

# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B – OCTOBER 1992 – REVISED JANUARY 1997

- Members of the Texas Instruments *Widebus™* Family
- State-of-the-Art *EPIC-II™* 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 ( $-32\text{-mA } I_{OH}$ ,  $64\text{-mA } I_{OL}$ )
- Parity-Error Flag With Parity Generator/Checker
- Latch for Storage of the 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

## description

The 'ABT16853 dual 8-bit to 9-bit parity transceivers are designed for communication between data buses. When data is transmitted from the A bus to the B bus, a parity bit is generated. When data is transmitted from the B bus to the A bus, with its corresponding parity bit, the open-collector parity-error ( $\overline{ERR}$ ) output indicates whether or not an error in the B data has occurred. The output-enable ( $\overline{OE}$ A and  $\overline{OE}$ B) inputs can be used to disable the device so that the buses are effectively isolated. The 'ABT16853 provide true data at the outputs.

A 9-bit parity generator/checker generates a parity-odd (PARITY) output and monitors the parity of the I/O ports with the  $\overline{ERR}$  flag. The parity-error output can be passed, sampled, stored, or cleared from the latch using the latch-enable ( $\overline{LE}$ ) and clear ( $\overline{CLR}$ ) control inputs. When both  $\overline{OE}$ A and  $\overline{OE}$ 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.

SN54ABT16853 . . . WD PACKAGE  
SN74ABT16853 . . . DGG OR DL PACKAGE  
(TOP VIEW)

$\overline{1OE}$ B	1	56	$\overline{1OE}$ A
$\overline{1LE}$	2	55	$\overline{1CLR}$
$\overline{1ERR}$	3	54	$\overline{1PARITY}$
GND	4	53	GND
1A1	5	52	1B1
1A2	6	51	1B2
$V_{CC}$	7	50	$V_{CC}$
1A3	8	49	1B3
1A4	9	48	1B4
1A5	10	47	1B5
GND	11	46	GND
1A6	12	45	1B6
1A7	13	44	1B7
1A8	14	43	1B8
2A1	15	42	2B1
2A2	16	41	2B2
2A3	17	40	2B3
GND	18	39	GND
2A4	19	38	2B4
2A5	20	37	2B5
2A6	21	36	2B6
$V_{CC}$	22	35	$V_{CC}$
2A7	23	34	2B7
2A8	24	33	2B8
GND	25	32	GND
$\overline{2ERR}$	26	31	$\overline{2PARITY}$
$\overline{2LE}$	27	30	$\overline{2CLR}$
$\overline{2OE}$ B	28	29	$\overline{2OE}$ A

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# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B – OCTOBER 1992 – REVISED JANUARY 1997

## description (continued)

The SN54ABT16853 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ABT16853 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS						OUTPUT AND I/O				FUNCTION
OEB	OEA	CLR	LE	Ai Σ OF H	Bi† Σ OF H	A	B	PARITY	ERR‡	
L	H	X	X	Odd Even	NA	NA	A	L H	NA	A data to B bus and generate parity
H	L	X	L	NA	Odd Even	B	NA	NA	H L	B data to A bus and check parity
H	L	H	H	NA	X	X	NA	NA	NC	Store error flag
X	X	L	H	X	X	X	NA	NA	H	Clear error-flag register
H	H	H	H	X	X	Z	Z	Z	NC	Isolation§ (parity check)
		L	H	X					H	
		X	L	L Odd					H	
		X	L	H Even					L	
L	L	X	X	Odd Even	NA	NA	A	H L	NA	A data to B bus and generate inverted parity

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

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

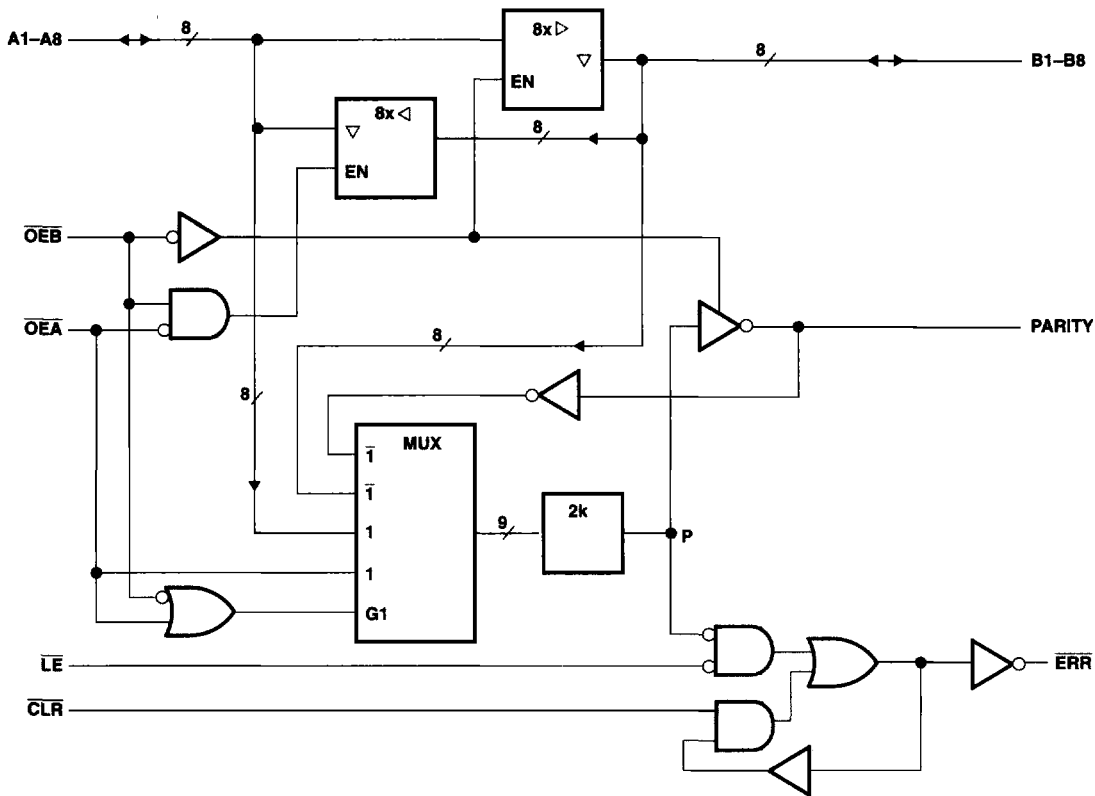
‡ Output states shown assume ERR was previously high.

§ In this mode, ERR (when clocked) shows inverted parity of the A bus.

# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B - OCTOBER 1982 - REVISED JANUARY 1987

logic diagram (each transceiver) (positive logic)



ERROR-FLAG FUNCTION TABLE

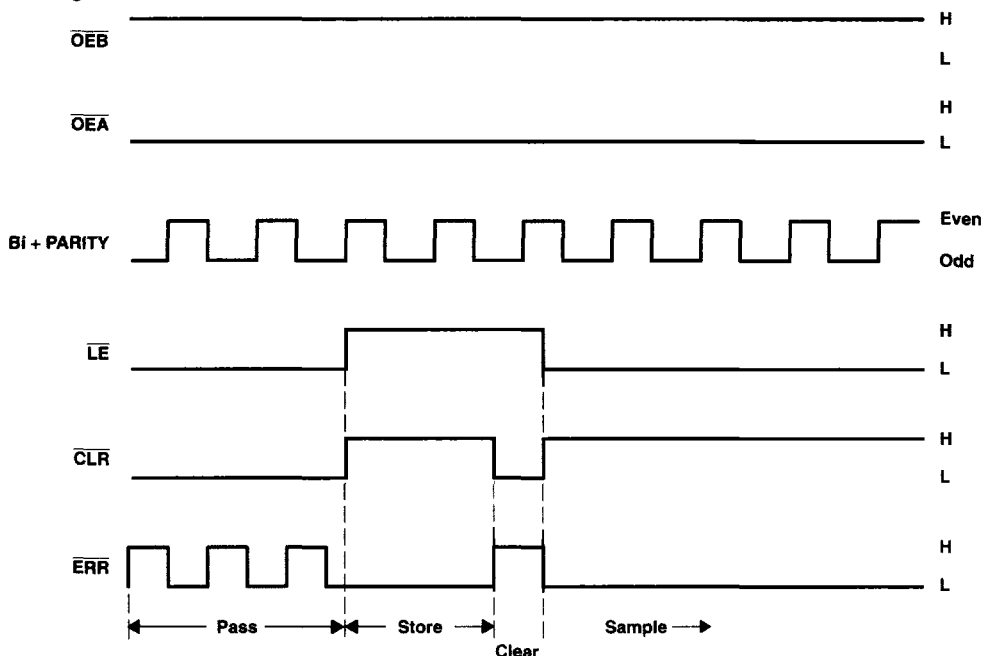
INPUTS		INTERNAL TO DEVICE	OUTPUT	OUTPUT	FUNCTION
CLR	LE	POINT P	ERR <sub>n-1</sub> †	ERR	
L	L	L	X	L	Pass
		H	X	H	
H	L	L	X	L	Sample
		H	H	H	
L	H	X	X	H	Clear
H	H	X	L	L	Store
			H	H	

† State of ERR before changes at CLR, LE, or point P

# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B – OCTOBER 1992 – REVISED JANUARY 1997

## error-flag waveforms



## 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, $I_{OL}$ : SN54ABT16853 .....	96 mA
SN74ABT16853 .....	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.

# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B - OCTOBER 1992 - REVISED JANUARY 1997

## recommended operating conditions (see Note 3)

		SN54ABT16853		SN74ABT16853		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.5	4.5	5.5	V
V <sub>IH</sub>	High-level input voltage	2		2		V
V <sub>IL</sub>	Low-level input voltage		0.8		0.8	V
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
V <sub>OH</sub>	High-level output voltage	ERR		5.5		V
I <sub>OH</sub>	High-level output current	Except ERR		-24		mA
I <sub>OL</sub>	Low-level output current			48	64	mA
ΔV/Δv	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
T <sub>A</sub>	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.

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

PARAMETER		TEST CONDITIONS		T <sub>A</sub> = 25°C			SN54ABT16853		SN74ABT16853		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			V	
V <sub>OH</sub>	All outputs except 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				2					
			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>	ERR	V <sub>CC</sub> = 4.5 V,	V <sub>OH</sub> = 5.5 V			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		32	40		40		40		
			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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# SN54ABT16853, SN74ABT16853 DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

SCBS153B – OCTOBER 1992 – REVISED JANUARY 1997

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		SN54ABT16853		SN74ABT16853		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration	$\overline{LE}$ high or low	8.5		8.5		8.5		ns
		CLR low	4		4		4		
t <sub>su</sub>	Setup time	A, B, and PARITY before $\overline{LE}\downarrow$	10		10		10		ns
		CLR before $\overline{LE}\downarrow$	0		0		0		
t <sub>h</sub>	Hold time	A, B, and PARITY after $\overline{LE}\downarrow$	0		0		0		ns
		CLR after $\overline{LE}\downarrow$	0		0		0		

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

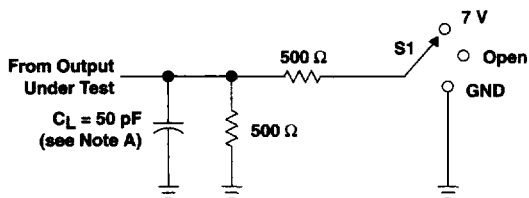
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C			SN54ABT16853		SN74ABT16853		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	1.5	2.5	3.3	1.5	4.2	1.5	4.1	ns
t <sub>PHL</sub>			2	3.1	3.9	2	4.5	2	4.3	
t <sub>PLH</sub>	A or $\overline{OE}$	PARITY	2	4.6	5.9	2	7.3	2	7.1	ns
t <sub>PHL</sub>			2	4.8	6.2	2	7.6	2	7.2	
t <sub>PLH</sub>	$\overline{CLR}$	$\overline{ERR}$	2	3.7	5.1	2	5.9	2	5.7	ns
t <sub>PZH</sub>	$\overline{OE}$	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>	$\overline{OE}$	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>PZH</sub>	$\overline{OE}$	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>	$\overline{OE}$	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>	$\overline{LE}$	$\overline{ERR}$	2	3.5	4.2	2	5	2	4.8	ns
t <sub>PHL</sub>			2	3.4	4.4	2	5.2	2	4.9	
t <sub>PLH</sub>	A, B, or PARITY	$\overline{ERR}$	2	4.5	6.3	2	7.5	2	7.2	ns
t <sub>PHL</sub>			2	4.8	6.3	2	7.7	2	7.4	

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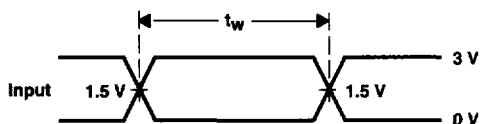
PARAMETER MEASUREMENT INFORMATION



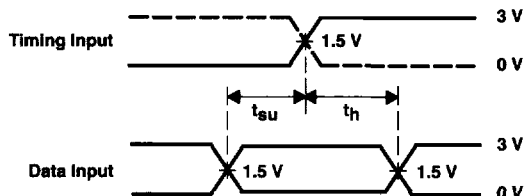
LOAD CIRCUIT

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

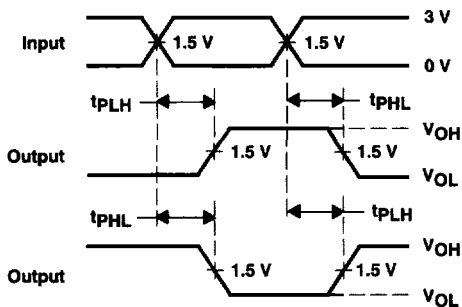
ERR	S1
$t_{PHL}$ (see Note E)	7 V
$t_{PLH}$ (see Note F)	7 V



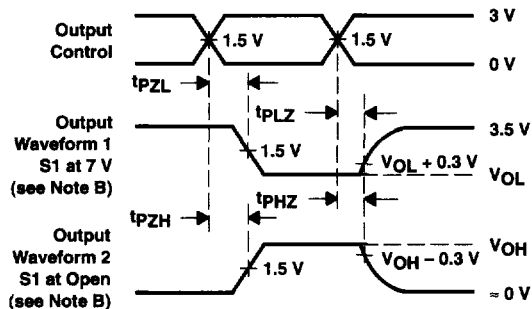
VOLTAGE WAVEFORMS  
PULSE DURATION



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