CDx4AC245, CDx4ACT245 Octal-Bus Transceiver, Three-State, Non-Inverting

1 Features

- Buffered inputs
- Typical propagation delay
  - 4ns at V_{CC} = 5V, T_A = 25°C, C_L = 50pF
- SCR-latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST™/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5V to 5.5V operation and balanced noise immunity at 30% of the supply
- ± 24mA output drive current
  - Fanout to 15 FAST™ ICs
  - Drives 50Ω transmission line

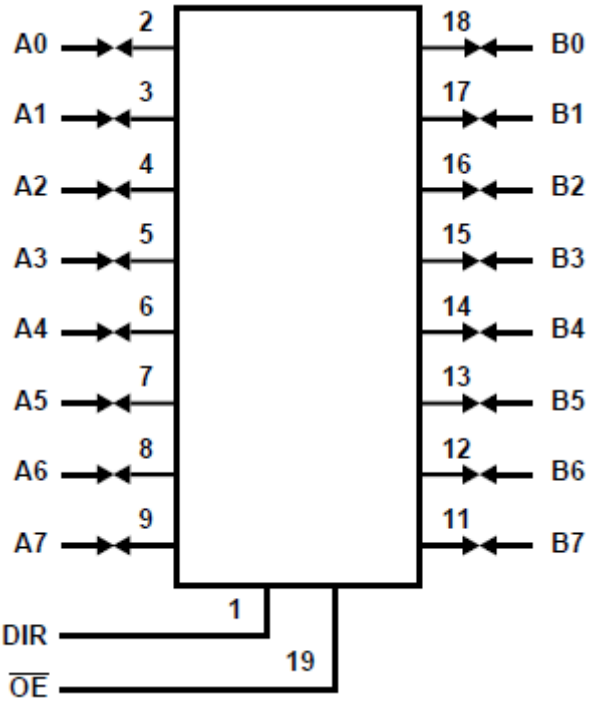
2 Description

The 'AC245 and 'ACT245 are octal-bus transceivers that utilize Advanced CMOS Logic technology.

Device Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)	BODY SIZE(3)
CD74AC245/ CD74ACT245	N (PDIP, 20)	24.33mm × 9.4mm	24.33mm × 6.35mm
	DW (SOIC, 20)	12.80mm × 10.3mm	12.80mm × 7.50mm
CD54AC245/ CD54ACT245	J (CDIP, 20)	24.2mm × 7.62mm	24.2mm × 6.92mm
CD74ACT245	DB (SSOP, 20)	7.2mm × 7.8mm	7.2mm × 5.3mm

(1) For more information, see Section 10.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.
(3) The body size (length × width) is a nominal value and does not include pins.



Logic Diagram (Positive Logic)

Table of Contents

3 Pin Configuration and Functions

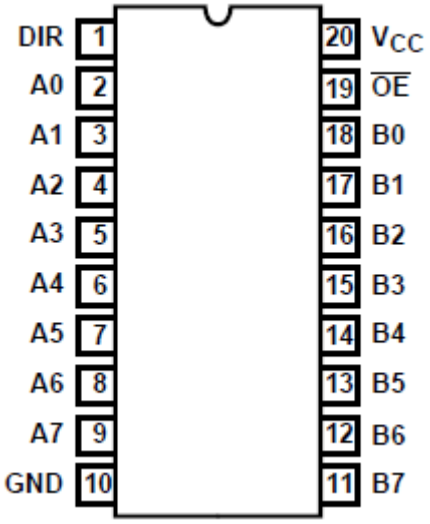


Figure 3-1. CD54AC245, CD54ACT245 (CERDIP), CD74AC245, CD74ACT245 (PDIP, SOIC, SSOP) Top View

Pin Functions

PIN		TYPE[1]	DESCRIPTION
NO.	NAME		
1	DIR	I/O	Direction Pin
2	A0	I/O	A1 Input/Output
3	A1	I/O	A2 Input/Output
4	A2	I/O	A3 Input/Output
5	A3	I/O	A4 Input/Output
6	A4	I/O	A5 Input/Output
7	A5	I/O	A6 Input/Output
8	A6	I/O	A7 Input/Output
9	A7	I/O	A8 Input/Output
10	GND	—	Ground Pin
11	B7	I/O	B7 Input/Output
12	B6	I/O	B6 Input/Output
13	B5	I/O	B5 Input/Output
14	B4	I/O	B4 Input/Output
15	B3	I/O	B3 Input/Output
16	B2	I/O	B2 Input/Output
17	B1	I/O	B1 Input/Output
18	B0	I/O	B0 Input/Output
19	$\overline{OE}$	I/O	Output Enable
20	V_{CC}	—	Power Pin

(1) Signal Types: I = Input, O = Output, I/O = Input or Output

4 Specifications

4.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		−0.5	6	V
I_{IK}	Input diode current	V_I < -0.5V or V_I > V_{CC} + 0.5V		± 20	mA
I_{OK}	Output diode current	V_O < -0.5V or V_O > V_{CC} + 0.5V		± 50	mA
I_O	Output source or sink current per output pin	V_O > -0.5V or V_O < V_{CC} + 0.5V		± 50	mA
I_{OK} (2)	V_{CC} or ground current	I_{CC} or I_{GND}		± 100	mA
T_{stg}	Storage temperature		−65	150	°C

(1) 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.
(2) For up to 4 outputs per device, add ±25mA for each additional output.

4.2 Recommended Operating Conditions

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

			CDx4AC245		CDx4ACT245		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage(1)		1.5V	5.5V	4.5V	5.5V	V
V_I, V_O	Input or Output Voltage		0V	V_{CC}	0V	V_{CC}	V
dt/dv	Input Rise and Fall Slew Rate	1.5V to 3V		50			ns
		3.6V to 5.5V		20			
		4.5V to 5.5V				10	
T_A	Temperature range		–55	125	–55	125	°C

(1) Unless otherwise specified, all voltages are referenced to ground.

4.3 Thermal Information

THERMAL METRIC(1)		CDx4AC14/ CDx4ACT14			UNIT
		N (PDIP)	DW (SOIC)	DB (SSOP)	
		20 PINS			
$R_{\theta JA}$	Junction-to-ambient thermal resistance	69	98.6	105.4	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, SPRA953.

4.4 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		V_{CC}	T_A = 25°C		-40°C TO 85°C		-55°C TO 125°C		UNIT
		V_I (V)	I_O (mA)		MIN	MAX	MIN	MAX	MIN	MAX	
AC TYPES											
V_{IH}	High-level input voltage			1.5	1.2		1.2		1.2		V
				3	2.1		2.1		2.1		
				5.5	3.85		3.85		3.85		
V_{IL}	Low-level input voltage	V_{IL}		1.5		0.3		0.3		0.3	V
				3		0.9		0.9		0.9	
				5.5		1.65		1.65		1.65	
V_{OH}	High-level output voltage	V_{IH} or V_{IL}	-0.05	1.5	1.4		1.4		1.4		VV_{OH}
			-0.05	3	2.9		2.9		2.9		
			-0.05	4.5	4.4		4.4		4.4		
			-4	3	2.58		2.48		2.4		
			-24	4.5	3.94		3.8		3.7		
			-75	5.5			3.85				
			-50	5.5					3.85		
V_{OL}	Low-level output voltage	V_{IH} or V_{IL}	0.05	1.5 V		0.1		0.1		0.1	V
			0.05	3 V		0.1		0.1		0.1	
			0.05	4.5 V		0.1		0.1		0.1	
			12	3 V		0.36		0.44		0.5	
			24	4.5 V		0.36		0.44		0.5	
			75[1]	5.5 V				1.65			
			50[1]	5.5 V						1.65	
I_I	Input leakage current	V_{CC} or GND		5.5		± 0.1		± 1		± 1	µ A
I_{OZ}	Three-state leakage current	V_{IH} or V_{IL}, VO = V_{CC} or GND		5.5 V		± 0.5		± 5		± 10	µ A
I_{CC}	Quiescent supply current MSI	V_{CC} or GND	0	5.5 V		8		80		160	µ A
ACT TYPES											
V_{IH}	High-level input voltage			4.5 V to 5.5 V	2		2		2		V
V_{IL}	Low-level input voltage			4.5 V to 5.5 V		0.8		0.8		0.8	V
V_{OH}	High-level output voltage	V_{IH} or V_{IL}	-0.05	4.5 V	4.4		4.4		4.4	0.8	V
			-24	4.5 V	3.94		3.8		3.7		
			-75[1]	5.5 V			3.85				
			-50	5.5 V					3.85		

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

PARAMETER		TEST CONDITIONS		V_{CC}	T_A = 25°C		-40°C TO 85°C		-55°C TO 125°C		UNIT
		V_I (V)	I_O (mA)		MIN	MAX	MIN	MAX	MIN	MAX	
V_{OL}	Low-level output voltage	V_{IH} or V_{IL}	0.05	4.5		0.1		0.1		0.1	V
			24	4.5		0.36		0.44		0.5	
			75[1]	5.5				1.65			
			50[1]	5.5						1.65	
											V
I_I	Input leakage current	V_{CC} or GND		5.5 V		± 0.1		± 1		± 1	µA
I_{OZ}	Three-state or leakage current	V_{IH} or $V_{IL}V_O$ = V_{CC} or GND		5.5 V		± 0.5		± 5		± 10	µA
I_{CC}	Quiescent supply current MSI	V_{CC} or GND	0	5.5 V		8		80		160	µA
Δ I_{CC}	Additional supply current per input pin TTL inputs high 1 unit load	V_{CC} -2.1		4.5 to 5.5		2.4		2.8		3	mA

1. Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation. Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

4.5 Switching Characteristics

Input t_r, t_f = 3ns, C_L = 50pF (Worst Case). Over recommended operating free-air temperature range (unless otherwise noted) (see Load Circuit and Voltage Waveforms)

PARAMETER		V_{CC} (V)	-40°C TO 85°C			-55°C TO 125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
AC TYPES									
t_{PLH}, t_{PHL}	Propagation delay, data to output	1.5			96			106	ns
		3.3		3.2	10.8	3		11.9	
		5		2.2	7.7	2.1		8.5	
t_{PLZ}, t_{PHZ}	Propagation delay, output disable to output	1.5			159			175	ns
		3.3		4.7	15.9	4.4		17.5	
		5		3.7	12.7	3.5		14	
t_{PZL}, t_{PZH}	Propagation delay, output enable to output	1.5			159			175	ns
		3.3		5.6	19	5.3		21	
		5		3.7	12.7	3.5			
V_{OHV}	Minimum (Valley) V_{OH} During switching of other outputs (output under test not switching)	5		4 at 25°C			4 at 25°C		V

Input t_r, t_f = 3ns, C_L = 50pF (Worst Case). Over recommended operating free-air temperature range (unless otherwise noted) (see Load Circuit and Voltage Waveforms)

PARAMETER		V_{CC} (V)	-40°C TO 85°C			-55°C TO 125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OLP}	Maximum (Peak) V_{OL} During switching of other outputs (output under test not switching)	5		1 at 25°C			1 at 25°C		V
C_O	Three-state output capacitance			15			15		pF
C_I	Input capacitance				10			10	pF
C_{PD}	Power dissipation capacitance			57			57		pF
ACT TYPES									
t_{PLH}, t_{PHL}	Propagation delay, data to output	5	2.7		9.1	2.5		10	ns
t_{PLZ}, t_{PHZ}	Propagation delay, output disable to output	5	3.7		12.7	3.5		14	ns
t_{PZL}, t_{PZH}	Propagation delay, output enable to output	5	3.8		13.1	3.6		14.4	ns
V_{OHV}	Minimum (Valley) V_{OH} During switching of other outputs (output under test not switching)	5		4 at 25°C			4 at 25°C		V
V_{OLP}	Maximum (Peak) V_{OL} During switching of other outputs (output under test not switching)	5		1 at 25°C			1 at 25°C		V
C_O	Three-state output capacitance			15			15		pF
C_I	Input capacitance				10			10	pF
C_{PD}	Power dissipation capacitance			57			57		pF

1. Limits tested 100%
2. 3.3V Min is at 3.6V, Max is at 3V
3. 5V Min is at 5.5V, Max is at 4.5V
4. CPD is used to determine the dynamic power consumption per channel
   - AC: PD = VCC2 fi (CPD + CL)
   - ACT: PD = VCC2 fi (CPD + CL) + VCC Δ ICC where fi = input frequency, CL = output load capacitance, VCC = supply voltage

4.6 Timing Diagrams

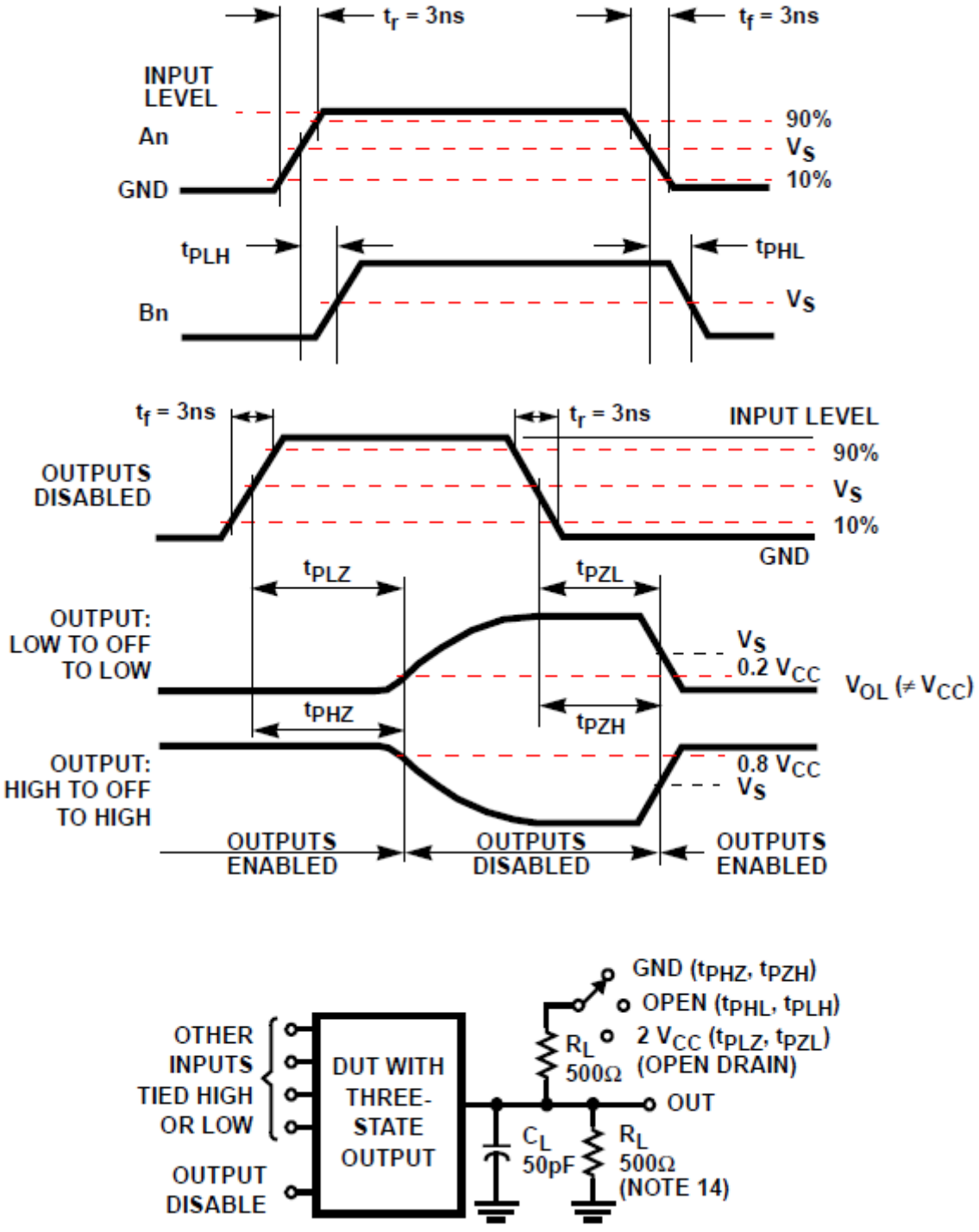


Figure 4-1. THREE-STATE PROPAGATION DELAY TIMES AND TEST CIRCUIT

Figure 4-1. SIMULTANEOUS SWITCHING TRANSIENT WAVEFORMS

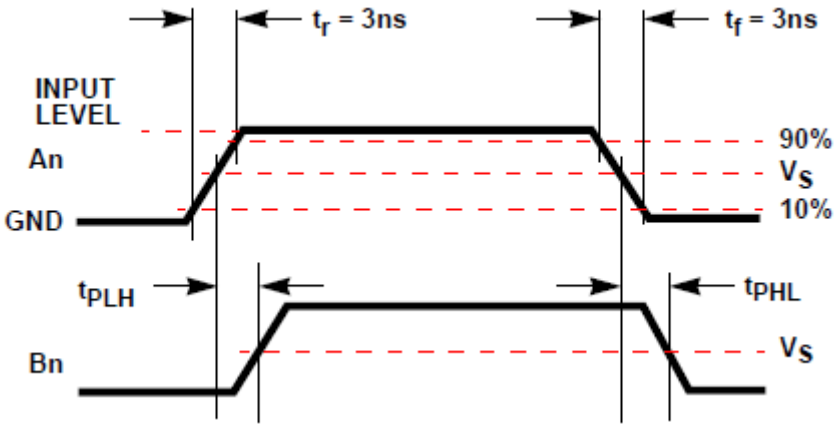
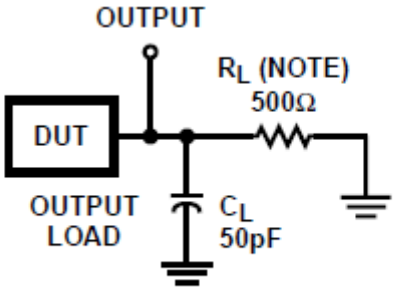


Figure 4-3. PROPAGATION DELAY TIMES



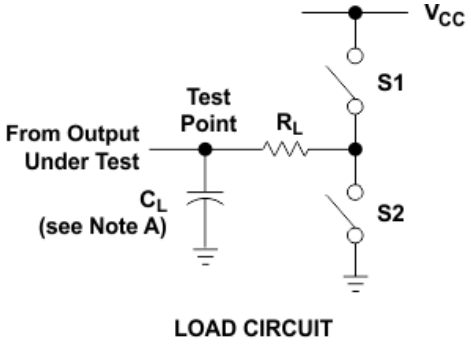
NOTE: For AC Series Only: When V_{CC} = 1.5V, R_L = 1kΩ.

Table 4-1.

	AC	ACT
Input Level	V_{CC}	3V
Input Switching Voltage, V_S	0.5 V_{CC}	1.5V
Output Switching Voltage, V_S	0.5 V_{CC}	0.5 V_{CC}

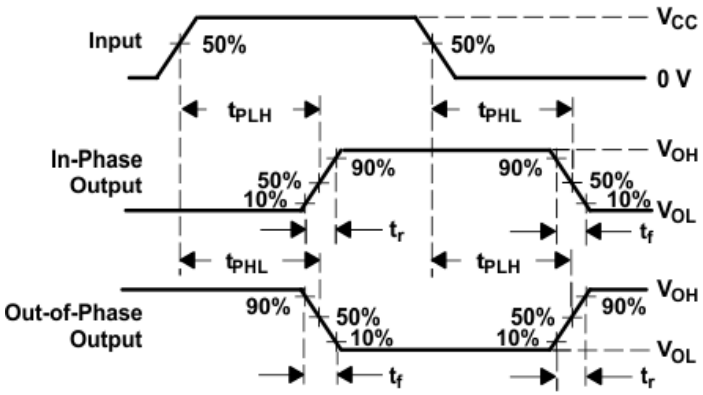
Figure 4-4. PROPAGATION DELAY TIMES

5 Parameter Measurement Information

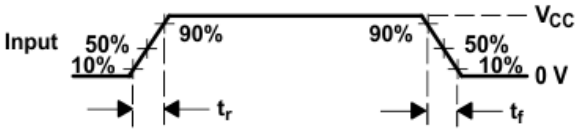


LOAD CIRCUIT

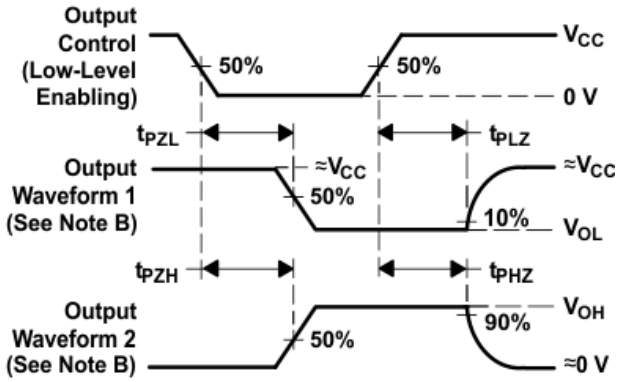
PARAMETER		R_L	C_L	S1	S2
t_{en}	t_{PZH}	1 kΩ	50 pF or 150 pF	Open	Closed
	t_{PZL}			Closed	Open
t_{dis}	t_{PHZ}	1 kΩ	50 pF	Open	Closed
	t_{PLZ}			Closed	Open
t_{pd} or t_t		--	50 pF or 150 pF	Open	Open



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORM
INPUT RISE AND FALL TIMES



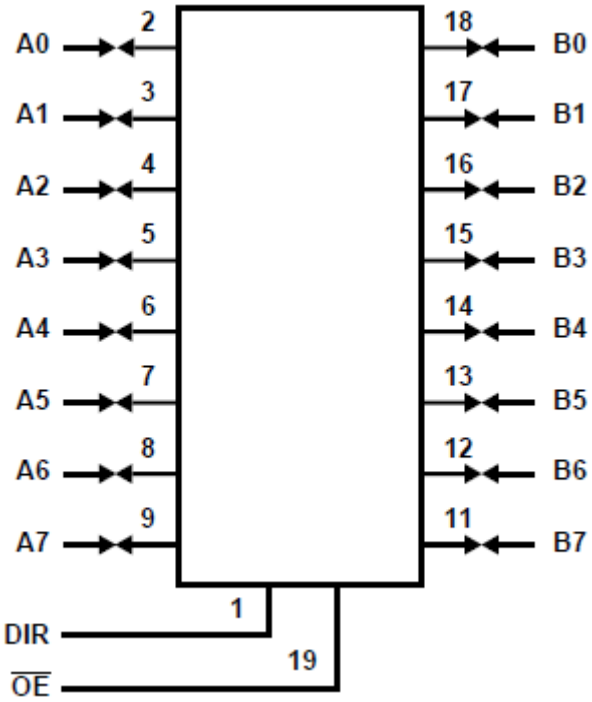
VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS

6 Detailed Description

6.1 Overview

The 'AC245 and 'ACT245 are non-inverting three-state bidirectional transceiver-buffers intended for two-way transmission from “A” bus to “B” bus or “B” bus to “A”. The logic level present on the direction input (DIR) determines the data direction. When the output enable input ($\overline{OE}$) is HIGH, the outputs are in the high-impedance state.

6.2 Functional Block Diagram



Logic Diagram (Positive Logic)

6.3 Device Functional Modes

Function Table lists the function modes of the CDx4AC245, CDx4ACT245.

Table 6-1. Function Table

INPUTS(1)		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

(1) H = High Voltage Level, L = Low Voltage Level, X = Don’t Care

7 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

7.1 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the *Section 4.2*.

Each V_{CC} pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 µF is recommended; if there are multiple V_{CC} pins, then 0.01 µF or 0.022 µF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 µF and a 1 µF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

7.2 Layout

7.2.1 Layout Guidelines

When using multiple-bit logic devices, inputs should never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Section 7.2.2 specifies the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC}, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the output section of the part when asserted. This will not disable the input section of the IOs, so they cannot float when disabled.

7.2.2 Layout Example

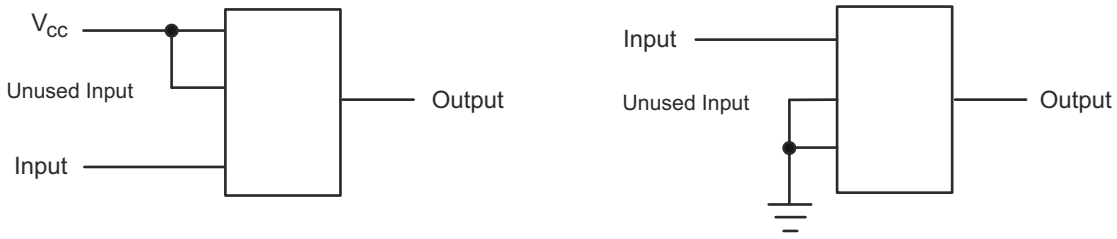


Figure 7-1. Layout Diagram

8 Device and Documentation Support

8.1 Documentation Support

8.1.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 8-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
CD54AC245	Click here	Click here	Click here	Click here	Click here
CD74AC245	Click here	Click here	Click here	Click here	Click here
CD54ACT245	Click here	Click here	Click here	Click here	Click here
CD74ACT245	Click here	Click here	Click here	Click here	Click here

8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

8.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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8.4 Trademarks

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8.5 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.6 Glossary

TI Glossary — This glossary lists and explains terms, acronyms, and definitions.

9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision C (May 2023) to Revision D (April 2024)	Page
• Added *Application and Implementation* section, *Device and Documentation Support* section, and package size to *Device Information* table	1
• Updated RθJA values: DW = 58 to 98.6, DB = 70 to 105.4, all values in °C/W	4

Changes from Revision B (April 2002) to Revision C (May 2023)	Page
• Added *Package Information* table, *Pin Functions* table, and *Thermal Information* table	1

10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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