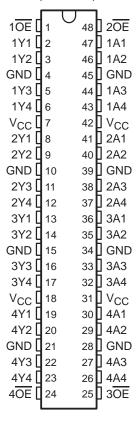
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- State-of-the-Art Advanced BiCMOS
 Technology (ABT) Widebus™ Design for
 2.5-V and 3.3-V Operation and Low Static
 Power Dissipation
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 2.3-V to 3.6-V V_{CC})
- Typical V_{OLP} (Output Ground Bounce)
 <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- High Drive (-24/24 mA at 2.5-V and -32/64 mA at 3.3-V V_{CC})
- Power Off Disables Outputs, Permitting Live Insertion
- High-Impedance State During Power Up and Power Down Prevents Driver Conflict
- Use Bus Hold on Data Inputs in Place of External Pullup/Pulldown Resistors to Prevent the Bus From Floating
- Auto3-State Eliminates Bus Current Loading When Output Exceeds V_{CC} + 0.5 V
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model; and Exceeds 1000 V Using Charged-Device Model, Robotic Method
- Flow-Through Architecture Facilitates
 Printed Circuit Board Layout
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- Package Options Include Plastic Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), Thin Very Small-Outline (DGV) Packages, and 380-mil Fine-Pitch Ceramic Flat (WD) Package

SN54ALVTH16240 . . . WD PACKAGE SN74ALVTH16240 . . . DGG, DGV, OR DL PACKAGE (TOP VIEW)



description

The 'ALVTH16240 devices are 16-bit buffers/line drivers designed for 2.5-V or 3.3-V V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

These devices are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.



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.

Widebus is a trademark of Texas Instruments Incorporated.

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description (continued)

The devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. The devices provide inverting outputs and symmetrical active-low output-enable (\overline{OE}) inputs.

When V_{CC} is between 0 and 1.5 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, \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.

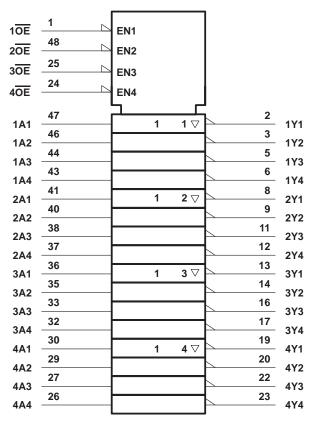
Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN54ALVTH16240 is characterized for operation over the full military temperature range of -55°C to 125°C. The SN74ALVTH16240 is characterized for operation from -40°C to 85°C.

FUNCTION TABLE (each 4-bit buffer)

INP	JTS	OUTPUT
OE	Α	Υ
L	Н	L
L	L	Н
Н	Χ	Z

logic symbol†

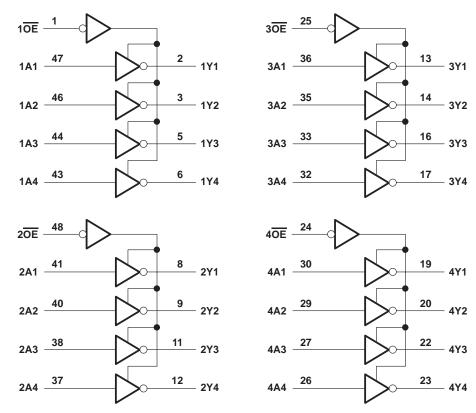


[†] This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



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logic diagram (positive logic)



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)	
Voltage range applied to any output in the high-impedance	
or power-off state, V _O (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state, V _O (see Note 1)	0.5 V to 7 V
Output current in the low state, IO: SN54ALVTH16240	96 mA
SN74ALVTH16240	128 mA
Output current in the high state, IO: SN54ALVTH16240	–48 mA
SN74ALVTH16240	–64 mA
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ _{JA} (see Note 2): DGG package	89°C/W
DGV package	
DL package	
Storage temperature range, T _{stg}	

[†] 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. The package thermal impedance is calculated in accordance with JESD 51.



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recommended operating conditions, $V_{\mbox{\footnotesize{CC}}}$ = 2.5 V \pm 0.2 V (see Note 3)

				SN54ALVTH16240			SN74ALVTH16240		
			MIN	TYP	MAX	MIN	TYP	MAX	UNIT
Vcc	Supply voltage		2.3		2.7	2.3		2.7	V
VIH	High-level input voltage				7	1.7			V
V _{IL}	Low-level input voltage			Š	0.7			0.7	V
VI	Input voltage			Vcc	5.5	0	VCC	5.5	V
IOH	High-level output current			7	-6			-8	mA
lou	Low-level output current			5	6			8	mA
lOL	Low-level output current; current duty cycle ≤	output current; current duty cycle ≤ 50%; f ≥ 1 kHz		7	18			24	IIIA
Δt/Δv	Input transition rise or fall rate Outputs enabled		Q		10			10	ns/V
Δt/ΔV _{CC}	Power-up ramp rate		200			200			μs/V
TA	Operating free-air temperature				125	-40		85	°C

NOTE 3: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

recommended operating conditions, $V_{\mbox{\footnotesize{CC}}}$ = 3.3 V \pm 0.3 V (see Note 3)

				SN54ALVTH16240			SN74ALVTH16240			
			MIN	TYP	MAX	MIN	TYP	MAX	UNIT	
Vcc	Supply voltage		3		3.6	3		3.6	V	
VIH	High-level input voltage				1/2	2			V	
V _{IL}	Low-level input voltage			3	0.8			0.8	V	
VI	Input voltage			Vcc	5.5	0	VCC	5.5	V	
loн	High-level output current			7.	-24			-32	mA	
la:	Low-level output current			2	24			32	m A	
lOL	Low-level output current; current duty cycle ≤ 5	50%; f≥1 kHz		5	48			64	mA	
Δt/Δν	Input transition rise or fall rate Outputs enabled		Q		10			10	ns/V	
Δt/ΔV _{CC}	Power-up ramp rate		200			200			μs/V	
T _A	Operating free-air temperature				125	-40		85	°C	

NOTE 3: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

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electrical characteristics over recommended operating free-air temperature range, V_{CC} = 2.5 V \pm 0.2 V (unless otherwise noted)

PARAMETER		TEST 0	ONDITIONS	SN54	ALVTH1	6240	SN74	ALVTH1	6240	UNIT	
		IESI C	ONDITIONS	MIN	TYP†	MAX	MIN	TYP [†]	MAX	UNII	
٧ıK		$V_{CC} = 2.3 \text{ V},$	I _I = -18 mA			-1.2			-1.2	V	
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V},$	$I_{OH} = -100 \mu A$	V _{CC} -0.	2		V _{CC} -0	.2			
VOH		V 22V	I _{OH} = -6 mA	1.8						V	
		V _{CC} = 2.3 V	I _{OH} = -8 mA				1.8				
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V},$	I _{OL} = 100 μA			0.2			0.2		
			I _{OL} = 6 mA			0.4					
VOL		V _{CC} = 2.3 V	$I_{OL} = 8 \text{ mA}$						0.4	V	
		VCC = 2.3 V	I _{OL} = 18 mA			0.5					
0.441		I _{OL} = 24 mA						0.5			
	Control inputs	$V_{CC} = 2.7 \text{ V},$	$V_I = V_{CC}$ or GND			±1			±1		
	Control inputs	$V_{CC} = 0 \text{ or } 2.7 \text{ V},$	V _I = 5.5 V			<u>\$</u> 10			10		
l _l		V _{CC} = 2.7 V	V _I = 5.5 V		1	10			10	μΑ	
	Data inputs		$V_I = V_{CC}$		77	1			1		
			V _I = 0		1	- 5			- 5		
l _{off}		$V_{CC} = 0$,	V_I or $V_O = 0$ to 4.5 V		3				±100	μΑ	
I _{BHL} ‡		$V_{CC} = 2.3 \text{ V},$	V _I = 0.7 V		115			115		μΑ	
I _{BHH} §	•	$V_{CC} = 2.3 \text{ V},$	V _I = 1.7 V	Q"	-10			-10		μΑ	
IBHLO	,¶	$V_{CC} = 2.7 \text{ V},$	$V_I = 0$ to V_{CC}	300			300			μΑ	
IBHHC) [#]	$V_{CC} = 2.7 \text{ V},$	$V_I = 0$ to V_{CC}	-300			-300			μΑ	
ΙΕΧ		$V_{CC} = 2.3 \text{ V},$	V _O = 5.5 V			125			125	μΑ	
I _{OZ(Pl}	U/PD)☆	$V_{CC} \le 1.2 \text{ V}, V_{O} = \underline{0.5} \text{ V}$ $V_{I} = \text{GND or } V_{CC}, \text{OE} = \underline{0.5} \text{ V}$	V to V _{CC} , = don't care			±100			±100	μΑ	
lozh		V _{CC} = 2.7 V	$V_0 = 2.3 \text{ V},$ $V_1 = 0.7 \text{ V or } 1.7 \text{ V}$			5			5	μΑ	
lozL		V _{CC} = 2.7 V	V _O = 0.5 V, V _I = 0.7 V or 1.7 V			-5			-5	μΑ	
		V _{CC} = 2.7 V,	Outputs high	1	0.04	0.1		0.04	0.1		
Icc		$V_{CC} = 2.7 \text{ V},$	Outputs low		2.3	4.5		2.3	4.5	mA	
		$V_I = V_{CC}$ or GND	Outputs disabled		0.04	0.1		0.04	0.1		
Ci		V _{CC} = 2.5 V,	V _I = 2.5 V or 0		3.5			3.5		pF	
Co		V _{CC} = 2.5 V,	V _O = 2.5 V or 0		6			6		pF	



[†] All typical values are at V_{CC} = 2.5 V, T_A = 25°C. ‡ The bus-hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_{IN} to GND and then raising it to $V_{\mbox{\scriptsize IL}}$ max.

[§] The bus-hold circuit can source at least the minimum high sustaining current at VIH min. IBHH should be measured after raising VIN to VCC and then lowering it to VIH min.

[¶] An external driver must source at least I_{BHLO} to switch this node from low to high.

[#] An external driver must sink at least IBHHO to switch this node from high to low.

 $[\]parallel$ Current into an output in the high state when $V_O > V_{CC}$

^{*}High-impedance state during power up or power down

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electrical characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V \pm 0.3 V (unless otherwise noted)

V _{IK} V _{CC} = 3 V. I _I = −18 mA −1.2 V _{CC} −0.2 V _{CC} −0.2 <t< th=""><th colspan="2">PARAMETER</th><th colspan="2">TEST CONDITIONS</th><th>SN54</th><th>ALVTH1</th><th>6240</th><th colspan="3">SN74ALVTH16240</th><th>UNIT</th></t<>	PARAMETER		TEST CONDITIONS		SN54	ALVTH1	6240	SN74ALVTH16240			UNIT
Voc = 3 V to 3.6 V, IoH = -100 μA Voc -0.2 Voc	PA	RAWEIER	lesi Co	ONDITIONS	MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	UNII
VOH V _{CC} = 3 V IOH = −24 mA 2 0 0 0 0 0 0 0 0 0	VIK		V _{CC} = 3 V,	I _I = -18 mA	T		-1.2			-1.2	V
V _{CC} = 3 V I _{OH} = −32 mA 2 − − − − − − − − − − − − − − − − −			$V_{CC} = 3 \text{ V to } 3.6 \text{ V},$	I _{OH} = -100 μA	V _{CC} -0	2		V _{CC} -0	.2		
O _C = 3 ∨ to 3.6 ∨, O _C = 100 µA O.2 O.2 O _C = 3 ∨ to 3.6 ∨, O _C = 100 µA O.5 O _C = 3 ∨ O.5 O _C = 0 or 3.6 ∨ V _I = V _{CC} or GND O.5 O _C = 0 or 3.6 ∨ V _I = 5.5 ∨ O.5 O _C = 0 or 3.6 ∨ V _I = 5.5 ∨ O.5 O _C = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to 4.5 ∨ O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to V _O or V _O O.5 O _C = 3 ∨ V _I = 0 ∨ V _I or V _O = 0 to V _O or V _O O.5 O _C = 3 ∨ V _I = 0 v _I or V _O = 0 to V _O or V _O O.5 O _C = 3 ∨ V _I = 0 to V _O or V _O O.5 O _C = 3 ∨ V _I = 0 to V _O or O.5 O.5 O.5 O _C = 3 ∨ V _I = 0 to V _O or O.5 O.5 O.5 O _C = 3 ∘ V V _I = 0 v _I or 2 ∨ O.5 O.5 O _C = 3 ∘ V V _I = 0 v _I or 2 ∨ O.5 O.5 O _C = 0 ∘ V _I = 0 ∘ O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ V _I = 0 ∘ O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5 O.5 O.5 O.5 O _C = 0 ∘ O.5	Vон		V 2.V	I _{OH} = -24 mA	2						V
$V_{OL} = \begin{cases} V_{CC} = 3 \ V \ to \ 3.6 \ V, & I_{OL} = 100 \ \mu A \\ \hline V_{CC} = 3 \ V & I_{OL} = 16 \ mA \\ \hline I_{OL} = 24 \ mA & 0.5 \\ \hline I_{OL} = 32 \ mA & 0.55 \\ \hline I_{OL} = 48 \ mA & 0.55 \\ \hline I_{OL} = 48 \ mA & 0.55 \\ \hline I_{OL} = 64 \ mA & 0.55 \\ \hline V_{CC} = 3.6 \ V, & V_{I} = V_{CC} \ or \ GND \\ \hline V_{CC} = 0 \ or \ 3.6 \ V, & V_{I} = 5.5 \ V & 10 & 10 \\ \hline V_{I} = 0.5 \ V & V_{I} = 0.5 \ V & 10 & 10 \\ \hline V_{I} = 0.5 \ V & 10 & $			ACC = 3 A	$I_{OH} = -32 \text{ mA}$	T			2			
VOL VCC = 3 V IOL = 24 mA 0.5 VCC = 3 V IOL = 32 mA 0.55			V _{CC} = 3 V to 3.6 V,				0.2			0.2	
Vol				I _{OL} = 16 mA						0.4	
VCC = 3 V	\/~·			I _{OL} = 24 mA			0.5				W
$ \begin{array}{ c c c c c } \hline & I_{OL} = 64 \text{ mA} & 0.55 \\ \hline & V_{CC} = 3.6 \text{ V}, & V_{I} = V_{CC} \text{ or GND} & \pm 1 & \pm 1 \\ \hline & V_{CC} = 0 \text{ or } 3.6 \text{ V}, & V_{I} = 5.5 \text{ V} & 10 & 10 \\ \hline & Data inputs & V_{CC} = 3.6 \text{ V} & V_{I} = 5.5 \text{ V} & 10 & 10 \\ \hline & V_{I} = 0 & -5 & -5 \\ \hline & V_{I} = 0 & -5 & -5 \\ \hline & V_{I} = 0 & -5 & -5 \\ \hline & I_{BHL} & V_{CC} = 3.6 \text{ V} & V_{I} = 0.8 \text{ V} & 76 & 75 \\ \hline & I_{BHL} & V_{CC} = 3 \text{ V}, & V_{I} = 0.8 \text{ V} & 76 & 75 \\ \hline & I_{BHL} & V_{CC} = 3 \text{ V}, & V_{I} = 0.8 \text{ V} & 76 & 75 \\ \hline & I_{BHL} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.0 \text{ V}_{CC} & 500 & 500 \\ \hline & I_{BHD} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.0 \text{ V}_{CC} & -500 & -500 \\ \hline & I_{EXII} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.0 \text{ V}_{CC} & -500 & -500 \\ \hline & I_{CZ} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.5 \text{ V} \text{ to V}_{CC}, \\ \hline & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.8 \text{ V or 2 V} \\ \hline & I_{OZH} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.8 \text{ V or 2 V} \\ \hline & I_{OZL} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.8 \text{ V or 2 V} \\ \hline & I_{OZD} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.8 \text{ V or 2 V} \\ \hline & I_{OZD} & V_{CC} = 3.6 \text{ V}, & 0.0000000000000000000000000000000000$	VOL		V _{CC} = 3 V	I _{OL} = 32 mA						0.5	V
				I _{OL} = 48 mA			0.55				
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			I _{OL} = 64 mA						0.55		
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Control innuts	V _{CC} = 3.6 V,	V _I = V _{CC} or GND			<u>\$</u> ±1			±1	
$\begin{array}{ c c c c c c } \hline Data inputs & V_{CC} = 3.6 \ V & \hline V_{I} = V_{CC} & 1 & 1 & 1 \\ \hline V_{I} = 0 & -5 & -5 & -5 \\ \hline \hline V_{I} = 0 & -5 & -5 & -5 \\ \hline \hline V_{I} = V_{CC} = 0, & V_{I} \text{ or } V_{O} = 0 \text{ to } 4.5 \ V & \pm 100 & \mu \\ \hline \hline V_{IBHL}^{\ddagger} & V_{CC} = 3 \ V, & V_{I} = 0.8 \ V & 76 & 75 & \mu \\ \hline \hline V_{IBHH}^{\$} & V_{CC} = 3 \ V, & V_{I} = 2 \ V & -75 & -75 & \mu \\ \hline \hline V_{IBHLO}^{\$} & V_{CC} = 3.6 \ V, & V_{I} = 0 \text{ to } V_{CC} & 500 & 500 & \mu \\ \hline \hline V_{IBHHO}^{\#} & V_{CC} = 3.6 \ V, & V_{I} = 0 \text{ to } V_{CC} & -500 & -500 & \mu \\ \hline \hline V_{IEX}^{\$} & V_{CC} = 3 \ V, & V_{O} = 0.5 \ V & V_{$		Control inputs	V _{CC} = 0 or 3.6 V,	V _I = 5.5 V		.3	10			10	
$\begin{array}{ c c c c c c } \hline & V_{CC} = 0, & V_{I} \text{ or } V_{O} = 0 \text{ to } 4.5 \text{ V} \\ \hline & I_{BHL}^{\ddagger} & V_{CC} = 3 \text{ V}, & V_{I} = 0.8 \text{ V} & 76 & 75 & \mu \\ \hline & I_{BHH}^{\$} & V_{CC} = 3 \text{ V}, & V_{I} = 0.8 \text{ V} & 76 & 75 & \mu \\ \hline & I_{BHH}^{\$} & V_{CC} = 3 \text{ V}, & V_{I} = 2 \text{ V} & -75 & -75 & \mu \\ \hline & I_{BHLO}^{\$} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & 500 & 500 & \mu \\ \hline & I_{BHHO}^{\#} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & -500 & -500 & \mu \\ \hline & I_{EX}^{\parallel} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & -500 & -500 & \mu \\ \hline & I_{OZ}(PU/PD)^{\rangle} & V_{CC} = 3.6 \text{ V}, & V_{O} = 0.5 \text{ V} \text{ to } V_{CC}, \\ V_{I} = GND \text{ or } V_{CC}, \overline{OE} = \text{ don't care} & \pm 100 & \pm 100 & \mu \\ \hline & I_{OZH} & V_{CC} = 3.6 \text{ V} & V_{O} = 0.5 \text{ V}, \\ V_{I} = 0.8 \text{ V or } 2 \text{ V} & 5 & 5 & \mu \\ \hline & I_{OZL} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0.8 \text{ V or } 2 \text{ V} \\ \hline & I_{OZ} = 0.5 \text{ V}, & V_{I} = 0.8 \text{ V or } 2 \text{ V} \\ \hline & I_{OZ} = 3.6 \text{ V}, & Outputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline & I_{CC} & V_{CC} = 3.6 \text{ V}, & Outputs low & 3.2 & 5.5 & 3.2 & 5 \\ \hline & V_{CC} = 3.6 \text{ V}, Outputs disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 \text{ V}, Other inputs at V_{CC} \text{ or GND} \\ \hline & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, One input at V_{CC} - 0.6 $	Ιį			V _I = 5.5 V		72	10			10	μΑ
$\begin{array}{ c c c c c } \hline l_{Off} & V_{CC} = 0, & V_{I} \text{ or } V_{O} = 0 \text{ to } 4.5 \text{ V} \\ \hline l_{BHL}^{\pm} & V_{CC} = 3 \text{ V}, & V_{I} = 0.8 \text{ V} & 75 & 75 \\ \hline l_{BHH}^{\$} & V_{CC} = 3 \text{ V}, & V_{I} = 2 \text{ V} & -75 & -75 \\ \hline l_{BHLO}^{\$} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & 500 & 500 \\ \hline l_{BHHO}^{\$} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & 500 & 500 \\ \hline l_{EX}^{\parallel} & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & -500 & -500 \\ \hline l_{EX}^{\parallel} & V_{CC} = 3.6 \text{ V}, & V_{O} = 5.5 \text{ V} & 125 & 125 & \mu/2 \\ \hline l_{OZ}(PU/PD)^{\rangle} & V_{CC} \leq 1.2 \text{ V}, V_{O} = 0.5 \text{ V} \text{ to } V_{CC}, \\ V_{I} = \text{GND or } V_{CC}, \overline{\text{OE}} = \text{don't care} \\ \hline l_{OZH} & V_{CC} = 3.6 \text{ V} & V_{O} = 0.5 \text{ V}, \\ V_{I} = 0.8 \text{ V or } 2 \text{ V} & 5 & 5 & \mu/2 \\ \hline l_{CC} & V_{CC} = 3.6 \text{ V}, & 0 \text{ outputs high} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline l_{CC} & V_{CC} = 3.6 \text{ V}, & 0 \text{ outputs high} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline l_{CC} & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, \text{ One input at } V_{CC} - 0.6 \text{ V}, \\ Other inputs at } V_{CC} = 3 \text{ V to } 3.6 \text{ V}, \text{ One input at } V_{CC} - 0.6 \text{ V}, \\ Other inputs at } V_{CC} = GND & 0.4 & 0.4 & m. \\ \hline \end{array}$		Data inputs	V _{CC} = 3.6 V	$V_I = V_{CC}$		15	1			1	
$\begin{array}{ c c c c c c c c c }\hline IBHL^{\pm} & V_{CC} = 3 \ V, & V_{I} = 0.8 \ V & 76 & 75 & \mu \\ \hline IBHHS & V_{CC} = 3 \ V, & V_{I} = 2 \ V & -75 & -75 & \mu \\ \hline IBHLO^{\P} & V_{CC} = 3.6 \ V, & V_{I} = 0 \ to \ V_{CC} & 500 & 500 & \mu \\ \hline IBHHO^{\#} & V_{CC} = 3.6 \ V, & V_{I} = 0 \ to \ V_{CC} & -500 & -500 & \mu \\ \hline IEX I & V_{CC} = 3 \ V, & V_{O} = 5.5 \ V & 125 & 125 & \mu \\ \hline IOZ(PU/PD)^{*} & V_{CC} \le 1.2 \ V, \ V_{O} = 0.5 \ V \ to \ V_{CC}, \\ V_{I} = GND \ or \ V_{CC}, \ OE = don't \ care & \pm 100 & \pm 100 & \mu \\ \hline IOZH & V_{CC} = 3.6 \ V & V_{I} = 0.8 \ V \ or \ 2 \ V & -5 & -5 & \mu \\ \hline IOZL & V_{CC} = 3.6 \ V, & V_{I} = 0.8 \ V \ or \ 2 \ V & -5 & -5 & \mu \\ \hline IOZC & V_{I} = 0.8 \ V \ or \ 2 \ V & 0.04 & 0.4 & 0.4 \\ \hline IOZC & V_{I} = V_{CC} \ or \ GND & Other \ inputs \ at \ V_{CC} \ or \ GND & 0.4 & 0.4 & 0.4 \\ \hline \end{array}$				V _I = 0		2	-5		•	-5	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	l _{off}		$V_{CC} = 0$,	V_{I} or $V_{O} = 0$ to 4.5 V		5				±100	μΑ
$ \begin{array}{ c c c c c } \hline \text{IBHLO}^{\P} & V_{\text{CC}} = 3.6 \text{ V}, & V_{\text{I}} = 0 \text{ to V}_{\text{CC}} & 500 & 500 & \mu \\ \hline \hline \text{IBHHO}^{\#} & V_{\text{CC}} = 3.6 \text{ V}, & V_{\text{I}} = 0 \text{ to V}_{\text{CC}} & -500 & -500 & \mu \\ \hline \hline \text{IEX} & V_{\text{CC}} = 3 \text{ V}, & V_{\text{O}} = 5.5 \text{ V} & 125 & 125 & \mu \\ \hline \hline \text{IOZ(PU/PD)}^{$^{\times}$} & V_{\text{CC}}^{$^{\times}$} = 4.2 \text{ V}, V_{\text{O}} = \frac{0.5}{0.5} \text{ V to V}_{\text{CC}}, \\ V_{\text{I}} = \text{GND or V}_{\text{CC}}, \overline{\text{OE}} = \text{don't care} & \pm 100 & \pm 100 & \mu \\ \hline \hline \text{IOZH} & V_{\text{CC}} = 3.6 \text{ V} & V_{\text{O}} = 3 \text{ V}, \\ V_{\text{I}} = 0.8 \text{ V or 2 V} & 5 & 5 & 5 \\ \hline \text{IOZL} & V_{\text{CC}} = 3.6 \text{ V} & V_{\text{O}} = 0.5 \text{ V}, \\ V_{\text{I}} = 0.8 \text{ V or 2 V} & -5 & -5 & \mu \\ \hline \text{ICC} & V_{\text{CC}} = 3.6 \text{ V}, & Outputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \text{IOZL} & V_{\text{CC}} = 3.6 \text{ V}, & Outputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \text{Outputs low} & 3.2 & 5.5 & 3.2 & 5 \\ \hline \text{Outputs disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0$	I _{BHL} ‡		V _{CC} = 3 V,	V _I = 0.8 V	75			75			μΑ
$ \begin{array}{ c c c c c } \hline \text{IBHLO}^{\P} & V_{\text{CC}} = 3.6 \text{ V}, & V_{\text{I}} = 0 \text{ to V}_{\text{CC}} & 500 & 500 & \mu \\ \hline \hline \text{IBHHO}^{\#} & V_{\text{CC}} = 3.6 \text{ V}, & V_{\text{I}} = 0 \text{ to V}_{\text{CC}} & -500 & -500 & \mu \\ \hline \hline \text{IEX} & V_{\text{CC}} = 3 \text{ V}, & V_{\text{O}} = 5.5 \text{ V} & 125 & 125 & \mu \\ \hline \hline \text{IOZ(PU/PD)}^{$^{\times}$} & V_{\text{CC}}^{$^{\times}$} = 4.2 \text{ V}, V_{\text{O}} = \frac{0.5}{0.5} \text{ V to V}_{\text{CC}}, \\ V_{\text{I}} = \text{GND or V}_{\text{CC}}, \overline{\text{OE}} = \text{don't care} & \pm 100 & \pm 100 & \mu \\ \hline \hline \text{IOZH} & V_{\text{CC}} = 3.6 \text{ V} & V_{\text{O}} = 3 \text{ V}, \\ V_{\text{I}} = 0.8 \text{ V or 2 V} & 5 & 5 & 5 \\ \hline \text{IOZL} & V_{\text{CC}} = 3.6 \text{ V} & V_{\text{O}} = 0.5 \text{ V}, \\ V_{\text{I}} = 0.8 \text{ V or 2 V} & -5 & -5 & \mu \\ \hline \text{ICC} & V_{\text{CC}} = 3.6 \text{ V}, & Outputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \text{IOZL} & V_{\text{CC}} = 3.6 \text{ V}, & Outputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \text{Outputs low} & 3.2 & 5.5 & 3.2 & 5 \\ \hline \text{Outputs disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline \hline \text{OUTPUTS disabled} & 0.07 & 0.1 & 0$	I _{BHH} §		V _{CC} = 3 V,	V _I = 2 V	-75			-75			μΑ
$\begin{array}{ c c c c c c c c c }\hline & BBHHO^\# & V_{CC} = 3.6 \text{ V}, & V_{I} = 0 \text{ to } V_{CC} & -500 & -500 & \mu \\ \hline & I_{EX} & V_{CC} = 3 \text{ V}, & V_{O} = 5.5 \text{ V} & 125 & 125 & \mu \\ \hline & V_{CC} \leq 1.2 \text{ V}, V_{O} = 0.5 \text{ V to } V_{CC}, \\ V_{I} = \text{GND or } V_{CC}, \overline{\text{OE}} = \text{don't care} & \pm 100 & \pm 100 & \mu \\ \hline & I_{OZH} & V_{CC} = 3.6 \text{ V} & V_{O} = 3 \text{ V}, \\ V_{I} = 0.8 \text{ V or } 2 \text{ V} & 5 & 5 & 5 \\ \hline & I_{OZL} & V_{CC} = 3.6 \text{ V} & V_{O} = 0.5 \text{ V}, \\ V_{I} = 0.8 \text{ V or } 2 \text{ V} & -5 & -5 & \mu \\ \hline & I_{CC} & V_{CC} = 3.6 \text{ V}, & 0utputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline & I_{O} = 0, & 0utputs high & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline & I_{O} = 0, & 0utputs low & 3.2 & 5.5 & 3.2 & 5 \\ \hline & I_{O} = 0, & 0utputs disabled & 0.07 & 0.1 & 0.07 & 0.1 \\ \hline & I_{CC} & V_{CC} = 3 \text{ V to } 3.6 \text{ V}, \text{ One input at } V_{CC} - 0.6 \text{ V}, \\ \hline & Other inputs at V_{CC} \text{ or GND} & 0.4 & 0.4 & m. \end{array}$		Ī		V _I = 0 to V _{CC}	500			500			μΑ
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	^Т ВННО [‡]	#		V _I = 0 to V _{CC}	-500			-500			μΑ
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			V _{CC} = 3 V,	V _O = 5.5 V			125			125	μΑ
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	I _{OZ(PU}	l/PD)☆	$V_{CC} \le 1.2 \text{ V}, V_{O} = 0.5 \text{ V}$ V _I = GND or V _{CC} , OE =	/ to V _{CC} , don't care			±100			±100	μА
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				V _O = 3 V,				†		_	_
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	IOZH		ACC = 3.6 A	V _I = 0.8 V or 2 V			5			5	μΑ
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				V _O = 0.5 V,	1	-	_			_	
	IOZL		ACC = 3.6 A	V _I = 0.8 V or 2 V			-5			-5	μΑ
			V00 - 36 V	Outputs high		0.07	0.1		0.07	0.1	
$V_{\rm I} = V_{\rm CC} \text{ or GND} \qquad \text{Outputs disabled} \qquad 0.07 \qquad 0.1 \qquad 0.07 \qquad 0.1$ $V_{\rm CC} = 3 \text{ V to } 3.6 \text{ V, One input at } V_{\rm CC} - 0.6 \text{ V,} \qquad 0.4 \qquad 0.4 \qquad 0.4$ $Other \text{ inputs at } V_{\rm CC} \text{ or GND} \qquad 0.4 \qquad 0.4$	l _{CC}			Outputs low		3.2	5.5		3.2	5	mA
Other inputs at V _{CC} or GND				Outputs disabled	1	0.07	0.1		0.07	0.1	
C_i $V_{CC} = 3.3 \text{ V}, V_I = 3.3 \text{ V or } 0$ 3.5 pt	∆lcc□						0.4			0.4	mA
	Ci		V _{CC} = 3.3 V,	V _I = 3.3 V or 0	1	3.5			3.5		pF
$V_{CC} = 3.3 \text{ V}, \qquad V_{O} = 3.3 \text{ V or } 0$ 6 pt			i e			6			6		pF

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

[□]This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.



[‡] The bus-hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_{IN} to GND and then raising it to V_{IL} max.

[§] The bus-hold circuit can source at least the minimum high sustaining current at VIH min. IBHH should be measured after raising VIN to VCC and then lowering it to VIH min.

 $[\]P$ An external driver must source at least $I_{\mbox{\footnotesize{BHLO}}}$ to switch this node from low to high.

[#]An external driver must sink at least I_{BHHO} to switch this node from high to low.

 $[\]parallel$ Current into an output in the high state when $V_O > V_{CC}$

^{*}High-impedance state during power up or power down

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switching characteristics over recommended operating free-air temperature range, C_L = 30 pF, V_{CC} = 2.5 V \pm 0.2 V (unless otherwise noted) (see Figure 1)

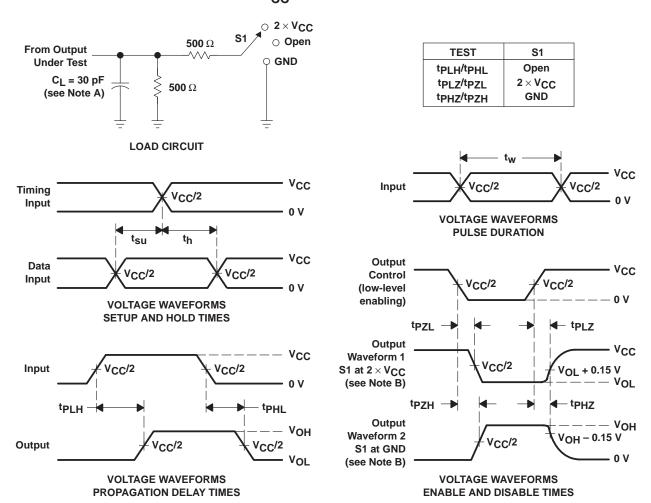
PARAMETER	FROM	то	SN54ALVTH16240	SN74ALVTI	UNIT	
PARAMETER	(INPUT)	(OUTPUT)	MIN MAX	MIN	MAX	UNII
^t PLH	_	V	1 4 3.8	1	3.7	no
t _{PHL}	A	Ť	1 4 3.6	1	3.5	ns
^t PZH	OE	v	1. 5.4	1	5.3	ns
t _{PZL}	OE OE	Ť	4.3	1	4.2	115
^t PHZ	OE	v	S 1 4.8	1	4.7	ns
tPLZ]	'	1 3.6	1	3.5	113

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF, V_{CC} = 3.3 V \pm 0.3 V (unless otherwise noted) (see Figure 2)

PARAMETER	FROM	ТО	SN54ALVTI	116240	SN74ALVT	UNIT	
	(INPUT)	(OUTPUT)	MIN	MAX	MIN	MAX	ONIT
^t PLH	۸	V	1	3.4	1	3.3	ns
^t PHL	А	'	1 4	3.3	1	3.2	115
^t PZH	-	V	1,0	3.8	1	3.7	ns
t _{PZL}	OE	'	3	3.2	1	3.1	115
^t PHZ	<u>OE</u>	V	P.4	5.1	1.5	5	ns
t _{PLZ}	OE	ı ı	1.4	4.2	1.5	4.1	113

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PARAMETER MEASUREMENT INFORMATION V_{CC} = 2.5 V \pm 0.2 V



NOTES: A. C_L includes probe and jig capacitance.

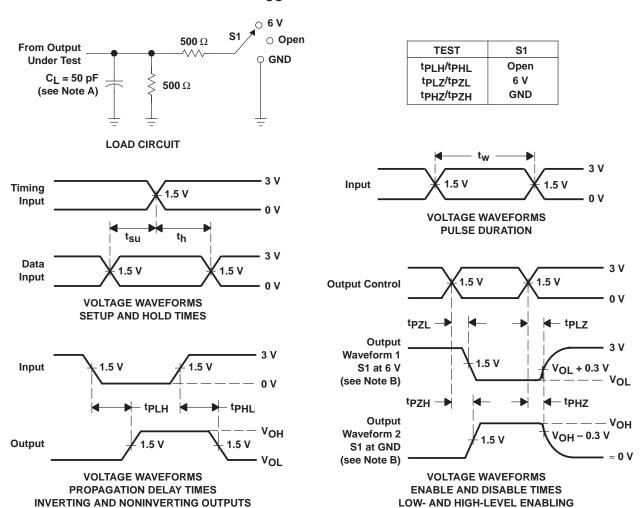
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_Q = 50~\Omega$, $t_f \leq$ 2 ns, $t_f \leq$ 2 ns.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms



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PARAMETER MEASUREMENT INFORMATION V_{CC} = 3.3 V \pm 0.3 V



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.

Figure 2. Load Circuit and Voltage Waveforms

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