

## 74LVX373

# Low Voltage Octal Transparent Latch with 3-STATE Outputs

## General Description

The LVX373 consists of eight latches with 3-STATE outputs for bus organized system applications. The latches appear transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data satisfying the input timing requirements is latched. Data appears on the bus when the Output Enable ( $\overline{OE}$ ) is LOW. When  $\overline{OE}$  is HIGH, the bus output is in the high impedance state. The inputs tolerate up to 7V allowing interface of 5V systems to 3V systems.

## Features

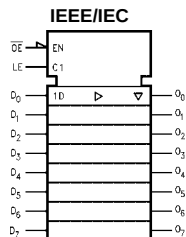
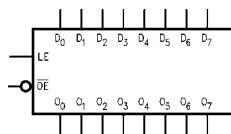
- Input voltage translation from 5V to 3V
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance

## Ordering Code:

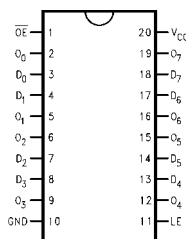
| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| 74LVX373M    | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| 74LVX373SJ   | M20D           | Pb-Free 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide       |
| 74LVX373MTC  | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.  
Pb-Free package per JEDEC J-STD-020B.

## Logic Symbols



## 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 Latch Outputs |

## 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

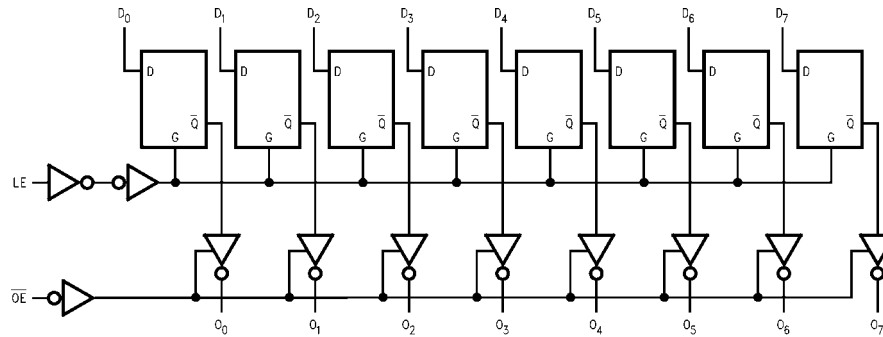
74LVX373 Low Voltage Octal Transparent Latch with 3-STATE Outputs

## Functional Description

The LVX373 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 tran-

sition 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.

## 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 Diode Current ( $I_{IK}$ )  |                          |
| $V_I = -0.5V$                        | -20 mA                   |
| DC Input Voltage ( $V_I$ )           | -0.5V to 7V              |
| DC Output Diode Current ( $I_{OK}$ ) |                          |
| $V_O = -0.5V$                        | -20 mA                   |
| $V_O = V_{CC} + 0.5V$                | +20 mA                   |
| DC Output Voltage ( $V_O$ )          | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Source                     |                          |
| or Sink Current ( $I_O$ )            | $\pm 25$ mA              |
| DC $V_{CC}$ or Ground Current        |                          |
| ( $I_{CC}$ or $I_{GND}$ )            | $\pm 75$ mA              |
| Storage Temperature ( $T_{STG}$ )    | -65°C to +150°C          |
| Power Dissipation                    | 180 mW                   |

**Recommended Operating Conditions** (Note 2)

|                                                  |                    |
|--------------------------------------------------|--------------------|
| Supply Voltage ( $V_{CC}$ )                      | 2.0V to 3.6V       |
| Input Voltage ( $V_I$ )                          | 0V to 5.5V         |
| Output Voltage ( $V_O$ )                         | 0V to $V_{CC}$     |
| Operating Temperature ( $T_A$ )                  | -40°C to +85°C     |
| Input Rise and Fall Time ( $\Delta t/\Delta V$ ) | 0 ns/V to 100 ns/V |

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

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

**DC Electrical Characteristics**

| Symbol   | Parameter                           | $V_{CC}$ | $T_A = +25^\circ\text{C}$ |     |            | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |           | Units         | Conditions                                                                                                            |
|----------|-------------------------------------|----------|---------------------------|-----|------------|-------------------------------------------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------|
|          |                                     |          | Min                       | Typ | Max        | Min                                             | Max       |               |                                                                                                                       |
| $V_{IH}$ | HIGH Level<br>Input Voltage         | 2.0      | 1.5                       |     |            | 1.5                                             |           | V             |                                                                                                                       |
|          |                                     | 3.0      | 2.0                       |     |            | 2.0                                             |           |               |                                                                                                                       |
|          |                                     | 3.6      | 2.4                       |     |            | 2.4                                             |           |               |                                                                                                                       |
| $V_{IL}$ | LOW Level<br>Input Voltage          | 2.0      |                           |     | 0.5        |                                                 | 0.5       | V             |                                                                                                                       |
|          |                                     | 3.0      |                           |     | 0.8        |                                                 | 0.8       |               |                                                                                                                       |
|          |                                     | 3.6      |                           |     | 0.8        |                                                 | 0.8       |               |                                                                                                                       |
| $V_{OH}$ | HIGH Level<br>Output Voltage        | 2.0      | 1.9                       | 2.0 |            | 1.9                                             |           | V             | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OH} = -50 \mu\text{A}$<br>$I_{OH} = -50 \mu\text{A}$<br>$I_{OH} = -4 \text{ mA}$ |
|          |                                     | 3.0      | 2.9                       | 3.0 |            | 2.9                                             |           |               |                                                                                                                       |
|          |                                     | 3.0      | 2.58                      |     |            | 2.48                                            |           |               |                                                                                                                       |
| $V_{OL}$ | LOW Level<br>Output Voltage         | 2.0      |                           | 0.0 | 0.1        |                                                 | 0.1       | V             | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OL} = 50 \mu\text{A}$<br>$I_{OL} = 50 \mu\text{A}$<br>$I_{OL} = 4 \text{ mA}$    |
|          |                                     | 3.0      |                           | 0.0 | 0.1        |                                                 | 0.1       |               |                                                                                                                       |
|          |                                     | 3.0      |                           |     | 0.36       |                                                 | 0.44      |               |                                                                                                                       |
| $I_{OZ}$ | 3-STATE Output<br>Off-State Current | 3.6      |                           |     | $\pm 0.25$ |                                                 | $\pm 2.5$ | $\mu\text{A}$ | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$V_{OUT} = V_{CC}$ or GND                                                            |
| $I_{IN}$ | Input Leakage Current               | 3.6      |                           |     | $\pm 0.1$  |                                                 | $\pm 1.0$ | $\mu\text{A}$ | $V_{IN} = 5.5V$ or GND                                                                                                |
| $I_{CC}$ | Quiescent Supply Current            | 3.6      |                           |     | 4.0        |                                                 | 40.0      | $\mu\text{A}$ | $V_{IN} = V_{CC}$ or GND                                                                                              |

**Noise Characteristics** (Note 3)

| Symbol    | Parameter                                | $V_{CC}$<br>(V) | $T_A = 25^\circ\text{C}$ |       | Units | $C_L$ (pF) |
|-----------|------------------------------------------|-----------------|--------------------------|-------|-------|------------|
|           |                                          |                 | Typ                      | Limit |       |            |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$    | 3.3             | 0.5                      | 0.8   | V     | 50         |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$    | 3.3             | -0.5                     | -0.8  | V     | 50         |
| $V_{IHD}$ | Minimum HIGH Level Dynamic Input Voltage | 3.3             |                          | 2.0   | V     | 50         |
| $V_{ILD}$ | Maximum LOW Level Dynamic Input Voltage  | 3.3             |                          | 0.8   | V     | 50         |

**Note 3:** Input  $t_r = t_f = 3 \text{ ns}$ .

## 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  |       |                                               |
| t <sub>PLH</sub>  | Propagation Delay Time<br>D <sub>n</sub> to O <sub>n</sub> | 2.7                    |                        | 7.7  | 15.0 | 1.0                             | 18.5 | ns    | C <sub>L</sub> = 15 pF                        |
| t <sub>PHL</sub>  |                                                            |                        |                        | 10.2 | 18.5 | 1.0                             | 22.0 |       | C <sub>L</sub> = 50 pF                        |
|                   |                                                            | 3.3 ± 0.3              |                        | 6.0  | 9.7  | 1.0                             | 11.5 |       | C <sub>L</sub> = 15 pF                        |
|                   |                                                            |                        |                        | 8.5  | 13.2 | 1.0                             | 15.0 |       | C <sub>L</sub> = 50 pF                        |
| t <sub>PLH</sub>  | Propagation Delay Time<br>LE to O <sub>n</sub>             | 2.7                    |                        | 7.5  | 14.5 | 1.0                             | 17.5 | ns    | C <sub>L</sub> = 15 pF                        |
| t <sub>PHL</sub>  |                                                            |                        |                        | 10.0 | 18.0 | 1.0                             | 21.0 |       | C <sub>L</sub> = 50 pF                        |
|                   |                                                            | 3.3 ± 0.3              |                        | 5.8  | 9.3  | 1.0                             | 11.0 |       | C <sub>L</sub> = 15 pF                        |
|                   |                                                            |                        |                        | 8.3  | 12.8 | 1.0                             | 14.5 |       | C <sub>L</sub> = 50 pF                        |
| t <sub>PZL</sub>  | 3-STATE Output<br>Enable Time                              | 2.7                    |                        | 7.7  | 15.0 | 1.0                             | 18.5 | ns    | C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 kΩ |
| t <sub>PZH</sub>  |                                                            |                        |                        | 10.2 | 18.5 | 1.0                             | 22.0 |       | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 1 kΩ |
|                   |                                                            | 3.3 ± 0.3              |                        | 6.0  | 9.7  | 1.0                             | 11.5 |       | C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 kΩ |
|                   |                                                            |                        |                        | 8.5  | 13.2 | 1.0                             | 15.0 |       | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 1 kΩ |
| t <sub>PLZ</sub>  | 3-STATE Output<br>Disable Time                             | 2.7                    |                        | 9.8  | 18.0 | 1.0                             | 21.0 | ns    | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 1 kΩ |
| t <sub>PHZ</sub>  |                                                            | 3.3 ± 0.3              |                        | 8.2  | 12.8 | 1.0                             | 14.5 |       | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 1 kΩ |
| t <sub>W</sub>    | LE Pulse Width, HIGH                                       | 2.7                    | 6.5                    |      |      | 7.5                             |      | ns    |                                               |
|                   |                                                            | 3.3 ± 0.3              | 5.0                    |      |      | 5.0                             |      |       |                                               |
| t <sub>S</sub>    | Setup Time, D <sub>n</sub> to LE                           | 2.7                    | 6.0                    |      |      | 6.0                             |      | ns    |                                               |
|                   |                                                            | 3.3 ± 0.3              | 4.0                    |      |      | 4.0                             |      |       |                                               |
| t <sub>H</sub>    | Hold Time, D <sub>n</sub> to LE                            | 2.7                    | 1.0                    |      |      | 1.0                             |      | ns    |                                               |
|                   |                                                            | 3.3 ± 0.3              | 1.0                    |      |      | 1.0                             |      |       |                                               |
| t <sub>OSLH</sub> | Output to Output Skew<br>(Note 4)                          | 2.7                    |                        |      | 1.5  |                                 | 1.5  | ns    | C <sub>L</sub> = 50 pF                        |
| t <sub>OSHL</sub> |                                                            | 3.3                    |                        |      | 1.5  |                                 | 1.5  |       |                                               |

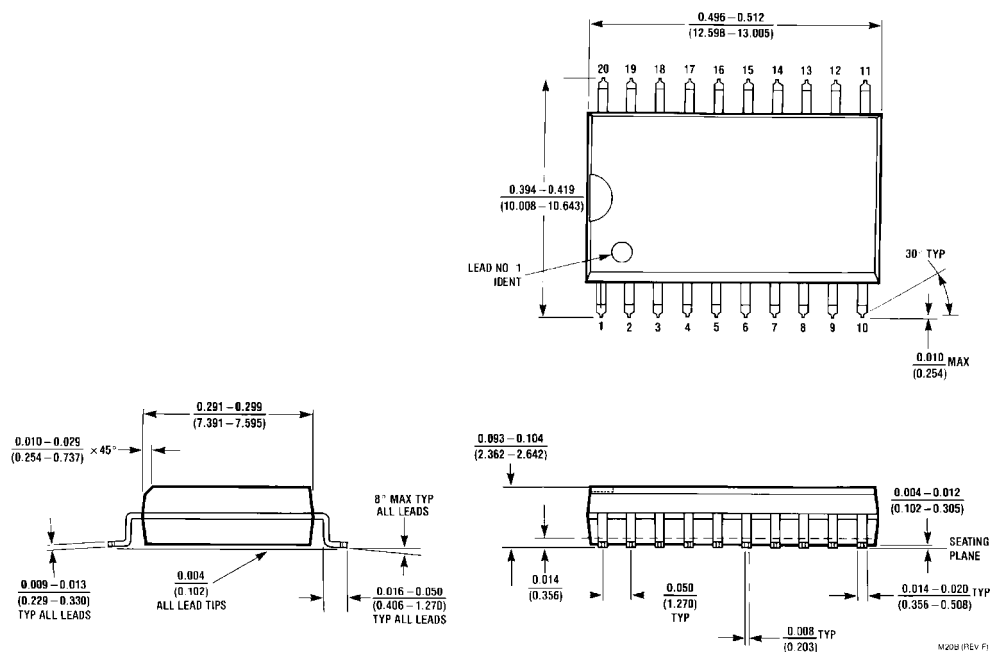
**Note 4:** Parameter guaranteed by design.  $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$

## Capacitance

| Symbol           | Parameter                                 | T <sub>A</sub> = +25°C |     |     | T <sub>A</sub> = -40°C to +85°C |     | Units |
|------------------|-------------------------------------------|------------------------|-----|-----|---------------------------------|-----|-------|
|                  |                                           | Min                    | Typ | Max | Min                             | Max |       |
| C <sub>IN</sub>  | Input Capacitance                         |                        | 4   | 10  |                                 |     | pF    |
| C <sub>OUT</sub> | Output Capacitance                        |                        | 6   |     |                                 |     | pF    |
| C <sub>PD</sub>  | Power Dissipation<br>Capacitance (Note 5) |                        | 27  |     |                                 |     | pF    |

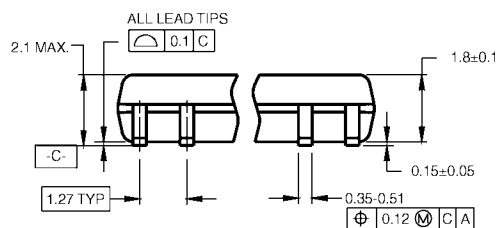
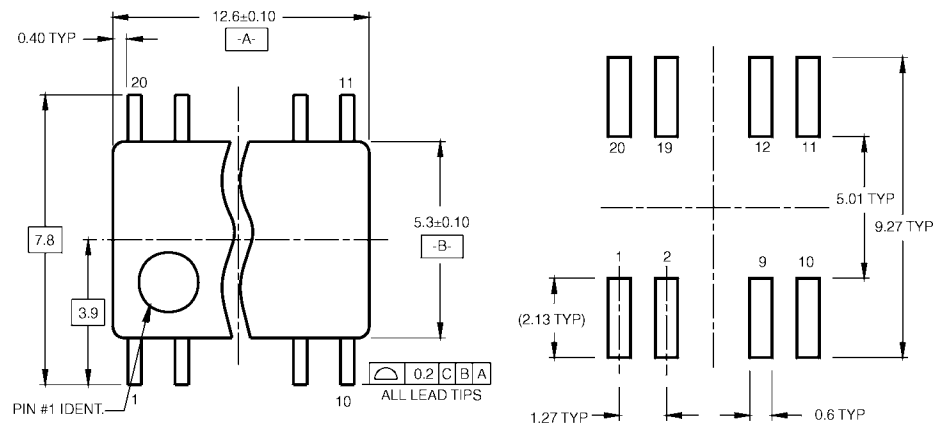
**Note 5:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

$$\text{Average operating current can be obtained by the equation: } I_{CC(opr)} = \frac{C_{PD} \times V_{CC} \times f_{IN} + I_{CC}}{8 \text{ (per Latch)}}$$

**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)

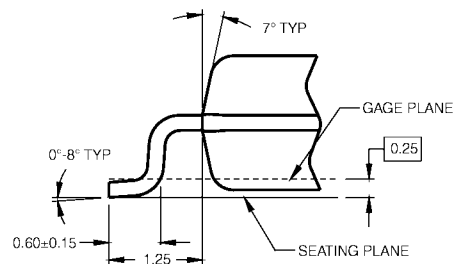


DIMENSIONS ARE IN MILLIMETERS

## 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.

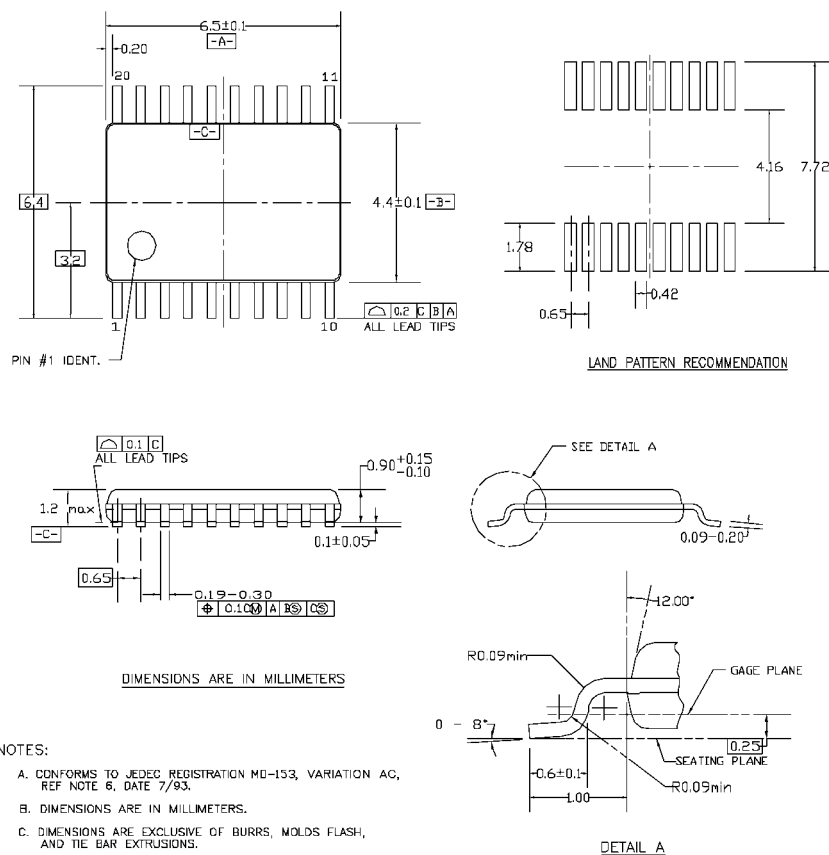
M20DRevB1



DETAIL A

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

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



MTC20REV D1

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

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