0  |                      | 2.9   |           |               |                                  |  |
|          |                           | 4.5              | 4.4                      | 4.5  |                      | 4.4   |           | V             |                                  | $I_{OH} = -4 \text{ mA}$<br>$I_{OH} = -8 \text{ mA}$ |
|          |                           | 3.0              | 2.58                     |      |                      | 2.48  |           |               |                                  |  |
| 4.5      | 3.94                      |                  |                          | 3.80 |                      |   |           |               |                                  |  |
| $V_{OL}$ | LOW Level Output Voltage  | 2.0              |                          | 0.0  | 0.1                  |   | 0.1       | V             | $V_{IN} = V_{IH}$<br>or $V_{IL}$ | $I_{OL} = 50 \mu\text{A}$                            |
|          |                           | 3.0              |                          | 0.0  | 0.1                  |   | 0.1       |               |                                  |  |
|          |                           | 4.5              |                          | 0.0  | 0.1                  |   | 0.1       | V             |                                  | $I_{OL} = 4 \text{ mA}$<br>$I_{OL} = 8 \text{ mA}$   |
|          |                           | 3.0              |                          |      | 0.36                 |   | 0.44      |               |                                  |  |
| 4.5      |                           |                  | 0.36                     |      | 0.44                 |   |           |               |                                  |  |
| $I_{IN}$ | Input Leakage Current     | 0 – 5.5          |                          |      | $\pm 0.1$            |   | $\pm 1.0$ | $\mu\text{A}$ | $V_{IN} = 5.5V$ or GND           |  |
| $I_{CC}$ | Quiescent Supply Current  | 5.5              |                          |      | 4.0                  |   | 40.0      | $\mu\text{A}$ | $V_{IN} = V_{CC}$ or GND         |  |

**Noise Characteristics**

| Symbol                | Parameter                                | $V_{CC}$<br>(V) | $T_A = 25^\circ\text{C}$ |        | Units | Conditions            |
|-----------------------|--|-----------------|--------------------------|--------|-------|-----------------------|
|                       |  |                 | Typ                      | Limits |       |                       |
| $V_{OLP}$<br>(Note 3) | Quiet Output Maximum Dynamic $V_{OL}$    | 5.0             | 0.6                      | 0.9    | V     | $C_L = 50 \text{ pF}$ |
| $V_{OLV}$<br>(Note 3) | Quiet Output Minimum Dynamic $V_{OL}$    | 5.0             | -0.6                     | -0.9   | V     | $C_L = 50 \text{ pF}$ |
| $V_{IHD}$<br>(Note 3) | Minimum HIGH Level Dynamic Input Voltage | 5.0             |                          |        | V     | $C_L = 50 \text{ pF}$ |
| $V_{ILD}$<br>(Note 3) | Maximum LOW Level Dynamic Input Voltage  | 5.0             |                          |        | V     | $C_L = 50 \text{ pF}$ |

**Note 3:** Parameter guaranteed by design.

## AC Electrical Characteristics

| Symbol            | Parameter                       | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |      |      | T <sub>A</sub> = -40°C to +85°C |     | Units                  | Conditions             |
|-------------------|---------------------------------|------------------------|-----------------------|------|------|---------------------------------|-----|------------------------|------------------------|
|                   |                                 |                        | Min                   | Typ  | Max  | Min                             | Max |                        |                        |
| f <sub>MAX</sub>  | Maximum Clock Frequency         | 3.3 ± 0.3              | 75                    | 120  |      | 65                              |     | MHz                    | C <sub>L</sub> = 15 pF |
|                   |                                 |                        | 50                    | 75   |      | 45                              |     |                        | C <sub>L</sub> = 50 pF |
|                   |                                 | 5.0 ± 0.5              | 120                   | 165  |      | 100                             |     | MHz                    | C <sub>L</sub> = 15 pF |
|                   |                                 |                        | 80                    | 110  |      | 70                              |     |                        | C <sub>L</sub> = 50 pF |
| t <sub>PLH</sub>  | Propagation Delay Time (CK - Q) | 3.3 ± 0.3              | 8.7                   | 13.6 | 1.0  | 16.0                            | ns  | C <sub>L</sub> = 15 pF |                        |
|                   |                                 |                        | 11.2                  | 17.1 | 1.0  | 19.5                            |     | C <sub>L</sub> = 50 pF |                        |
| t <sub>PHL</sub>  |                                 | 5.0 ± 0.5              | 5.8                   | 9.0  | 1.0  | 10.5                            | ns  | C <sub>L</sub> = 15 pF |                        |
|                   |                                 |                        | 7.3                   | 11.0 | 1.0  | 12.5                            |     | C <sub>L</sub> = 50 pF |                        |
| t <sub>PHL</sub>  | Propagation Delay Time (MR - Q) | 3.3 ± 0.3              | 8.9                   | 13.6 | 1.0  | 16.0                            | ns  | C <sub>L</sub> = 15 pF |                        |
|                   |                                 |                        |                       | 11.4 | 17.1 | 1.0                             |     | 19.5                   | C <sub>L</sub> = 50 pF |
|                   |                                 | 5.0 ± 0.5              | 5.2                   | 8.5  | 1.0  | 10.0                            | ns  | C <sub>L</sub> = 15 pF |                        |
|                   |                                 |                        | 6.7                   | 10.5 | 1.0  | 12.0                            |     | C <sub>L</sub> = 50 pF |                        |
| t <sub>OSLH</sub> | Output to                       | 3.3 ± 0.3              |                       | 1.5  |      | 1.5                             | ns  | (Note 4)               |                        |
| t <sub>OSHL</sub> | Output Skew                     | 5.0 ± 0.5              |                       | 1.0  |      | 1.0                             |     |                        |                        |
| C <sub>IN</sub>   | Input Capacitance               |                        | 4                     | 10   |      | 10                              | pF  | V <sub>CC</sub> = Open |                        |
| C <sub>PD</sub>   | Power Dissipation Capacitance   |                        | 31                    |      |      |                                 | pF  | (Note 5)               |                        |

**Note 4:** Parameter guaranteed by design  $t_{OSLH} = |t_{PLHmax} - t_{PLHmin}|$ ;  $t_{OSHL} = |t_{PHLmax} - t_{PHLmin}|$ .

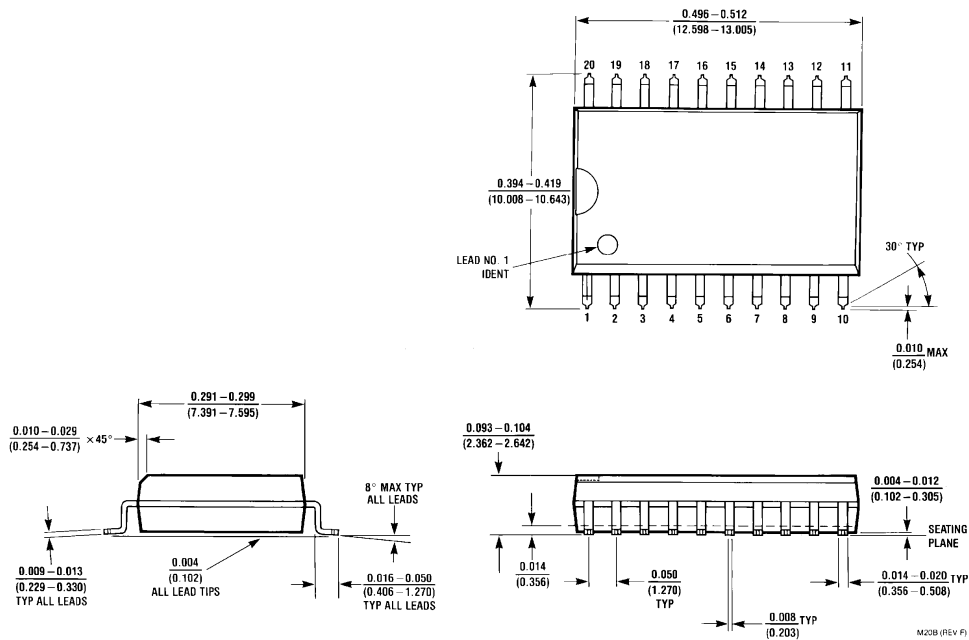
**Note 5:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained from the equation:  $I_{CC(opr.)} = C_{PD} * V_{CC} * f_{IN} + I_{CC}/8$  (per F/F). The total C<sub>PD</sub> when n pieces of the Flip Flop operates can be calculated by the equation:  $C_{PD}(total) = 22 + 9n$ .

## AC Operating Requirements

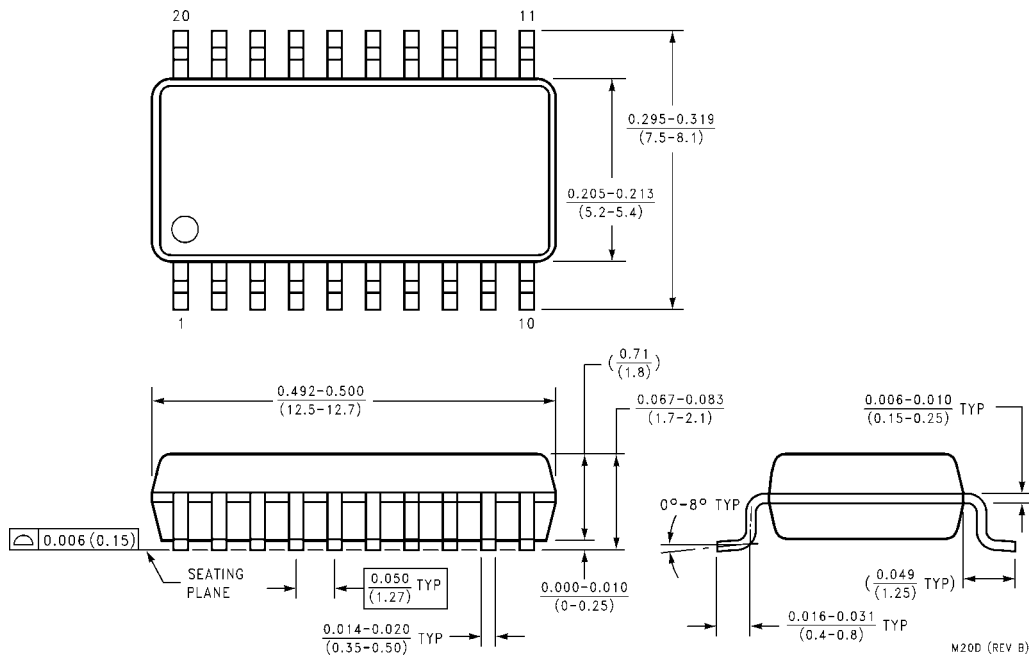
| Symbol            | Parameter                 | V <sub>CC</sub><br>(V)<br>(Note 6) | T <sub>A</sub> = 25°C |                    | T <sub>A</sub> = -40°C to +85°C |    | Units |
|-------------------|---------------------------|------------------------------------|-----------------------|--------------------|---------------------------------|----|-------|
|                   |                           |                                    | Typ                   | Guaranteed Minimum |                                 |    |       |
| t <sub>W(L)</sub> | Minimum Pulse Width (CK)  | 3.3                                |                       | 5.5                | 6.5                             | ns |       |
| t <sub>W(H)</sub> |                           | 5.0                                |                       | 5.0                | 5.0                             |    |       |
| t <sub>W(L)</sub> | Minimum Pulse Width (MR)  | 3.3                                |                       | 5.0                | 6.0                             | ns |       |
|                   |                           | 5.0                                |                       | 5.0                | 5.0                             |    |       |
| t <sub>S</sub>    | Minimum Setup Time        | 3.3                                |                       | 5.5                | 6.5                             | ns |       |
|                   |                           | 5.0                                |                       | 4.5                | 4.5                             |    |       |
| t <sub>H</sub>    | Minimum Hold Time         | 3.3                                |                       | 1.0                | 1.0                             | ns |       |
|                   |                           | 5.0                                |                       | 1.0                | 1.0                             |    |       |
| t <sub>REC</sub>  | Minimum Removal Time (MR) | 3.3                                |                       | 2.5                | 2.5                             | ns |       |
|                   |                           | 5.0                                |                       | 2.0                | 2.0                             |    |       |

**Note 6:** V<sub>CC</sub> is 3.3 ± 0.3V or 5.0 ± 0.5V

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

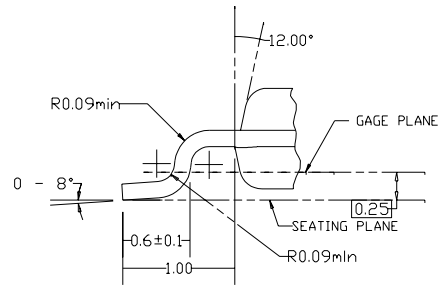
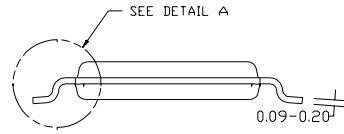
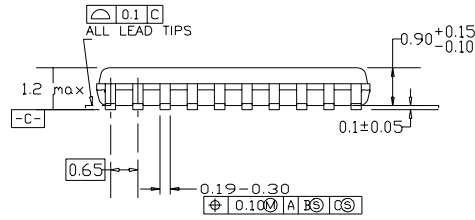
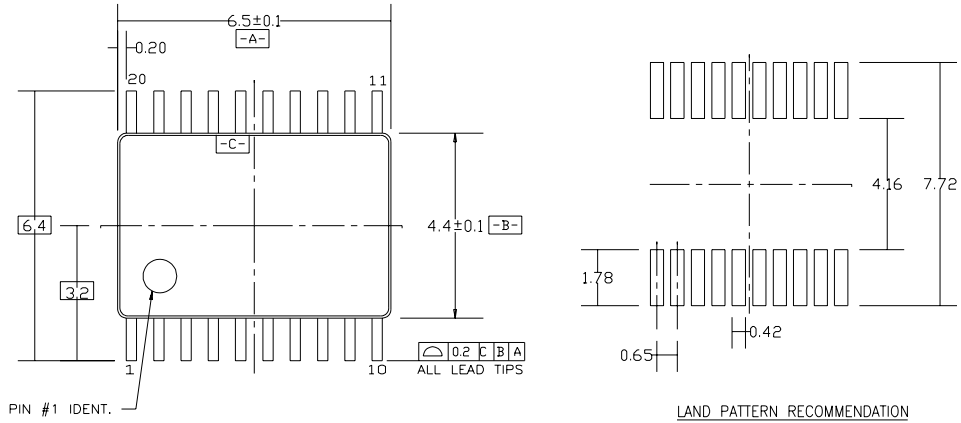


**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide  
Package Number M20B**



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

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



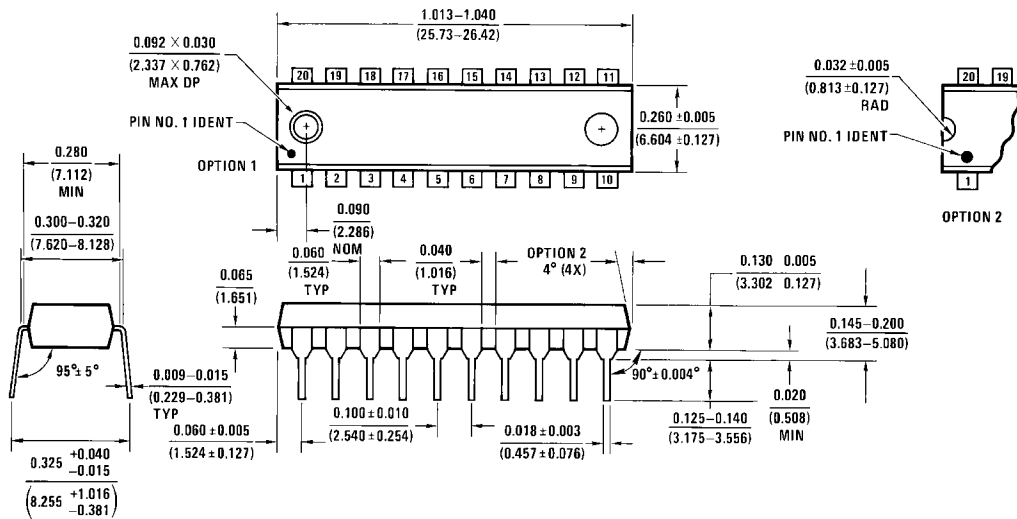
DETAIL A

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.

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

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



**20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide  
Package Number N20A**

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2. 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.

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