

# SN54AHC245, SN74AHC245 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCLS230B – OCTOBER 1995 – REVISED MARCH 1996

- Operating Range 2-V to 5.5-V  $V_{CC}$
- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- High Latch-Up Immunity Exceeds 250 mA Per JEDEC Standard JESD-17
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

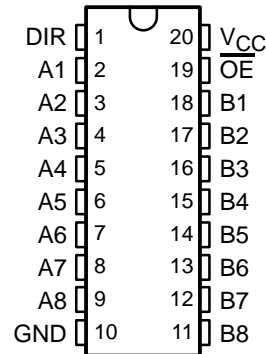
## description

The 'AHC245 octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

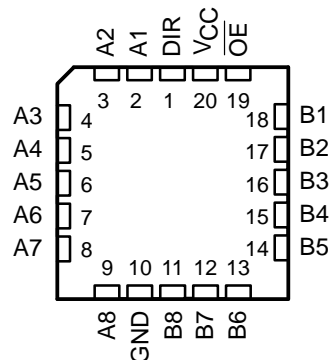
These allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending upon the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

The SN54AHC245 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74AHC245 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

SN54AHC245 . . . J OR W PACKAGE  
SN74AHC245 . . . DB, DW, N, OR PW PACKAGE  
(TOP VIEW)



SN54AHC245 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE

INPUTS		OUTPUT
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation



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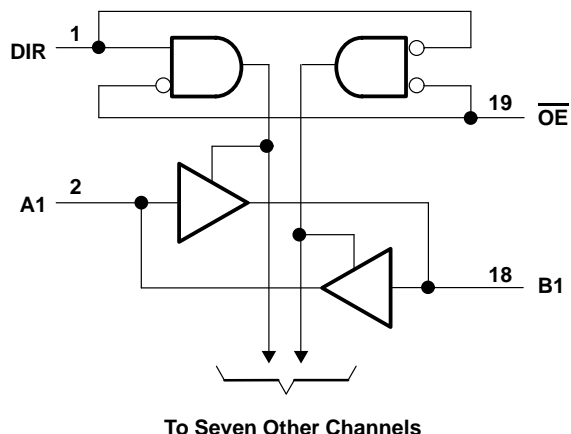
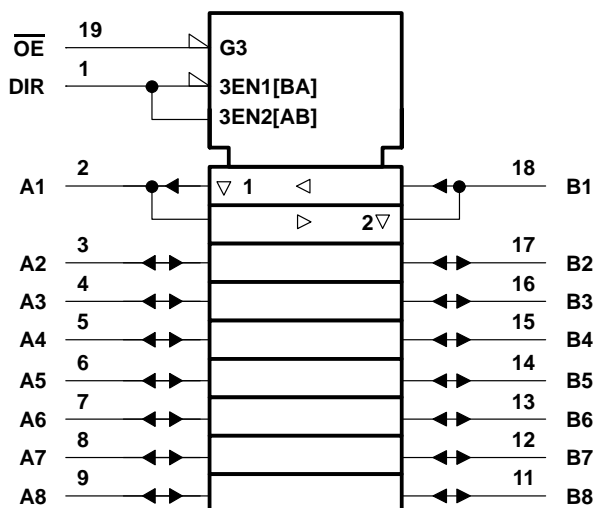
**TEXAS  
INSTRUMENTS**

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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 7 V
Input voltage range, $V_I$ (see Note 1)	.....	-0.5 V to 7 V
Output voltage range, $V_O$ (see Note 1)	.....	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	.....	-20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	.....	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	.....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND	.....	$\pm 75$ mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2):		
	DB package	0.6 W
	DW package	1.6 W
	N package	1.3 W
	PW package	0.7 W
Storage temperature range, $T_{stg}$	.....	$-65^\circ\text{C}$ to $150^\circ\text{C}$

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, except for the N package, which has a trace length of zero.

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## recommended operating conditions (see Note 3)

			SN54AHC245		SN74AHC245		UNIT
			MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage		2	5.5	2	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5		1.5		V
		V <sub>CC</sub> = 3 V	2.1		2.1		
		V <sub>CC</sub> = 5.5 V	3.85		3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V		0.5		0.5	V
		V <sub>CC</sub> = 3 V		0.9		0.9	
		V <sub>CC</sub> = 5.5 V		1.65		1.65	
V <sub>I</sub>	Input voltage	$\overline{\text{OE}}$ or DIR	0	5.5	0	5.5	V
V <sub>IO</sub>	Output voltage	A or B	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V		–50		–50	$\mu\text{A}$ mA
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V		–4		–4	
		V <sub>CC</sub> = 5 V $\pm$ 0.5 V		–8		–8	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V		50		50	$\mu\text{A}$ mA
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V		4		4	
		V <sub>CC</sub> = 5 V $\pm$ 0.5 V		8		8	
$\Delta t/\Delta v$	Input transition rise or fall rate	V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V		100		100	ns/V
		V <sub>CC</sub> = 5 V $\pm$ 0.5 V		20		20	
T <sub>A</sub>	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: Unused inputs 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	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54AHC245		SN74AHC245		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>		I <sub>OH</sub> = –50 $\mu\text{A}$	2 V	1.9	2		1.9		1.9		V
			3 V	2.9	3		2.9		2.9		
			4.5 V	4.4	4.5		4.4		4.4		
		I <sub>OH</sub> = –4 mA	3 V	2.58			2.48		2.48		
			4.5 V	3.94			3.8		3.8		
V <sub>OL</sub>		I <sub>OL</sub> = 50 $\mu\text{A}$	2 V			0.1		0.1		0.1	V
			3 V			0.1		0.1		0.1	
			4.5 V			0.1		0.1		0.1	
		I <sub>OL</sub> = 4 mA	3 V			0.36		0.5		0.44	
			4.5 V			0.36		0.5		0.44	
I <sub>I</sub>	A or B inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu\text{A}$
	$\overline{\text{OE}}$ or DIR					$\pm 0.1$		$\pm 1$		$\pm 1$	
I <sub>OZ</sub> <sup>†</sup>		V <sub>O</sub> = V <sub>CC</sub> or GND, V <sub>I</sub> (OE) = V <sub>IL</sub> or V <sub>IH</sub>	5.5 V			$\pm 0.25$		$\pm 2.5$		$\pm 2.5$	$\mu\text{A}$
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			4		40		40	$\mu\text{A}$
C <sub>i</sub>	$\overline{\text{OE}}$ or DIR inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		2.5	10				10	pF
C <sub>io</sub>	A or B inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		4						pF

<sup>†</sup> The parameter I<sub>OZ</sub> includes the input leakage current.



# SN54AHC245, SN74AHC245

## OCTAL BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

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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)	OUTPUT CAPACITANCE	SN54AHC245				UNIT
				$T_A = 25^\circ\text{C}$			MIN	MAX
				MIN	TYP	MAX		
$t_{PLH}^*$	A or B	B or A	$C_L = 15 \text{ pF}$	5.8	8.4	1	10	ns
$t_{PHL}^*$				5.8	8.4	1	10	
$t_{PZH}^*$	$\overline{OE}$	A or B	$C_L = 15 \text{ pF}$	8.5	13.2	1	15.5	ns
$t_{PZL}^*$				8.5	13.2	1	15.5	
$t_{PHZ}^*$	$\overline{OE}$	A or B	$C_L = 15 \text{ pF}$	8.9	12.5	1	15.5	ns
$t_{PLZ}^*$				8.9	12.5	1	15.5	
$t_{PLH}$	A or B	B or A	$C_L = 50 \text{ pF}$	8.3	11.9	1	13.5	ns
$t_{PHL}$				8.3	11.9	1	13.5	
$t_{PZH}$	$\overline{OE}$	A or B	$C_L = 50 \text{ pF}$	11	16.7	1	19	ns
$t_{PZL}$				11	16.7	1	19	
$t_{PHZ}$	$\overline{OE}$	A or B	$C_L = 50 \text{ pF}$	11.5	15.8	1	18	ns
$t_{PLZ}$				11.5	15.8	1	18	

\* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

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)	OUTPUT CAPACITANCE	SN74AHC245				UNIT
				$T_A = 25^\circ\text{C}$			MIN	MAX
				MIN	TYP	MAX		
$t_{PLH}$	A or B	B or A	$C_L = 15 \text{ pF}$	5.8	8.4	1	10	ns
$t_{PHL}$				5.8	8.4	1	10	
$t_{PZH}$	$\overline{OE}$	A or B	$C_L = 15 \text{ pF}$	8.5	13.2	1	15.5	ns
$t_{PZL}$				8.5	13.2	1	15.5	
$t_{PHZ}$	$\overline{OE}$	A or B	$C_L = 15 \text{ pF}$	8.9	12.5	1	15.5	ns
$t_{PLZ}$				8.9	12.5	1	15.5	
$t_{PLH}$	A or B	B or A	$C_L = 50 \text{ pF}$	8.3	11.9	1	13.5	ns
$t_{PHL}$				8.3	11.9	1	13.5	
$t_{PZH}$	$\overline{OE}$	A or B	$C_L = 50 \text{ pF}$	11	16.7	1	19	ns
$t_{PZL}$				11	16.7	1	19	
$t_{PHZ}$	$\overline{OE}$	A or B	$C_L = 50 \text{ pF}$	11.5	15.8	1	18	ns
$t_{PLZ}$				11.5	15.8	1	18	

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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)	OUTPUT CAPACITANCE	SN54AHC245				UNIT	
				T <sub>A</sub> = 25°C			MIN		MAX
				MIN	TYP	MAX			
t <sub>PLH</sub> *	A or B	B or A	C <sub>L</sub> = 15 pF	4	5.5	1	6.5	ns	
t <sub>PHL</sub> *				4	5.5	1	6.5		
t <sub>PZH</sub> *	OE	A or B	C <sub>L</sub> = 15 pF	5.8	8.5	1	10	ns	
t <sub>PZL</sub> *				5.8	8.5	1	10		
t <sub>PHZ</sub> *	OE	A or B	C <sub>L</sub> = 15 pF	5.6	7.8	1	9.2	ns	
t <sub>PLZ</sub> *				5.6	7.8	1	9.2		
t <sub>PLH</sub>	A or B	B or A	C <sub>L</sub> = 50 pF	5.5	7.5	1	8.5	ns	
t <sub>PHL</sub>				5.5	7.5	1	8.5		
t <sub>PZH</sub>	OE	A or B	C <sub>L</sub> = 50 pF	7.3	10.6	1	12	ns	
t <sub>PZL</sub>				7.3	10.6	1	12		
t <sub>PHZ</sub>	OE	A or B	C <sub>L</sub> = 50 pF	7	9.7	1	11	ns	
t <sub>PLZ</sub>				7	9.7	1	11		

\* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

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)	OUTPUT CAPACITANCE	SN74AHC245				UNIT	
				T <sub>A</sub> = 25°C			MIN		MAX
				MIN	TYP	MAX			
t <sub>PLH</sub>	A or B	B or A	C <sub>L</sub> = 15 pF	4	5.5	1	6.5	ns	
t <sub>PHL</sub>				4	5.5	1	6.5		
t <sub>PZH</sub>	OE	A or B	C <sub>L</sub> = 15 pF	5.8	8.5	1	10	ns	
t <sub>PZL</sub>				5.8	8.5	1	10		
t <sub>PHZ</sub>	OE	A or B	C <sub>L</sub> = 15 pF	5.6	7.8	1	9.2	ns	
t <sub>PLZ</sub>				5.6	7.8	1	9.2		
t <sub>PLH</sub>	A or B	B or A	C <sub>L</sub> = 50 pF	5.5	7.5	1	8.5	ns	
t <sub>PHL</sub>				5.5	7.5	1	8.5		
t <sub>PZH</sub>	OE	A or B	C <sub>L</sub> = 50 pF	7.3	10.6	1	12	ns	
t <sub>PZL</sub>				7.3	10.6	1	12		
t <sub>PHZ</sub>	OE	A or B	C <sub>L</sub> = 50 pF	7	9.7	1	11	ns	
t <sub>PLZ</sub>				7	9.7	1	11		

output-skew characteristics,  $C_L = 50\text{ pF}$  (see Note 4)

PARAMETER		VCC	SN74AHC245				UNIT
			TA = 25°C		MIN	MAX	
			MIN	MAX			
tsk(o)    Output skew	3.3 V ± 0.3 V	1.5		1.5		ns	
	5 V ± 0.5 V	1		1			

NOTE 4: Characteristics are determined during product characterization and ensured by design.

# SN54AHC245, SN74AHC245

## OCTAL BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

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noise characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 5)

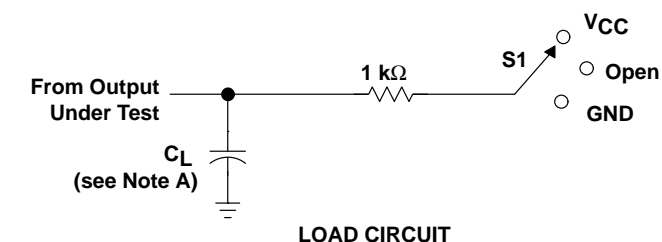
PARAMETER	SN74AHC245			UNIT
	MIN	TYP	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic $V_{OL}$		0.9		V
$V_{OL(V)}$ Quiet output, minimum dynamic $V_{OL}$		-0.9		V
$V_{OH(V)}$ Quiet output, minimum dynamic $V_{OH}$		4.3		V
$V_{IH(D)}$ High-level dynamic input voltage	3.5			V
$V_{IL(D)}$ Low-level dynamic input voltage			1.5	V

NOTE 5: Characteristics are determined during product characterization and ensured by design for surface-mount packages only.

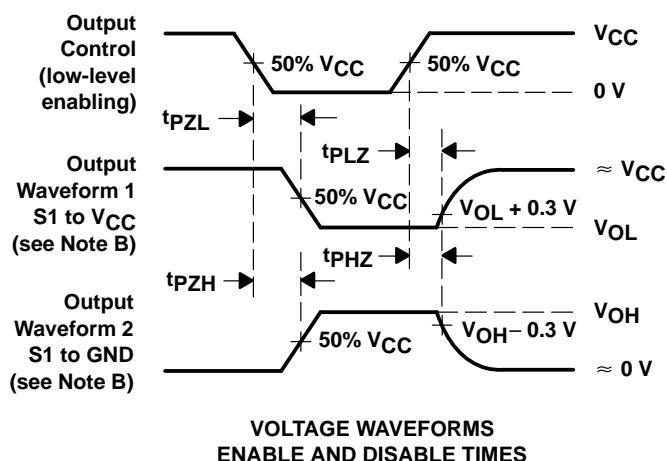
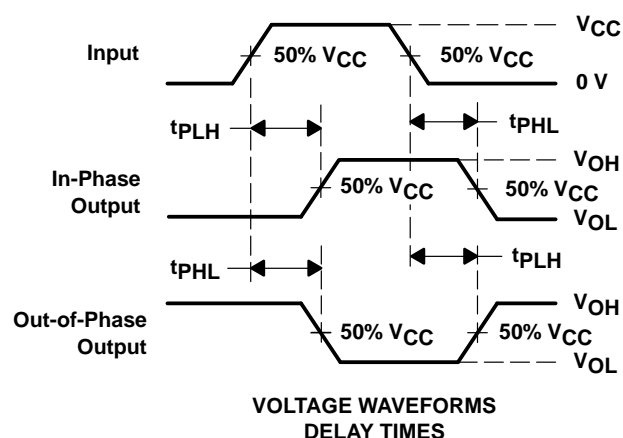
operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance per transceiver	No load, $f = 1\text{ MHz}$	14	pF

## PARAMETER MEASUREMENT INFORMATION



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



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = 3\text{ ns}$ ,  $t_f = 3\text{ ns}$ .
  - The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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