

SN54LV373, SN74LV373 OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCLS196C – FEBRUARY 1993 – REVISED APRIL 1996

- **EPIC™ (Enhanced-Performance Implanted CMOS) 2-μ Process**
- **Typical V_{OLP} (Output Ground Bounce) $< 0.8 V$ at V_{CC} , $T_A = 25^\circ C$**
- **Typical V_{OHV} (Output V_{OH} Undershoot) $> 2 V$ at V_{CC} , $T_A = 25^\circ C$**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ($C = 200 pF$, $R = 0$)**
- **Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17**
- **Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), Ceramic Flat (W) Packages, Chip Carriers (FK), and (J) 300-mil DIPs**

description

These octal transparent D-type latches are designed for 2.7-V to 5.5-V V_{CC} operation.

While the latch-enable (LE) input is high, the Q outputs follow the data (D) inputs. When LE is taken low, the Q outputs are latched at the logic levels set up at the D inputs.

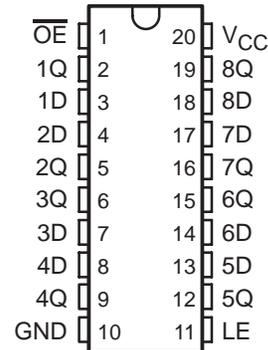
A buffered output-enable (\overline{OE}) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components.

\overline{OE} does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

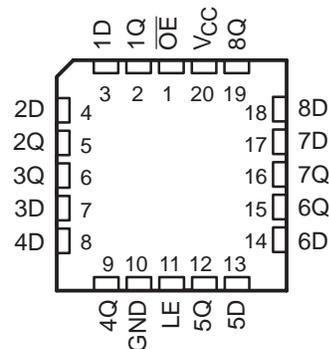
The SN74LV373 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54LV373 is characterized for operation over the full military temperature range of $-55^\circ C$ to $125^\circ C$. The SN74LV373 is characterized for operation from $-40^\circ C$ to $85^\circ C$.

SN54LV373 . . . J OR W PACKAGE
SN74LV373 . . . DB, DW, OR PW PACKAGE
(TOP VIEW)



SN54LV373 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each latch)

INPUTS			OUTPUT
\overline{OE}	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q_0
H	X	X	Z



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**TEXAS
INSTRUMENTS**

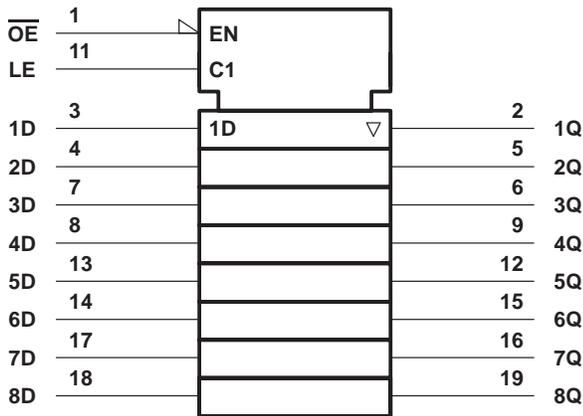
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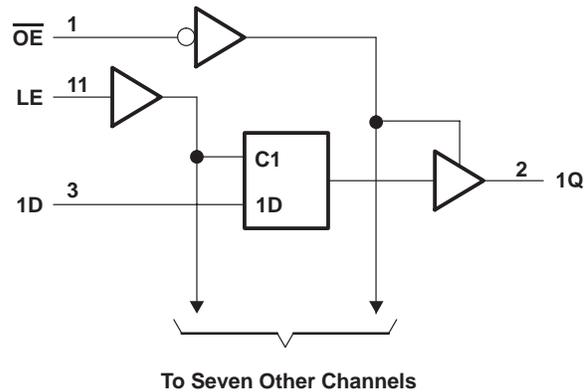
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logic symbol†



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for DB, DW, J, PW, and W packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V_{CC}	-0.5 V to 7 V
Input voltage range, V_I (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Output voltage range, V_O (see Notes 1 and 2)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$)	± 20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	± 50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	± 35 mA
Continuous current through V_{CC} or GND	± 70 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3):	
DB package	0.6 W
DW package	1.6 W
PW package	0.7 W
Storage temperature range, T_{stg}	-65°C to 150°C

‡ Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

2. This value is limited to 7 V maximum.

3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

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recommended operating conditions (see Note 4)

		SN54LV373		SN74LV373		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage	2.7	5.5	2.7	5.5	V
V_{IH}	High-level input voltage	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		2		V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$		3.15		
V_{IL}	Low-level input voltage	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		0.8		V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$		1.65		
V_I	Input voltage	0	V_{CC}	0	V_{CC}	V
V_O	Output voltage	0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		-8		mA
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$		-16		
I_{OL}	Low-level output current	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		8		mA
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$		16		
$\Delta t/\Delta v$	Input transition rise or fall rate	0	100	0	100	ns/V
T_A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 4: Unused inputs must be held high or low to prevent them from floating.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}^\dagger	SN54LV373			SN74LV373			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	$I_{OH} = -100\ \mu\text{A}$ $I_{OH} = -8\ \text{mA}$ $I_{OH} = -16\ \text{mA}$	MIN to MAX	$V_{CC}-0.2$			$V_{CC}-0.2$			V
		3 V	2.4			2.4			
		4.5 V	3.6			3.6			
V_{OL}	$I_{OL} = 100\ \mu\text{A}$ $I_{OL} = 8\ \text{mA}$ $I_{OL} = 16\ \text{mA}$	MIN to MAX	0.2			0.2			V
		3 V	0.4			0.4			
		4.5 V	0.55			0.55			
I_I	$V_I = V_{CC}$ or GND	3.6 V	± 1			± 1			μA
		5.5 V	± 1			± 1			
I_{OZ}	$V_O = V_{CC}$ or GND	3.6 V	± 5			± 5			μA
		5.5 V	± 5			± 5			
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6 V	20			20			μA
		5.5 V	20			20			
ΔI_{CC}	One input at $V_{CC} - 0.6\text{ V}$, Other inputs at V_{CC} or GND	3 V to 3.6 V	500			500			μA
C_i	$V_I = V_{CC}$ or GND	3.3 V	2.5			2.5			pF
		5 V	3			3			
C_o	$V_O = V_{CC}$ or GND	3.3 V	7			7			pF
		5 V	7.5			7.5			

† For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.

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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

			SN54LV373						UNIT
			V _{CC} = 5 V ± 0.5 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration, LE high		10		10		8		ns
t _{su}	Setup time, data before LE↓	High or low	4		6		6		ns
t _h	Hold time, data after LE↓	High or low	6		6		6		ns

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

			SN74LV373						UNIT
			V _{CC} = 5 V ± 0.5 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration, LE high		10		10		8		ns
t _{su}	Setup time, data before LE↓	High or low	4		6		6		ns
t _h	Hold time, data after LE↓	High or low	6		6		6		ns

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LV373						UNIT		
			V _{CC} = 5 V ± 0.5 V			V _{CC} = 3.3 V ± 0.3 V				V _{CC} = 2.7 V	
			MIN	TYP	MAX	MIN	TYP	MAX		MIN	MAX
t _{pd}	D	Q	8	16		11	22		28	ns	
	LE		11	19		15	25		26		
t _{en}	\overline{OE}	Q	15	23		15	27		28	ns	
t _{dis}	\overline{OE}	Q	15	23		15	27		28	ns	

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LV373						UNIT		
			V _{CC} = 5 V ± 0.5 V			V _{CC} = 3.3 V ± 0.3 V				V _{CC} = 2.7 V	
			MIN	TYP	MAX	MIN	TYP	MAX		MIN	MAX
t _{pd}	D	Q	8	16		11	22		28	ns	
	LE		11	19		15	25		26		
t _{en}	\overline{OE}	Q	15	23		15	27		28	ns	
t _{dis}	\overline{OE}	Q	15	23		15	27		28	ns	

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS		V _{CC}	TYP	UNIT
C _{pd}	Power dissipation capacitance per latch	Outputs enabled		3.3 V	47	pF
		Outputs disabled			29	
		Outputs enabled		5 V	112	
		Outputs disabled			62	

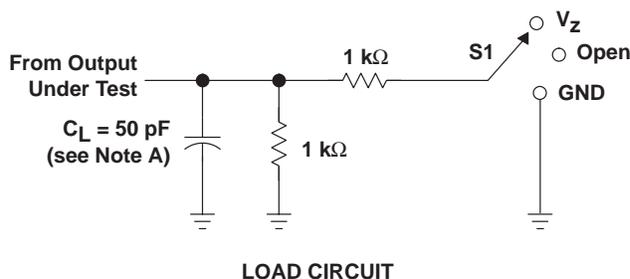
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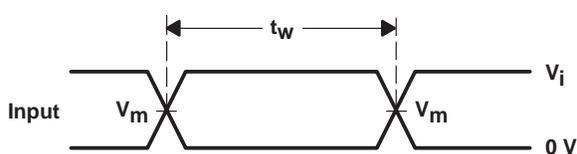
PARAMETER MEASUREMENT INFORMATION



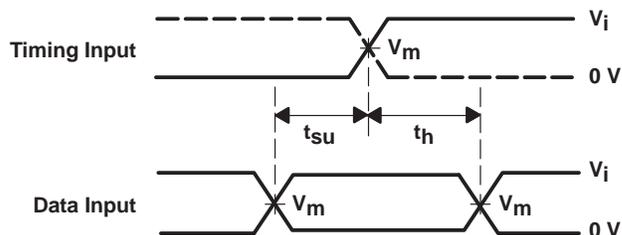
LOAD CIRCUIT

TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _Z
t _{PHZ} /t _{PZH}	GND

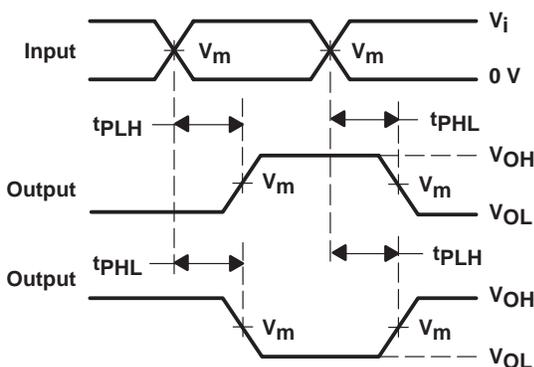
WAVEFORM CONDITION	V _{CC} = 4.5 V to 5.5 V	V _{CC} = 2.7 V to 3.6 V
V _m	0.5 × V _{CC}	1.5 V
V _i	V _{CC}	2.7 V
V _Z	2 × V _{CC}	6 V



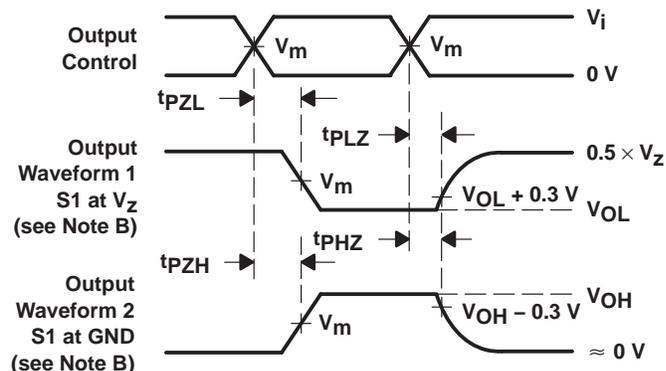
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- C_L includes probe and jig capacitance.
 - Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 - All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis}.
 - t_{PZL} and t_{PZH} are the same as t_{en}.
 - t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LV373DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74LV373DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74LV373DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74LV373PWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

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Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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