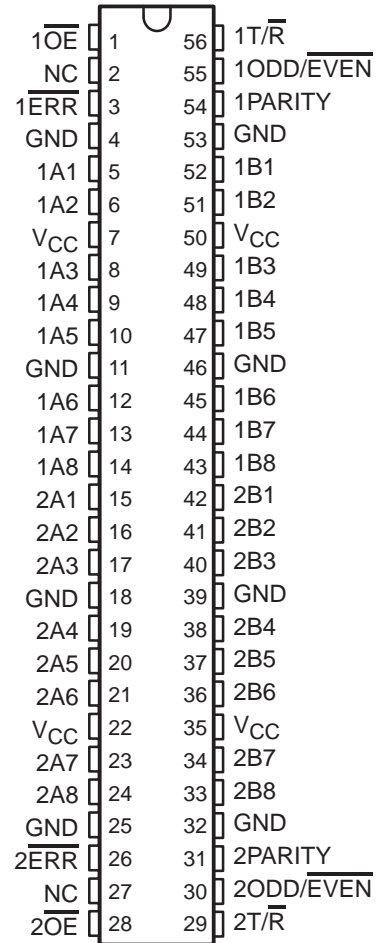


# 54ACT16657, 74ACT16657 16-BIT TRANSCEIVERS WITH PARITY GENERATORS/CHECKERS AND 3-STATE OUTPUTS

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- **Members of the Texas Instruments Widebus™ Family**
- **Inputs Are TTL-Voltage Compatible**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Distributed V<sub>CC</sub> and GND Pin Configuration Minimizes 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 300-mil Shrink Small-Outline (DL) Packages Using 25-mil Center-to-Center Pin Spacings and 380-mil Fine-Pitch Ceramic Flat (WD) Packages Using 25-mil Center-to-Center Pin Spacings**

54ACT16657 . . . WD PACKAGE  
74ACT16657 . . . DL PACKAGE  
(TOP VIEW)



## description

The 'ACT16657 contain two noninverting octal transceiver sections with separate parity generator/checker circuits and control signals. For either section, the transmit/receive (1T/R or 2T/R) input determines the direction of data flow. When 1T/R (or 2T/R) is high, data flows from the 1A (or 2A) port to the 1B (or 2B) port (transmit mode); when 1T/R (or 2T/R) is low, data flows from the 1B (or 2B) port to the 1A (or 2A) port (receive mode). When the output-enable (1OE or 2OE) input 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/EVEN (or 2ODD/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/EVEN (or 2ODD/EVEN) input. For example, if 1ODD/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.

NC – No internal connection



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**description (continued)**

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

The 74ACT16657 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54ACT16657 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The 74ACT16657 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

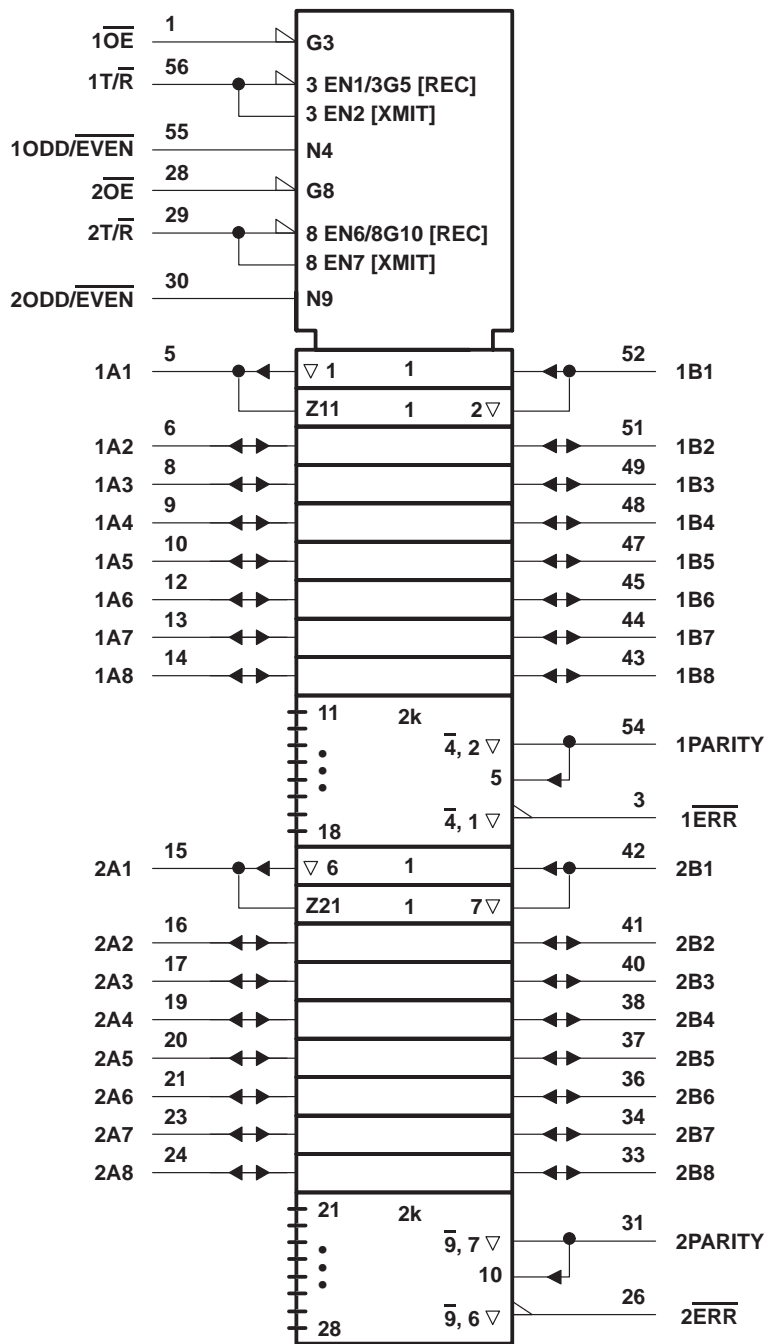
FUNCTION TABLE

NUMBER OF A OR B INPUTS THAT ARE HIGH	INPUTS			INPUT/OUTPUT PARITY	OUTPUTS	
	$\overline{OE}$	$\overline{T/R}$	$\text{ODD}/\overline{\text{EVEN}}$		$\overline{ERR}$	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†

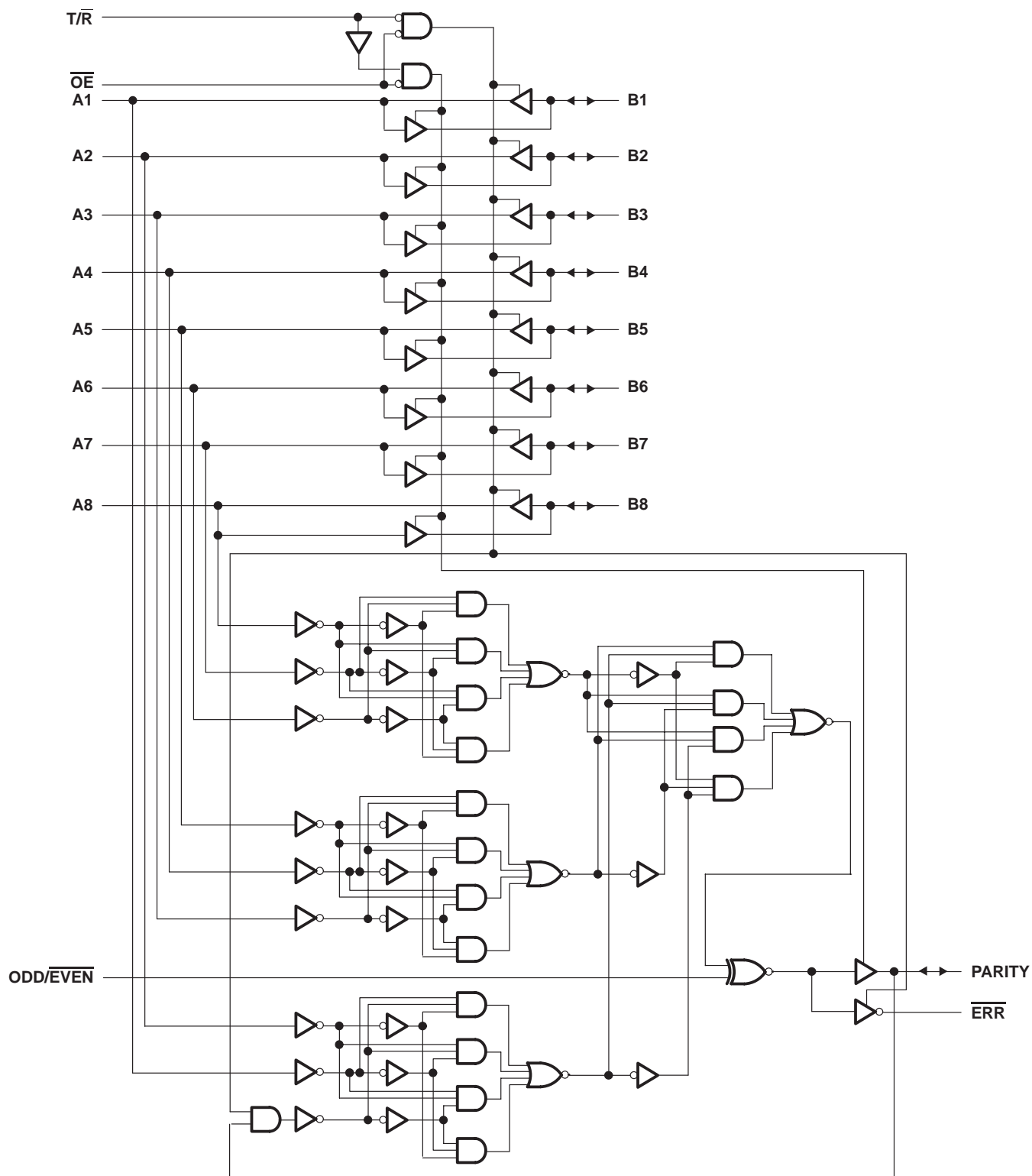


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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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 $V_I > V_{CC}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 50$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 500$ mA
Maximum package power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DL package .....	1.4 W
Storage temperature range, $T_{stg}$ .....	$-65^\circ\text{C}$ to $150^\circ\text{C}$

† 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 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  $150^\circ\text{C}$  and a board trace length of 750 mils.

**recommended operating conditions (see Note 3)**

	54ACT16657			74ACT16657			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.5	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
$V_O$ Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$I_{OH}$ High-level output current			-24			-24	mA
$I_{OL}$ Low-level output current			24			24	mA
$\Delta t/\Delta v$ Input transition rise or fall rate	0		10	0		10	ns/V
$T_A$ Operating free-air temperature	-55		125	-40		85	$^\circ\text{C}$

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			54ACT16657		74ACT16657		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	4.5 V	4.4			4.4		4.4	V	
		5.5 V	5.4			5.4		5.4		
	I <sub>OH</sub> = -24 mA	4.5 V	3.94			3.8		3.8		
		5.5 V	4.94			4.8		4.8		
I <sub>OH</sub> = -75 mA†	5.5 V				3.85		3.85			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	4.5 V			0.1		0.1	0.1	V	
		5.5 V			0.1		0.1	0.1		
	I <sub>OL</sub> = 24 mA	4.5 V			0.36		0.44	0.44		
		5.5 V			0.36		0.44	0.44		
I <sub>OL</sub> = 75 mA†	5.5 V					1.65	1.65			
I <sub>I</sub>	A or B ports	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1		±1	±1	μA
I <sub>OZ</sub> ‡	Control inputs	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V			±0.5		±5	±5	μA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			8		80	80	μA
ΔI <sub>CC</sub> §		One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	5.5 V			0.9		1	1	mA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			4.5				pF
C <sub>O</sub>	$\overline{\text{ERR}}$	V <sub>O</sub> = V <sub>CC</sub> or GND	5 V			11				pF
C <sub>io</sub>	A or B ports	V <sub>O</sub> = V <sub>CC</sub> 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<sub>OZ</sub> includes the input leakage current.

§ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V<sub>CC</sub>.

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

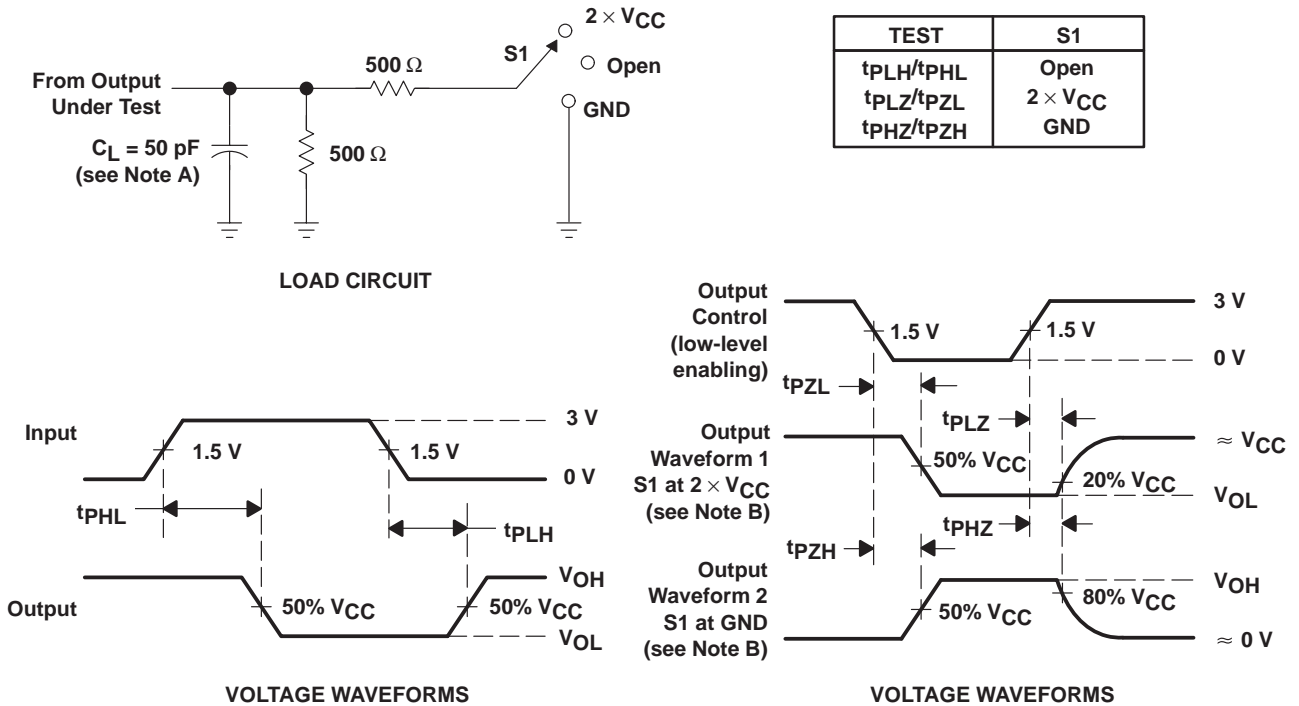
PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			54ACT16657		74ACT16657		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	4.1	7.3	9.6	4.1	10.7	4.1	10.7	ns
t <sub>PHL</sub>			3.2	6.8	9.8	3.2	10.6	3.2	10.6	
t <sub>PLH</sub>	A	PARITY	4	8.6	12.9	4	14.3	4	14.3	ns
t <sub>PHL</sub>			4.3	9	13.1	4.3	14.3	4.3	14.3	
t <sub>PLH</sub>	ODD/ $\overline{\text{EVEN}}$	PARITY, $\overline{\text{ERR}}$	3.7	8.3	12.3	3.7	13.7	3.7	13.7	ns
t <sub>PHL</sub>			4.1	8.8	12.8	4.1	14.1	4.1	14.1	
t <sub>PLH</sub>	B	$\overline{\text{ERR}}$	3.9	8.6	13	3.9	14.6	3.9	14.6	ns
t <sub>PHL</sub>			4.3	9	13.3	4.3	14.7	4.3	14.7	
t <sub>PLH</sub>	PARITY	$\overline{\text{ERR}}$	3.8	8.4	12.2	3.8	13.8	3.8	13.8	ns
t <sub>PHL</sub>			4.1	8	12.8	4.1	14.2	4.1	14.2	
t <sub>PZH</sub>	$\overline{\text{OE}}$	A, B, PARITY, or $\overline{\text{ERR}}$	2.6	6.1	10.1	2.6	11.3	2.6	11.3	ns
t <sub>PZL</sub>			3.2	7.2	11.7	3.2	13	3.2	13	
t <sub>PHZ</sub>	$\overline{\text{OE}}$	A, B, PARITY, or $\overline{\text{ERR}}$	5.9	8.6	10.5	5.9	11.2	5.9	11.2	ns
t <sub>PLZ</sub>			5.3	8	9.8	5.3	10.5	5.3	10.5	

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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	Outputs enabled	$C_L = 50\text{ pF}$ , $f = 1\text{ MHz}$	76
		Outputs disabled		35

**PARAMETER MEASUREMENT INFORMATION**



- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = 3\text{ ns}$ ,  $t_f = 3\text{ ns}$ .  
 D. The outputs are measured one at a time with one input transition per measurement.

**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>
74ACT16657DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16657DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16657DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16657DLRG4	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
74ACT16657DLR	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)
74ACT16657DLR	SSOP	DL	56	1000	346.0	346.0	49.0

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