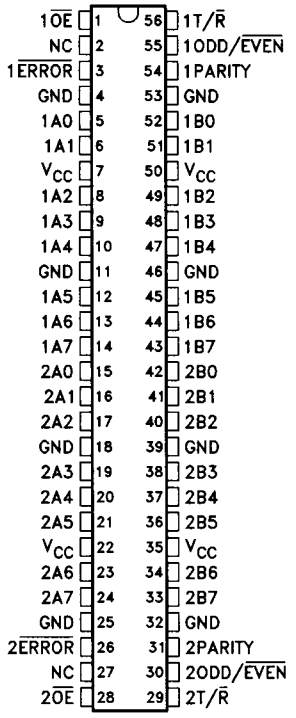
TI0245—D3586, JUNE 1990

- **Members of Texas Instruments Widebus™ Family**
- **Packaged in Shrink Small-Outline 300-mil Packages (SSOP) and 380-mil Fine-Pitch Ceramic Flat Packages Using 25-mil Center-to-Center Pin Spacings**
- **3-State Outputs Drive Bus Lines Directly**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Distributed 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**

54AC16657 ... WD PACKAGE
74AC16657 ... DL PACKAGE
(TOP VIEW)



description

The 'AC16657 contains two noninverting octal transceiver sections with separate parity generator/checker circuits and control signals. For either section, the transmit/receive input (1T/$\overline{R}$ or 2T/$\overline{R}$) determines the direction of data flow. When 1T/$\overline{R}$ (or 2T/$\overline{R}$) is high, data flows from the 1A (or 2A) port to the 1B (or 2B) port (transmit mode); when 1T/$\overline{R}$ (or 2T/$\overline{R}$) is low, data flows from the 1B (or 2B) port to the 1A (or 2A) port (receive mode). When the output-enable input 1$\overline{OE}$ (or 2$\overline{OE}$) is high, both the 1A (or 2A) and 1B (or 2B) ports are in the high-impedance state.

Odd or even parity is selected by a logic high or low level, respectively, on the 1ODD/$\overline{EVEN}$ (or 2ODD/$\overline{EVEN}$) input. 1PARITY (or 2PARITY) carries the parity bit value; it is an output from the parity generator/checker in the transmit mode and an input to the parity generator/checker in the receive mode.

In the transmit mode, after the 1A (or 2A) bus is polled to determine the number of high bits, 1PARITY (or 2PARITY) is set to the logic level that maintains the parity sense selected by the level at the 1ODD/$\overline{EVEN}$ (or 2ODD/$\overline{EVEN}$) input. For example, if 1ODD/$\overline{EVEN}$ is low (even parity selected) and there are five high bits on the 1A bus, then 1PARITY is set to the logic high level so that an even number of the nine total bits (eight 1A-bus bits plus parity bit) are high.

In the receive mode, after the 1B (or 2B) bus is polled to determine the number of high bits, the 1$\overline{ERROR}$ (or 2$\overline{ERROR}$) output logic level indicates whether or not the data to be received exhibits the correct parity sense. For example, if 1ODD/$\overline{EVEN}$ is high (odd parity selected), 1PARITY is high, and there are three high bits on the 1B bus, then 1$\overline{ERROR}$ is low, indicating a parity error.

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EPIC and Widebus are trademarks of Texas Instruments Incorporated.

The 'AC16657 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of a standard small-outline package in the same printed-circuit-board.

The 54AC16657 is characterized over the full military temperature range of −55°C to 125°C. The 74AC16657 is characterized for operation from −40°C to 85°C.

FUNCTION TABLE, EACH SECTION

NUMBER OF A OR B	INPUTS			INPUT/OUTPUT	OUTPUTS	
INPUTS THAT ARE HIGH	$\overline{OE}$	T/$\overline{R}$	ODD/$\overline{EVEN}$	PARITY	$\overline{ERROR}$	OUTPUT MODE
0, 2, 4, 6, 8	L	H	H	H	Z	Transmit
	L	H	L	L	Z	Transmit
	L	L	H	H	H	Receive
	L	L	H	L	L	Receive
	L	L	L	H	L	Receive
	L	L	L	L	H	Receive
1, 3, 5, 7	L	H	H	L	Z	Transmit
	L	H	L	H	Z	Transmit
	L	L	H	H	L	Receive
	L	L	H	L	H	Receive
	L	L	L	H	H	Receive
	L	L	L	L	L	Receive
DON'T CARE	H	X	X	Z	Z	Z

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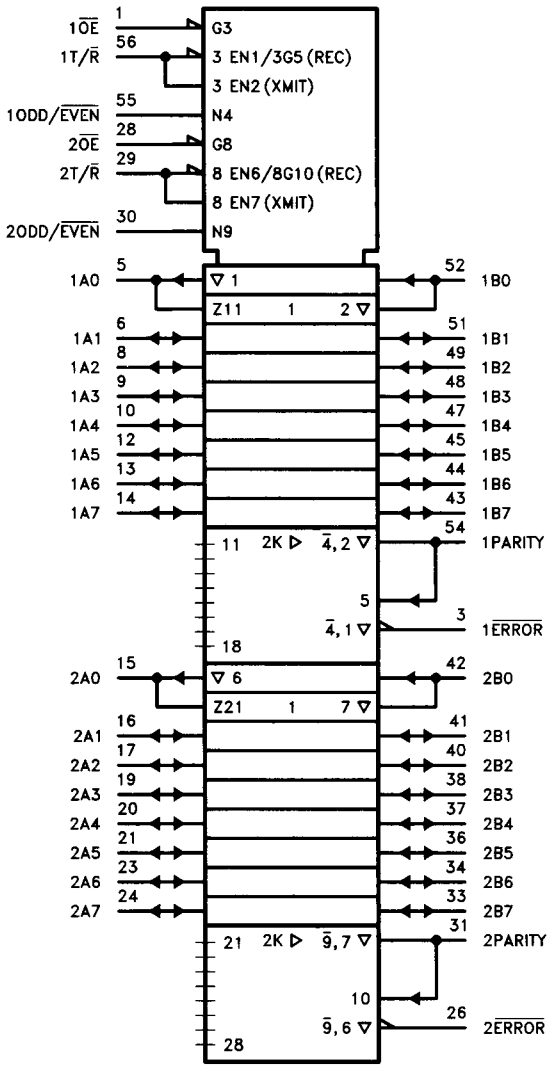
logic symbol†



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

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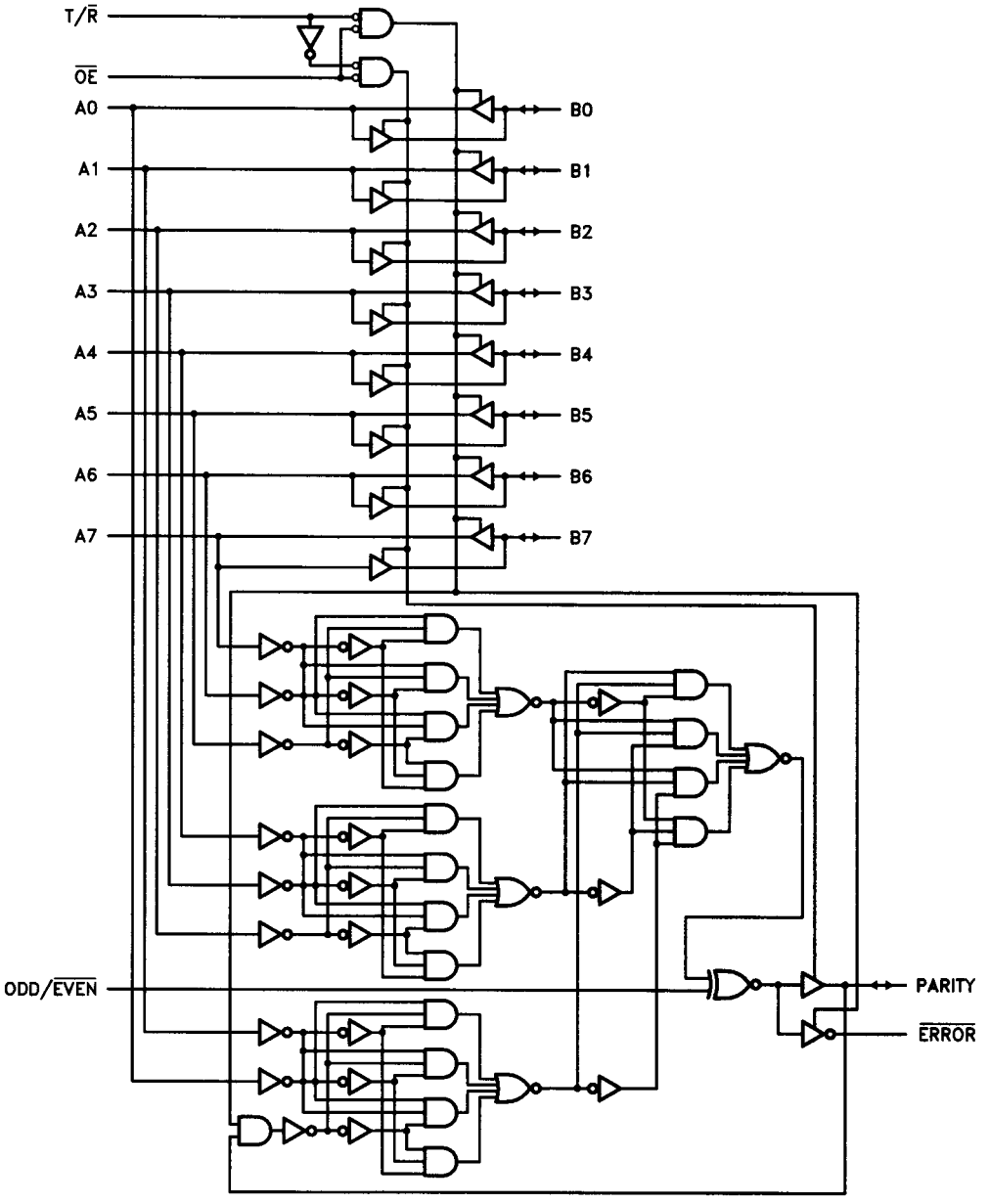
logic diagram, each transceiver (positive logic)



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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 (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 ..... ±500 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.

recommended operating conditions

			54AC16657			74AC16657			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage (see Note 2)		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		0		10	0		10	ns/V
T_A	Operating free-air temperature		−55		125	−40		85	°C

NOTE 2: All V_{CC} and GND pins must be connected to the proper voltage power supply.

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

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			54AC16657		74AC16657		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_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		±10		±5	μA
I_{CC}		V_I = V_{CC} or GND, I_O = 0	5.5 V			8		160		80	μA
C_i	Control inputs	V_I = V_{CC} or GND	5 V		4.5						pF
C_{io}	A or B ports	V_O = V_{CC} or GND	5 V		16						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 current.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC16657		74AC16657		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A								ns
t_{PHL}										
t_{PLH}	A_n	PARITY								ns
t_{PHL}										
t_{PLH}	ODD/$\overline{EVEN}$	PARITY,$\overline{ERROR}$								ns
t_{PHL}										
t_{PLH}	B_n	$\overline{ERROR}$								ns
t_{PHL}										
t_{PLH}	PARITY	$\overline{ERROR}$								ns
t_{PHL}										
t_{PZH}	$\overline{OE}$	A_n, B_n, PARITY or $\overline{ERROR}$								ns
t_{PZL}										
t_{PHZ}	$\overline{OE}$	A_n, B_n, PARITY or $\overline{ERROR}$								ns
t_{PLZ}										

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switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC16657		74AC16657		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A								ns
t_{PHL}										
t_{PLH}	A_n	PARITY								ns
t_{PHL}										
t_{PLH}	ODD/$\overline{\text{EVEN}}$	PARITY,$\overline{\text{ERROR}}$								ns
t_{PHL}										
t_{PLH}	B_n	$\overline{\text{ERROR}}$								ns
t_{PHL}										
t_{PLH}	PARITY	$\overline{\text{ERROR}}$								ns
t_{PHL}										
t_{PZH}	$\overline{\text{OE}}$	A_n, B_n, PARITY or $\overline{\text{ERROR}}$								ns
t_{PZL}										
t_{PHZ}	$\overline{\text{OE}}$	A_n, B_n, PARITY or $\overline{\text{ERROR}}$								ns
t_{PLZ}										

NOTE 3: Load circuit and voltage waveforms are shown in Section 1.

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		pF
		Outputs disabled			

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