



1.8V CMOS 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

IDT74AUC16245

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: $\pm 9\text{mA}$ @ $V_{DD} = 2.3\text{V}$
- Supports hot insertion
- Available in TSSOP, TVSOP, and VFBGA packages

APPLICATIONS:

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

DESCRIPTION:

This 16-bit bus transceiver is built using advanced CMOS technology. The AUC16245 is designed specifically for asynchronous communications between data buses. The control function implementation minimizes external timing requirements.

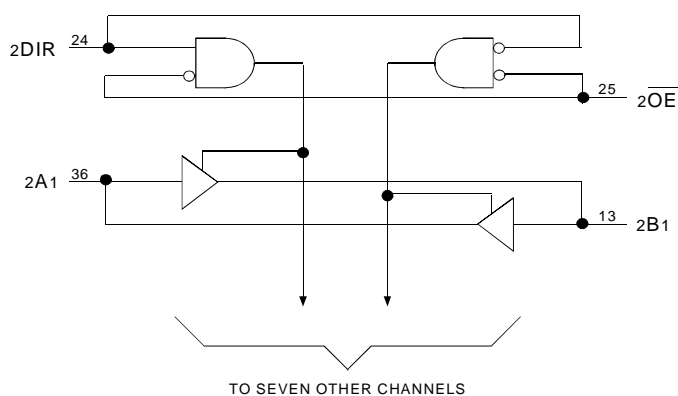
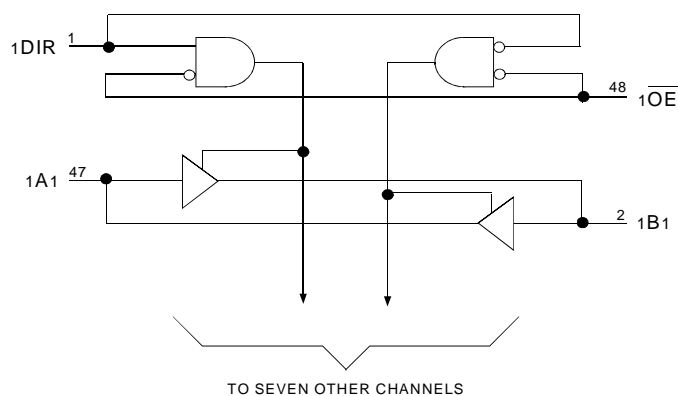
This device can be used as one 16-bit transceiver or two 8-bit transceivers. It allows data transmission from A bus to B bus or from B bus to A bus, depending on the logic level at the direction-control (DIR) input. The output-enable (\overline{OE}) input can be used to disable the device so that the 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 AUC16245 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{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



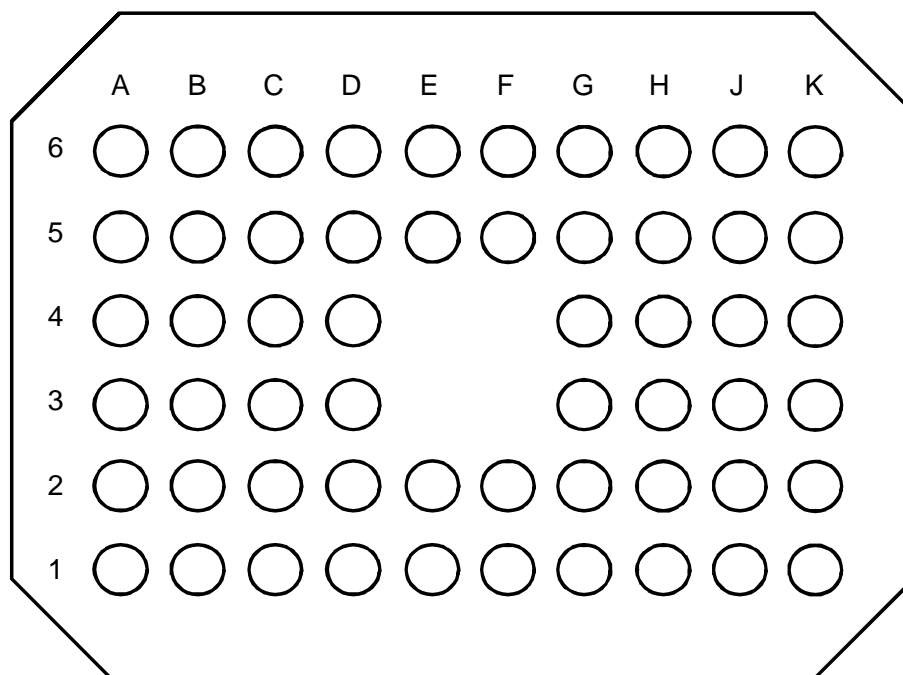
PINOUT CONFIGURATION

| | | | | | | | | | | |
|---|------------------|-----|-----------------|-----|-----|-----|-----|-----------------|-----|------------------|
| 6 | $\overline{1OE}$ | 1A2 | 1A4 | 1A6 | 1A8 | 2A1 | 2A3 | 2A5 | 2A7 | $\overline{2OE}$ |
| 5 | NC | 1A1 | 1A3 | 1A5 | 1A7 | 2A2 | 2A4 | 2A6 | 2A8 | NC |
| 4 | NC | GND | V _{DD} | GND | | | GND | V _{DD} | GND | NC |
| 3 | NC | GND | V _{DD} | GND | | | GND | V _{DD} | GND | NC |
| 2 | NC | 1B1 | 1B3 | 1B5 | 1B7 | 2B2 | 2B4 | 2B6 | 2B8 | NC |
| 1 | 1DIR | 1B2 | 1B4 | 1B6 | 1B8 | 2B1 | 2B3 | 2B5 | 2B7 | 2DIR |
| | A | B | C | D | E | F | G | H | J | K |

NOTE:
NC = No Internal Connection

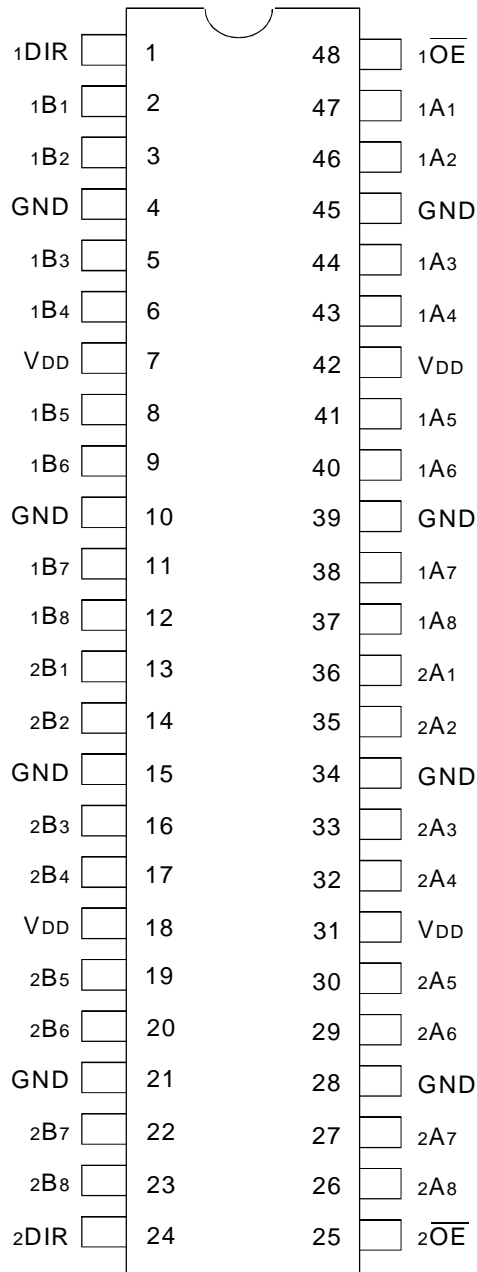
VFBGA

56 BALL VFBGA PACKAGE LAYOUT



TOP VIEW

PIN CONFIGURATION



TSSOP/ TVSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Description | Max | Unit |
|------------------------------------|---|----------------------------------|------|
| VTERM | Terminal Voltage with Respect to GND (all input and VDD terminals) | -0.5 to +3.6 | V |
| VTERM | 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 |
| VTERM | Terminal Voltage with Respect to GND (any I/O or Output terminals in high or low state) | -0.5 to +3.6 | V |
| TSTG | Storage Temperature | -65 to +150 | °C |
| IOUT | Continuous DC Output Current | ±20 | mA |
| I _{IK} | Continuous Clamp Current | V _i > V _{DD} | +50 |
| | | V _i < 0 | -50 |
| I _{OK} | Continuous Clamp Current, V _o < 0 | -50 | mA |
| I _{DD} I _{SS} | Continuous Current through each VDD or GND | ±100 | mA |

NOTE:

1. 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:

1. Applies to the Control Inputs.
2. 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:

1. 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} | | | | | | | Control Inputs |
| 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⁾ | | | | | | | V _O = GND |
| I _{DDL} | Quiescent Power Supply Current | V _{DD} = 0.8V to 2.7V | — | — | 20 | μA | |
| I _{BDDH} | | | | | | | V _{IN} = GND or V _{DD} |
| I _{BDDZ} | | | | | | | |

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 _{DD} = 2.3V ⁽⁵⁾ | I _{OH} = -9mA | 1.8 | — | — | |
| 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 _{OL} = 9mA | — | — | 0.6 | |

NOTES:

- 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.
- Demonstrates operation for nominal V_{DD} = 1.2V.
- Demonstrates operation for nominal V_{DD} = 1.5V.
- Demonstrates operation for nominal V_{DD} = 1.8V.
- 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 |
|-----------------|-------------------------------|------------------|-----------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------|
| C _{PD} | Power Dissipation Capacitance | Outputs Enabled | C _L = 0pF f = 10MHz | 22 | 23 | 24 | 25 | 29 | pF |
| | | Outputs Disabled | | 1 | 1 | 1 | 1 | | |

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 xAx to xBx or xBx to xAx | 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 xOE to xAx or xBx | 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 xOE to xAx or xBx | 12.8 | 0.8 | 6.8 | 0.8 | 5 | 0.8 | 3.4 | 4.8 | 0.5 | 2.9 | ns | | |

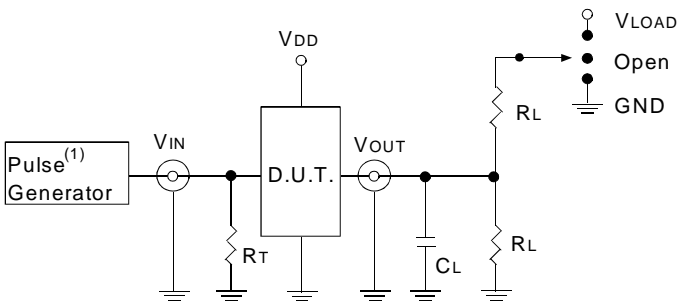
NOTE:

- 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.

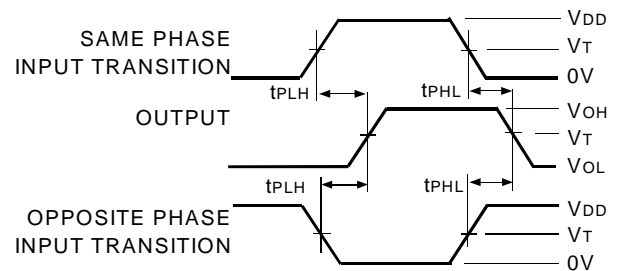
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTE:

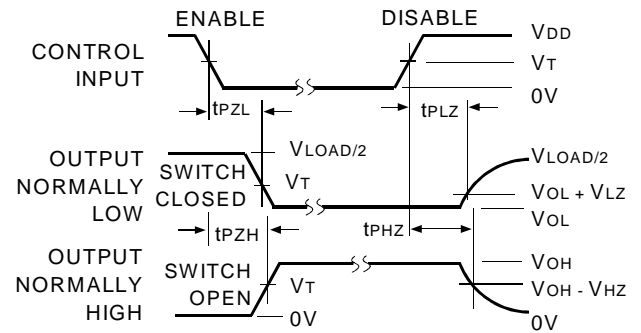
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; Slew Rate ≥ 1V/ns.

SWITCH POSITION

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



Propagation Delay

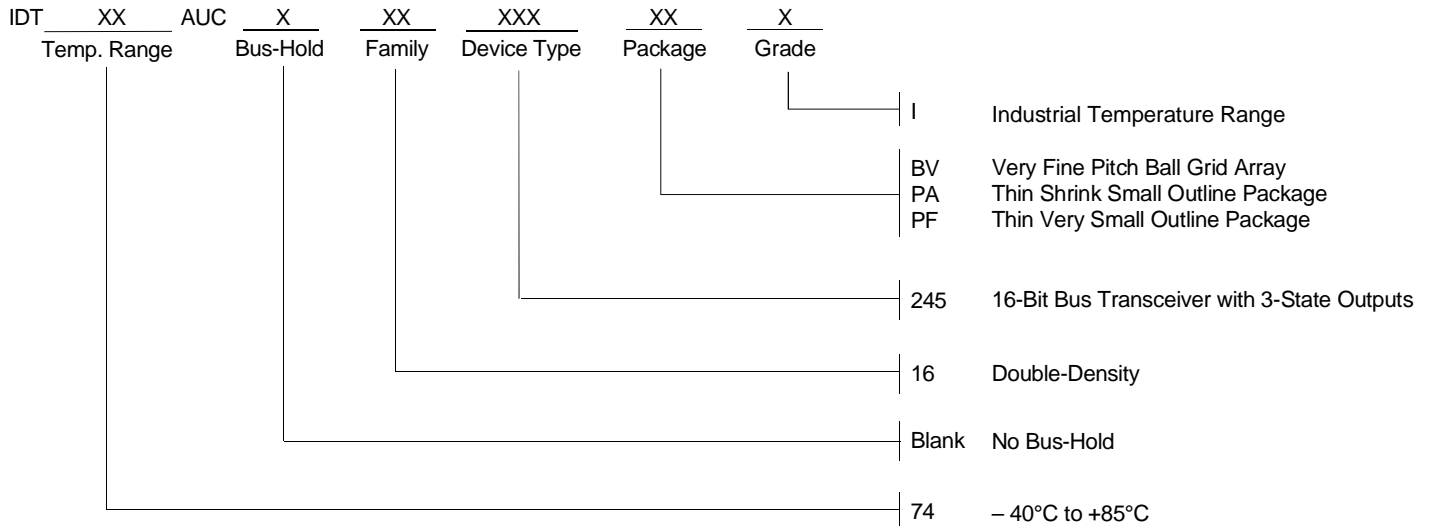


NOTE:

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

Enable and Disable Times

ORDERING INFORMATION



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