

MC74VHC245

Octal Bus Buffer/Line Driver

The MC74VHC245 is an advanced high speed CMOS octal bus transceiver fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

It is intended for two-way asynchronous communication between data buses. The direction of data transmission is determined by the level of the DIR input. The output enable pin (\overline{OE}) can be used to disable the device, so that the buses are effectively isolated.

All inputs are equipped with protection circuits against static discharge.

- High Speed: $t_{PD} = 4.0$ ns (Typ) at $V_{CC} = 5$ V
- Low Power Dissipation: $I_{CC} = 4$ μ A (Max) at $T_A = 25^\circ$ C
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC}
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 1.2$ V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 308 FETs or 77 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant

APPLICATION NOTES

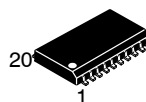
- Do not force a signal on an I/O pin when it is an active output, damage may occur.
- All floating (high impedance) input or I/O pins must be fixed by means of pull up or pull down resistors or bus terminator ICs.
- A parasitic diode is formed between the bus and V_{CC} terminals. Therefore, the VHC245 cannot be used to interface 5 V to 3 V systems directly.



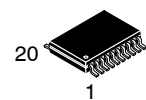
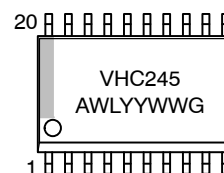
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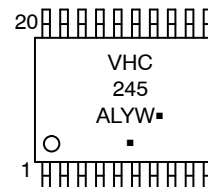
MARKING DIAGRAMS



SOIC-20
DW SUFFIX
CASE 751D



TSSOP-20
DT SUFFIX
CASE 948E



VHC245 = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW, W = Work Week
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|-----------------|----------|-----------------|
| MC74VHC245DWG | SOIC-20 | 38 Units/Rail |
| MC74VHC245DTG | TSSOP-20 | 75 Units/Rail |
| MC74VHC245DWR2G | SOIC-20 | 1000 Units/Reel |
| MC74VHC245DTR2G | TSSOP-20 | 2500 Units/T&R |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

MC74VHC245

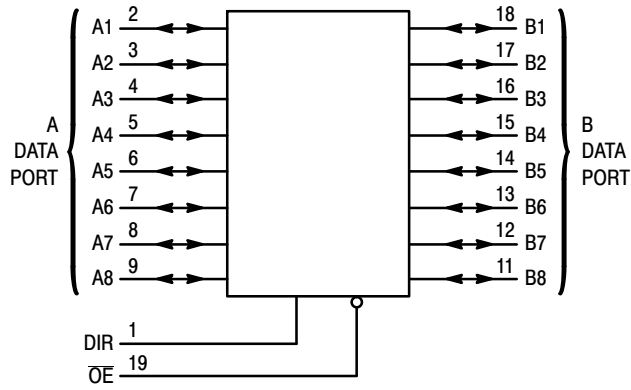


Figure 1. LOGIC DIAGRAM



Figure 2. PIN ASSIGNMENT

FUNCTION TABLE

| Control Inputs | | Operation |
|----------------|-----|---------------------------------------|
| OE | DIR | |
| L | L | Data Transmitted from Bus B to Bus A |
| L | H | Data Transmitted from Bus A to Bus B |
| H | X | Buses Isolated (High-Impedance State) |

MC74VHC245

MAXIMUM RATINGS*

| Symbol | Parameter | Value | Unit | |
|------------------|---|----------------------------------|------------|----|
| V _{CC} | DC Supply Voltage | - 0.5 to + 7.0 | V | |
| V _{in} | DC Input Voltage | - 0.5 to + 7.0 | V | |
| V _{out} | DC Output Voltage | - 0.5 to V _{CC} + 0.5 | V | |
| I _{IK} | Input Diode Current | - 20 | mA | |
| I _{OK} | Output Diode Current | ± 20 | mA | |
| I _{out} | DC Output Current, per Pin | ± 25 | mA | |
| I _{CC} | DC Supply Current, V _{CC} and GND Pins | ± 75 | mA | |
| P _D | Power Dissipation in Still Air | SOIC Packages† TSSOP Package† | 500 450 | mW |
| T _{stg} | Storage Temperature | - 65 to + 150 | °C | |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND ≤ (V_{in} or V_{out}) ≤ V_{CC}. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied.

† Derating — SOIC Packages: - 7 mW/°C from 65° to 125°C
TSSOP Package: - 6.1 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|---------------------------------|--------------------------|--|-----------------|------|
| V _{CC} | DC Supply Voltage | 2.0 | 5.5 | V |
| V _{in} | DC Input Voltage | 0 | 5.5 | V |
| V _{out} | DC Output Voltage | 0 | V _{CC} | V |
| T _A | Operating Temperature | - 40 | + 85 | °C |
| t _r , t _f | Input Rise and Fall Time | V _{CC} = 3.3V ± 0.3V V _{CC} = 5.0V ± 0.5V | 0 100 20 | ns/V |

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | V _{CC} V | T _A = 25°C | | | T _A = - 40 to 85°C | | Unit |
|-----------------|-----------------------------------|--|----------------------|-------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|------|
| | | | | Min | Typ | Max | Min | Max | |
| V _{IH} | Minimum High-Level Input Voltage | | 2.0 3.0 to 5.5 | 1.50 V _{CC} × 0.7 | | | 1.50 V _{CC} × 0.7 | | V |
| V _{IL} | Maximum Low-Level Input Voltage | | 2.0 3.0 to 5.5 | | | 0.50 V _{CC} × 0.3 | | 0.50 V _{CC} × 0.3 | V |
| V _{OH} | Minimum High-Level Output Voltage | V _{in} = V _{IH} or V _{IL} I _{OH} = - 50μA | 2.0 3.0 4.5 | 1.9 2.9 4.4 | 2.0 3.0 4.5 | | 1.9 2.9 4.4 | | V |
| | | V _{in} = V _{IH} or V _{IL} I _{OH} = - 4mA I _{OH} = - 8mA | 3.0 4.5 | 2.58 3.94 | | | 2.48 3.80 | | |
| V _{OL} | Maximum Low-Level Output Voltage | V _{in} = V _{IH} or V _{IL} I _{OL} = 50μA | 2.0 3.0 4.5 | | 0.0 0.0 0.0 | 0.1 0.1 0.1 | | 0.1 0.1 0.1 | V |
| | | V _{in} = V _{IH} or V _{IL} I _{OL} = 4mA I _{OL} = 8mA | 3.0 4.5 | | | 0.36 0.36 | | 0.44 0.44 | |
| I _{in} | Maximum Input Leakage Current | V _{in} = 5.5 V or GND (DIR, OE) | 0 to 5.5 | | | ± 0.1 | | ± 1.0 | μA |

MC74VHC245

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | V _{CC} V | T _A = 25°C | | | T _A = - 40 to 85°C | | Unit |
|-----------------|-------------------------------------|---|----------------------|-----------------------|-----|--------|-------------------------------|-------|------|
| | | | | Min | Typ | Max | Min | Max | |
| I _{OZ} | Maximum Three-State Leakage Current | V _{in} = V _{IL} or V _{IH} V _{out} = V _{CC} or GND | 5.5 | | | ± 0.25 | | ± 2.5 | μA |
| I _{CC} | Maximum Quiescent Supply Current | V _{in} = V _{CC} or GND | 5.5 | | | 4.0 | | 40.0 | μA |

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0ns)

| Symbol | Parameter | Test Conditions | T _A = 25°C | | | T _A = - 40 to 85°C | | Unit |
|--|--|--|-----------------------|------|------|-------------------------------|------|------|
| | | | Min | Typ | Max | Min | Max | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, A to B or B to A | V _{CC} = 3.3 ± 0.3V C _L = 15pF | | 5.8 | 8.4 | 1.0 | 10.0 | ns |
| | | C _L = 50pF | | 8.3 | 11.9 | 1.0 | 13.5 | |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF | | 4.0 | 5.5 | 1.0 | 6.5 | |
| | | C _L = 50pF | | 5.5 | 7.5 | 1.0 | 8.5 | |
| t _{PZL} , t _{PZH} | Output Enable Time OE to A or B | V _{CC} = 3.3 ± 0.3V C _L = 15pF | | 8.5 | 13.2 | 1.0 | 15.5 | ns |
| | | R _L = 1 kΩ C _L = 50pF | | 11.0 | 16.7 | 1.0 | 19.0 | |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF | | 5.8 | 8.5 | 1.0 | 10.0 | |
| | | R _L = 1 kΩ C _L = 50pF | | 7.3 | 10.6 | 1.0 | 12.0 | |
| t _{PLZ} , t _{PHZ} | Output Disable Time OE to A or B | V _{CC} = 3.3 ± 0.3V C _L = 50pF | | 11.5 | 15.8 | 1.0 | 18.0 | ns |
| | | R _L = 1 kΩ | | | | | | |
| | | V _{CC} = 5.0 ± 0.5V C _L = 50pF | | 7.0 | 9.7 | 1.0 | 11.0 | |
| | | R _L = 1 kΩ | | | | | | |
| t _{OSLH} , t _{OSHL} | Output to Output Skew | V _{CC} = 3.3 ± 0.3V C _L = 50pF (Note 1) | | | 1.5 | | 1.5 | ns |
| | | V _{CC} = 5.0 ± 0.5V C _L = 50pF (Note 1) | | | 1.0 | | 1.0 | ns |
| C _{in} | Maximum Input Capacitance DIR, OE | | | 4 | 10 | | 10 | pF |
| C _{I/O} | Maximum Three-State I/O Capacitance | | | 8 | | | | pF |

| C _{PD} | Power Dissipation Capacitance (Note 2) | Typical @ 25°C, V _{CC} = 5.0V | | pF |
|-----------------|--|--|--|----|
| | | 21 | | |
| | | | | |

1. Parameter guaranteed by design. t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|.

2. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC} / 8 (per bit). C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

NOISE CHARACTERISTICS (Input t_r = t_f = 3.0ns, C_L = 50pF, V_{CC} = 5.0V)

| Symbol | Parameter | T _A = 25°C | | Unit |
|------------------|--|-----------------------|------|------|
| | | Typ | Max | |
| V _{OLP} | Quiet Output Maximum Dynamic V _{OL} | 0.9 | 1.2 | V |
| V _{OLV} | Quiet Output Minimum Dynamic V _{OL} | -0.9 | -1.2 | V |
| V _{IHD} | Minimum High Level Dynamic Input Voltage | | 3.5 | V |
| V _{ILD} | Maximum Low Level Dynamic Input Voltage | | 1.5 | V |

MC74VHC245

SWITCHING WAVEFORMS

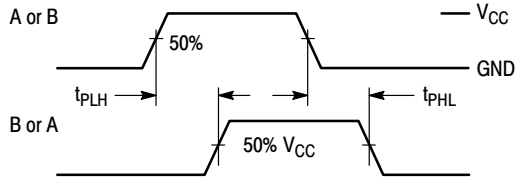


Figure 3.

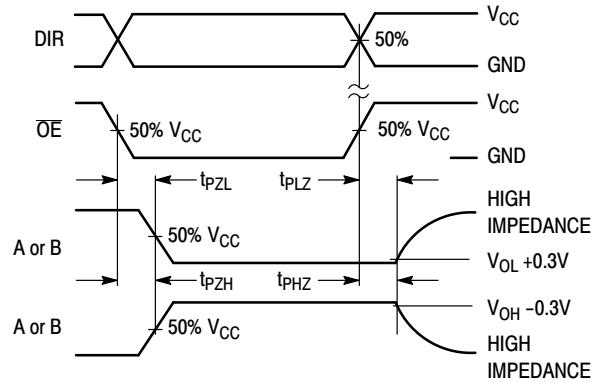
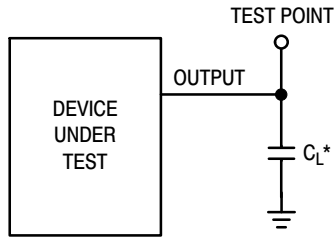


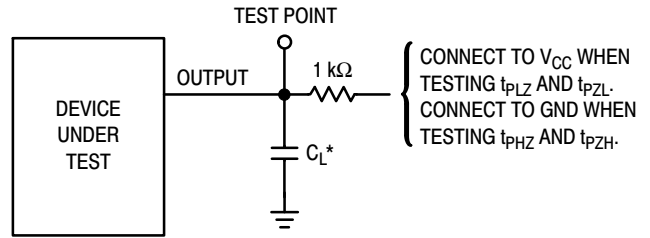
Figure 4.

TEST CIRCUITS



*Includes all probe and jig capacitance

Figure 5.



*Includes all probe and jig capacitance

Figure 6.

MC74VHC245



Figure 7. EXPANDED LOGIC DIAGRAM

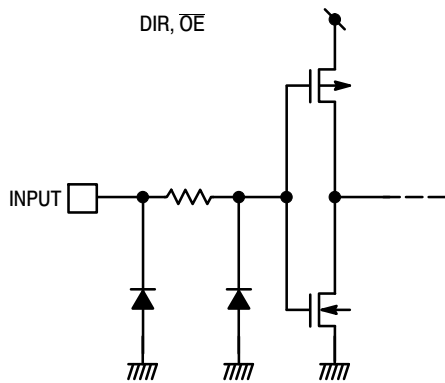


Figure 8. INPUT EQUIVALENT CIRCUIT

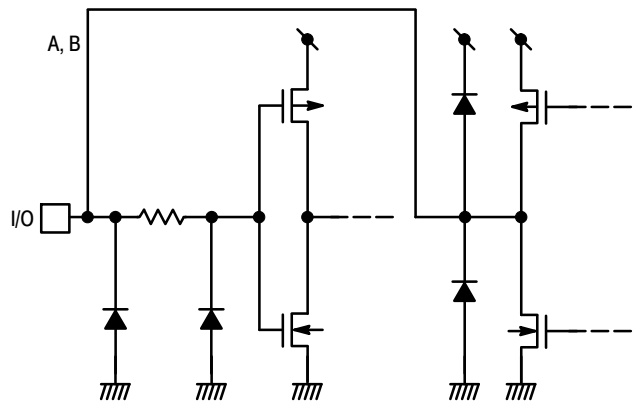


Figure 9. BUS TERMINAL EQUIVALENT CIRCUIT

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-20 WB
CASE 751D-05
ISSUE H

DATE 22 APR 2015



NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | MIN | MAX |
| A | 2.35 | 2.65 |
| A1 | 0.10 | 0.25 |
| b | 0.35 | 0.49 |
| c | 0.23 | 0.32 |
| D | 12.65 | 12.95 |
| E | 7.40 | 7.60 |
| e | 1.27 BSC | |
| H | 10.05 | 10.55 |
| h | 0.25 | 0.75 |
| L | 0.50 | 0.90 |
| θ | 0° | 7° |

RECOMMENDED
SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC
MARKING DIAGRAM*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

SCALE 2:1



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 6.40 | 6.60 | 0.252 | 0.260 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | --- | 1.20 | --- | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 BSC | | 0.026 BSC | |
| H | 0.27 | 0.37 | 0.011 | 0.015 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 BSC | | 0.252 BSC | |
| M | 0° | 8° | 0° | 8° |



SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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