

## 74LCX373

### Low-Voltage Octal Transparent Latch with 5V Tolerant Inputs and Outputs

#### General Description

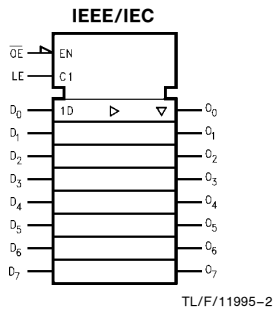
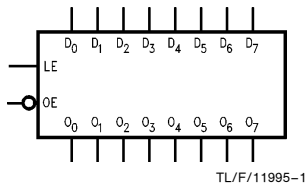
The LCX373 consists of eight latches with TRI-STATE® outputs for bus organized system applications. The device is designed for low voltage (3.3V)  $V_{CC}$  applications with capability of interfacing to a 5V signal environment.

The LCX373 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

#### Features

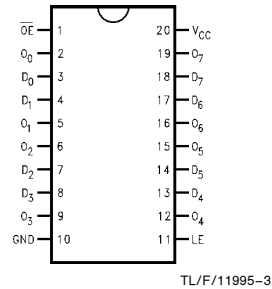
- 5V tolerant inputs and outputs
- 8.0 ns  $t_{PD}$  max, 10  $\mu A$   $I_{CCQ}$  max
- Power-down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V  $V_{CC}$  supply operation
- $\pm 24$  mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with the 74 series 373
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human Body Model > 2000V
  - Machine Model > 200V

#### Logic Symbols



#### Connection Diagram

Pin Assignment for SOIC, SSOP and TSSOP



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

	SOIC JEDEC	SOIC EIAJ	SSOP Type II	TSSOP JEDEC
Order Number	74LCX373WM 74LCX373WMX	74LCX373SJ 74LCX373SJX	74LCX373MSA 74LCX373MSAX	74LCX373MTC 74LCX373MTCX
See NS Package Number	M20B	M20D	MSA20	MTC20

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Quiet Series™ is a trademark of National Semiconductor Corporation.

## Functional Description

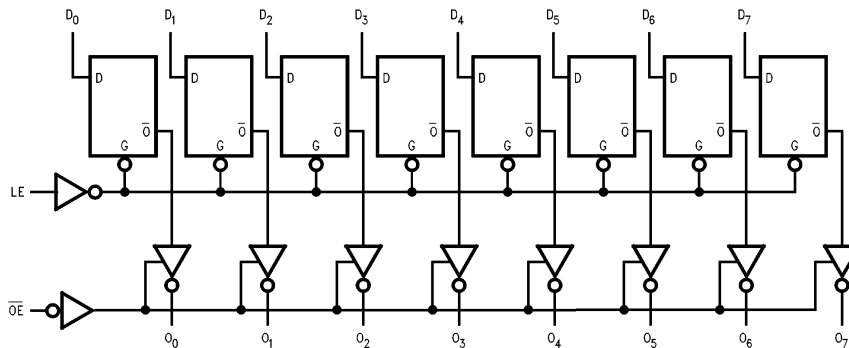
The LCX373 contains eight D-type latches with TRI-STATE standard outputs. When the Latch Enable (LE) input is HIGH, data on the  $D_n$  inputs enters the latches. In this condition the latches are transparent, i.e. a latch output will change state each time its D input changes. When LE is LOW, the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW transition of LE. The TRI-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



TL/F/11995-4

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)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
$V_{CC}$	Supply Voltage	-0.5 to +7.0		V
$V_I$	DC Input Voltage	-0.5 to +7.0		V
$V_O$	DC Output Voltage	-0.5 to +7.0	Output in TRI-STATE	V
		-0.5 to $V_{CC} + 0.5$	Output in High or Low State (Note 2)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < \text{GND}$	mA
$I_{OK}$	DC Output Diode Current	-50	$V_O < \text{GND}$	mA
		+50	$V_O > V_{CC}$	
$I_O$	DC Output Source/Sink Current	$\pm 50$		mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		$^{\circ}\text{C}$

**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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:**  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
$V_{CC}$	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	
$V_I$	Input Voltage	0	5.5	V	
$V_O$	Output Voltage	HIGH or LOW State	0	$V_{CC}$	V
		TRI-STATE	0	5.5	
$I_{OH}/I_{OL}$	Output Current		$\pm 24$ $\pm 12$	mA	
$T_A$	Free-Air Operating Temperature	-40	85	$^{\circ}\text{C}$	
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8\text{V}-2.0\text{V}$ , $V_{CC} = 3.0\text{V}$	0	10	ns/V	

## DC Electrical Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		Units
				Min	Max	
$V_{IH}$	HIGH Level Input Voltage		2.7-3.6	2.0		V
$V_{IL}$	LOW Level Input Voltage		2.7-3.6		0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu\text{A}$	2.7-3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		V
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		V
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		V
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu\text{A}$	2.7-3.6		0.2	V
		$I_{OL} = 12 \text{ mA}$	2.7		0.4	V
		$I_{OL} = 16 \text{ mA}$	3.0		0.4	V
		$I_{OL} = 24 \text{ mA}$	3.0		0.55	V
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5\text{V}$	2.7-3.6		$\pm 5.0$	$\mu\text{A}$
$I_{OZ}$	TRI-STATE Output Leakage	$0 \leq V_O \leq 5.5\text{V}$ $V_I = V_{IH}$ or $V_{IL}$	2.7-3.6		$\pm 5.0$	$\mu\text{A}$
$I_{OFF}$	Power-Off Leakage Current	$V_I$ or $V_O = 5.5\text{V}$	0		10	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or $\text{GND}$	2.7-3.6		10	$\mu\text{A}$
		$3.6\text{V} \leq V_I, V_O \leq 5.5\text{V}$	2.7-3.6		$\pm 10$	$\mu\text{A}$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6\text{V}$	2.7-3.6		500	$\mu\text{A}$

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
$t_{PHL}$ $t_{PLH}$	Propagation Delay $D_n$ to $O_n$	1.5 1.5	8.0 8.0	1.5 1.5	9.0 9.0	ns
$t_{PHL}$ $t_{PLH}$	Propagation Delay LE to $O_n$	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
$t_{PZL}$ $t_{PZH}$	Output Enable Time	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	1.5 1.5	7.5 7.5	1.5 1.5	8.5 8.5	ns
$t_s$	Setup Time, $D_n$ to LE	2.5		2.5		ns
$t_H$	Hold Time, $D_n$ to LE	1.5		1.5		ns
$t_W$	LE Pulse Width	3.3		3.3		ns
$t_{OSHL}$ $t_{OSLH}$	Output to Output Skew (Note 1)		1.0 1.0			ns

**Note 1:** 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 ( $t_{OSLH}$ ).

## Dynamic Switching Characteristics

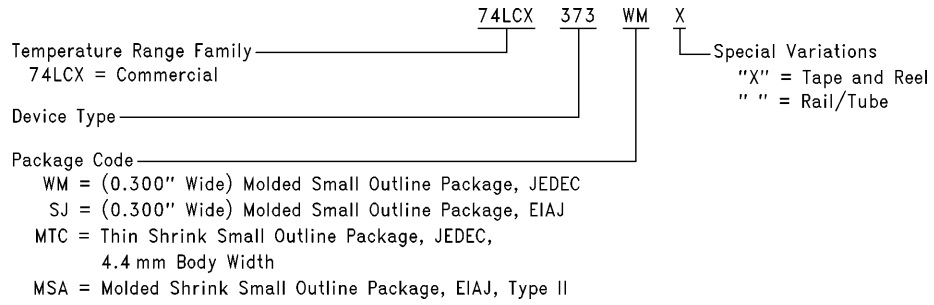
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^{\circ}\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50\text{ pF}$ , $V_{IH} = 3.3V$ , $V_{IL} = 0V$	3.3	0.8	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50\text{ pF}$ , $V_{IH} = 3.3V$ , $V_{IL} = 0V$	3.3	-0.8	V

## Capacitance

Symbol	Parameter	Conditions	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}$ , $V_I = 0V$ or $V_{CC}$	7	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3V$ , $V_I = 0V$ or $V_{CC}$	8	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CC} = 3.3V$ , $V_I = 0V$ or $V_{CC}$ , $F = 10\text{ MHz}$	25	pF

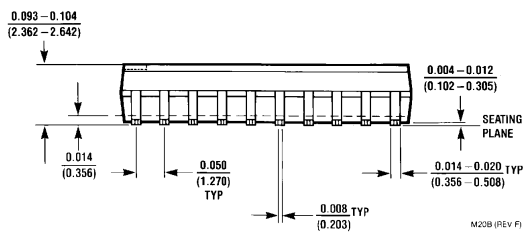
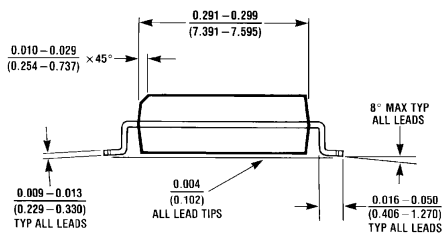
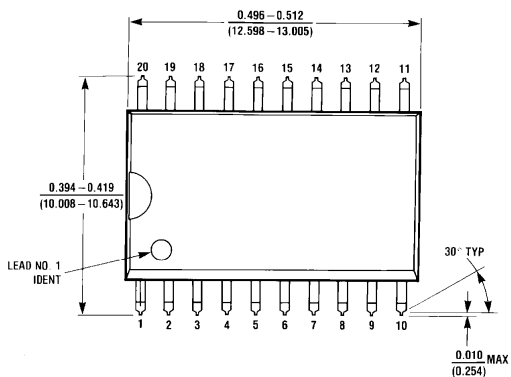
## 74LCX373 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



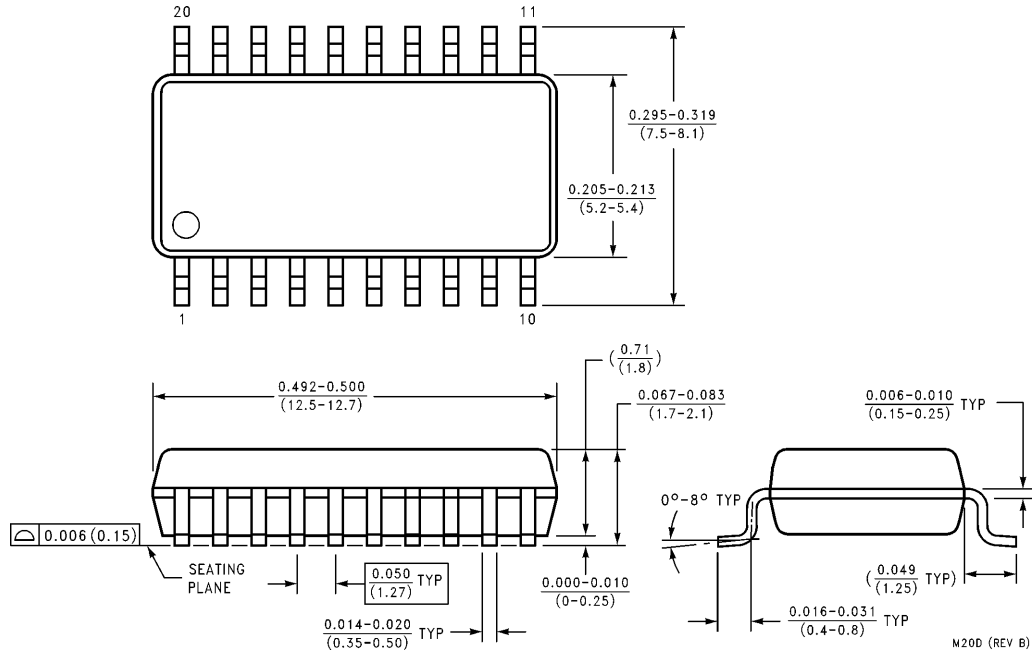
TL/F/11995-5

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

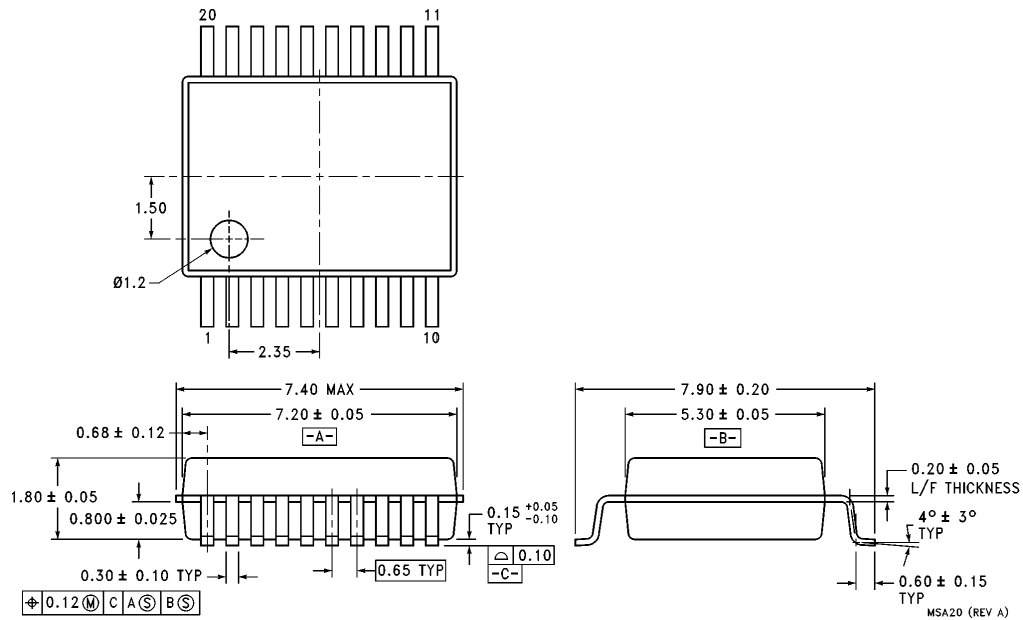


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC**  
**Order Number 74LCX373WM or 74LCX373WMX**  
**NS Package Number M20B**

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



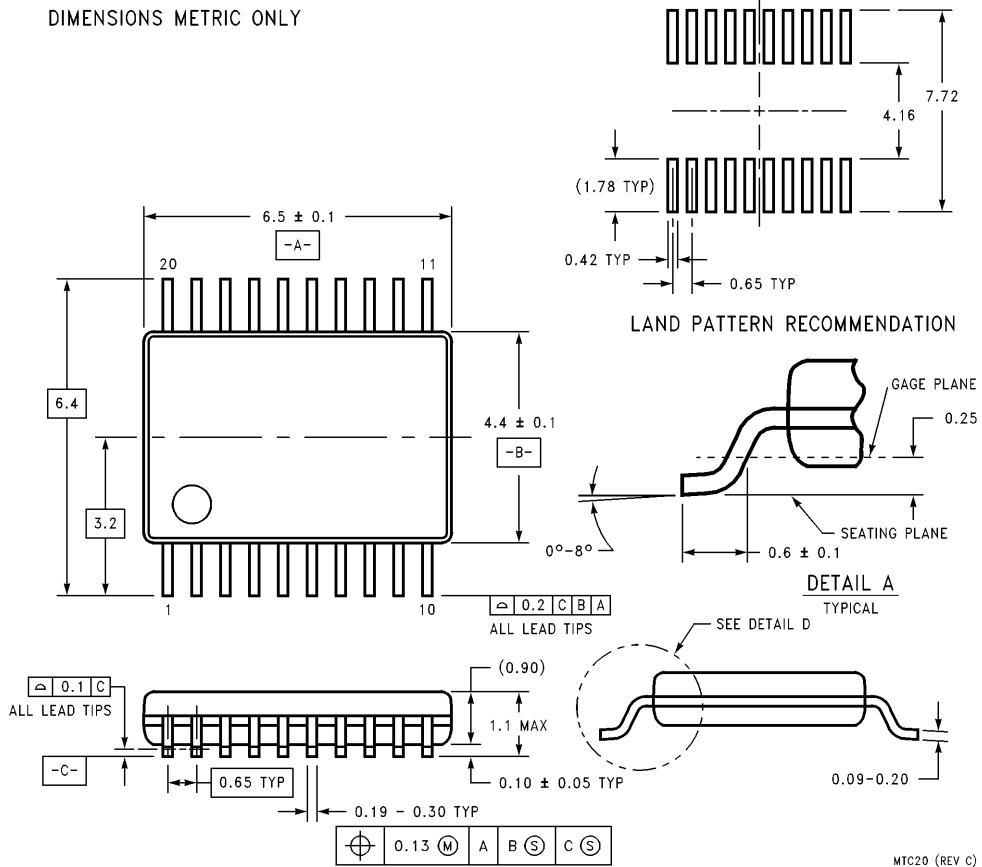
**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ**  
**Order Number 74LCX373SJ or 74LCX373SJX**  
**NS Package Number M20D**



**20-Lead Molded Shrink Small Outline Package, EIAJ, Type II**  
**Order Number 74LCX373MSA or 74LCX373MSAX**  
**NS Package Number MSA20**

All dimensions are in millimeters

**Physical Dimensions** All dimensions are in millimeters (Continued)



**20-Lead Thin Shrink Small Outline Package, JEDEC  
Order Number 74LCX373MTC or 74LCX373MTCX  
NS Package Number MTC20**

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