

54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

- Members of the Texas Instruments *Widebus*™ Family
- 3-State True Outputs
- Flow-Through Architecture Optimizes PCB Layout
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) Package Using 25-mil Center-to-Center Pin Spacings and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Pin Spacings

description

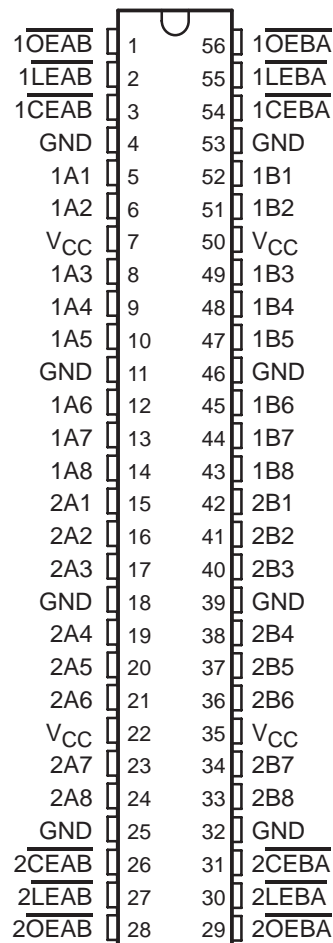
The 'AC16543 are 16-bit registered transceivers that contain two sets of D-type latches for temporary storage of data flowing in either direction. They can be used as two 8-bit transceivers or one 16-bit transceiver. Separate latch-enable (\overline{LEAB} or \overline{LEBA}) and output-enable (\overline{OEAB} or \overline{OEBA}) inputs are provided for each register to permit independent control in either direction of data flow.

The A-to-B enable (\overline{CEAB}) input must be low to enter data from A or to output data to B. Having \overline{CEAB} low and \overline{LEAB} low makes the A-to-B latches transparent; a subsequent low-to-high transition at \overline{LEAB} puts the A latches in the storage mode. Data flow from B to A is similar, but requires using the \overline{CEBA} , \overline{LEBA} , and \overline{OEBA} inputs.

The 74AC16543 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54AC16543 is characterized for operation over the full military temperature range of -55°C to 125°C. The 74AC16543 is characterized for operation from -40°C to 85°C.

54AC16543 . . . WD PACKAGE
74AC16543 . . . 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.

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
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

Copyright © 1996, Texas Instruments Incorporated

54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

FUNCTION TABLE†
(each 8-bit section)

INPUTS				OUTPUT
$\overline{\text{CEAB}}$	$\overline{\text{LEAB}}$	$\overline{\text{OEAB}}$	A	B
H	X	X	X	Z
X	X	H	X	Z
L	H	L	X	B_0^\ddagger
L	L	L	L	L
L	L	L	H	H

† A-to-B data flow is shown; B-to-A flow control is the same except that it uses CEBA, LEBA, and OEBA.

‡ Output level before the indicated steady-state input conditions were established

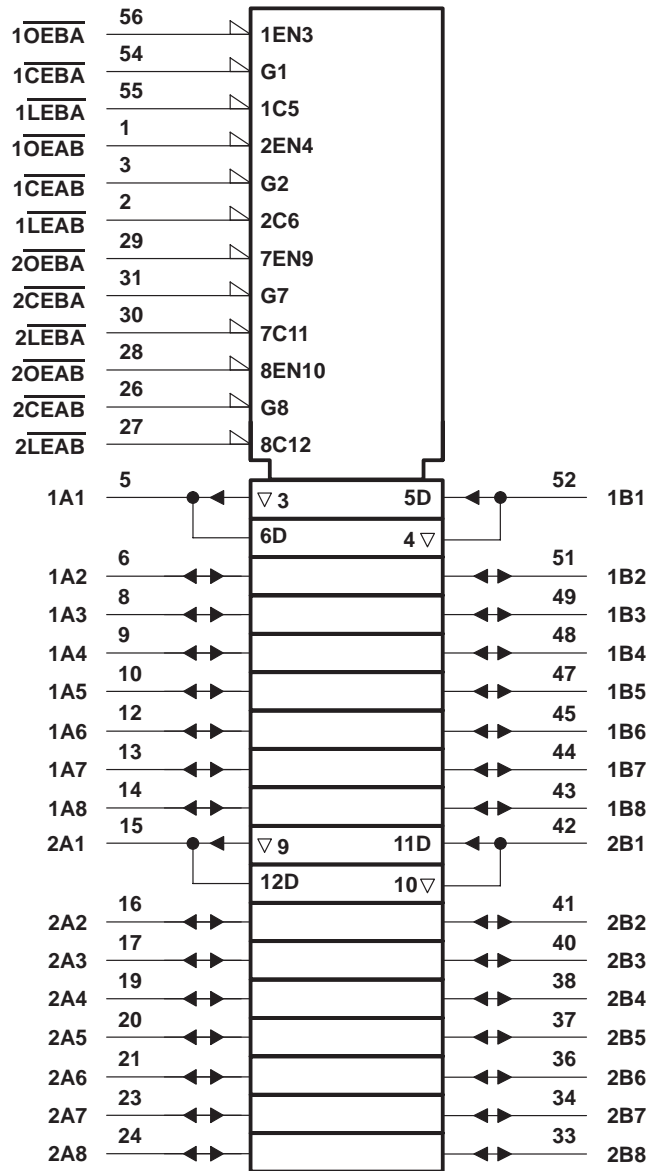


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

logic symbol†



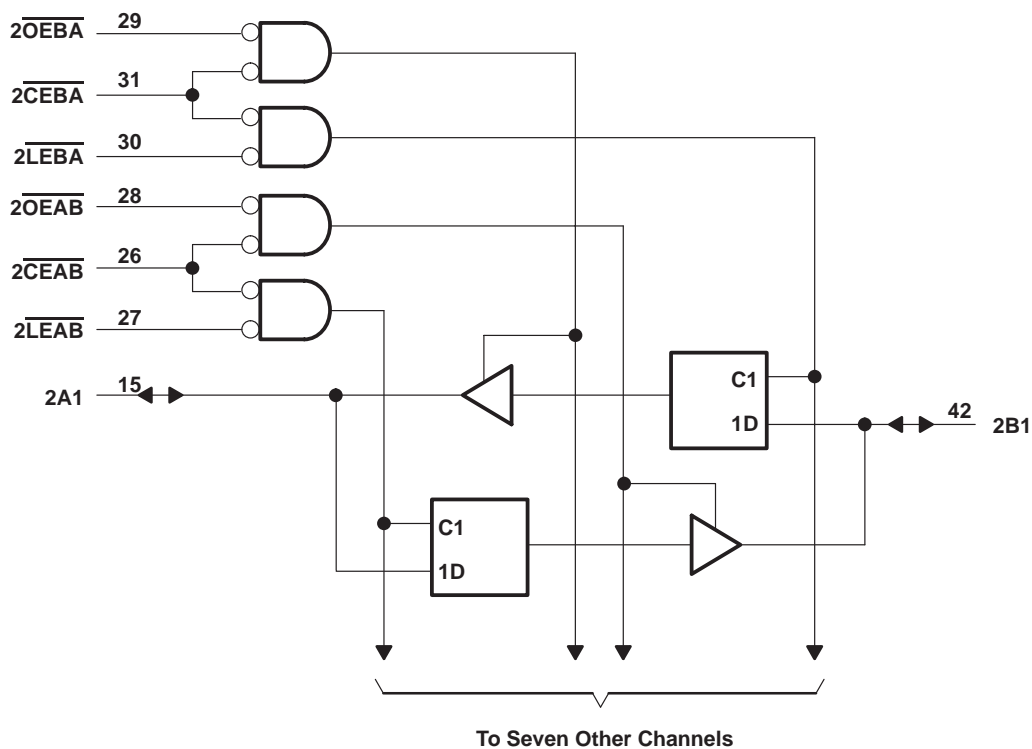
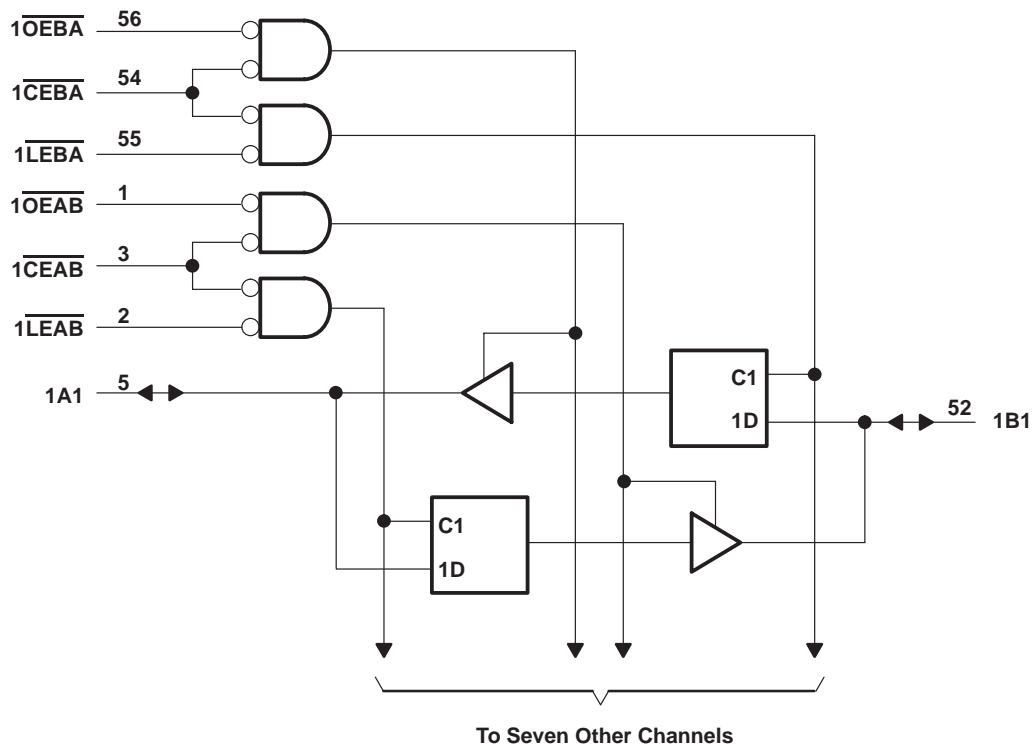
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

logic diagram (positive logic)



54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

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 Note 1)	–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})	±50 mA
Continuous current through V_{CC} or GND	±400 mA
Maximum power package dissipation at $T_A = 55^\circ\text{C}$ (in still air)(see Note 2): DL package	1.4 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. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

recommended operating conditions (see Note 3)

		54AC16543			74AC16543			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	3	5	5.5	3	5	5.5	V
V_{IH}	High-level input voltage	$V_{CC} = 3$ V		2.1	$V_{CC} = 3$ V		2.1	V
		$V_{CC} = 4.5$ V		3.15	$V_{CC} = 4.5$ V		3.15	
		$V_{CC} = 5.5$ V		3.85	$V_{CC} = 5.5$ V		3.85	
V_{IL}	Low-level input voltage	$V_{CC} = 3$ V			$V_{CC} = 3$ V		0.9	V
		$V_{CC} = 4.5$ V			$V_{CC} = 4.5$ V		1.35	
		$V_{CC} = 5.5$ V			$V_{CC} = 5.5$ 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	$V_{CC} = 3$ V			$V_{CC} = 3$ V		–4	mA
		$V_{CC} = 4.5$ V			$V_{CC} = 4.5$ V		–24	
		$V_{CC} = 5.5$ V			$V_{CC} = 5.5$ V		–24	
I_{OL}	Low-level output current	$V_{CC} = 3$ V			$V_{CC} = 3$ V		12	mA
		$V_{CC} = 4.5$ V			$V_{CC} = 4.5$ V		24	
		$V_{CC} = 5.5$ V			$V_{CC} = 5.5$ V		24	
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	0		10	ns/V
T_A	Operating free-air temperature	–55		125	–40		85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



54AC16543, 74AC16543
16-BIT REGISTERED TRANSCEIVERS
WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			54AC16543		74AC16543		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 μA	3 V	2.9			2.9		2.9	V	
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	I _{OH} = -4 mA	3 V	2.58			2.48		2.48		
		4.5 V	3.94			3.8		3.8		
		5.5 V	4.94			4.8		4.8		
I _{OH} = -75 mA†	5.5 V				3.85		3.85			
V _{OL}	I _{OL} = 50 μA	3 V			0.1		0.1	0.1	V	
		4.5 V			0.1		0.1	0.1		
		5.5 V			0.1		0.1	0.1		
	I _{OL} = 12 mA	3 V			0.36		0.44	0.44		
		4.5 V			0.36		0.44	0.44		
	I _{OL} = 24 mA	5.5 V			0.36		0.44	0.44		
		5.5 V				1.65		1.65		
I _I	Control inputs	V _I = V _{CC} or GND	5.5 V		±0.1		±1	±1	μA	
I _{OZ}	A or B ports	V _O = V _{CC} or GND	5.5 V		±0.5		±5	±5	μA	
I _{CC}		V _I = V _{CC} or GND, I _O = 0	5.5 V		8		80	80	μA	
C _i	Control inputs	V _I = V _{CC} or GND	5 V		3				pF	
C _{io}	A or B ports	V _O = V _{CC} or GND	5 V		11.5				pF	

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

timing requirements over recommended operating free-air temperature range,
V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

		T _A = 25°C		54AC16543		74AC16543		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration, $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ low	5		5		5		ns
t _{su}	Setup time, data before $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ ↑	1		1		1		ns
t _h	Hold time, data after $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ ↑	3.5		3.5		3.5		ns

timing requirements over recommended operating free-air temperature range,
V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

		T _A = 25°C		54AC16543		74AC16543		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration, $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ low	4		4		4		ns
t _{su}	Setup time, data before $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ ↑	1		1		1		ns
t _h	Hold time, data after $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ ↑	3		3		3		ns

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



54AC16543, 74AC16543 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS125B – MARCH 1990 – REVISED APRIL 1996

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC16543		74AC16543		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	3.2	8.6	12.5	3.2	13.9	3.2	13.9	ns
t_{PLH}	\overline{LEBA} or \overline{LEAB}	A or B	4.6	11.8	16	4.6	18	4.6	18	ns
t_{PHL}			4.6	11.3	15.4	4.6	16.8	4.6	16.8	
t_{PZH}	\overline{CEBA} or \overline{CEAB}	A or B	3.7	10	14	3.7	15.8	3.7	15.8	ns
t_{PZL}			4.6	12.7	17.7	4.6	19.8	4.6	19.8	
t_{PHZ}	\overline{OEBA} or \overline{OEAB}	A or B	4.7	7.8	10.1	4.7	10.8	4.7	10.8	ns
t_{PLZ}			4.3	7.3	9.7	4.3	10.4	4.3	10.4	
t_{PZH}	\overline{OEBA} or \overline{OEAB}	A or B	3.5	9.7	13.9	3.5	15.7	3.5	15.7	ns
t_{PZL}			4.5	12.5	17.6	4.5	19.7	4.5	19.7	
t_{PHZ}	\overline{OEBA} or \overline{OEAB}	A or B	4.8	7.5	9.6	4.8	10.2	4.8	10.2	ns
t_{PLZ}			4.1	6.8	9.2	4.1	9.8	4.1	9.8	

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC16543		74AC16543		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	2.7	5.2	7.8	2.7	8.8	2.7	8.8	ns
t_{PHL}			2.9	5.5	8.3	2.9	9.2	2.9	9.2	
t_{PLH}	\overline{LEBA} or \overline{LEAB}	A or B	3.9	7	10.2	3.9	11.5	3.9	11.5	ns
t_{PHL}			3.7	6.7	9.9	3.7	10.9	3.7	10.9	
t_{PZH}	\overline{CEBA} or \overline{CEAB}	A or B	3	5.8	8.7	3	9.8	3	9.8	ns
t_{PZL}			3.6	6.7	10.3	3.6	11.5	3.6	11.5	
t_{PHZ}	\overline{OEBA} or \overline{OEAB}	A or B	4.2	6.5	8.7	4.2	9.3	4.2	9.3	ns
t_{PLZ}			4	5.9	8.2	4	8.8	4	8.8	
t_{PZH}	\overline{OEBA} or \overline{OEAB}	A or B	2.9	5.6	8.5	2.9	9.6	2.9	9.6	ns
t_{PZL}			3.5	6.6	10.2	3.5	11.3	3.5	11.3	
t_{PHZ}	\overline{OEBA} or \overline{OEAB}	A or B	4.2	6.3	8.4	4.2	8.9	4.2	8.9	ns
t_{PLZ}			3.7	5.6	7.9	3.7	8.4	3.7	8.4	

operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per transceiver	Outputs enabled	53	pF
		Outputs disabled	11	

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

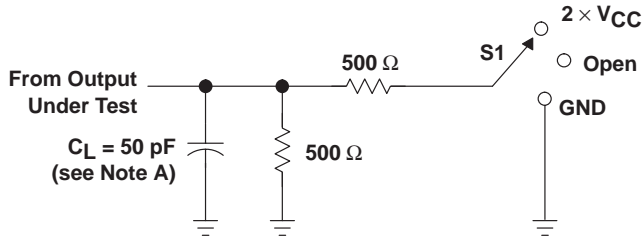


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
 POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

54AC16543, 74AC16543
16-BIT REGISTERED TRANSCEIVERS
WITH 3-STATE OUTPUTS

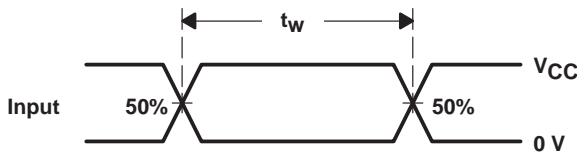
SCAS125B – MARCH 1990 – REVISED APRIL 1996

PARAMETER MEASUREMENT INFORMATION

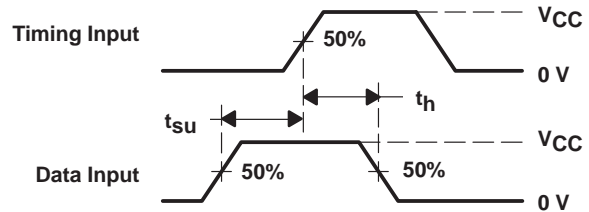


LOAD CIRCUIT

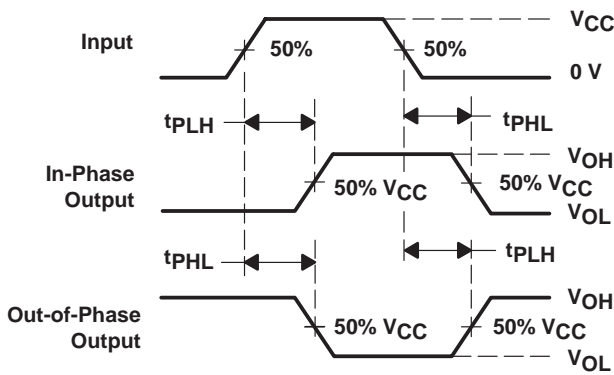
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND



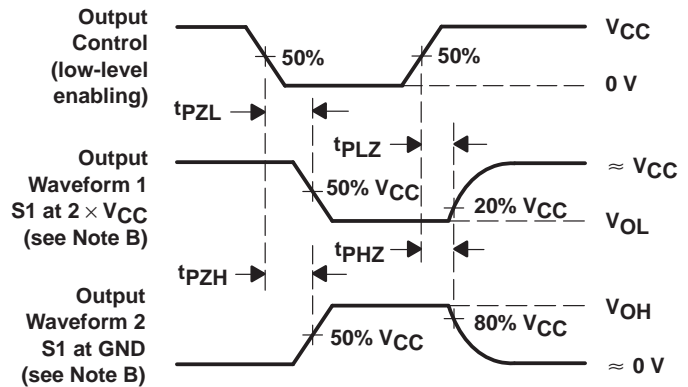
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

- 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: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2009, Texas Instruments Incorporated