

74LVQ373

Low Voltage Octal Transparent Latch with 3-STATE Outputs

General Description

The LVQ373 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.

Features

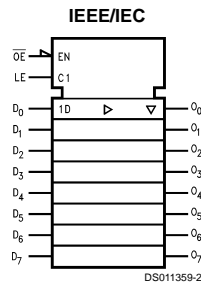
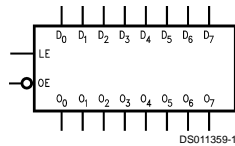
- Ideal for low power/low noise 3.3V applications
- Implements patented EMI reduction circuitry
- Available in SOIC JEDEC, SOIC EIAJ and QSOP packages
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Improved latch-up immunity
- Guaranteed incident wave switching into 75Ω
- 4 kV minimum ESD immunity

Ordering Code:

| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| 74LVQ373SC | M20B | 20-Lead (0.300" Wide) Molded Small Outline Package, SOIC JEDEC |
| 74LVQ373SJ | M20D | 20-Lead Molded Shrink Small Outline Package, SOIC EIAJ |
| 74LVQ373QSC | MQA20 | 20-Lead (0.150" Wide) Molded Shrink Small Outline Package, SSOP JEDEC |

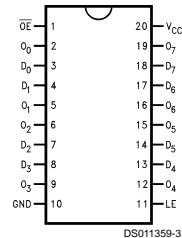
Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Logic Symbol



Connection Diagram

Pin Assignment for SOIC and QSOP



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 |

Functional Description

The LVQ373 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-type input changes. When LE is LOW, the latches store the information that was present on the D-type inputs a setup time preceding the HIGH-to-LOW

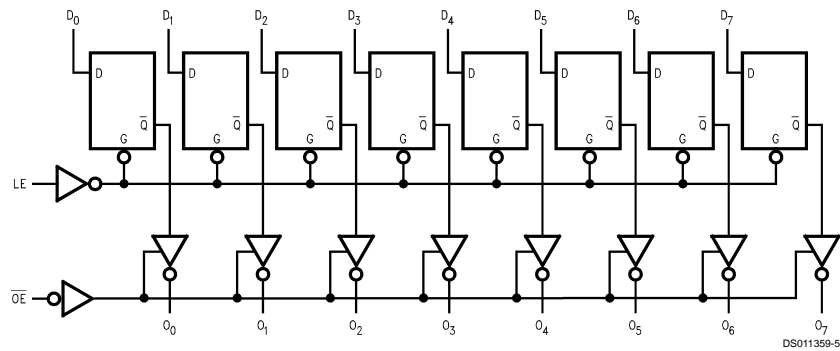
transition of LE. The 3-STATE standard outputs are controlled by the Output Enable (\overline{OE}) input. When \overline{OE} is LOW, the standard outputs are in the 2-state mode. When \overline{OE} is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering 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.

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 |
| $V_I = V_{CC} + 0.5V$ | +20 mA |
| DC Input Voltage (V_I) | -0.5V to $V_{CC} + 0.5V$ |
| 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) | ±50 mA |
| DC V_{CC} or Ground Current (I_{CC} or I_{GND}) | ±400 mA |
| Storage Temperature (T_{STG}) | -65°C to +150°C |
| DC Latch-Up Source or Sink Current | ±300 mA |

Recommended Operating Conditions (Note 2)

| | |
|---|----------------|
| Supply Voltage (V_{CC}) | 2.0V to 3.6V |
| Input Voltage (V_I) | 0V to V_{CC} |
| Output Voltage (V_O) | 0V to V_{CC} |
| Operating Temperature (T_A) | -40°C to +85°C |
| Minimum Input Edge Rate ($\Delta V/\Delta t$) | |
| V_{IN} from 0.8V to 2.0V | |
| V_{CC} @ 3.0V | 125 mV/ns |

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} (V) | $T_A = +25^\circ C$ | | $T_A = -40^\circ C$ to $+85^\circ C$ | Units | Conditions |
|-----------|--|-----------------|---------------------|-------------------|--------------------------------------|-------|---|
| | | | Typ | Guaranteed Limits | | | |
| V_{IH} | Minimum High Level Input Voltage | 3.0 | 1.5 | 2.0 | 2.0 | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ |
| V_{IL} | Maximum Low Level Input Voltage | 3.0 | 1.5 | 0.8 | 0.8 | V | $V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$ |
| V_{OH} | Minimum High Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | V | $I_{OUT} = -50 \mu A$ |
| | | 3.0 | | 2.58 | 2.48 | V | $V_{IN} = V_{IL}$ or V_{IH} (Note 3) $I_{OH} = -12 mA$ |
| V_{OL} | Maximum Low Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | V | $I_{OUT} = 50 \mu A$ |
| | | 3.0 | | 0.36 | 0.44 | V | $V_{IN} = V_{IL}$ or V_{IH} (Note 3) $I_{OL} = 12 mA$ |
| I_{IN} | Maximum Input Leakage Current | 3.6 | | ±0.1 | ±1.0 | μA | $V_I = V_{CC}, GND$ |
| I_{OLD} | Minimum Dynamic Output Current (Note 4) | 3.6 | | | 36 | mA | $V_{OLD} = 0.8V$ Max (Note 5) |
| I_{OHD} | | 3.6 | | | -25 | mA | $V_{OHD} = 2.0V$ Min (Note 5) |
| I_{CC} | Maximum Quiescent Supply Current | 3.6 | | 4.0 | 40.0 | μA | $V_{IN} = V_{CC}$ or GND |
| I_{OZ} | Maximum 3-STATE Leakage Current | 3.6 | | ±0.25 | ±2.5 | μA | V_I (OE) = V_{IL}, V_{IH} $V_I = V_{CC}, GND$ $V_O = V_{CC}, GND$ |
| V_{OLP} | Quiet Output Maximum Dynamic V_{OL} | 3.3 | 0.4 | 0.8 | | V | (Notes 6, 7) |
| V_{OLV} | Quiet Output Minimum Dynamic V_{OL} | 3.3 | -0.3 | -0.8 | | V | (Notes 6, 7) |
| V_{IHD} | Maximum High Level Dynamic Input Voltage | 3.3 | 1.7 | 2.0 | | V | (Notes 6, 8) |
| V_{ILD} | Maximum Low Level Dynamic Input Voltage | 3.3 | 1.6 | 0.8 | | V | (Notes 6, 8) |

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: Incident wave switching on transmission lines with impedances as low as 75Ω for commercial temperature range is guaranteed.

Note 6: Worst case package.

Note 7: Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V; one output at GND.

Note 8: Max number of Data Inputs (n) switching. (n - 1) inputs switching 0V to 3.3V. Input-under-test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), $f = 1 MHz$.

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
|-------------------|----------------------------------|------------------------|--|------|------|---|------|-------|
| | | | Min | Typ | Max | Min | Max | |
| t _{PHL} | Propagation Delay | 2.7 | 2.5 | 9.6 | 14.8 | 2.5 | 16.0 | ns |
| t _{PLH} | D _n to O _n | 3.3 ±0.3 | 2.5 | 8.0 | 10.5 | 2.5 | 11.0 | |
| t _{PLH} | Propagation Delay | 2.7 | 2.5 | 9.6 | 16.9 | 2.5 | 18.0 | n |
| t _{PHL} | LE to O _n | 3.3 ±0.3 | 2.5 | 8.0 | 12.0 | 2.5 | 12.5 | |
| t _{PZL} | Output Enable Time | 2.7 | 2.5 | 10.2 | 18.3 | 2.5 | 19.0 | ns |
| t _{PZH} | | 3.3 ±0.3 | 2.5 | 8.5 | 13.0 | 2.5 | 13.5 | |
| t _{PHZ} | Output Disable Time | 2.7 | 1.0 | 10.8 | 20.4 | 1.0 | 21.0 | ns |
| t _{PLZ} | | 3.3 ±0.3 | 1.0 | 9.0 | 14.5 | 1.0 | 15.0 | |
| t _{OSHL} | Output to Output Skew | 2.7 | | 1.0 | 1.5 | | 1.5 | ns |
| t _{OSLH} | (Note 9) | 3.3 ±0.3 | | 1.0 | 1.5 | | 1.5 | |

Note 9: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}). Parameter guaranteed by design.

AC Operating Requirements

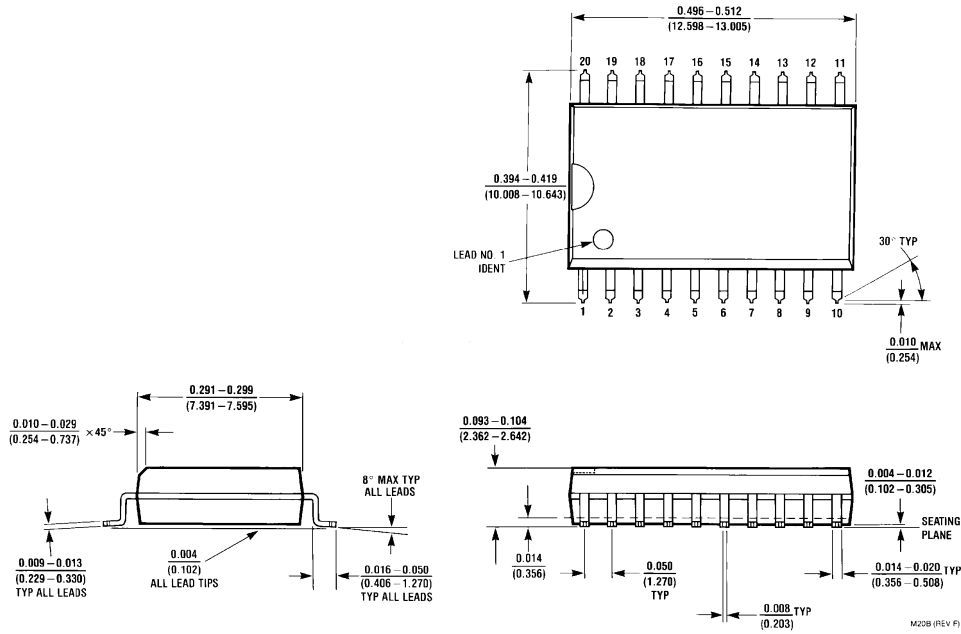
| Symbol | Parameter | V _{CC} (V) | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
|----------------|-------------------------|------------------------|--|--------------------|---|----|-------|
| | | | Typ | Guaranteed Minimum | | | |
| t _S | Setup Time, HIGH or LOW | 2.7 | 0 | 4.0 | 4.5 | ns | |
| | | 3.3 ±0.3 | 0 | 3.0 | 3.0 | | |
| t _H | Hold Time, HIGH or LOW | 2.7 | 0 | 1.5 | 1.5 | ns | |
| | | 3.3 ±0.3 | 0 | 1.5 | 1.5 | | |
| t _W | LE Pulse Width, HIGH | 2.7 | 2.4 | 5.0 | 6.0 | ns | |
| | | 3.3 ±0.3 | 2.0 | 4.0 | 4.0 | | |

Capacitance

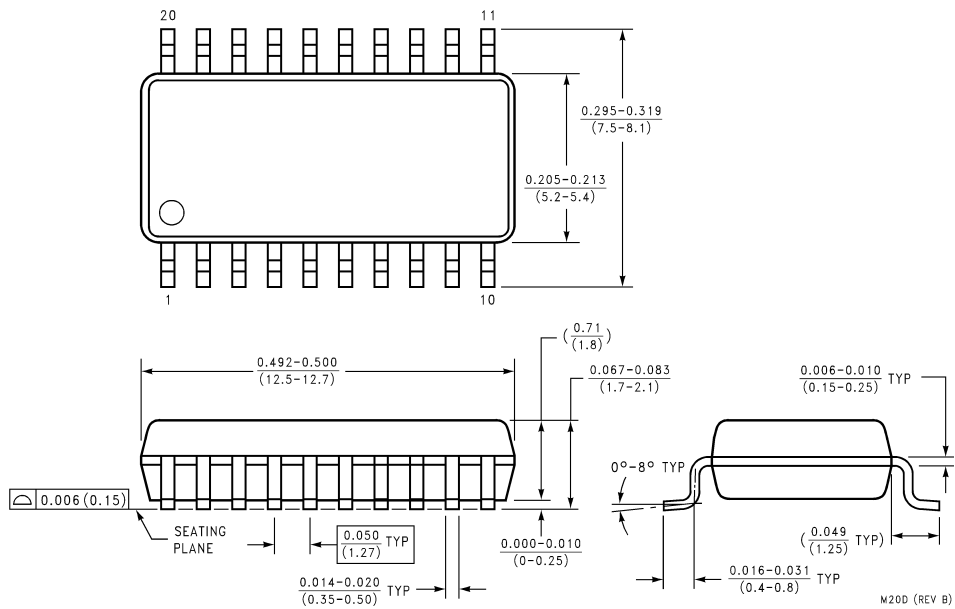
| Symbol | Parameter | Typ | Units | Conditions |
|---------------------------|-------------------------------|-----|-------|------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = Open |
| C _{PD} (Note 10) | Power Dissipation Capacitance | 39 | pF | V _{CC} = 3.3V |

Note 10: C_{PD} is measured at 10 MHz.

Physical Dimensions inches (millimeters) unless otherwise noted

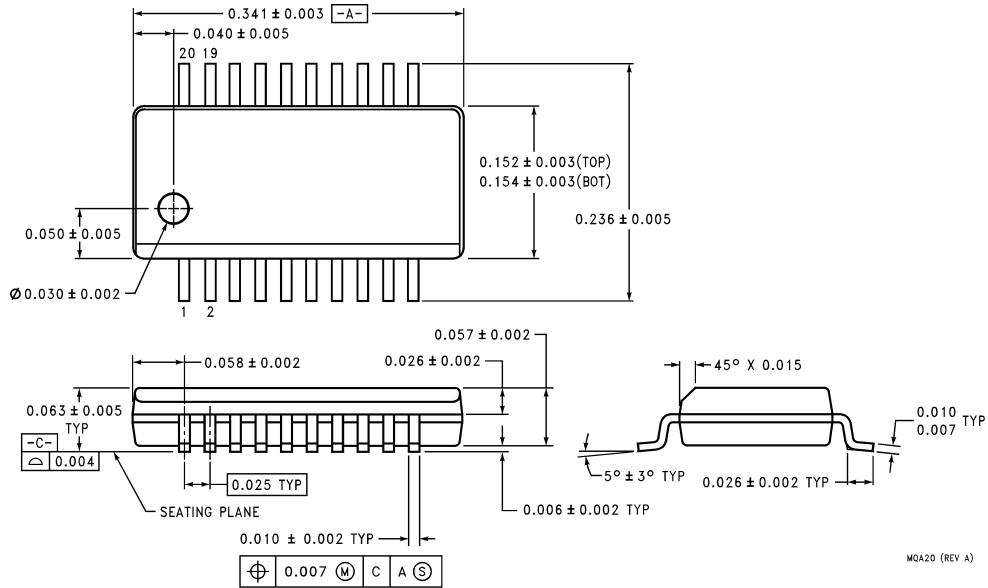


**20-Lead (0.300" Wide) Molded Small Outline Package, SOIC JEDEC
Package Number M20B**



**20-Lead Molded Shrink Small Outline Package, SOIC EIAJ
Package Number M20D**

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



**20-Lead (0.150" Wide) Molded Shrink Small Outline Package, SSOP JEDEC
(also known as QSOP)
Package Number MQA20**

MQA20 (REV A)

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