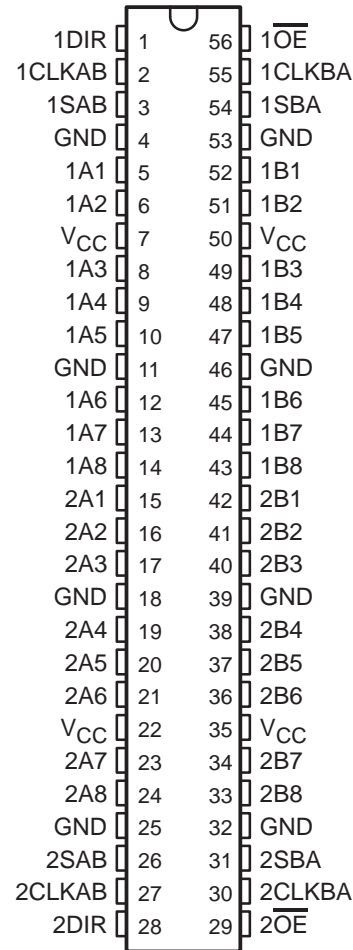


54ACT16646, 74ACT16646 16-BIT BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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- Members of the Texas Instruments *Widebus™* Family
- Inputs Are TTL-Voltage Compatible
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Flow-Through Architecture Optimizes PCB Layout
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- *EPIC™* (Enhanced-Performance Implanted CMOS) 1- μ m 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

54ACT16646 . . . WD PACKAGE
74ACT16646 . . . DL PACKAGE
(TOP VIEW)



description

The 'ACT16646 are 16-bit bus transceivers consisting of D-type flip-flops and control circuitry with 3-state outputs arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. The devices can be used as two 8-bit transceivers or one 16-bit transceiver. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the bus transceivers and registers.

Output-enable (\overline{OE}) and direction-control (DIR) inputs are provided to control the transceiver functions. In the transceiver mode, data present at the high-impedance port may be stored in either register or in both. The select controls (SAB and SBA) can multiplex stored and real-time (transparent mode) data. The circuitry used for select control eliminates the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. DIR determines which bus receives data when \overline{OE} is low. In the isolation mode (\overline{OE} high), A data may be stored in one register and/or B data may be stored in the other register.

When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time.

The 74ACT16646 is packaged in TI's shrink small-outline package, which provides twice the functionality of standard small-outline packages in the same printed-circuit-board area.

The 54ACT16646 is characterized for operation over the full military temperature range of -55°C to 125°C . The 74ACT16646 is characterized for operation from -40°C to 85°C .



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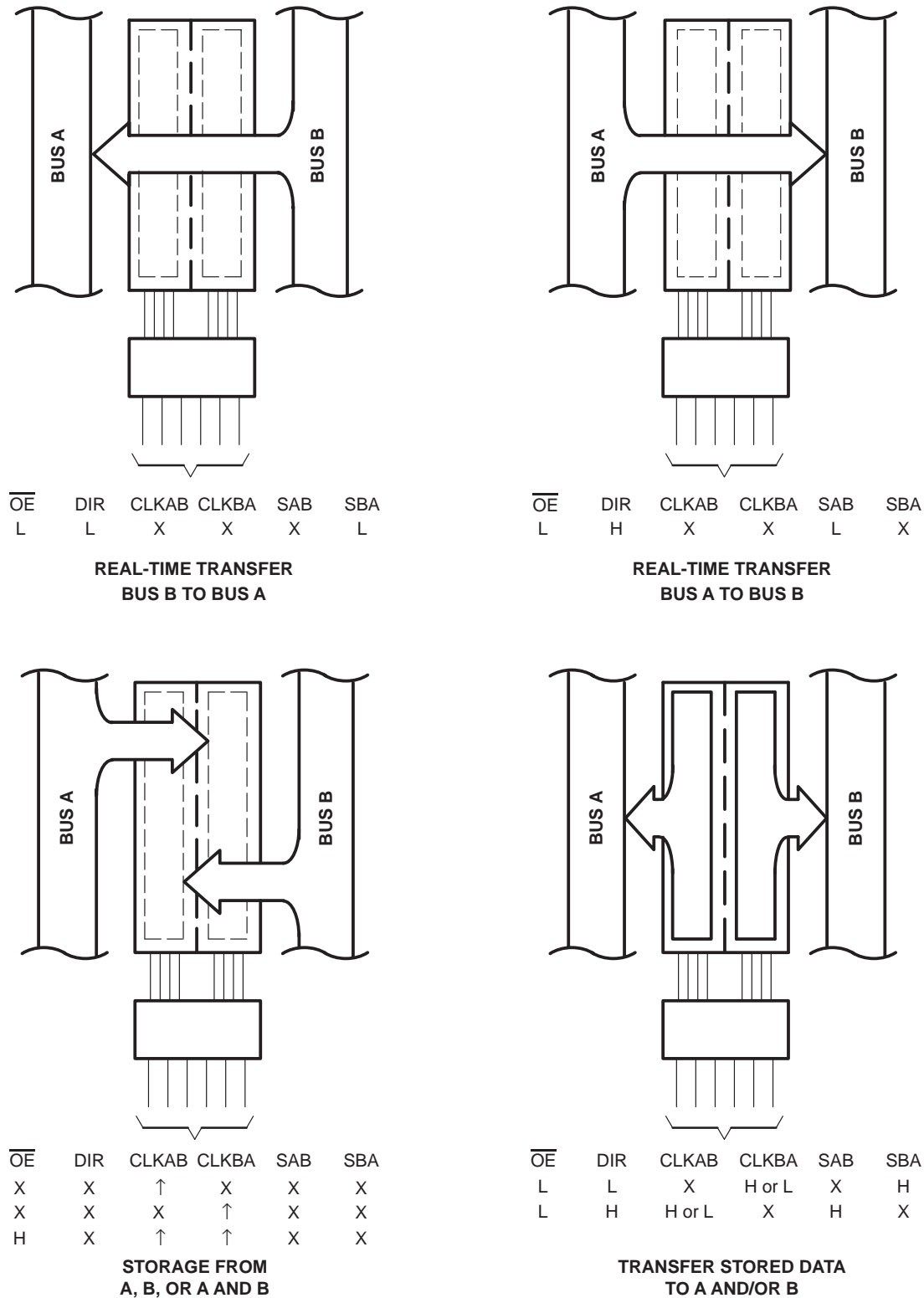


Figure 1. Bus-Management Functions

54ACT16646, 74ACT16646
16-BIT BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS

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FUNCTION TABLE

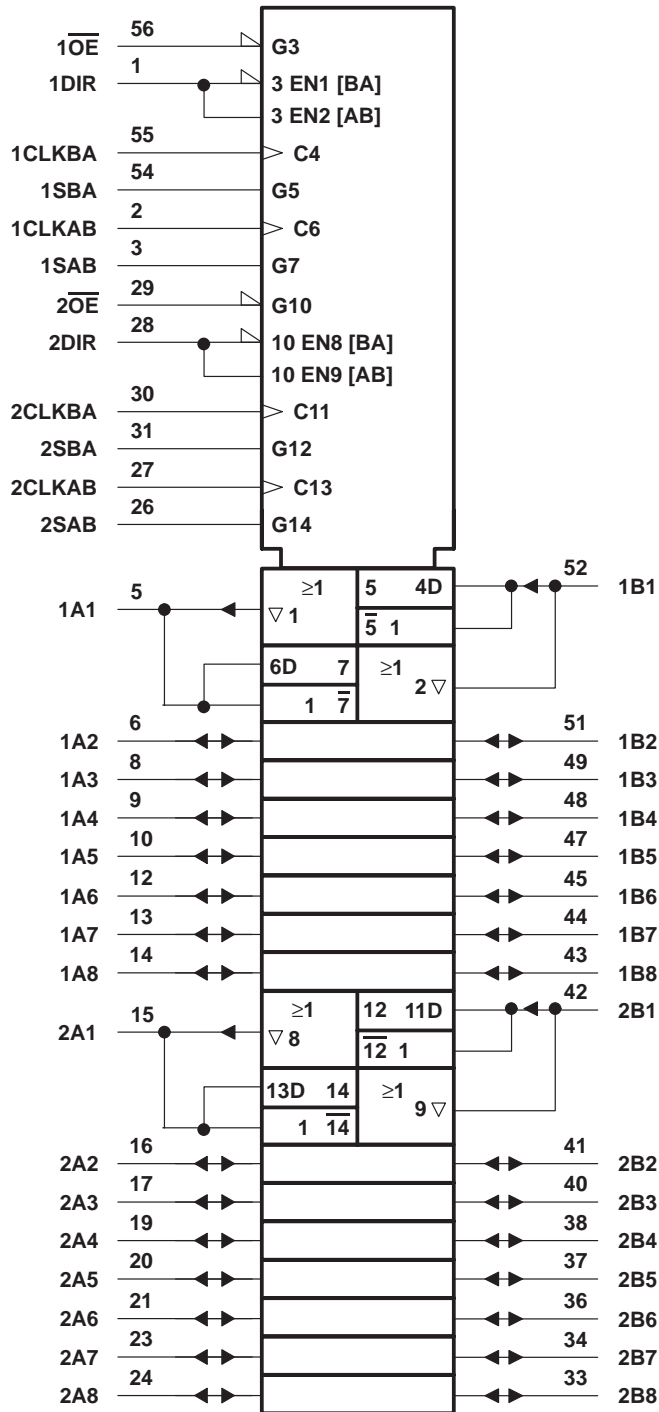
INPUTS						DATA I/O†		OPERATION OR FUNCTION
\overline{OE}	DIR	CLKAB	CLKBA	SAB	SBA	A1–A8	B1–B8	
X	X	↑	X	X	X	Input	Unspecified	Store A, B unspecified†
X	X	X	↑	X	X	Unspecified	Input	Store B, A unspecified†
H	X	↑	↑	X	X	Input	Input	Store A and B data
H	X	H or L	H or L	X	X	Input	Input	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-time B data to A bus
L	L	X	H or L	X	H	Output	Input	Stored B data to A bus
L	H	X	X	L	X	Input	Output	Real-time A data to B Bus
L	H	H or L	X	H	X	Input	Output	Stored A data to bus

† The data-output functions may be enabled or disabled by various signals at \overline{OE} or DIR. Data-input functions are always enabled, i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

54ACT16646, 74ACT16646 16-BIT BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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logic symbol†

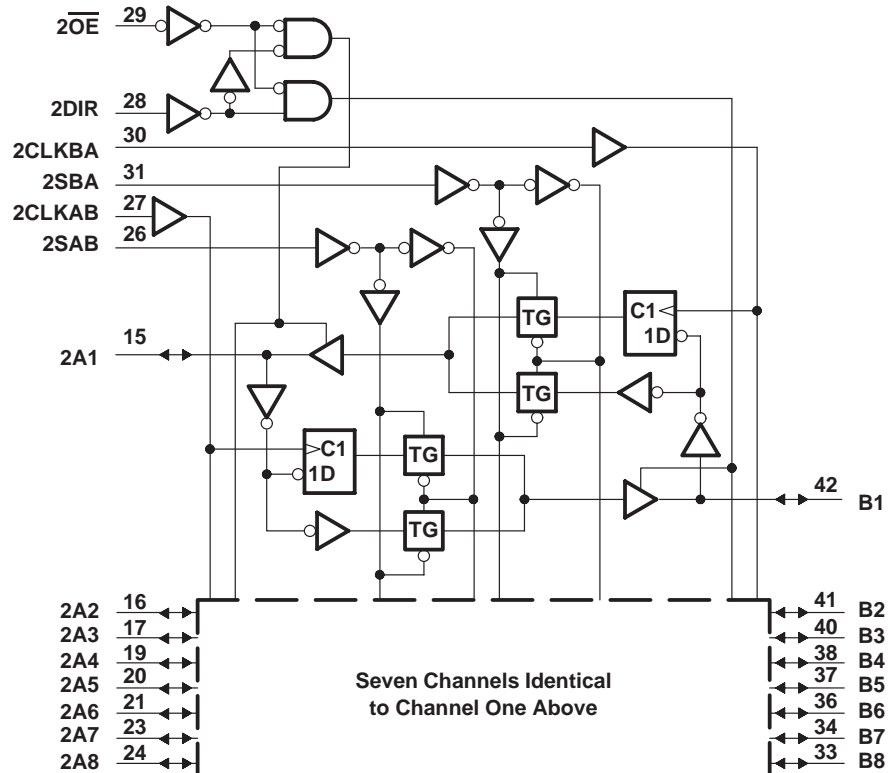
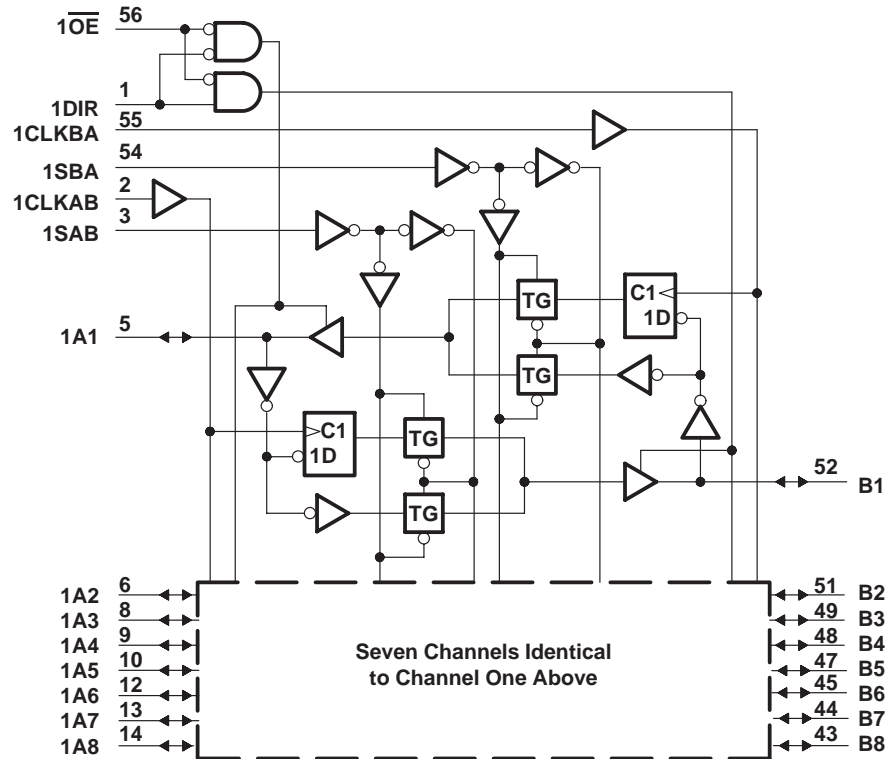


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

54ACT16646, 74ACT16646
 16-BIT BUS TRANSCEIVERS AND REGISTERS
 WITH 3-STATE OUTPUTS

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logic diagram (positive logic)



54ACT16646, 74ACT16646 16-BIT BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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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	± 400 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°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 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.

recommended operating conditions (see Note 3)

	54ACT16646		74ACT16646		UNIT
	MIN	MAX	MIN	MAX	
V_{CC} Supply voltage (see Note 4)	4.5	5.5	4.5	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	$^\circ\text{C}$

- NOTES: 3. Unused inputs must be held high or low to prevent them from floating.
4. All V_{CC} and GND pins must be connected to the proper voltage power supply.

54ACT16646, 74ACT16646
16-BIT BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS

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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			54ACT16646		74ACT16646		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 μA	4.5 V	4.4			4.4		4.4	V	
		5.5 V	5.4			5.4		5.4		
	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	4.5 V				0.1		0.1	V	
		5.5 V				0.1		0.1		
	I _{OL} = 24 mA	4.5 V				0.36		0.44		
		5.5 V				0.36		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	
ΔI _{CC} [§]		One input at 3.4 V, Other inputs at GND or V _{CC}	5.5 V		0.9		1	1	mA	
C _i	Control inputs	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 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_{CC}.

timing requirements over recommended ranges of supply voltage and operating free-air temperature, (unless otherwise noted) (see Figure 2)

		T _A = 25°C		54ACT16646		74ACT16646		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	0	90	0	90	0	90	MHz
t _w	Pulse duration, CLKAB or CLKBA high or low	5.5		5.5		5.5		ns
t _{su}	Setup time, A before CLKAB [↑] or B before CLKBA [↑]	Data high	4		4		4	ns
		Data low	6		6		6	
t _h	Hold time, A before CLKAB [↑] or B before CLKBA [↑]	1.5		1.5		1.5		ns

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54ACT16646, 74ACT16646 16-BIT BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, (unless otherwise noted) (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T _A = 25°C			54ACT16646		74ACT16646		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f _{max}			90			90		90		MHz
t _{PLH}	A or B	B or A	3.9	7.5	9.4	3.9	11.5	3.9	10.6	ns
t _{PHL}			3.4	7.6	10.6	3.4	12.2	3.4	11.4	
t _{PZH}	\overline{OE}	A or B	3.2	7.7	10.8	3.2	12.9	3.2	11.9	ns
t _{PZL}			4.2	9	12.2	4.2	14.6	4.2	13.5	
t _{PHZ}	\overline{OE}	A or B	5.3	7.7	9.6	5.3	10.4	5.3	10.2	ns
t _{PLZL}			4.9	7.3	9.2	4.9	10.3	4.9	9.9	
t _{PLH}	CLKBA or CLKAB	A or B	4.9	8.9	11.1	4.9	13.1	4.9	12.2	ns
t _{PHL}			5.1	9	11	5.1	13.1	5.1	12.3	
t _{PLH}	SAB or SBA† (with A or B high)	A or B	5.2	10.3	13.8	5.2	17.2	5.2	15.6	ns
t _{PHL}			4.9	8.2	10.6	4.9	12.5	4.9	11.7	
t _{PLH}	SBA or SAB† (with A or B high)	A or B	4.3	7.8	9.9	4.3	12.1	4.3	11.1	ns
t _{PHL}			5.9	11.2	14.9	5.9	18.2	5.9	16.7	
t _{PZH}	DIR	A or B	4.5	9.5	13.6	4.5	16.2	4.5	15.2	ns
t _{PZL}			4.3	9.2	11.8	4.3	14.2	4.3	13.1	
t _{PHZ}	DIR	A or B	4.5	7.9	10.2	4.5	11.2	4.5	10.8	ns
t _{PLZ}			4.4	7.5	9.8	4.4	10.8	4.4	10.4	

† These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

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

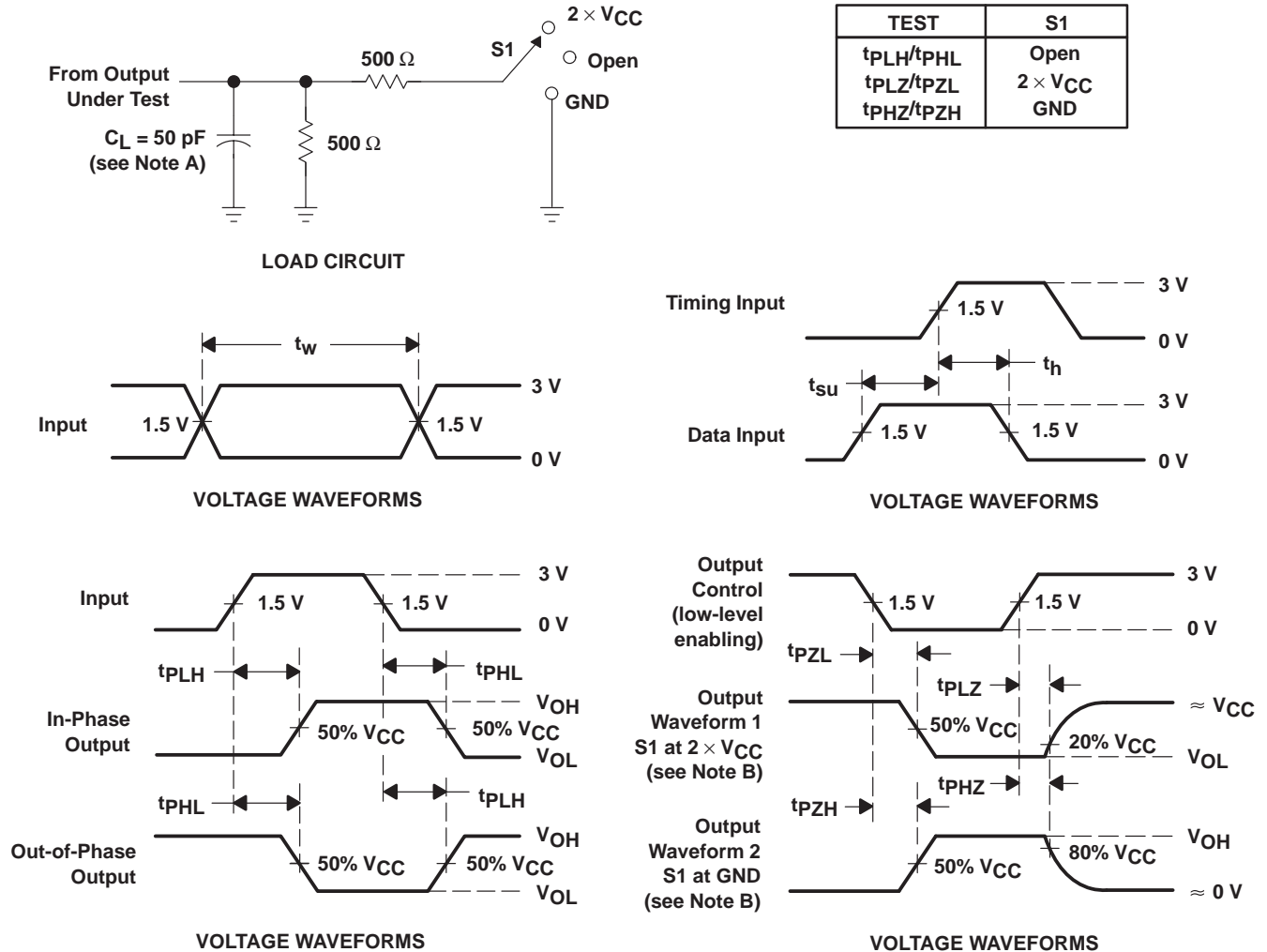
PARAMETER		TEST CONDITIONS	TYP	UNIT
C _{pd}	Power dissipation capacitance per transceiver	Outputs enabled	58	pF
		Outputs disabled	13	

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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 2. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74ACT16646DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16646DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16646DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16646DLRG4	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽¹⁾ 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.

⁽²⁾ 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)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

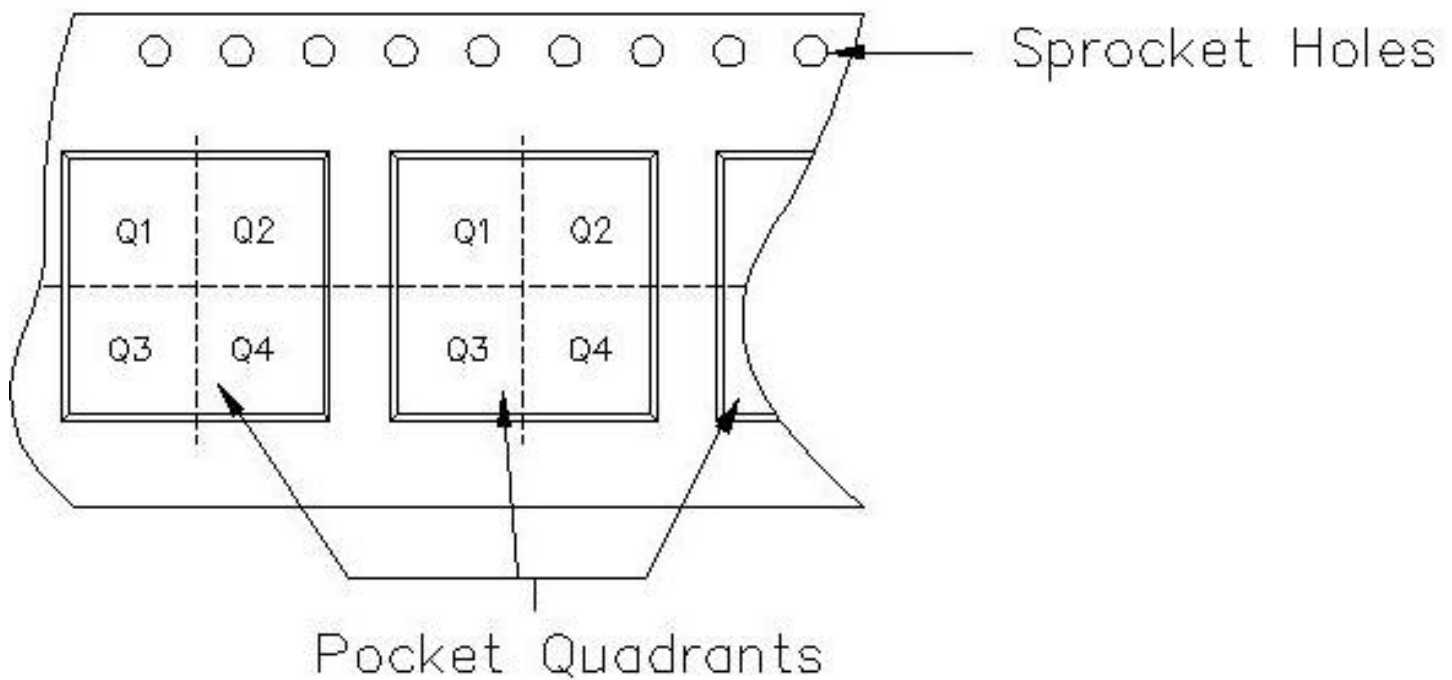
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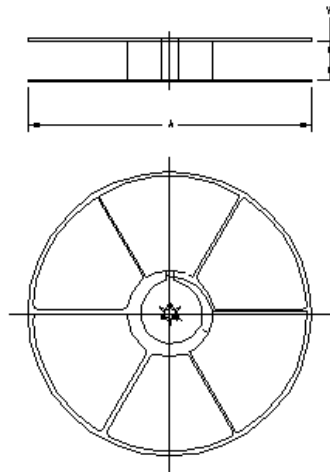
Carrier tape design is defined largely by the component length, width, and thickness.

A_o = Dimension designed to accommodate the component width.
B_o = Dimension designed to accommodate the component length.
K_o = Dimension designed to accommodate the component thickness.
W = Overall width of the carrier tape.
P = Pitch between successive cavity centers.



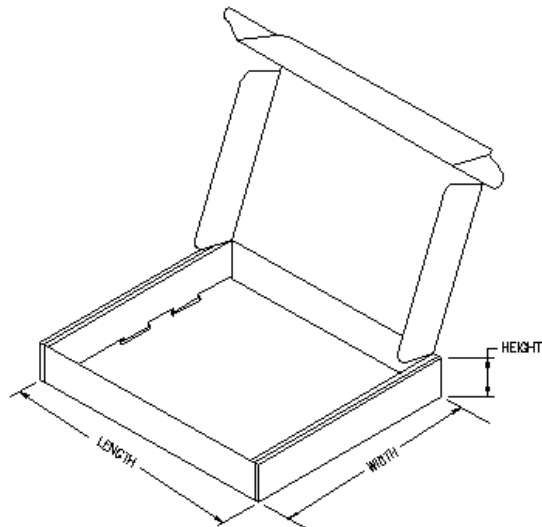
TAPE AND REEL INFORMATION

Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
74ACT16646DLR	DL	56	MLA	330	32	11.35	18.67	3.1	16	32	Q1



TAPE AND REEL BOX INFORMATION

Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
74ACT16646DLR	DL	56	MLA	346.0	346.0	49.0



DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 D. Falls within JEDEC MO-118

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