

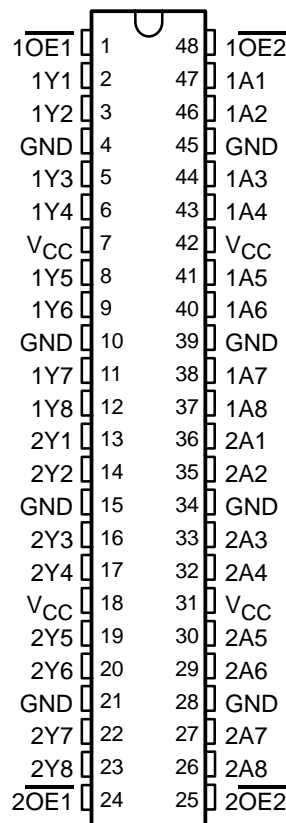
SN74LVCH16540A

16-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCAS569A – MARCH 1996 – REVISED JUNE 1996

- 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 $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ($C = 200\text{ pF}$, $R = 0$)
- Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V V_{CC})
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin-Shrink Small-Outline (DGG) Packages

DGG OR DL PACKAGE
(TOP VIEW)



description

This 16-bit buffer/driver is designed for 2.7-V to 3.6-V V_{CC} operation; it can interface to a 5-V system environment.

The SN74LVCH16540A provides a high-performance bus interface for wide datapaths.

The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output-enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all corresponding 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.

The SN74LVCH16540A is characterized for operation from -40°C to 85°C .

FUNCTION TABLE
(each 8-bit section)

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	H
L	L	H	L
H	X	X	Z
X	H	X	Z



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**TEXAS
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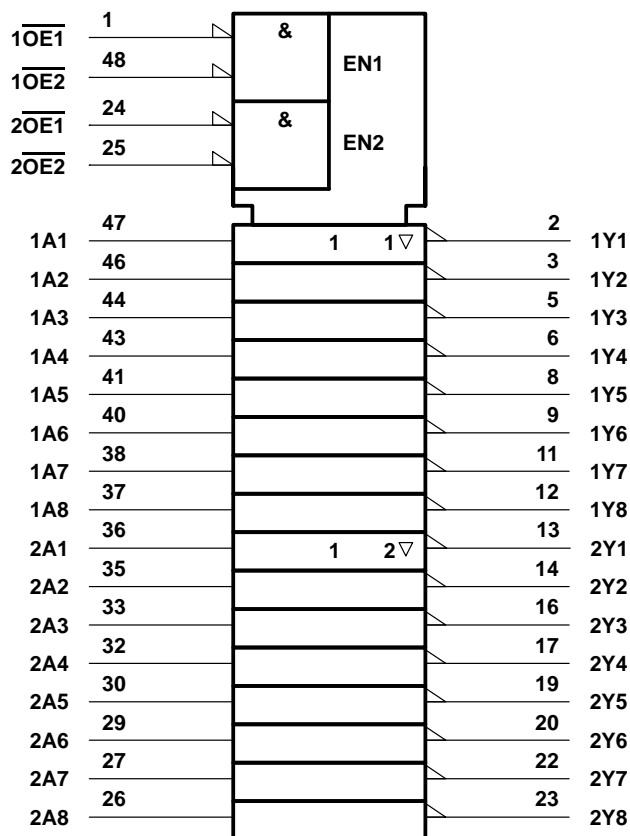
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16-BIT BUFFER/DRIVER

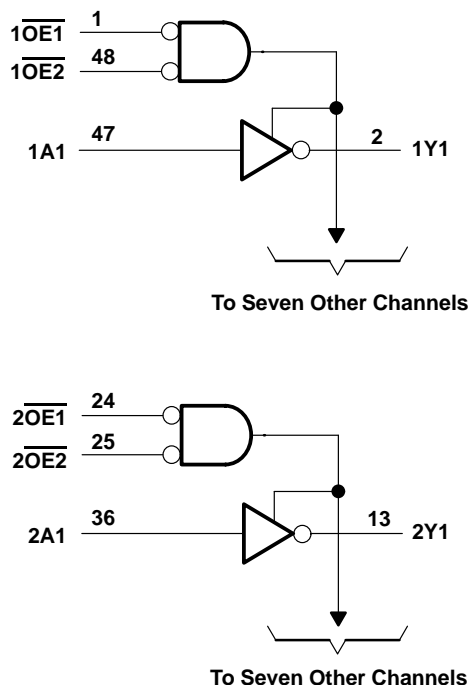
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logic symbol†



logic diagram (positive logic)



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

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

Supply voltage range, V_{CC}	–0.5 V to 6.5 V
Input voltage range, V_I	–0.5 V to 6.5 V
Voltage range applied to any output in the high-impedance state or power-off state, V_O (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, 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 each 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 *ABT Advanced BiCMOS Technology Data Book*.

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recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V_{CC}	Supply voltage	Operating	2	3.6	V
		Data retention only	1.5		
V_{IH}	High-level input voltage	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2		V
V_{IL}	Low-level input voltage	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		0.8	V
V_I	Input voltage		0	5.5	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2.7 \text{ V}$		-12	mA
		$V_{CC} = 3 \text{ V}$		-24	
I_{OL}	Low-level output current	$V_{CC} = 2.7 \text{ V}$		12	mA
		$V_{CC} = 3 \text{ V}$		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.

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 V	2			
		3 V	2.2			
	I _{OH} = −24 mA	3 V	2			
V _{OL}	I _{OL} = 100 μA	MIN to MAX	0.2		V	
	I _{OL} = 12 mA	2.7 V	0.4			
	I _{OL} = 24 mA	3 V	0.55			
I _I	V _I = 5.5 V or GND	3.6 V	±5		μA	
I _I (hold)	V _I = 0.8 V	3 V	75		μA	
	V _I = 2 V		−75			
	V _I = 0 to 3.6 V [§]	3.6 V	±500			
I _{off}	V _I or V _O = 5.5 V	0	50		μA	
I _{OZ}	V _O = 0 or 5.5 V	3.6 V	±20		μA	
I _{CC}	V _I = V _{CC} or GND, I _O = 0	3.6 V	20		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 V	5		pF	
C _O	V _O = V _{CC} or GND	3.3 V	6		pF	

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

[‡] All typical values are measured at $V_{CC} = 3.3 \text{ V}$, $T_A = 25^\circ\text{C}$.

[§] This is the bus-hold maximum dynamic current required to switch the input from one state to another.



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switching characteristics over recommended operating free-air temperature range, $C_L = 50$ 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}	A	Y	1	5.5	6.2		ns
t_{en}	\overline{OE}	Y	1.5	7	7.7		ns
t_{dis}	\overline{OE}	Y	1.5	7	7.7		ns
$t_{sk(o)}^\dagger$				1			ns

[†] Skew between any two outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

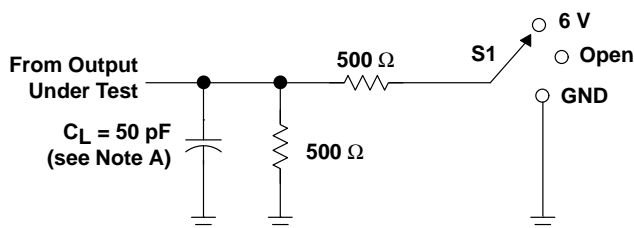
operating characteristics, $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per buffer/driver	Outputs enabled	20	pF
		Outputs disabled	4	



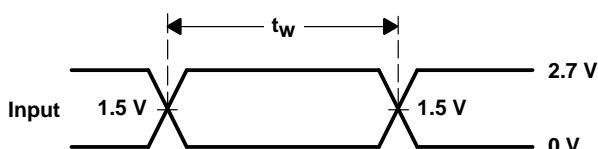
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PARAMETER MEASUREMENT INFORMATION

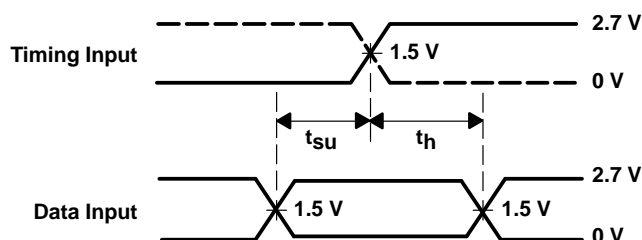


LOAD CIRCUIT FOR OUTPUTS

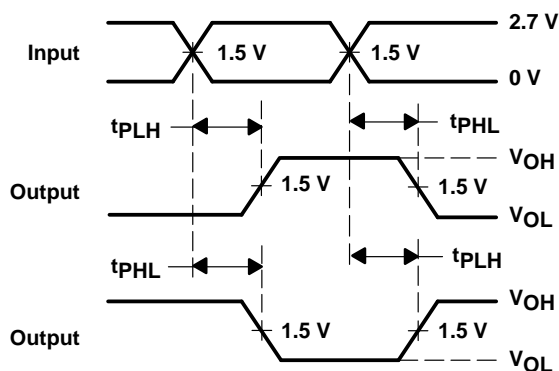
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



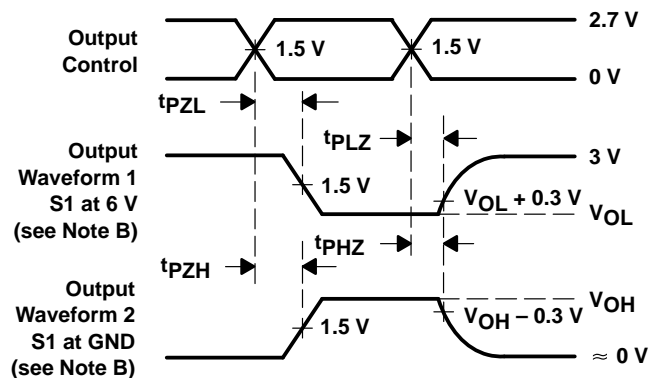
VOLTAGE WAVEFORMS
PULSE DURATION



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:
- 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: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ 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

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