54AC11640, 74AC11640
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

T-52-31-00

TI0093—D2957, JULY 1987—REVISED MARCH 1990

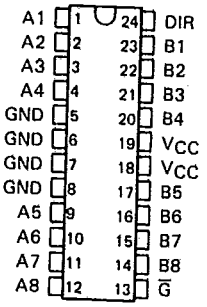
- Bidirectional Bus Transceivers in High-Density 24-Pin Packages
- Flow-Through Architecture to Optimize PCB Layout
- Center-Pin V_{CC} and GND Configurations to Minimize High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

description

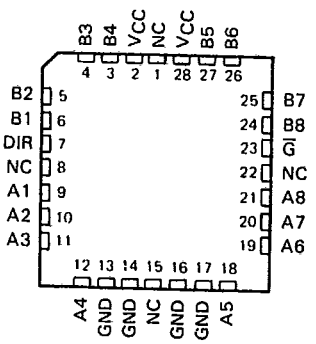
These octal bus transceivers are designed for asynchronous two-way communication between data buses. These devices transmit data from the A bus to the B bus or from the B bus to the A bus depending upon the level at the direction control (DIR) input. The enable input $\overline{G}$ can be used to disable the device so the buses are effectively isolated.

The 54AC11640 is characterized for operation over the full military temperature range of −55°C to 125°C. The 74AC11640 is characterized for operation from −40°C to 85°C.

54AC11640 ... JT PACKAGE
74AC11640 ... DW OR NT PACKAGE
(TOP VIEW)



54AC11640 ... FK PACKAGE
(TOP VIEW)



NC—No internal connection

FUNCTION TABLE

CONTROL INPUTS		OPERATION
$\overline{G}$	DIR	
L	L	$\overline{B}$ data to A bus
L	H	$\overline{A}$ data to B bus
H	X	Isolation

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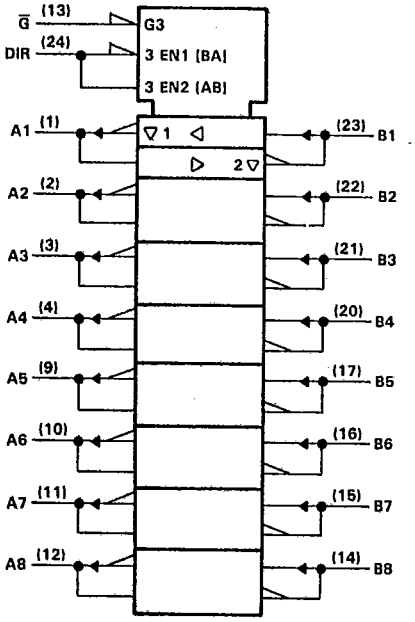
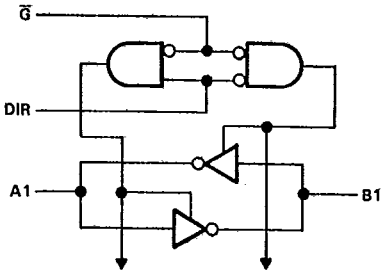
logic symbol†



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

logic diagram (positive logic)



Pin numbers shown are for DW, JT, and NT packages.

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 pins ..... ±200 mA
Storage temperature range ..... −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.
NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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recommended operating conditions

			54AC11640			74AC11640			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			2.1			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 5.5 V	3.85			3.85			
V_{IL}	Low-level input voltage	V_{CC} = 3 V			0.9			0.9	V
		V_{CC} = 4.5 V			1.35			1.35	
		V_{CC} = 5.5 V			1.65			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			−4			−4	mA
		V_{CC} = 4.5 V			−24			−24	
		V_{CC} = 5.5 V			−24			−24	
I_{OL}	Low-level output current	V_{CC} = 3 V			12			12	mA
		V_{CC} = 4.5 V			24			24	
		V_{CC} = 5.5 V			24			24	
$\Delta t/\Delta v$	Input transition rise or fall rate	$\overline{G}$ or DIR	0		5	0		5	ns/V
		Data	0		10	0		10	
T_A	Operating free-air temperature		−55		125	−40		85	°C

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

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			54AC11640		74AC11640		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			2.4		2.48		
		I_{OH} = −24 mA	4.5 V	3.94			3.7		3.8		
			5.5 V	4.94			4.7		4.8		
		I_{OH} = −50 mA†	5.5 V				3.85				
		I_{OH} = −75 mA†	5.5 V						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		0.5		0.44	
		I_{OL} = 24 mA	4.5 V			0.36		0.5		0.44	
			5.5 V			0.36		0.5		0.44	
		I_{OL} = 50 mA†	5.5 V					1.65			
		I_{OL} = 75 mA†	5.5 V							1.65	
I_{OZ}	A or B ports‡	V_O = V_{CC} or GND	5.5 V			±0.5		±10		±5	μA
I_I	$\overline{G}$ or DIR	V_I = V_{CC} or GND	5.5 V			±0.1		±1		±1	μA
I_{CC}		V_I = V_{CC} or GND, I_O = 0	5.5 V			8		160		80	μA
C_i	$\overline{G}$ or DIR	V_I = V_{CC} or GND	5 V		4						pF
C_{io}	A or B ports	V_O = V_{CC} or GND	5 V		12						pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.
‡ For I/O ports, the parameter I_{OZ} includes the input leakage.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC11640		74AC11640		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	1.5	7	10.5	1.5	13.1	1.5	12	ns
t_{PHL}	A or B	B or A	1.5	6.3	9.1	1.5	11	1.5	10.2	ns
t_{PZH}	$\overline{G}$	A or B	1.5	8.9	12.5	1.5	15.8	1.5	14.3	ns
t_{PZL}	$\overline{G}$	A or B	1.5	8.4	12.9	1.5	16.1	1.5	14.6	ns
t_{PHZ}	$\overline{G}$	A or B	1.5	7.9	10	1.5	11.5	1.5	10.8	ns
t_{PLZ}	$\overline{G}$	A or B	1.5	8.6	11	1.5	12.9	1.5	12	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC11640		74AC11640		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	1.5	5.1	7.7	1.5	9.7	1.5	8.8	ns
t_{PHL}	A or B	B or A	1.5	4.6	6.9	1.5	8.5	1.5	7.8	ns
t_{PZH}	$\overline{G}$	A or B	1.5	6.5	9.4	1.5	11.8	1.5	10.6	ns
t_{PZL}	$\overline{G}$	A or B	1.5	6.1	9.4	1.5	11.8	1.5	10.6	ns
t_{PHZ}	$\overline{G}$	A or B	1.5	6.7	8.6	1.5	9.9	1.5	9.3	ns
t_{PLZ}	$\overline{G}$	A or B	1.5	7.2	9.1	1.5	10.6	1.5	9.9	ns

operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER			TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per transceiver	Outputs enabled	C_L = 50 pF, f = 1 MHz	45	pF
		Outputs disabled		12	

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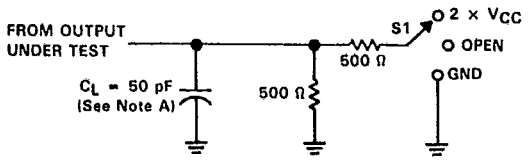
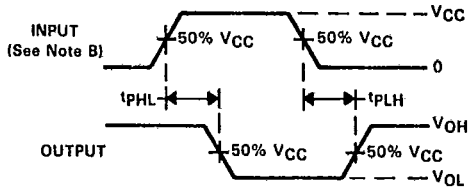
PARAMETER MEASUREMENT INFORMATION

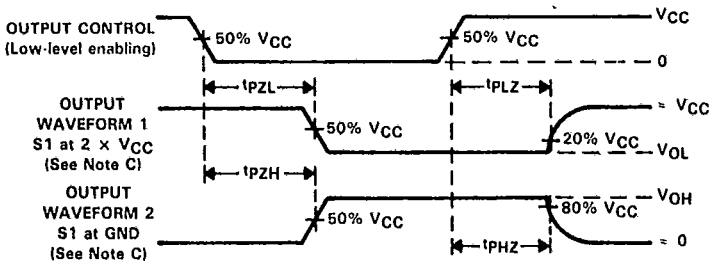


TEST	S1
t_{PLH}/t_{PHL}	OPEN
t_{PLZ}/t_{PZL}	2 × V_{CC}
t_{PHZ}/t_{PZH}	GND

LOAD CIRCUIT



PROPAGATION DELAY TIMES



ENABLE AND DISABLE TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. Input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
C. 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.
D. 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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