

# SN54LVT2952, SN74LVT2952 3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SCBS152E – MAY 1992 – REVISED JULY 1995

- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low-Static Power Dissipation
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Support Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ( $C = 200$  pF,  $R = 0$ )
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Bus-Hold Data Inputs Eliminate the Need for External Pullup Resistors
- Support Live Insertion
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Ceramic (JT) DIPs

## description

These octal bus transceivers and registers are designed specifically for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

The 'LVT2952 consist of two 8-bit back-to-back registers that store data flowing in both directions between two bidirectional buses. Data on the A or B bus is stored in the registers on the low-to-high transition of the clock (CLKAB or CLKBA) input provided that the clock-enable ( $\overline{\text{CLKENAB}}$  or  $\overline{\text{CLKENBA}}$ ) input is low. Taking the output-enable ( $\overline{\text{OEAB}}$  or  $\overline{\text{OEBA}}$ ) input low accesses the data on either port.

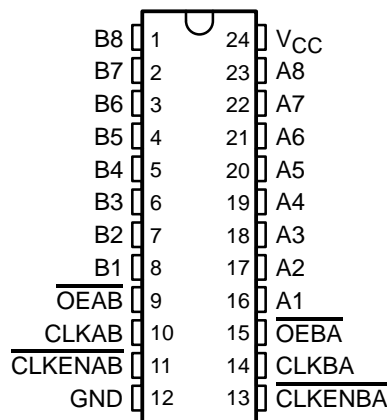
Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

To ensure the high-impedance state during power up or power down,  $\overline{\text{OE}}$  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.

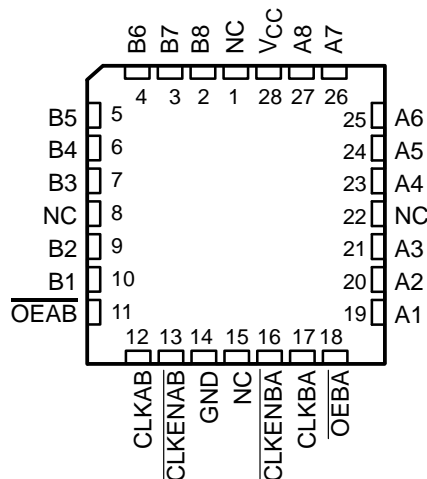
The SN74LVT2952 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54LVT2952 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74LVT2952 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54LVT2952 . . . JT PACKAGE  
SN74LVT2952 . . . DB, DW, OR PW PACKAGE  
(TOP VIEW)



SN54LVT2952 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection



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.

UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information 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

SN54LVT2952, SN74LVT2952  
3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS  
WITH 3-STATE OUTPUTS

SCBS152E – MAY 1992 – REVISED JULY 1995

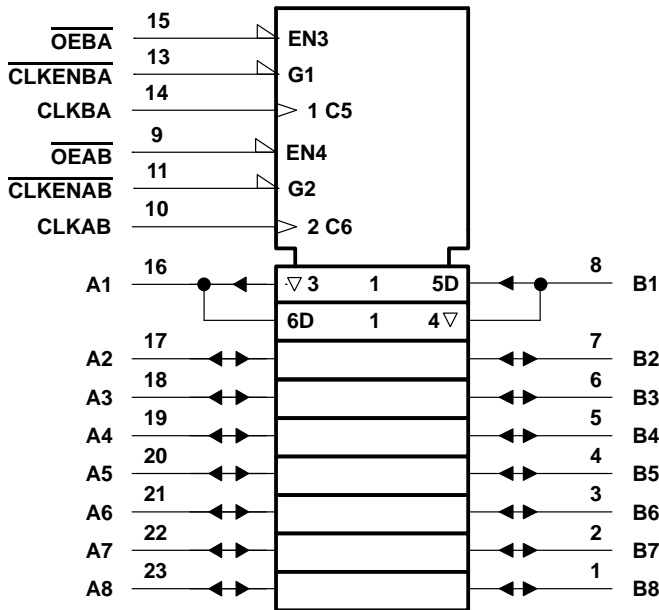
FUNCTION TABLE†

INPUTS				OUTPUT
CLKENAB	CLKAB	OEAB	A	B
H	X	L	X	B <sub>0</sub> ‡
X	H or L	L	X	B <sub>0</sub> ‡
L	↑	L	L	L
L	↑	L	H	H
X	X	H	X	Z

† A-to-B data flow is shown; B-to-A data flow is similar but uses  $\overline{\text{CLKENBA}}$ ,  $\text{CLKBA}$ , and  $\overline{\text{OEBA}}$ .

‡ Level of B before the indicated steady-state input conditions were established

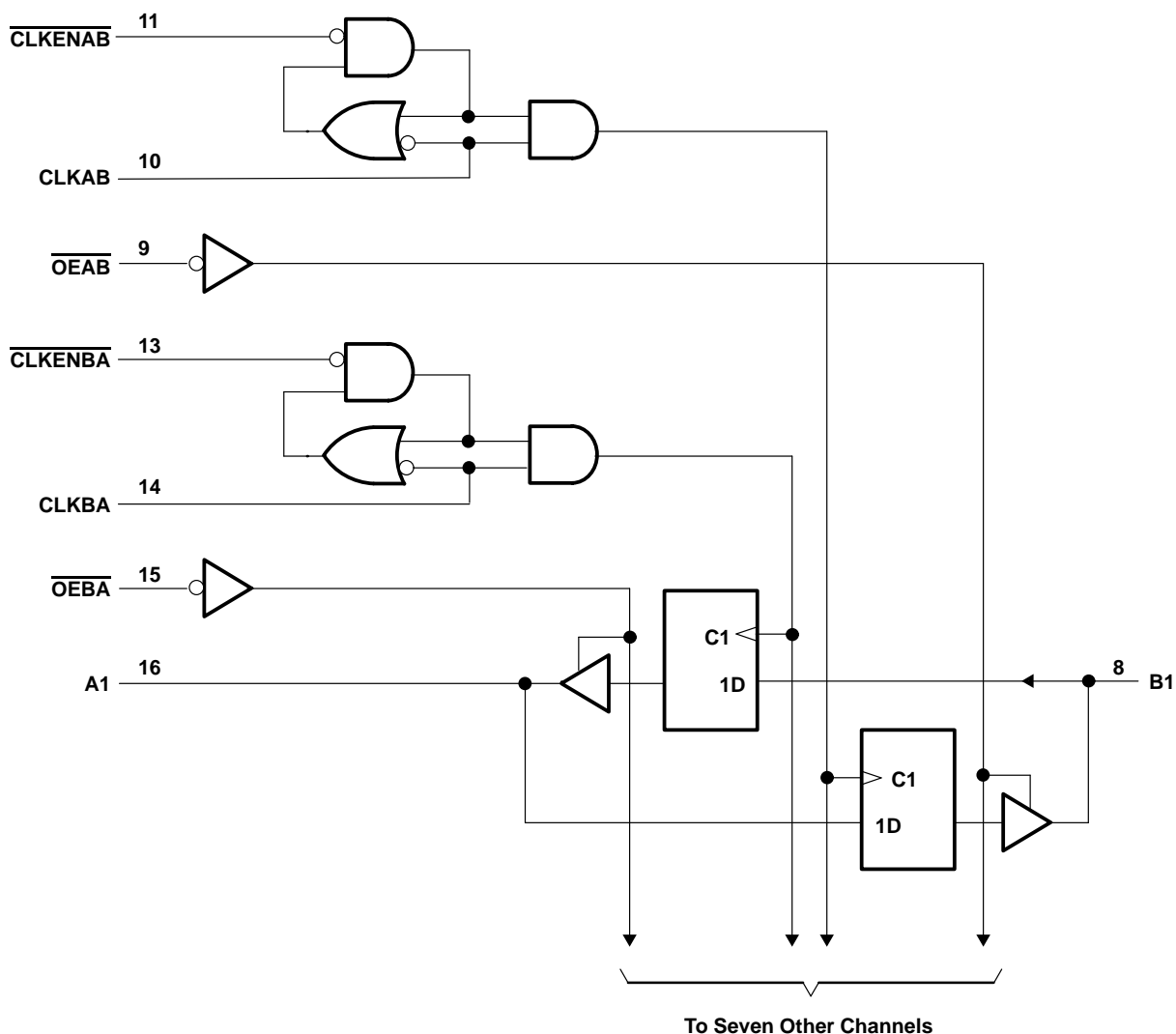
logic symbol§



§ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the DB, DW, JT, and PW packages.

SN54LVT2952, SN74LVT2952  
3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS  
WITH 3-STATE OUTPUTS  
SCBS152E – MAY 1992 – REVISED JULY 1995

logic diagram (positive logic)



Pin numbers shown are for the DB, DW, JT, and PW packages.

# SN54LVT2952, SN74LVT2952

## 3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

SCBS152E – MAY 1992 – REVISED JULY 1995

#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 4.6 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, $V_O$ (see Note 1)	–0.5 V to 7 V
Current into any output in the low state, $I_O$ : SN54LVT2952	96 mA
SN74LVT2952	128 mA
Current into any output in the high state, $I_O$ (see Note 2): SN54LVT2952	48 mA
SN74LVT2952	64 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–50 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3): DB package	0.65 W
DW package	1.7 W
PW package	0.7 W
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> 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 current flows only when the output is in the high state and  $V_O > V_{CC}$ .  
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)

		SN54LVT2952		SN74LVT2952		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	2.7	3.6	2.7	3.6	V
$V_{IH}$	High-level input voltage	2		2		V
$V_{IL}$	Low-level input voltage		0.8		0.8	V
$V_I$	Input voltage		5.5		5.5	V
$I_{OH}$	High-level output current		–24		–32	mA
$I_{OL}$	Low-level output current		48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

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

# SN54LVT2952, SN74LVT2952

## 3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

SCBS152E – MAY 1992 – REVISED JULY 1995

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

PARAMETER	TEST CONDITIONS		SN54LVT2952			SN74LVT2952			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$	$V_{CC} = 2.7\text{ V}$ , $I_I = -18\text{ mA}$				-1.2			-1.2	V
$V_{OH}$	$V_{CC} = \text{MIN to MAX}^\ddagger$ , $I_{OH} = -100\text{ }\mu\text{A}$		$V_{CC}-0.2$			$V_{CC}-0.2$			V
	$V_{CC} = 2.7\text{ V}$ , $I_{OH} = -8\text{ mA}$		2.4			2.4			
	$V_{CC} = 3\text{ V}$	$I_{OH} = -24\text{ mA}$	2						
		$I_{OH} = -32\text{ mA}$				2			
$V_{OL}$	$V_{CC} = 2.7\text{ V}$	$I_{OL} = 100\text{ }\mu\text{A}$			0.2			0.2	V
		$I_{OL} = 24\text{ mA}$			0.5			0.5	
	$V_{CC} = 3\text{ V}$	$I_{OL} = 16\text{ mA}$			0.4			0.4	
		$I_{OL} = 32\text{ mA}$			0.5			0.5	
		$I_{OL} = 48\text{ mA}$			0.55				
		$I_{OL} = 64\text{ mA}$						0.55	
$I_I$	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}\text{ or GND}$	Control inputs			$\pm 1$			$\pm 1$	$\mu\text{A}$
	$V_{CC} = 0\text{ or MAX}^\ddagger$ , $V_I = 5.5\text{ V}$				10			10	
	$V_{CC} = 3.6\text{ V}$	$V_I = 5.5\text{ V}$			20			20	
		$V_I = V_{CC}$			5			5	
		$V_I = 0$			-10			-10	
$I_{off}$	$V_{CC} = 0$ , $V_I\text{ or }V_O = 0\text{ to }4.5\text{ V}$							$\pm 100$	$\mu\text{A}$
$I_{I(\text{hold})}$	$V_{CC} = 3\text{ V}$	$V_I = 0.8\text{ V}$	A or B ports		75			75	$\mu\text{A}$
		$V_I = 2\text{ V}$			-75			-75	
$I_{OZH}$	$V_{CC} = 3.6\text{ V}$ , $V_O = 3\text{ V}$				1			1	$\mu\text{A}$
$I_{OZL}$	$V_{CC} = 3.6\text{ V}$ , $V_O = 0.5\text{ V}$				-1			-1	$\mu\text{A}$
$I_{CC}$	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}\text{ or GND}$	$I_O = 0$ , Outputs high			0.13 0.19			0.13 0.19	mA
		Outputs low			8.8 12			8.8 12	
		Outputs disabled			0.13 0.19			0.13 0.19	
$\Delta I_{CC}^\S$	$V_{CC} = 3\text{ V to }3.6\text{ V}$ , One input at $V_{CC} - 0.6\text{ V}$ , Other inputs at $V_{CC}\text{ or GND}$				0.2			0.2	mA
$C_i$	$V_I = 3\text{ V or }0$				4.5			4.5	pF
$C_{io}$	$V_O = 3\text{ V or }0$				11.5			11.5	pF

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

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

§ Unused terminals at  $V_{CC}$  or GND

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

# SN54LVT2952, SN74LVT2952

## 3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

SCBS152E – MAY 1992 – REVISED JULY 1995

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

			SN54LVT2952				SN74LVT2952				UNIT		
			$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$				
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
$f_{\text{clock}}$	Clock frequency						150		150		MHz		
$t_w$	Pulse duration		CLK high				3.3		3.3		ns		
			CLK low				3.3		3.3				
$t_{\text{su}}$	Setup time, A or B before CLK↑		Data high		2.6		2.9		2.5		2.8		ns
			Data low		2.6		3.1		2.5		3		
	Setup time, $\overline{\text{CE}}$ before CLK↑		Data high		0.9		0.8		0.9		0.8		
			Data low		2.5		2.7		2.4		2.7		
$t_h$	Hold time, A or B after CLK↑		1.5		0.7		1.5		0.7		ns		
	Hold time, $\overline{\text{CE}}$ after CLK↑		2.6		2.6		2.5		2.6				

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

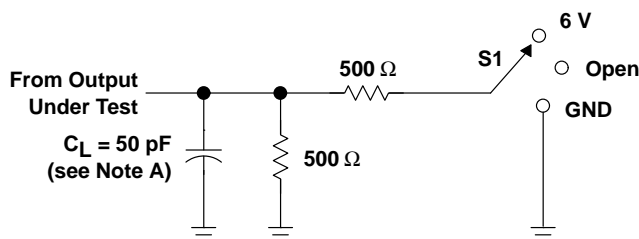
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVT2952				SN74LVT2952				UNIT	
			V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 2.7 V			
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
f <sub>max</sub>							150			150	MHz	
t <sub>PLH</sub>	CLKBA or CLKAB	A or B	1.3	6.4	2.7	7.4	1.3	3.6	6.1	2.7	7.1	ns
t <sub>PHL</sub>			1.8	6.1	2.7	7	1.8	3.7	6	2.7	6.9	
t <sub>PZH</sub>	$\overline{\text{OEBA}}$ or $\overline{\text{OEAB}}$	A or B	1	6.3	2.6	7.3	1	3.2	5.6	2.6	6.7	ns
t <sub>PZL</sub>			1.1	6.6	2.9	8.2	1.2	3.2	6.5	2.9	8	
t <sub>PHZ</sub>	$\overline{\text{OEBA}}$ or $\overline{\text{OEAB}}$	A or B	1	7	2.7	7.6	1	4.1	6.3	2.7	6.9	ns
t <sub>PLZ</sub>			1.6	5.8	1.7	6	1.6	3.3	5.1	1.8	5.3	

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

# SN54LVT2952, SN74LVT2952 3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

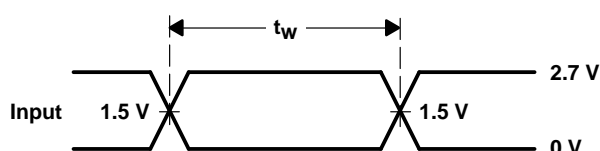
SCBS152E – MAY 1992 – REVISED JULY 1995

## PARAMETER MEASUREMENT INFORMATION

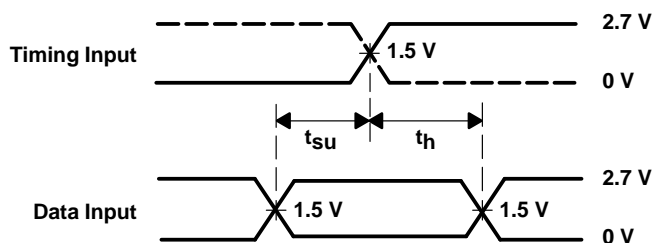


TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND

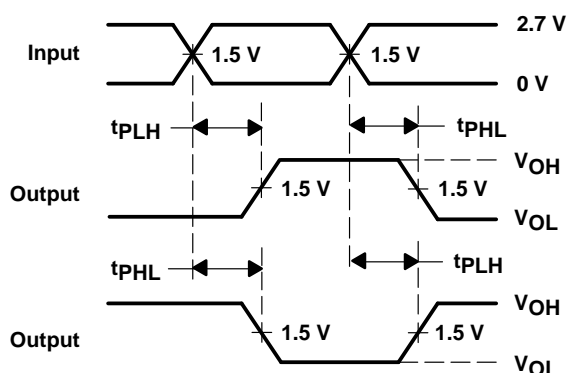
LOAD CIRCUIT FOR OUTPUTS



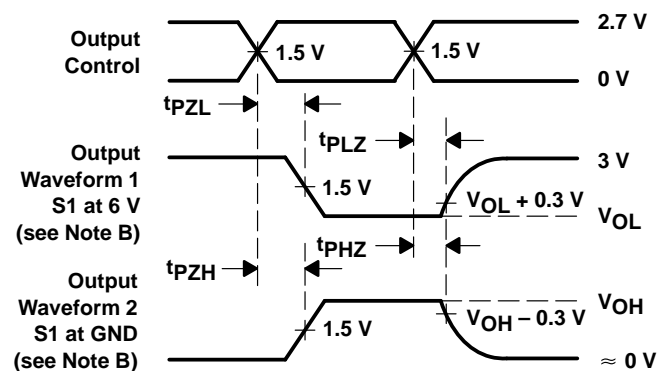
VOLTAGE WAVEFORMS  
PULSE DURATION



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.

Figure 1. Load Circuit and Voltage Waveforms





## **IMPORTANT NOTICE**

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software 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, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.**

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

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

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI 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.