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# 74VHC373

## Octal D-Type Latch with 3-STATE Outputs

### Features

- High Speed:  $t_{PD} = 5.0ns$  (typ) @  $V_{CC} = 5V$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Power Down Protection is provided on all inputs
- Low Noise:  $V_{OLP} = 0.6V$  (Typ.)
- Low Power Dissipation:  $I_{CC} = 4\mu A$  (Max) @  $T_A = 25^\circ C$
- Pin and Function Compatible with 74HC373

### General Description

The VHC373 is an advanced high speed CMOS octal D-type 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 ( $\overline{OE}$ ). The latches appear transparent to data when latch enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is LATCHED. When the  $\overline{OE}$  input is HIGH, the eight outputs are in a high impedance state.

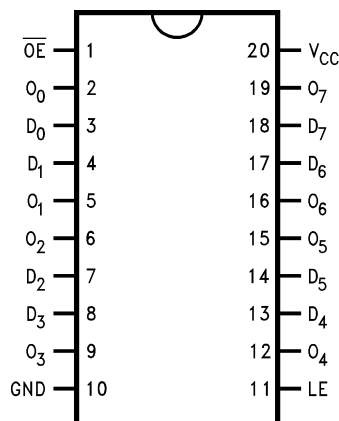
An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### Ordering Information

| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| 74VHC373M    | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74VHC373SJ   | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74VHC373MTC  | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering number. Pb-Free package per JEDEC J-STD-020B.

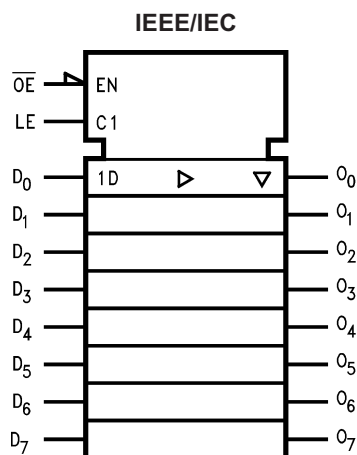
### Connection Diagram



### Pin Descriptions

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

## Logic Symbol



## Functional Description

The VHC373 contains eight D-type latches with 3-STATE standard outputs. 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 standard outputs are controlled by the Output Enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the standard outputs are in the 2-state mode. When  $\overline{OE}$  is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the latches.

## Truth Table

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

H = HIGH Voltage Level

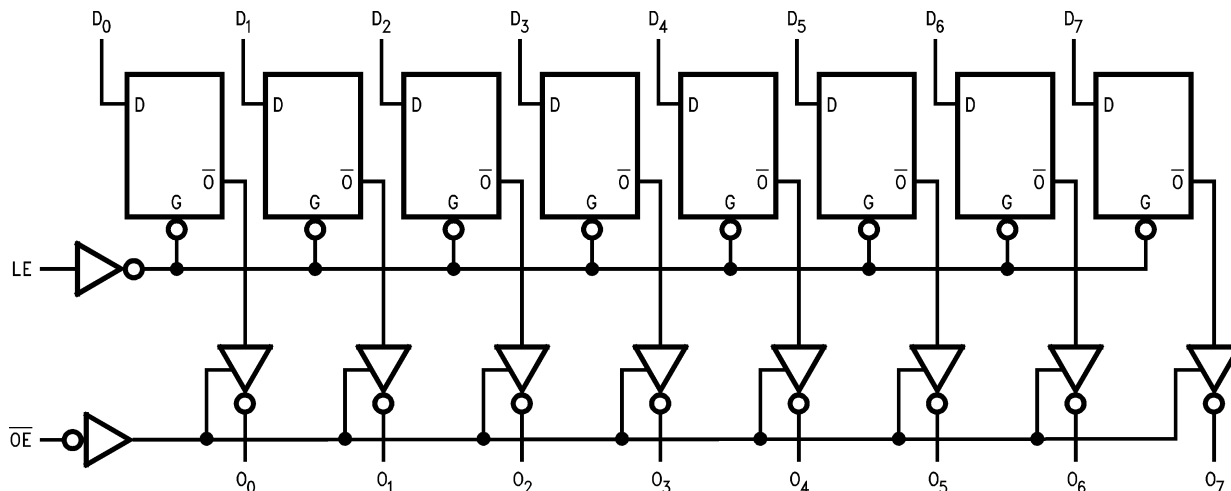
L = LOW Voltage Level

Z = High Impedance

X = Immaterial

$O_0$  = Previous  $O_0$  before HIGH-to-LOW transition of Latch Enable

## 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 1.

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

## Recommended Operating Conditions<sup>(1)</sup>

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

### Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

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

## Noise Characteristics

| Symbol                          | Parameter                                    | V <sub>CC</sub> (V) | Conditions            | T <sub>A</sub> = 25°C |        | Units |
|---------------------------------|----------------------------------------------|---------------------|-----------------------|-----------------------|--------|-------|
|                                 |                                              |                     |                       | Typ.                  | Limits |       |
| V <sub>OLP</sub> <sup>(2)</sup> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 5.0                 | C <sub>L</sub> = 50pF | 0.6                   | 0.9    | V     |
| V <sub>OLV</sub> <sup>(2)</sup> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 5.0                 | C <sub>L</sub> = 50pF | –0.6                  | –0.9   | V     |
| V <sub>IHD</sub> <sup>(2)</sup> | Minimum HIGH Level Dynamic Input Voltage     | 5.0                 | C <sub>L</sub> = 50pF |                       | 3.5    | V     |
| V <sub>ILD</sub> <sup>(2)</sup> | Maximum LOW Level Dynamic Input Voltage      | 5.0                 | C <sub>L</sub> = 50pF |                       | 1.5    | V     |

## Note:

2. Parameter guaranteed by design.

## AC Electrical Characteristics

| Symbol                                | Parameter                                      | V <sub>CC</sub> (V) | Conditions             |                       | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = −40°C to +85°C |      | Units |
|---------------------------------------|------------------------------------------------|---------------------|------------------------|-----------------------|------------------------|------|------|---------------------------------|------|-------|
|                                       |                                                |                     |                        |                       | Min.                   | Typ. | Max. | Min.                            | Max. |       |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time (LE to O <sub>n</sub> ) | 3.3 ± 0.3           |                        | C <sub>L</sub> = 15pF |                        | 7.0  | 11.0 | 1.0                             | 13.0 | ns    |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 9.5  | 14.5 | 1.0                             | 16.5 |       |
|                                       |                                                | 5.0 ± 0.5           |                        | C <sub>L</sub> = 15pF |                        | 4.9  | 7.2  | 1.0                             | 8.5  | ns    |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 6.4  | 9.2  | 1.0                             | 10.5 |       |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time (D to O <sub>n</sub> )  | 3.3 ± 0.3           |                        | C <sub>L</sub> = 15pF |                        | 7.3  | 11.4 | 1.0                             | 13.5 | ns    |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 9.8  | 14.9 | 1.0                             | 17.0 |       |
|                                       |                                                | 5.0 ± 0.5           |                        | C <sub>L</sub> = 15pF |                        | 5.0  | 7.2  | 1.0                             | 8.5  |       |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 6.5  | 9.2  | 1.0                             | 10.5 |       |
| t <sub>PZL</sub> , t <sub>PZH</sub>   | 3-STATE Output Enable Time                     | 3.3 ± 0.3           | R <sub>L</sub> = 1kΩ   | C <sub>L</sub> = 15pF |                        | 7.3  | 11.4 | 1.0                             | 13.5 | ns    |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 9.8  | 14.9 | 1.0                             | 17.0 |       |
|                                       |                                                | 5.0 ± 0.5           |                        | C <sub>L</sub> = 15pF |                        | 5.5  | 8.1  | 1.0                             | 9.5  | ns    |
|                                       |                                                |                     |                        | C <sub>L</sub> = 50pF |                        | 7.0  | 10.1 | 1.0                             | 11.5 |       |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>   | 3-STATE Output Disable Time                    | 3.3 ± 0.3           | R <sub>L</sub> = 1kΩ   | C <sub>L</sub> = 50pF |                        | 9.5  | 13.2 | 1.0                             | 15.0 | ns    |
|                                       |                                                | 5.0 ± 0.5           |                        | C <sub>L</sub> = 50pF |                        | 6.5  | 9.2  | 1.0                             | 10.5 |       |
| t <sub>OSLH</sub> , t <sub>OSHL</sub> | Output to Output Skew                          | 3.3 ± 0.3           | (3)                    | C <sub>L</sub> = 50pF |                        |      | 1.5  |                                 | 1.5  | ns    |
|                                       |                                                | 5.0 ± 0.5           |                        | C <sub>L</sub> = 50pF |                        |      | 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> = 5.0V |                       |                        | 6    |      |                                 |      | pF    |
| C <sub>PD</sub>                       | Power Dissipation Capacitance                  |                     | (4)                    |                       |                        | 27   |      |                                 |      | pF    |

## Notes:

3. 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|
4. 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:  
 $I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$  (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) = 14 + 13n.

## 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 |      | Units |
|--------------------|--------------------------|---------------------|------------------------|------|------|---------------------------------|------|-------|
|                    |                          |                     | Min.                   | Typ. | Max. | Min.                            | Max. |       |
| t <sub>W</sub> (H) | 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 Set-Up Time      | 3.3 ± 0.3           | 4.0                    |      |      | 4.0                             |      | ns    |
|                    |                          | 5.0 ± 0.5           | 4.0                    |      |      | 4.0                             |      |       |
| t <sub>H</sub>     | Minimum Hold Time        | 3.3 ± 0.3           | 1.0                    |      |      | 1.0                             |      | ns    |
|                    |                          | 5.0 ± 0.5           | 1.0                    |      |      | 1.0                             |      |       |

## Physical Dimensions

Dimensions are in inches (millimeters) unless otherwise noted.

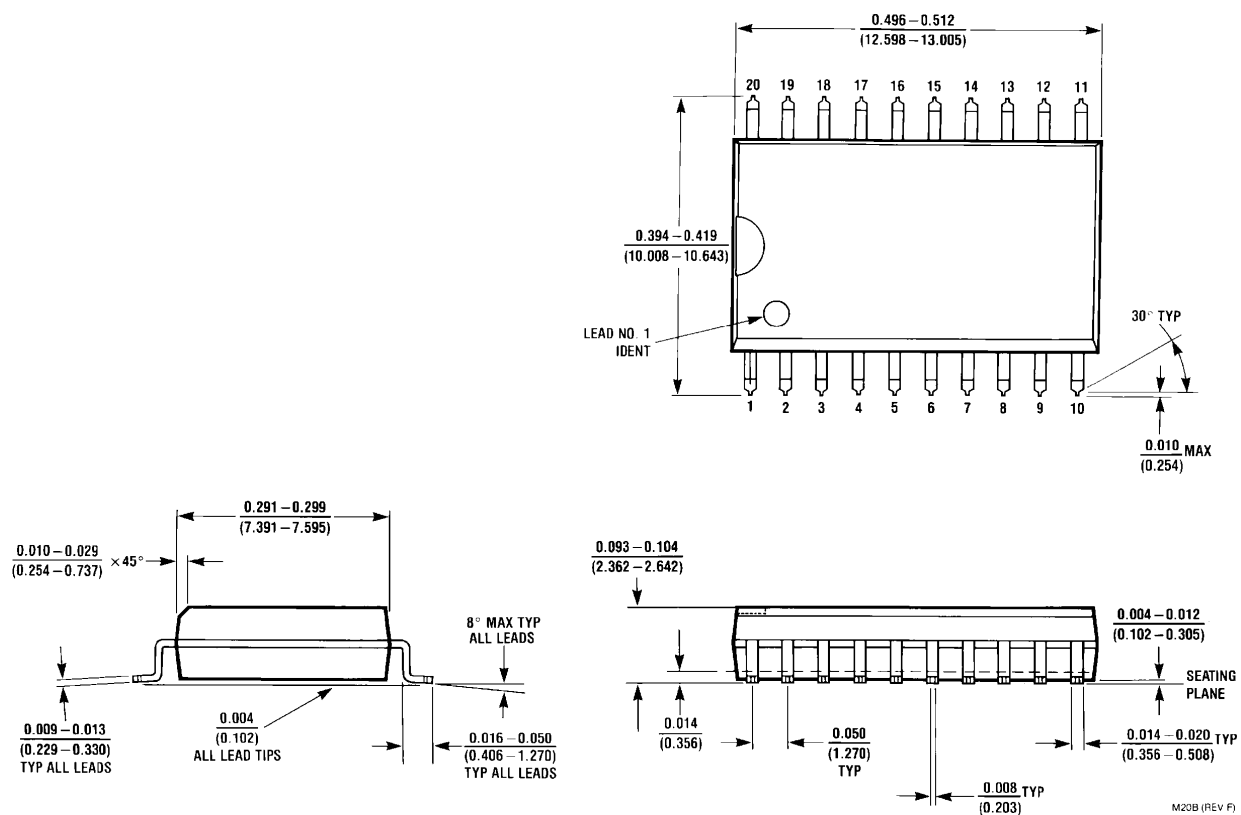
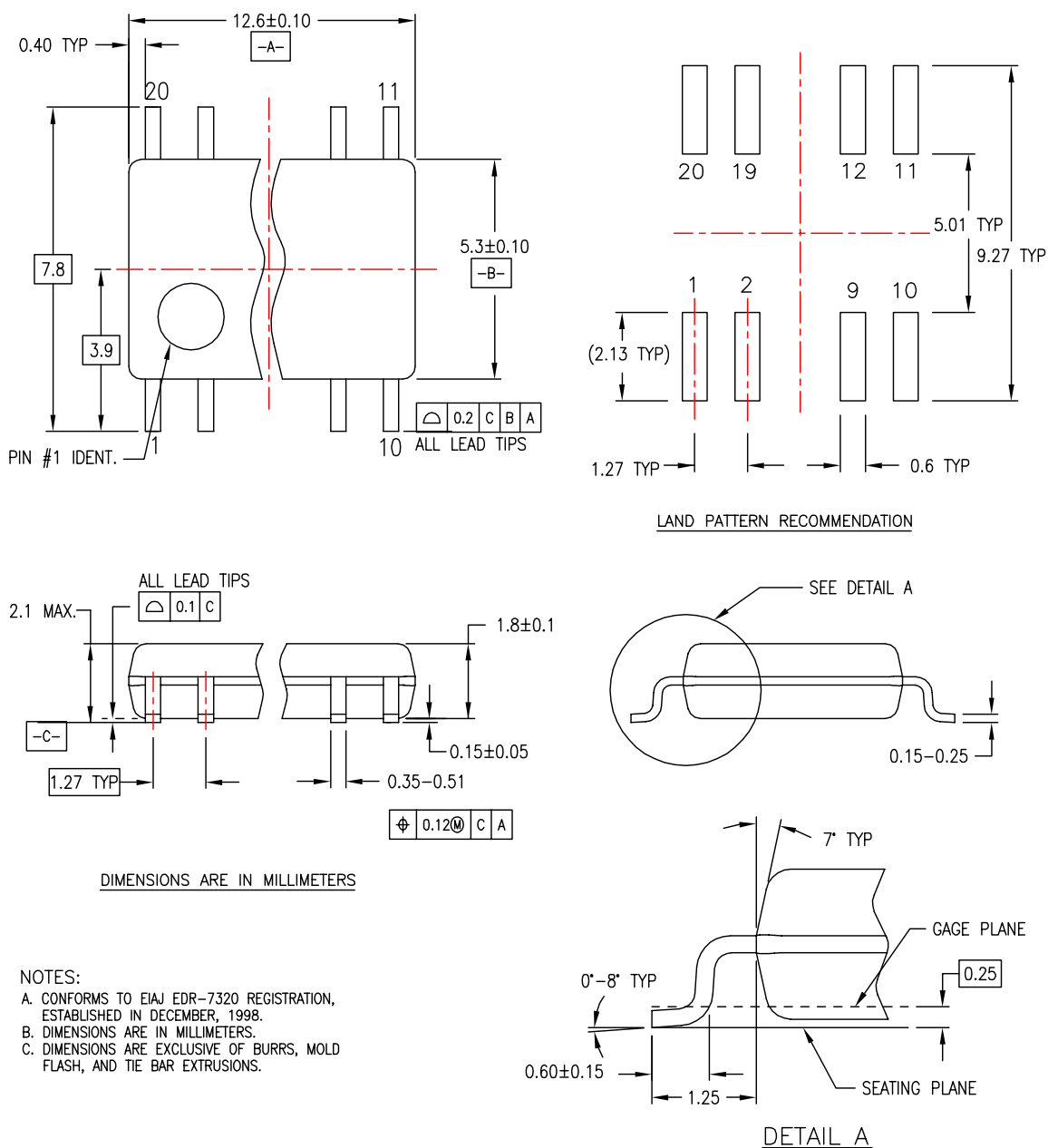


Figure 2. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Package Number M20B

### Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

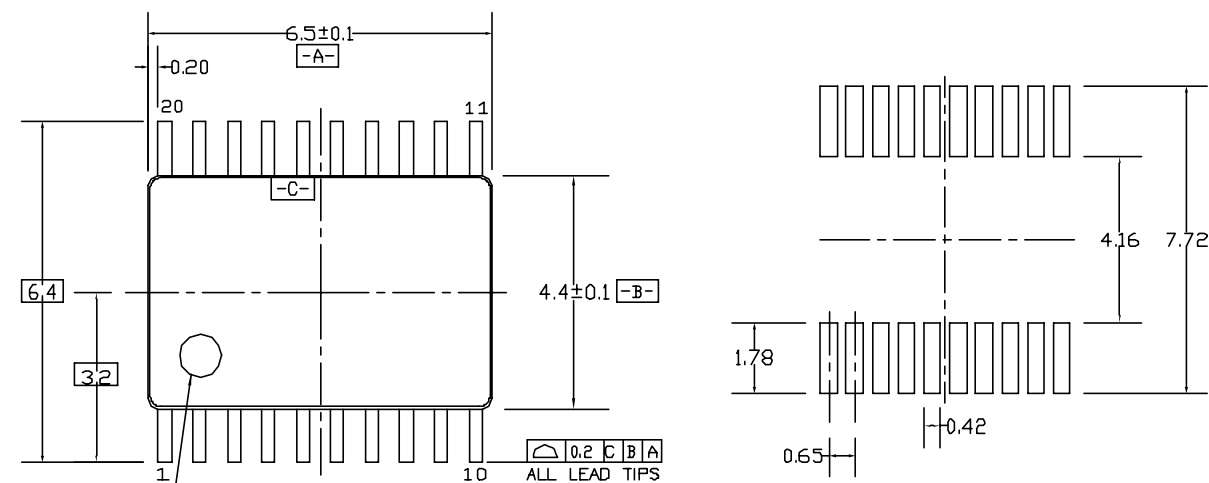


M20DREVC

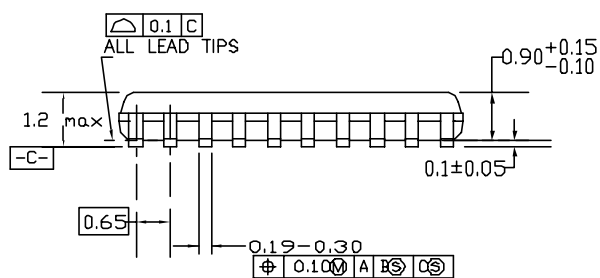
**Figure 3. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M20D**

### Physical Dimensions (Continued)

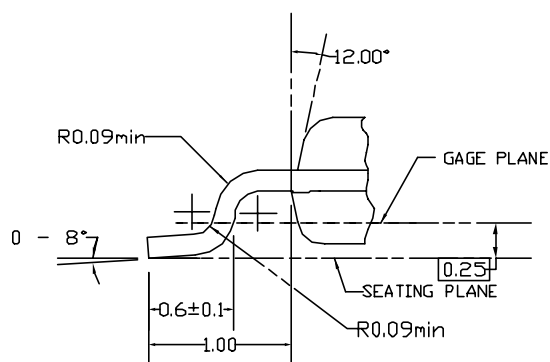
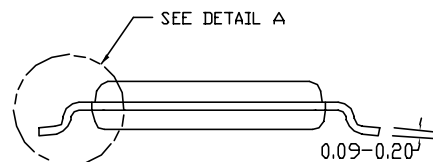
Dimensions are in millimeters unless otherwise noted.



### LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



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.

MTC20REV D1

**Figure 4. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC20**

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| ActiveArray <sup>™</sup>                         | ImpliedDisconnect <sup>™</sup> | QS <sup>™</sup>                                                                     | TinyPower <sup>™</sup>      |
| Bottomless <sup>™</sup>                          | IntelliMAX <sup>™</sup>        | QT Optoelectronics <sup>™</sup>                                                     | TinyWire <sup>™</sup>       |
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| CoolFET <sup>™</sup>                             | MICROCOUPLER <sup>™</sup>      | RapidConfigure <sup>™</sup>                                                         | μSerDes <sup>™</sup>        |
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| EcoSPARK <sup>®</sup>                            | OCXPro <sup>™</sup>            | SuperFET <sup>™</sup>                                                               |                             |
| EnSigna <sup>™</sup>                             | OPTOLOGIC <sup>®</sup>         | SuperSOT <sup>™</sup> -3                                                            |                             |
| FACT Quiet Series <sup>™</sup>                   | OPTOPLANAR <sup>®</sup>        | SuperSOT <sup>™</sup> -6                                                            |                             |
| FACT <sup>®</sup>                                | PACMAN <sup>™</sup>            | SuperSOT <sup>™</sup> -8                                                            |                             |
| FAST <sup>®</sup>                                | POP <sup>™</sup>               | SyncFET <sup>™</sup>                                                                |                             |
| FASTr <sup>™</sup>                               | Power220 <sup>®</sup>          | TCM <sup>™</sup>                                                                    |                             |
| FPS <sup>™</sup>                                 | Power247 <sup>®</sup>          | The Power Franchise <sup>®</sup>                                                    |                             |
| FRFET <sup>®</sup>                               | PowerEdge <sup>™</sup>         |  ™ |                             |
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### Definition of Terms

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