



**THE DATASHEET OF  
SN74ABT16833DGGR**

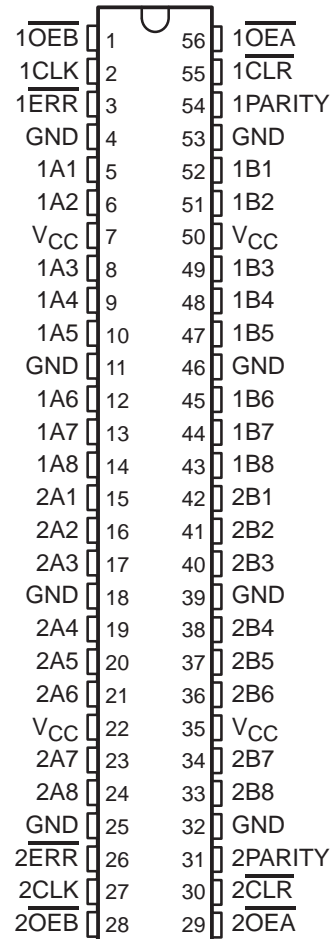


# SN54ABT16833, SN74ABT16833 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS097D – FEBRUARY 1991 – REVISED JANUARY 1997

- **Members of the Texas Instruments Widebus™ Family**
- **State-of-the-Art EPIC-IIB™ BiCMOS Design Significantly Reduces Power Dissipation**
- **Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17**
- **Typical  $V_{OLP}$  (Output Ground Bounce)  $< 1$  V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$**
- **Distributed  $V_{CC}$  and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **Flow-Through Architecture Optimizes PCB Layout**
- **High-Drive Outputs ( $-32$ -mA  $I_{OH}$ ,  $64$ -mA  $I_{OL}$ )**
- **Parity-Error Flag With Parity Generator/Checker**
- **Register for Storage of Parity-Error Flag**
- **Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings**

SN54ABT16833 . . . WD PACKAGE  
SN74ABT16833 . . . DGG OR DL PACKAGE  
(TOP VIEW)



## description

The 'ABT16833 consist of two noninverting 8-bit to 9-bit parity bus transceivers and are designed for communication between data buses. For each transceiver, when data is transmitted from the A bus to the B bus, an odd-parity bit is generated and output on the parity I/O pin (1PARITY or 2PARITY). When data is transmitted from the B bus to the A bus, 1PARITY (or 2PARITY) is configured as an input and combined with the B-input data to generate an active-low error flag if odd parity is not detected.

The error ( $\overline{1ERR}$  or  $\overline{2ERR}$ ) output is configured as an open-collector output. The B-to-A parity-error flag is clocked into  $\overline{1ERR}$  (or  $\overline{2ERR}$ ) on the low-to-high transition of the clock (1CLK or 2CLK) input.  $\overline{1ERR}$  (or  $\overline{2ERR}$ ) is cleared (set high) by taking the clear ( $\overline{1CLR}$  or  $\overline{2CLR}$ ) input low.

The output-enable ( $\overline{OE\bar{A}}$  and  $\overline{OE\bar{B}}$ ) inputs can be used to disable the device so that the buses are effectively isolated. When both  $\overline{OE\bar{A}}$  and  $\overline{OE\bar{B}}$  are low, data is transferred from the A bus to the B bus and inverted parity is generated. Inverted parity is a forced error condition that gives the designer more system diagnostic capability.

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.



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 **TEXAS  
INSTRUMENTS**

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# SN54ABT16833, SN74ABT16833 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

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## description (continued)

The SN54ABT16833 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ABT16833 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS						OUTPUT AND I/O				FUNCTION
$\overline{\text{OEB}}$	$\overline{\text{OEA}}$	$\overline{\text{CLR}}$	CLK	Ai $\Sigma$ OF H	Bi† $\Sigma$ OF H	A	B	PARITY	$\overline{\text{ERR}}\ddagger$	
L	H	X	X	Odd Even	NA	NA	A	L H	NA	A data to B bus and generate parity
H	L	H	$\uparrow$	NA	Odd Even	B	NA	NA	H L	B data to A bus and check parity
X	X	L	X	X	X	X	NA	NA	H	Check error-flag register
H	H	H	No $\uparrow$	X	X	Z	Z	Z	NC	Isolation§
		L	No $\uparrow$	H						
		H	$\uparrow$	H						
L	L	X	X	Odd	NA	NA	A	H	NA	A data to B bus and generate inverted parity
				Even				L		

NA = not applicable, NC = no change, X = don't care

† Summation of high-level inputs includes PARITY along with Bi inputs.

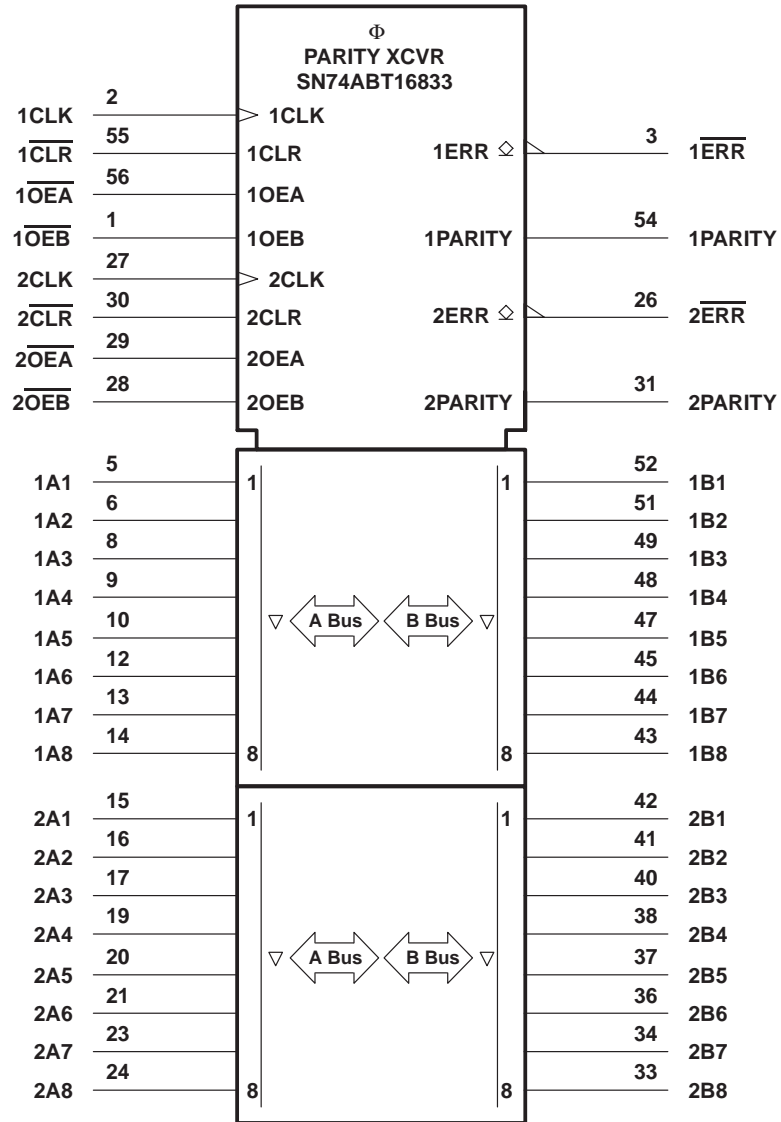
‡ Output states shown assume  $\overline{\text{ERR}}$  was previously high.

§ In this mode,  $\overline{\text{ERR}}$  (when clocked) shows inverted parity of the A bus.

# SN54ABT16833, SN74ABT16833 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

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logic symbol†

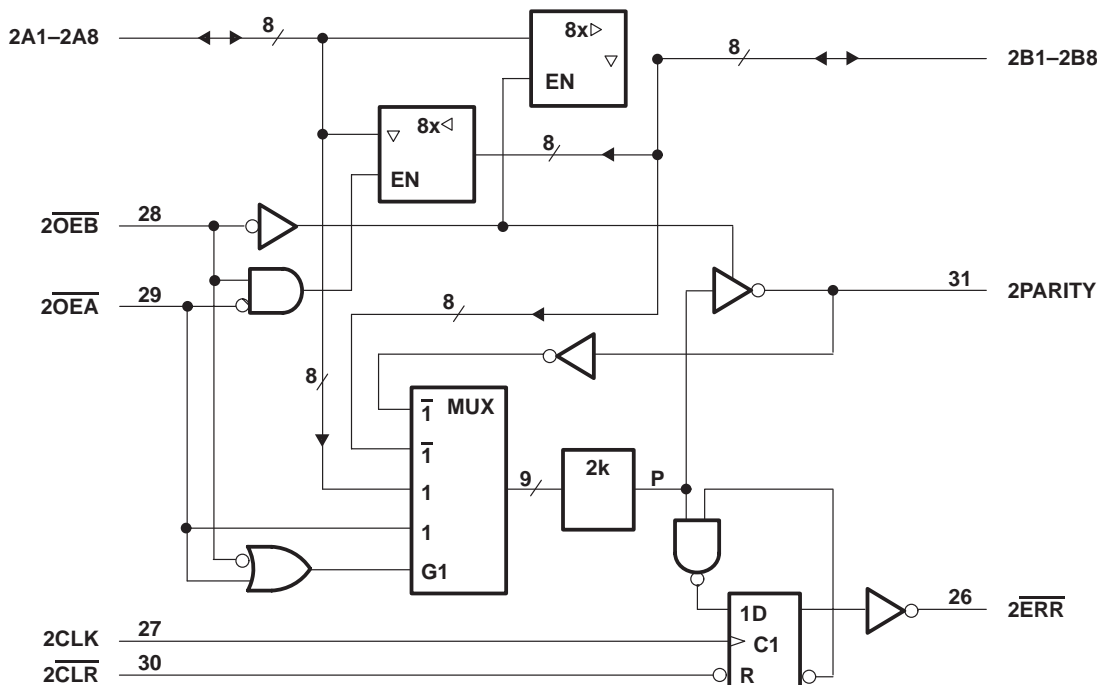
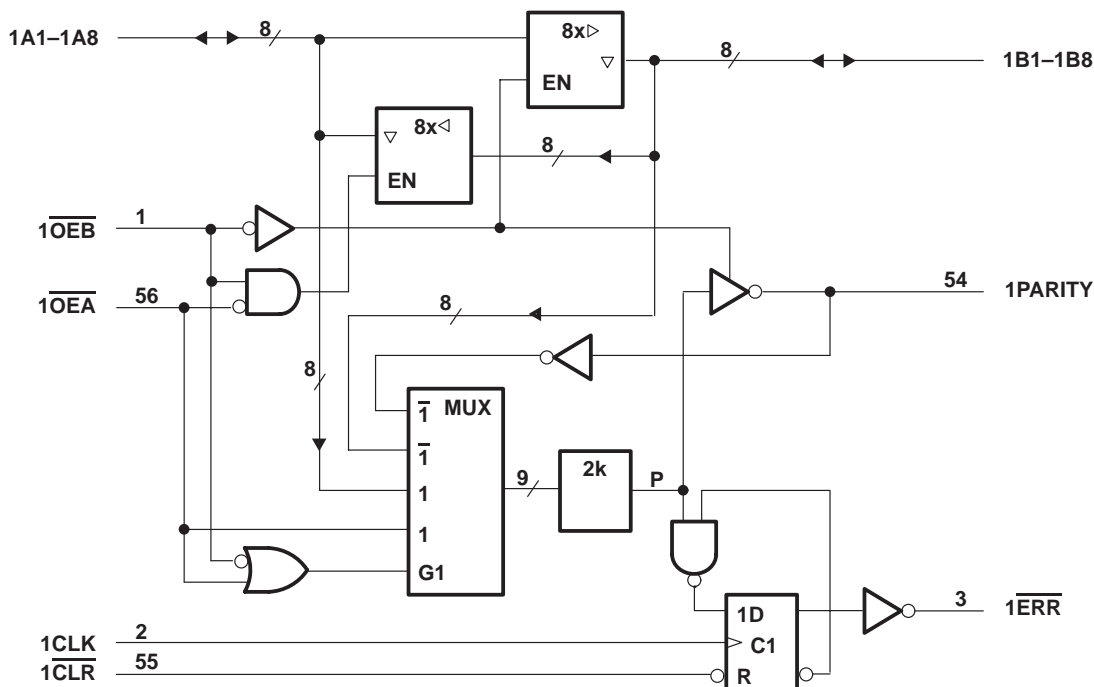


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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## logic diagram (positive logic)



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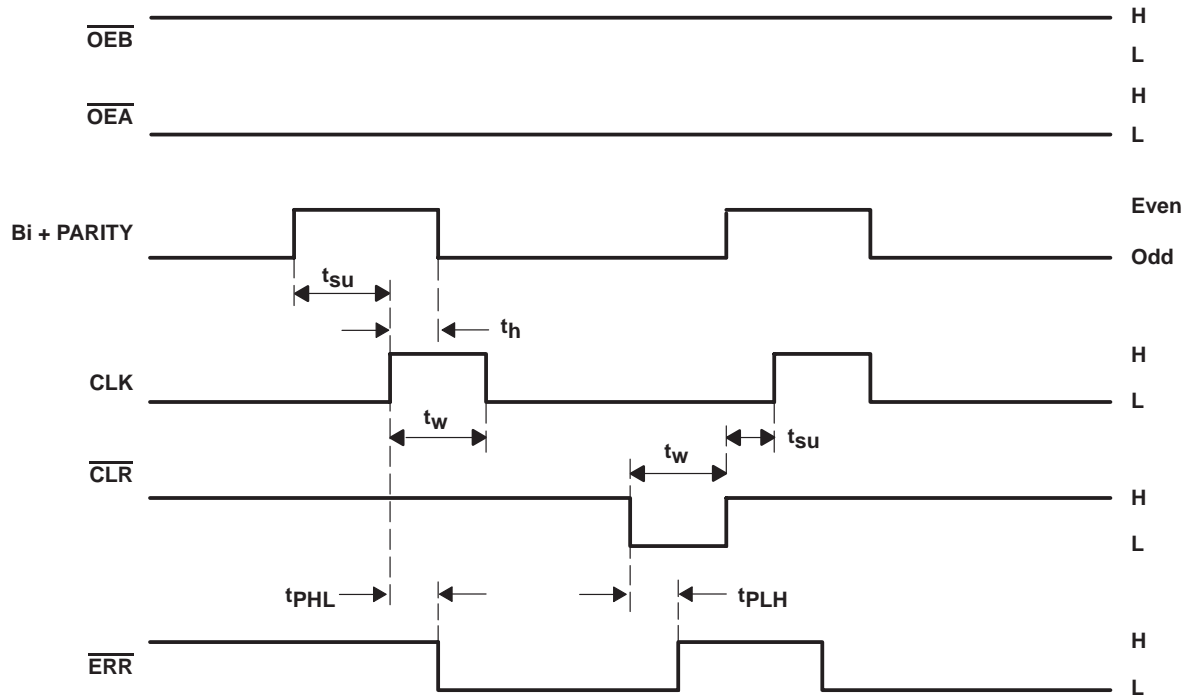
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ERROR-FLAG FUNCTION TABLE

INPUTS		INTERNAL TO DEVICE	OUTPUT PRE-STATE	OUTPUT ERR	FUNCTION
$\overline{\text{CLR}}$	CLK	POINT P	$\overline{\text{ERR}}_{n-1}^\dagger$		
H	↑	H	H	H	Sample
H	↑	X	L	L	
H	↑	L	X	L	
L	X	X	X	H	Clear

† State of  $\overline{\text{ERR}}$  before changes at  $\overline{\text{CLR}}$ , CLK, or point P

## error-flag waveforms



# SN54ABT16833, SN74ABT16833 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

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## 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, $V_I$ (except I/O ports) (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high or power-off state, $V_O$	–0.5 V to 5.5 V
Current into any output in the low state, $I_O$ : SN54ABT16833	96 mA
SN74ABT16833	128 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): DGG package	81°C/W
DL package	74°C/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. The package thermal impedance is calculated in accordance with EIA/JEDEC Std JESD51.

## recommended operating conditions (see Note 3)

		SN54ABT16833		SN74ABT16833		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	4.5	5.5	4.5	5.5	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	0	$V_{CC}$	0	$V_{CC}$	V
$V_{OH}$	High-level output voltage		ERR		5.5	V
$I_{OH}$	High-level output current		Except ERR		–24	mA
$I_{OL}$	Low-level output current				48	mA
$\Delta t/\Delta v$	Input transition rise or fall rate		Outputs enabled		10	ns/V
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: Unused pins (input or I/O) must be held high or low to prevent them from floating.

# SN54ABT16833, SN74ABT16833 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

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

PARAMETER		TEST CONDITIONS	T <sub>A</sub> = 25°C			SN54ABT16833		SN74ABT16833		UNIT	
			MIN	TYP†	MAX	MIN	MAX	MIN	MAX		
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA	-1.2			-1.2		-1.2		V	
V <sub>OH</sub>	All outputs except $\overline{\text{ERR}}$	V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = -3 mA	2.5	3		2.5			V		
		V <sub>CC</sub> = 5 V, I <sub>OH</sub> = -3 mA	3	3.4		3		3			
		V <sub>CC</sub> = 4.5 V									
		I <sub>OH</sub> = -24 mA									
		I <sub>OH</sub> = -32 mA	2*	2.7				2			
V <sub>OL</sub>		V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 24 mA		0.25	0.55	0.55		V		
			I <sub>OL</sub> = 64 mA		0.3	0.55*				0.55	
V <sub>hys</sub>			100							mV	
I <sub>OH</sub>	$\overline{\text{ERR}}$	V <sub>CC</sub> = 4.5 V, V <sub>OH</sub> = 5.5 V	20			20		20		μA	
I <sub>off</sub>		V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V	±100					±100		μA	
I <sub>CEX</sub>	Outputs high	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V	50			50		50		μA	
I <sub>I</sub>	Control inputs	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = V <sub>CC</sub> or GND	±1			±1		±1		μA	
	A or B ports		±100			±100		±100			
I <sub>IL</sub>	A or B ports	V <sub>CC</sub> = 0, V <sub>I</sub> = GND	-50			-50		-50		μA	
I <sub>O</sub> ‡		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.5 V	-50	-100	-180	-50	-180	-50	-180	mA	
I <sub>OZH</sub> §		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V	50			50		50		μA	
I <sub>OZL</sub> §		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.5 V	-50			-50		-50		μA	
I <sub>CC</sub>	A or B ports	V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND	Outputs high		1.5	2	2		2		mA
			Outputs low		28	36	36		36		
			Outputs disabled		1	2	2		2		
ΔI <sub>CC</sub> ¶		V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	50			50		50		μA	
C <sub>i</sub>	Control inputs	V <sub>I</sub> = 2.5 V or 0.5 V	3							pF	
C <sub>io</sub>	A or B ports	V <sub>O</sub> = 2.5 V or 0.5 V	9							pF	

\* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V<sub>CC</sub> = 5 V.

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

§ The parameters I<sub>OZH</sub> and I<sub>OZL</sub> include the input leakage current.

¶ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.

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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

		V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C		SN54ABT16833		SN74ABT16833		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration, CLK high or low	3		3		3		ns
t <sub>su</sub>	Setup time before CLK↑	A port		4.5		4.5		ns
		CLR		1		1		
		OEA		5		5		
t <sub>h</sub>	Hold time after CLK↑	A port or OEA		0		0		ns

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

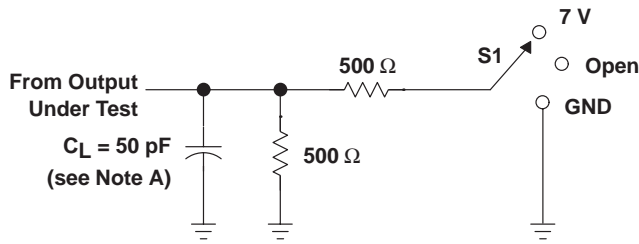
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C			SN54ABT16833		SN74ABT16833		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	1.5	2.5	3.3	1.5	4.2	1.5	4.1	ns
t <sub>PHL</sub>			2	3.1	3.9	2	4.5	2	4.3	
t <sub>PZH</sub>	OE	A or B	2	3.9	4.9	2	5.8	2	5.6	ns
t <sub>PZL</sub>			2.5	4.3	5.1	2.5	6.2	2.5	6	
t <sub>PHZ</sub>	OE	A or B	2	3.6	4.5	2	5.5	2	5.4	ns
t <sub>PLZ</sub>			1.5	3	3.8	1.5	4.7	1.5	4.3	
t <sub>PLH</sub>	A or OE	PARITY	2	4.6	5.4	2	7	2	6.7	ns
t <sub>PHL</sub>			2	4.3	5.1	2	6.5	2	6.1	
t <sub>PZH</sub>	OE	PARITY	2	3.6	5	2	5.8	2	5.7	ns
t <sub>PZL</sub>			2.5	4.4	5.8	2.5	6.7	2.5	6.5	
t <sub>PHZ</sub>	OE	PARITY	1.5	3.2	4	1.5	4.8	1.5	4.7	ns
t <sub>PLZ</sub>			1.5	2.9	3.7	1.5	4.2	1.5	4.1	
t <sub>PLH</sub>	CLK, CLR	ERR	2	3.4	4.2	2	4.8	2	4.6	ns
t <sub>PHL</sub>	CLK		2	2.8	3.6	2	4.1	2	3.9	

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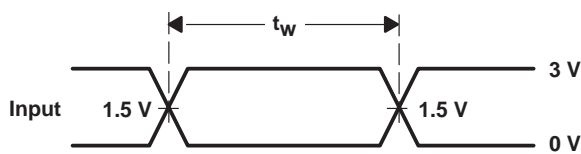
PARAMETER MEASUREMENT INFORMATION



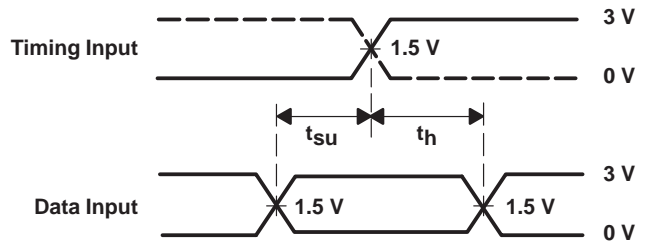
LOAD CIRCUIT

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open

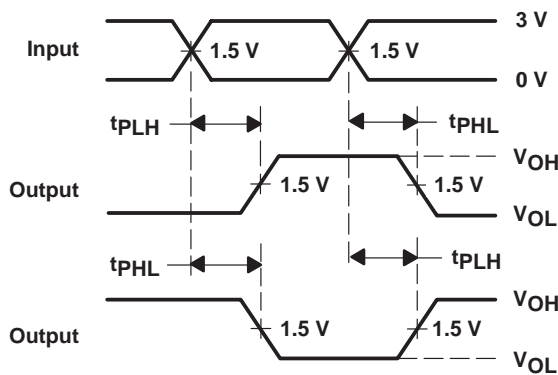
$\overline{\text{ERR}}$	S1
$t_{PHL}$ (see Note E)	7 V
$t_{PLH}$ (see Note F)	7 V



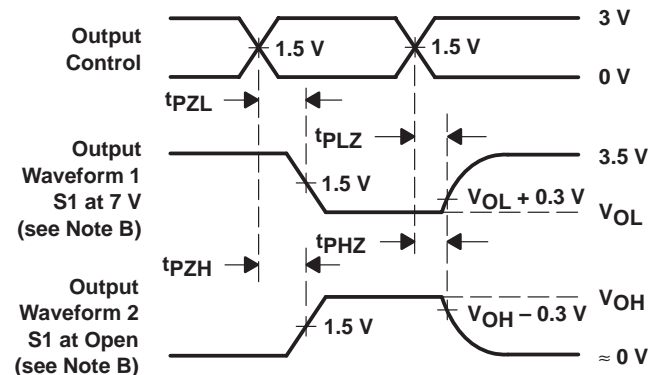
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .  
 D. The outputs are measured one at a time with one transition per measurement.  
 E.  $t_{PHL}$  is measured at 1.5 V.  
 F.  $t_{PLH}$  is measured at  $V_{OL} + 0.3 \text{ V}$ .

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74ABT16833DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16833DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16833DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16833DLRG4	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ABT16833DLR	SSOP	DL	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ABT16833DLR	SSOP	DL	56	1000	346.0	346.0	49.0

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