

SN74LVC16373

16-BIT TRANSPARENT D-TYPE LATCH

WITH 3-STATE OUTPUTS

SCAS315B – NOVEMBER 1993 – REVISED JULY 1995

- Member of the Texas Instruments *Widebus™* Family
- *EPIC™* (Enhanced-Performance Implanted CMOS) Submicron Process
- Typical V_{OLP} (Output Ground Bounce) $< 0.8\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) $> 2\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

description

This 16-bit transparent D-type latch is designed for 2.7-V to 3.6-V V_{CC} operation.

The SN74LVC16373 is particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers. It can be used as two 8-bit latches or one 16-bit latch. When 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 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 logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without need for interface or pullup components.

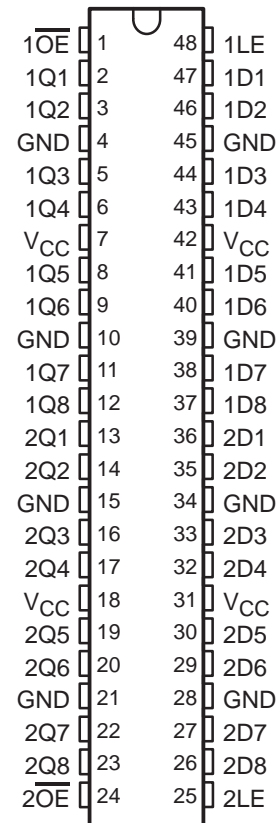
\overline{OE} does not affect internal operations of the latch. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN74LVC16373 is characterized for operation from -40°C to 85°C .

DGG OR DL PACKAGE
(TOP VIEW)



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

EPIC and Widebus are trademarks of Texas Instruments Incorporated.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1995, Texas Instruments Incorporated

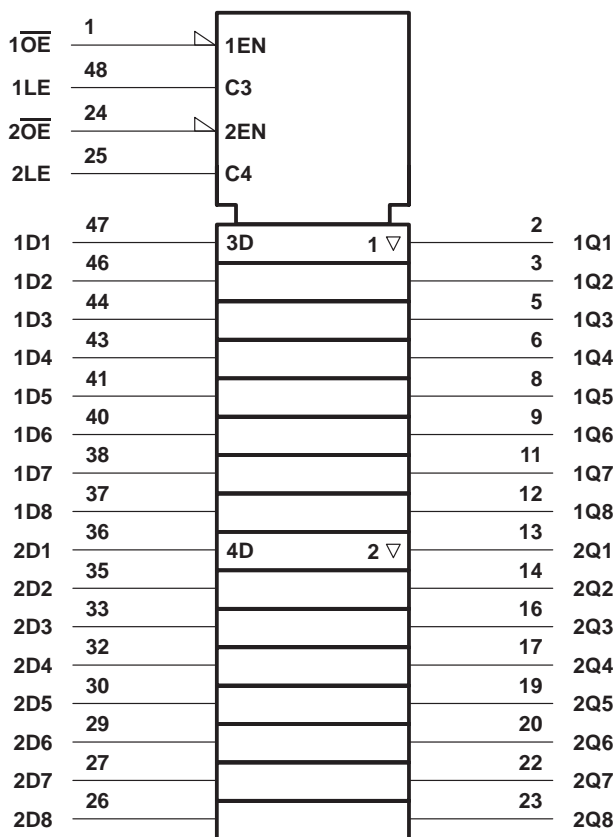
WITH 3-STATE OUTPUTS

SCAS315B – NOVEMBER 1993 – REVISED JULY 1995

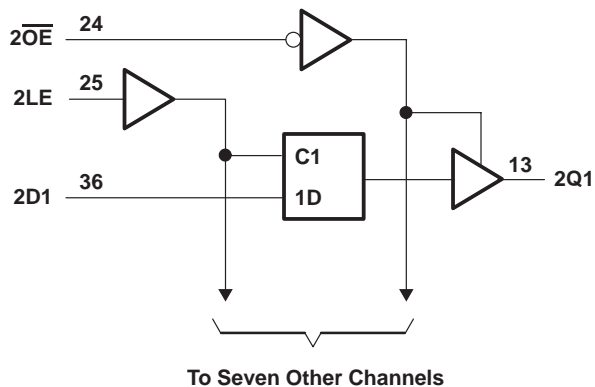
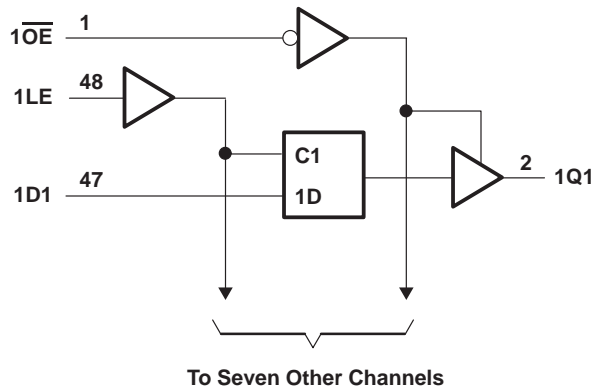
FUNCTION TABLE
(each 8-bit section)

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

logic symbol†



logic diagram (positive logic)



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

SN74LVC16373
16-BIT TRANSPARENT D-TYPE LATCH
WITH 3-STATE OUTPUTS

SCAS315B – NOVEMBER 1993 – REVISED JULY 1995

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

Supply voltage range, V_{CC}	–0.5 V to 4.6 V
Input voltage range, V_I (see Note 1)	–0.5 V to 4.6 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} ($V_I < 0$)	–50 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})	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3):	
DGG package	0.85 W
DL package	1.2 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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 4.6 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. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2.7	3.6	V
V_{IH}	High-level input voltage	$V_{CC} = 2.7$ V to 3.6 V	2		V
V_{IL}	Low-level input voltage	$V_{CC} = 2.7$ V to 3.6 V		0.8	V
V_I	Input voltage		0	V_{CC}	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2.7$ V		–12	mA
		$V_{CC} = 3$ V		–24	
I_{OL}	Low-level output current	$V_{CC} = 2.7$ V		12	mA
		$V_{CC} = 3$ V		24	
$\Delta t/\Delta V$	Input transition rise or fall rate		0	10	ns/V
T_A	Operating free-air temperature		–40	85	°C

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

SN74LVC16373

16-BIT TRANSPARENT D-TYPE LATCH

WITH 3-STATE OUTPUTS

SCAS315B – NOVEMBER 1993 – REVISED JULY 1995

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

PARAMETER		TEST CONDITIONS	V _{CC} [†]	MIN	TYP [‡]	MAX	UNIT
V _{OH}		I _{OH} = −100 μA	MIN to MAX	V _{CC} − 0.2			V
		I _{OH} = −12 mA	2.7	2.2			
			3	2.4			
		I _{OH} = −24 mA	3	2			
V _{OL}		I _{OL} = 100 μA	MIN to MAX	0.2			V
		I _{OL} = 12 mA	2.7	0.4			
		I _{OL} = 24 mA	3	0.55			
I _I		V _I = V _{CC} or GND	3.6	±5			μA
I _I (hold)	Data inputs	V _I = 0.8 V	3	75			μA
		V _I = 2 V		−75			
I _{OZ}		V _O = V _{CC} or GND	3.6	±10			μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	3.6	40			μA
ΔI _{CC}		One input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND	3 V to 3.6 V	500			μA
C _i		V _I = V _{CC} or GND	3.3	3.5			pF
C _o		V _O = V _{CC} or GND	3.3	7			pF

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

[‡] All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		UNIT
		MIN	MAX	MIN	MAX	
t _w	Pulse duration, LE high	4		4		ns
t _{su}	Setup time, data before LE↓	2		2		ns
t _h	Hold time, data after LE↓	2		2		ns

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		UNIT
			MIN	MAX	MIN	MAX	
t _{pd}	D	Q	1.5	7	8		ns
	LE		2	8	9		
t _{en}	$\overline{\text{OE}}$	Q	1.5	8	9		ns
t _{dis}	$\overline{\text{OE}}$	Q	1.5	7	8		ns

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C _{pd}	Power dissipation capacitance per latch	C _L = 50 pF, f = 10 MHz	20	pF
	Outputs enabled Outputs disabled		4	



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

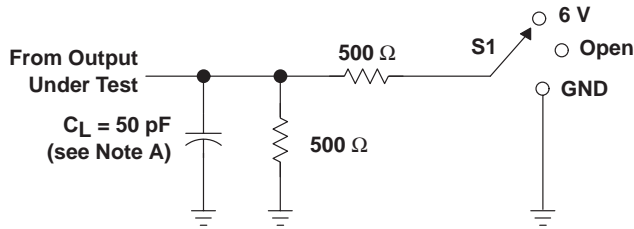
SN74LVC16373

16-BIT TRANSPARENT D-TYPE LATCH

WITH 3-STATE OUTPUTS

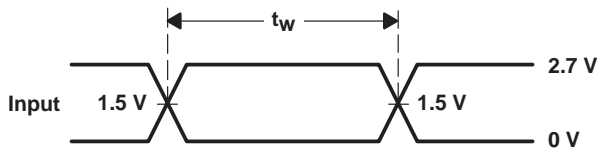
SCAS315B – NOVEMBER 1993 – REVISED JULY 1995

PARAMETER MEASUREMENT INFORMATION

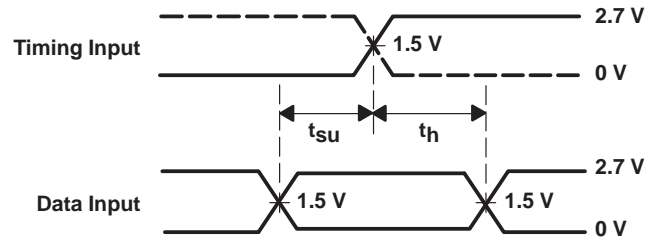


LOAD CIRCUIT FOR OUTPUTS

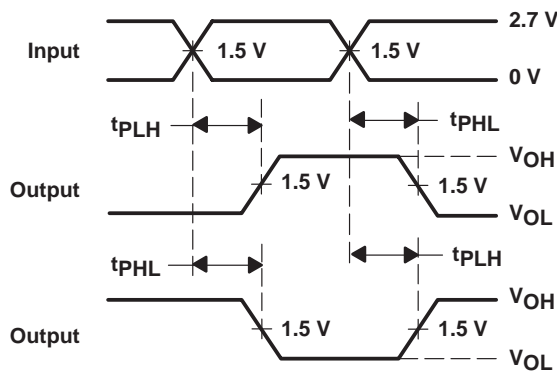
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



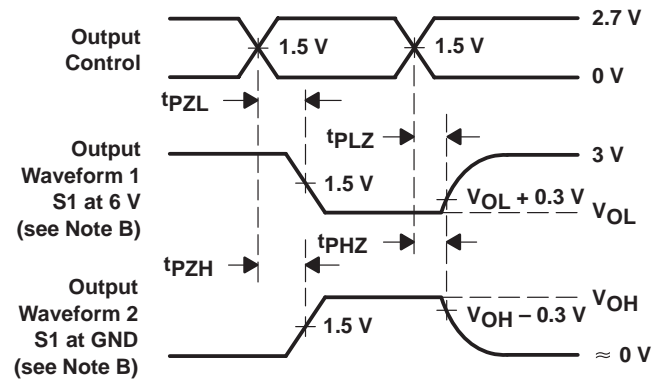
VOLTAGE WAVEFORMS
PULSE DURATION



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:
- A. C_L includes probe and jig capacitance.
 - B. 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.
 - C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ ns.
 - D. The outputs are measured one at a time with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.