



1.8V CMOS 32-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

IDT74AUC32245

FEATURES:

- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 1.8V Optimized
- 0.8V to 2.7V Operating Range
- Inputs/outputs tolerant up to 3.6V
- Output drivers: $\pm 8\text{mA}$ @ $V_{DD} = 1.8\text{V}$
- Supports hot insertion
- Available in 96-ball LFBGA package

APPLICATIONS:

- High performance, low voltage communications systems
- High performance, low voltage computing systems

DESCRIPTION:

This 32-bit bus transceiver is built using advanced CMOS technology. The AUC32245 is designed specifically for asynchronous communications between data buses. The control function implementation minimizes external timing requirements.

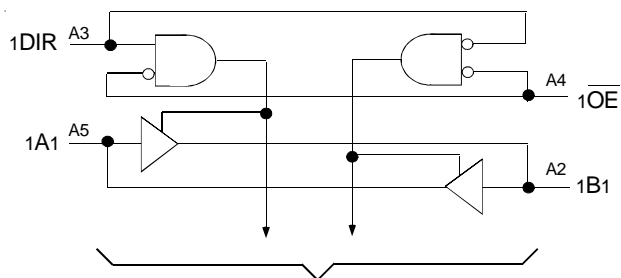
This device can be used as one 32-bit transceiver, two 16-bit transceivers, or four 8-bit transceivers. It allows data transmission from A bus to B bus or from B bus to A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ($\overline{\text{OE}}$) input can be used to disable the device so that the buses are effectively isolated.

This device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

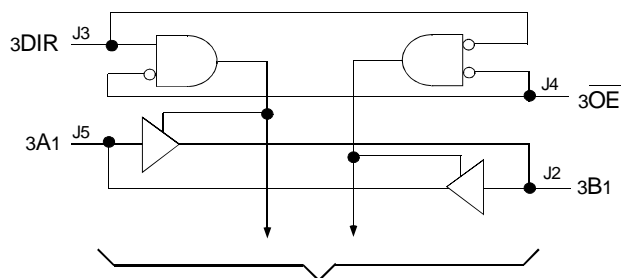
The AUC32245 is designed with a $\pm 9\text{mA}$ output driver. This driver is capable of driving a moderate load while maintaining speed performance.

To ensure the high-impedance state during power up or power down, $\overline{\text{OE}}$ should be tied to V_{DD} through a pull-up resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

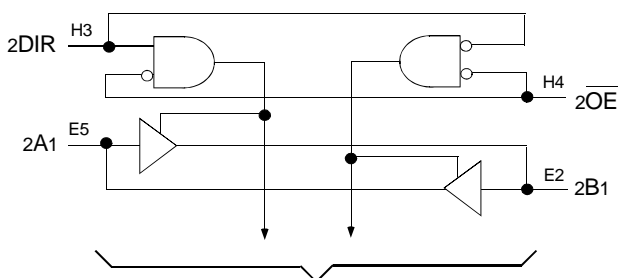
FUNCTIONAL BLOCK DIAGRAM



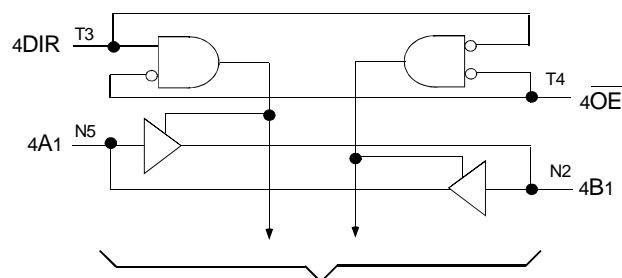
TO SEVEN OTHER CHANNELS



TO SEVEN OTHER CHANNELS



TO SEVEN OTHER CHANNELS



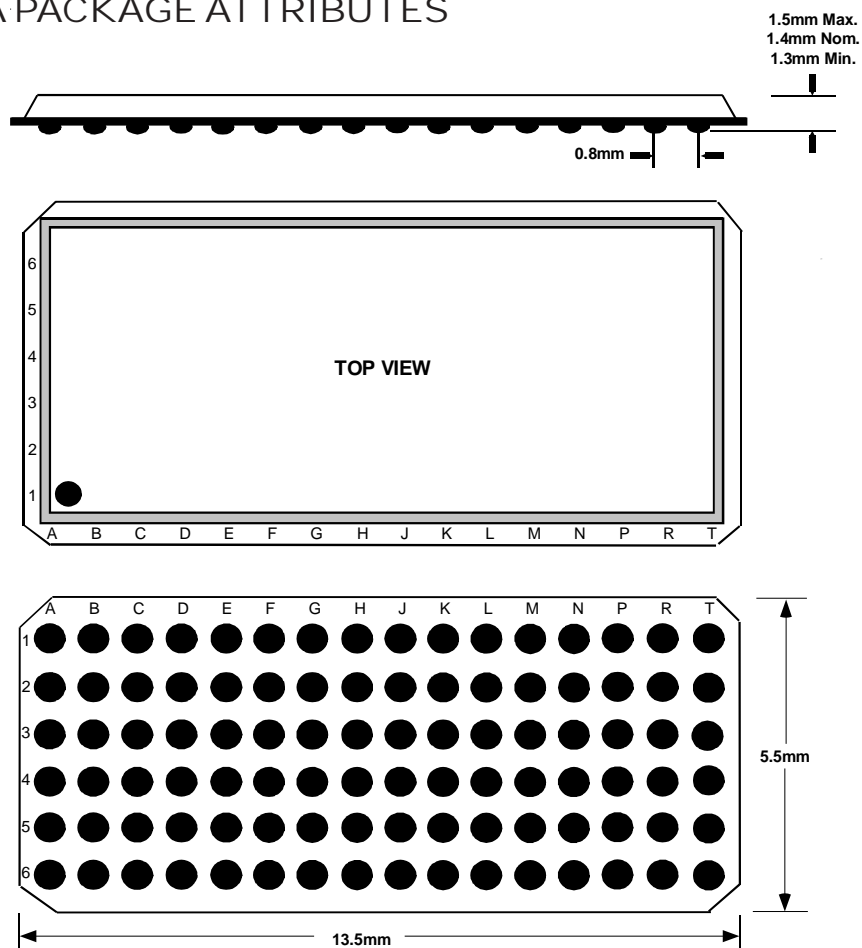
TO SEVEN OTHER CHANNELS

PINOUT CONFIGURATION

6	1A2	1A4	1A6	1A8	2A2	2A4	2A6	2A7	3A2	3A4	3A6	3A8	4A2	4A4	4A6	4A7
5	1A1	1A3	1A5	1A7	2A1	2A3	2A5	2A8	3A1	3A3	3A5	3A7	4A1	4A3	4A5	4A8
4	1 \overline{OE}	GND	VCC	GND	GND	VCC	GND	2 \overline{OE}	3 \overline{OE}	GND	VCC	GND	GND	VCC	GND	4 \overline{OE}
3	1DIR	GND	VCC	GND	GND	VCC	GND	2DIR	3DIR	GND	VCC	GND	GND	VCC	GND	4DIR
2	1B1	1B3	1B5	1B7	2B1	2B3	2B5	2B8	3B1	3B3	3B5	3B7	4B1	4B3	4B5	4B8
1	1B2	1B4	1B6	1B8	2B2	2B4	2B6	2B7	3B2	3B4	3B6	3B8	4B2	4B4	4B6	4B7
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T

LFBGA
TOP VIEW

96 BALL LFBGA PACKAGE ATTRIBUTES



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max	Unit	
V _{TERM}	Terminal Voltage with Respect to GND (all input and V _{DD} terminals)	-0.5 to +3.6	V	
V _{TERM}	Terminal Voltage with Respect to GND (any I/O or Output terminals in high-impedance or power-off state)	-0.5 to +3.6	V	
V _{TERM}	Terminal Voltage with Respect to GND (any I/O or Output terminals in high or low state)	-0.5 to +3.6	V	
T _{STG}	Storage Temperature	-65 to +150	°C	
I _{OUT}	Continuous DC Output Current	±20	mA	
I _{IK}	Continuous Clamp Current	V _I > V _{DD}	+50	mA
		V _I < 0	-50	
I _{OK}	Continuous Clamp Current, V _O < 0	-50	mA	
I _{DD}	Continuous Current through each V _{DD} or GND	±100	mA	
I _{SS}				

NOTE:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

CAPACITANCE (T_A = +25°C, f = 1.0MHz, V_{DD} = 2.5V)

Symbol	Parameter	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance ⁽¹⁾	V _{IN} = V _{DD} or GND	3		pF
C _{I/O}	I/O Port Capacitance ⁽²⁾	V _{I/O} = V _{DD} or GND	7		pF

NOTES:

- Applies to the Control Inputs.
- Applies to ports A and B.

PIN DESCRIPTION

Pin Names	Description
x \overline{OE}	3-State Output Enable Inputs (Active Low)
xDIR	Direction Control Inputs
xAx	A Side Inputs or 3-State Outputs
xBx	B Side Inputs or 3-State Outputs

FUNCTION TABLE (EACH 8-BIT SECTION)⁽¹⁾

Inputs		Outputs
x \overline{OE}	xDIR	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	Z

NOTE:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance

RECOMMENDED OPERATING CHARACTERISTICS⁽¹⁾

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V _{DD}	Supply Voltage		0.8	2.7	V
V _{IH}	Input HIGH Voltage Level	V _{DD} = 0.8V	V _{DD}	—	V
		V _{DD} = 1.1V to 1.3V	0.65 x V _{DD}	—	
		V _{DD} = 1.4V to 1.6V	0.65 x V _{DD}	—	
		V _{DD} = 1.65V to 1.95V	0.65 x V _{DD}	—	
		V _{DD} = 2.3V to 2.7V	1.7	—	
V _{IL}	Input LOW Voltage Level	V _{DD} = 0.8V	—	0	V
		V _{DD} = 1.1V to 1.3V	—	0.35 x V _{DD}	
		V _{DD} = 1.4V to 1.6V	—	0.35 x V _{DD}	
		V _{DD} = 1.65V to 1.95V	—	0.35 x V _{DD}	
		V _{DD} = 2.3V to 2.7V	—	0.7	
V _I	Input Voltage		0	2.7	V
V _O	Output Voltage	Active State	0	V _{DD}	V
		3-State	0	2.7	
I _{OH}	HIGH Level Output Current	V _{DD} = 0.8V	—	-0.7	mA
		V _{DD} = 1.1V	—	-3	
		V _{DD} = 1.4V	—	-5	
		V _{DD} = 1.65V	—	-8	
		V _{DD} = 2.3V	—	-9	
I _{OL}	LOW Level Output Current	V _{DD} = 0.8V	—	0.7	mA
		V _{DD} = 1.1V	—	3	
		V _{DD} = 1.4V	—	5	
		V _{DD} = 1.65V	—	8	
		V _{DD} = 2.3V	—	9	
Δt/Δv	Input Transition Rise or Fall Time		—	5	ns/V
T _A	Operating Free-Air Temperature		-40	+85	°C

NOTE:

- All unused inputs of the device must be held at V_{DD} or GND to ensure proper operation.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE⁽¹⁾

Following Conditions Apply Unless Otherwise Specified:

Operating Conditions: T_A = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I _{IH}	Input HIGH or LOW Current	V _{DD} = 2.7V, V _I = V _{DD} or GND	—	—	±10	μA
I _{IL}						
I _{OFF}	Input/Output Power Off Leakage	V _{DD} = 0V, V _{IN} or V _O ≤ 2.7V	—	—	±10	μA
I _{OZH} ⁽²⁾	High Impedance Output Current (3-State Output Pins)	V _{DD} = 2.7V	—	—	±10	μA
I _{OZL} ⁽²⁾						
I _{DDL}	Quiescent Power Supply Current	V _{DD} = 0.8V to 2.7V V _{IN} = GND or V _{DD}	—	—	40	μA
I _{DDH}						
I _{DDZ}						

NOTES:

- All unused inputs of the device must be held at V_{DD} or GND to ensure proper operation.
- For the I/O ports, the parameters I_{OZH} and I_{OZL} include the input leakage current.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ.	Max.	Unit
V _{OH}	Output HIGH Voltage	V _{DD} = 0.8V - 2.7V	I _{OH} = -100μA	V _{DD} - 0.1	—	—	V
		V _{DD} = 0.8V	I _{OH} = -0.7mA	—	0.55	—	
		V _{DD} = 1.1V ⁽²⁾	I _{OH} = -3mA	0.8	—	—	
		V _{DD} = 1.4V ⁽³⁾	I _{OH} = -5mA	1	—	—	
		V _{DD} = 1.65V ⁽⁴⁾	I _{OH} = -8mA	1.2	—	—	
V _{OL}	Output LOW Voltage	V _{DD} = 0.8V - 2.7V	I _{OH} = 100μA	—	—	0.2	V
		V _{DD} = 0.8V	I _{OL} = 0.7mA	—	0.25	—	
		V _{DD} = 1.1V ⁽²⁾	I _{OL} = 3mA	—	—	0.3	
		V _{DD} = 1.4V ⁽³⁾	I _{OL} = 5mA	—	—	0.4	
		V _{DD} = 1.65V ⁽⁴⁾	I _{OL} = 8mA	—	—	0.45	
		V _{DD} = 2.3V ⁽⁵⁾	I _{OH} = 9mA	—	—	0.6	

NOTES:

1. V_{IL} and V_{IH} must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS table for the appropriate V_{DD} range. T_A = -40°C to +85°C.
2. Demonstrates operation for nominal V_{DD} = 1.2V.
3. Demonstrates operation for nominal V_{DD} = 1.5V.
4. Demonstrates operation for nominal V_{DD} = 1.8V.
5. Demonstrates operation for nominal V_{DD} = 2.5V.

OPERATING CHARACTERISTICS, T_A = 25°C

Symbol	Parameter	Test Conditions	V _{DD} = 0.8V	V _{DD} = 1.2V	V _{DD} = 1.5V	V _{DD} = 1.8V	V _{DD} = 2.5V	Unit
CPD	Power Dissipation Capacitance per Output, Outputs Enabled	C _L = 0pF f = 10MHz	22	23	24	25	29	pF
CPD	Power Dissipation Capacitance per Output, Outputs Disabled		1	1	1	1	1	pF

SWITCHING CHARACTERISTICS⁽¹⁾

Symbol	Parameter	V _{DD} = 0.8V	V _{DD} = 1.2V±0.1V		V _{DD} = 1.5V±0.1V		V _{DD} = 1.8V±0.15V			V _{DD} = 2.5V±0.2V		Unit
		Typ.	Min.	Max.	Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
t _{PLH} t _{PHL}	Propagation Delay x _A to x _B or x _B to x _A	5.6	0.5	3.1	0.5	2	0.5	1.5	2	0.4	1.9	ns
t _{PZH} t _{PZL}	Output Enable Time x _{OE} to x _A or x _B	10	0.7	4.6	0.7	3.1	0.7	2.1	3.1	0.7	2.6	ns
t _{PHZ} t _{PLZ}	Output Disable Time x _{OE} to x _A or x _B	12.8	0.8	6.8	0.8	5	0.8	3.4	4.8	0.5	2.9	ns

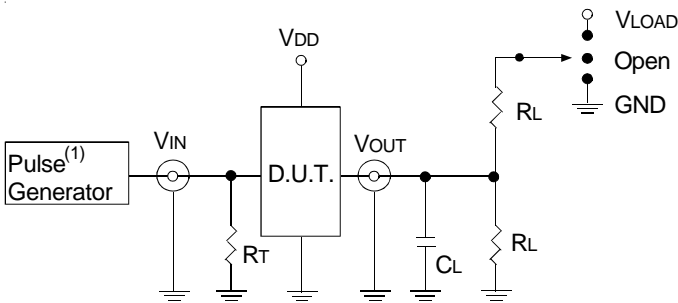
NOTE:

1. See TEST CIRCUITS AND WAVEFORMS. T_A = -40°C to +85°C.

TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS⁽¹⁾

Symbol	V _{DD} = 0.8V	V _{DD} = 1.2V±0.1V	V _{DD} = 1.5V±0.1V	V _{DD} = 1.8V±0.15V	V _{DD} = 2.5V±0.2V	Unit
V _{LOAD}	2xV _{DD}	2xV _{DD}	2xV _{DD}	2xV _{DD}	2xV _{DD}	V
V _T	V _{DD} /2	V _{DD} /2	V _{DD} /2	V _{DD} /2	V _{DD} /2	V
V _{LZ}	100	100	100	150	150	mV
V _{HZ}	100	100	100	150	150	mV
R _L	2	2	2	1	0.5	kΩ
C _L	15	15	15	30	30	pF



Test Circuits for All Outputs

DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

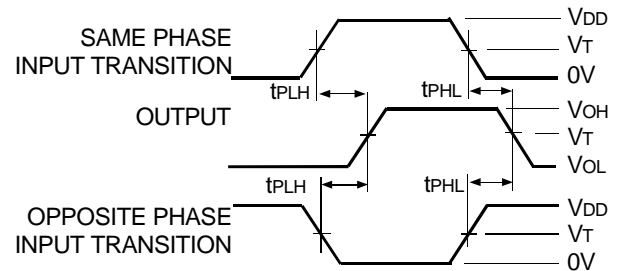
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTE:

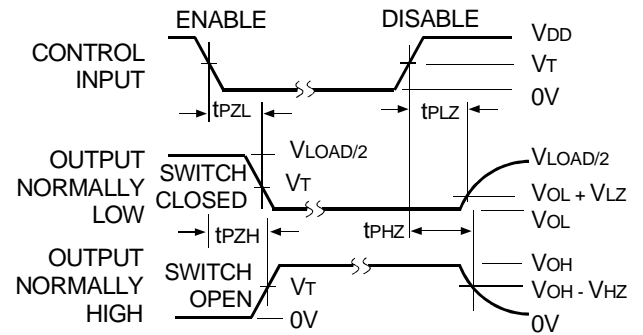
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; Slew Rate ≥ 1V/ns.

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V _{LOAD}
Disable High Enable High	GND
All Other Tests	Open



Propagation Delay

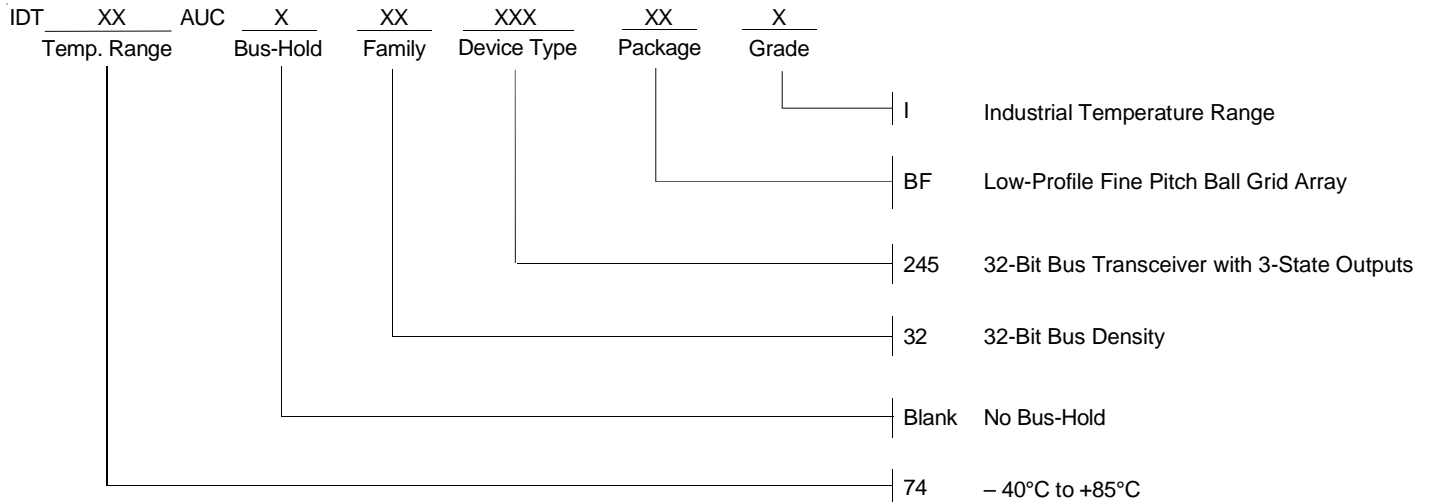


NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times

ORDERING INFORMATION



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