

SN64BCT245 OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SCBS040A – JANUARY 1990 – REVISED JANUARY 1994

- BiCMOS Design Significantly Reduces I_{CCZ}
- 3-State True Outputs Drive Bus Lines Directly
- High-Impedance State During Power Up and Power Down
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015
- Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic 300-mil DIPs (N)

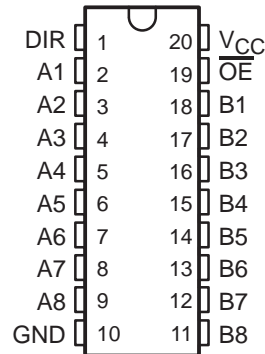
description

This octal bus transceiver is designed for asynchronous communication between data buses. The devices transmit data from the A bus to the B bus or from the B bus to the A bus depending upon the logic level at the direction-control (DIR) input. The output-enable (\overline{OE}) input can be used to disable the device so the buses are effectively isolated.

The outputs are in a high-impedance state during power up and power down while the supply voltage is less than approximately 3 V.

The SN64BCT245 is characterized for operation from -40°C to 85°C and 0°C to 70°C .

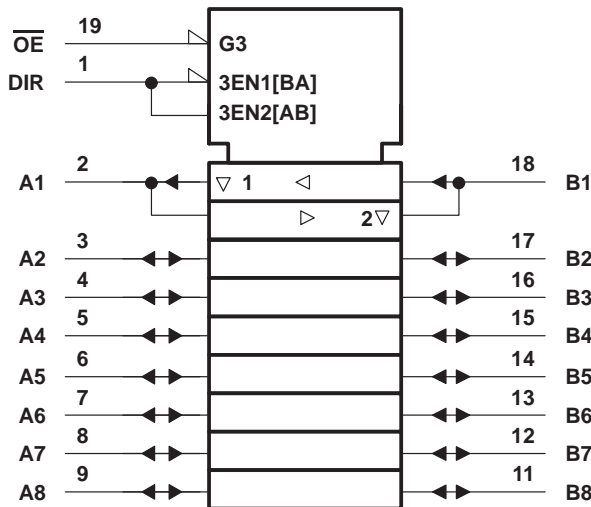
DW OR N PACKAGE
(TOP VIEW)



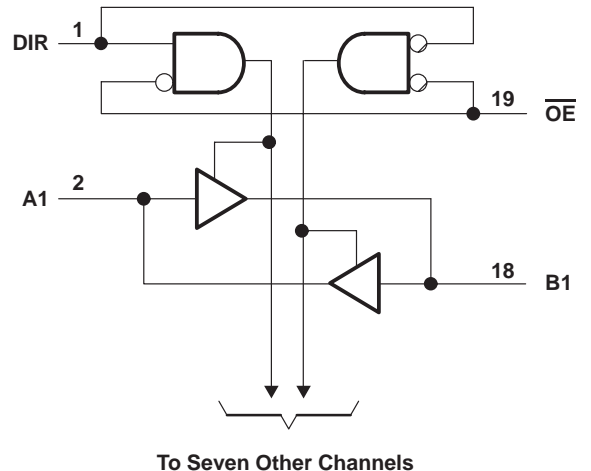
FUNCTION TABLE

| INPUTS | | OPERATION |
|-----------------|-----|-----------------|
| \overline{OE} | DIR | |
| L | L | B data to A bus |
| L | H | A data to B bus |
| H | X | Isolation |

logic symbol†



logic diagram (positive logic)



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

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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 7 V |
| Voltage range applied to any output in the disabled or power-off state, V_O | – 0.5 V to 5.5 V |
| Voltage range applied to any output in the high state, V_O | – 0.5 V to V_{CC} |
| Current into any output in the low state | 128 mA |
| Operating free-air temperature range | – 40°C to 85°C |
| Storage temperature range | – 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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

recommended operating conditions

| | | MIN | NOM | MAX | UNIT |
|----------|--------------------------------|-------|-----|-----|------|
| V_{CC} | Supply voltage | 4.5 | 5 | 5.5 | V |
| V_{IH} | High-level input voltage | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.8 | V |
| I_{IK} | Input clamp current | | | –18 | mA |
| I_{OH} | High-level output current | A1–A8 | | –3 | mA |
| | | B1–B8 | | –15 | |
| I_{OL} | Low-level output current | A1–A8 | | 24 | mA |
| | | B1–B8 | | 64 | |
| T_A | Operating free-air temperature | –40 | | 85 | °C |



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

| PARAMETER | | TEST CONDITIONS | | MIN | TYP† | MAX | UNIT |
|-------------------|------------|------------------------------|---------------------------------|-------------|------|-------|------|
| V _{IK} | | V _{CC} = 4.5 V, | I _I = -18 mA | | | -1.2 | V |
| V _{OH} | Any A | V _{CC} = 4.5 V | I _{OH} = -1 mA | 2.5 | 3.4 | | V |
| | Any A or B | | I _{OH} = -3 mA | 2.4 | 3.3 | | |
| | Any B | | I _{OH} = -15 mA | 2 | 3.1 | | |
| V _{OL} | Any A | V _{CC} = 4.5 V | I _{OL} = 24 mA | | 0.35 | 0.5 | V |
| | Any B | | I _{OL} = 64 mA | | 0.42 | 0.55 | |
| I _{OZ} | Power up | V _{CC} = 0 to 2.3 V | V _O = 2.7 V | OE at 0.8 V | | 70 | μA |
| | | | V _O = 0.5 V | | | -0.65 | |
| | Power down | V _{CC} = 1.8 V to 0 | V _O = 2.7 V | OE at 0.8 V | | 70 | μA |
| | | | V _O = 0.5 V | | | -0.65 | |
| I _I ‡ | A and B | V _{CC} = 5.5 V, | V _I = 5.5 V | | | 1 | mA |
| | DIR and OE | | | | | 0.1 | |
| I _{IH} ‡ | A and B | V _{CC} = 5.5 V, | V _I = 2.7 V | | | 70 | μA |
| | DIR and OE | | | | | 20 | |
| I _{IL} | A and B | V _{CC} = 5.5 V, | V _I = 0.5 V | | | -0.65 | mA |
| | DIR and OE | | | | | -1.2 | |
| I _{OS} § | Any A | V _{CC} = 5.5 V, | V _O = 0 | | | -60 | mA |
| | Any B | | | | | -100 | |
| I _{CCH} | A-to-B | V _{CC} = 5.5 V | | | 36 | 57 | mA |
| I _{CCL} | A-to-B | V _{CC} = 5.5 V | | | 57 | 90 | |
| I _{CCZ} | | V _{CC} = 5.5 V | | | 10 | 15 | |
| C _i | OE and DIR | V _{CC} = 5 V, | V _I = 2.5 V or 0.5 V | | | 7 | pF |
| C _{io} | A to B | V _{CC} = 5 V, | V _I = 2.5 V or 0.5 V | | | 9 | pF |
| | B to A | | | | | 12 | |

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

‡ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

§ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

switching characteristics (see Note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = 25°C | | V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω | | | | UNIT |
|------------------|--------------|-------------|--|------|---|------|---------------------------------|------|------|
| | | | | | T _A = -40°C to 85°C | | T _A = 0°C to 70°C | | |
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | B or A | 1 | 6 | 1 | 7.2 | 1 | 7 | ns |
| t _{PHL} | | | 1.5 | 6.6 | 1.5 | 7.6 | 1.5 | 7 | |
| t _{PZH} | OE | A or B | 1.5 | 9.4 | 1.5 | 11.2 | 1.5 | 10.9 | ns |
| t _{PZL} | | | 1.5 | 10.2 | 1.5 | 11.8 | 1.5 | 11.6 | |
| t _{PHZ} | OE | A or B | 1.5 | 8.3 | 1.5 | 9.7 | 1.5 | 9.3 | ns |
| t _{PLZ} | | | 1.5 | 7.8 | 1.5 | 9.6 | 1.5 | 9.1 | |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN64BCT245DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245DWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245N | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN64BCT245NE4 | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN64BCT245NSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245NSRE4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN64BCT245NSRG4 | ACTIVE | SO | NS | 20 | 2000 | 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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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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN64BCT245DWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 2.7 | 12.0 | 24.0 | Q1 |
| SN64BCT245NSR | SO | NS | 20 | 2000 | 330.0 | 24.4 | 8.2 | 13.0 | 2.5 | 12.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN64BCT245DWR | SOIC | DW | 20 | 2000 | 346.0 | 346.0 | 41.0 |
| SN64BCT245NSR | SO | NS | 20 | 2000 | 346.0 | 346.0 | 41.0 |

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 MS-013 variation AC.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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