

74HC245; 74HCT245

Octal bus transceiver; 3-state

Rev. 4 — 26 February 2016

Product data sheet

1. General description

The 74HC245; 74HCT245 is an 8-bit transceiver with 3-state outputs. The device features an output enable (\overline{OE}) and send/receive (DIR) for direction control. A HIGH on \overline{OE} causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and benefits

- Complies with JEDEC standard JESD7A
- Input levels:
 - ◆ For 74HC245: CMOS level
 - ◆ For 74HCT245: TTL level
- Octal bidirectional bus interface
- Non-inverting 3-state outputs
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|---|----------|---|----------|
| | Temperature range | Name | Description | Version |
| 74HC245D | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74HCT245D | | | | |
| 74HC245DB | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP20 | plastic shrink small outline package; 20 leads; body width 5.3 mm | SOT339-1 |
| 74HCT245DB | | | | |
| 74HC245PW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74HCT245PW | | | | |
| 74HC245BQ | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | DHVQFN20 | plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body $2.5 \times 4.5 \times 0.85\text{ mm}$ | SOT764-1 |
| 74HCT245BQ | | | | |

4. Functional diagram



Fig 1. Logic symbol



Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------------------|--------------------------------|----------------------------------|
| DIR | 1 | direction control |
| A0, A1, A2, A3, A4, A5, A6, A7 | 2, 3, 4, 5, 6, 7, 8, 9 | data input/output |
| GND | 10 | ground (0 V) |
| B7, B6, B5, B4, B3, B2, B1, B0 | 11, 12, 13, 14, 15, 16, 17, 18 | data input/output |
| \overline{OE} | 19 | output enable input (active LOW) |
| V _{CC} | 20 | supply voltage |

6. Functional description

6.1 Function table

Table 3. Function table^[1]

| Input | | Input/output | |
|-------|-----|--------------|-------|
| OE | DIR | An | Bn |
| L | L | A = B | input |
| L | H | input | B = A |
| H | X | Z | Z |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|----------|------|
| V_{CC} | supply voltage | | -0.5 | +7 | V |
| I_{IK} | input clamping current | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | - | ± 20 | mA |
| I_{OK} | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | - | ± 20 | mA |
| I_O | output current | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ | - | ± 35 | mA |
| I_{CC} | supply current | | - | 70 | mA |
| I_{GND} | ground current | | -70 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | SO20, SSOP20, TSSOP20 and DHVQFN20 packages | [1] | 500 | mW |

[1] For SO20 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.
 For SSOP20 and TSSOP20 packages: above 60 °C, P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN20 packages: above 60 °C, P_{tot} derates linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | 74HC245 | | | 74HCT245 | | | Unit |
|---------------------|-------------------------------------|-------------------------|---------|------|----------|----------|------|----------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | V_{CC} | 0 | - | V_{CC} | V |
| V_O | output voltage | | 0 | - | V_{CC} | 0 | - | V_{CC} | V |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.0\text{ V}$ | - | - | 625 | - | - | - | ns/V |
| | | $V_{CC} = 4.5\text{ V}$ | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | $V_{CC} = 6.0\text{ V}$ | - | - | 83 | - | - | - | ns/V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|-----------------|---------------------------|--|-------|------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HC245 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | 3.15 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | 4.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | 2.8 | 1.8 | - | 1.8 | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = –20 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = –20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = –20 μA; V _{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | I _O = –6.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 20 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| | | V _I = V _{IH} or V _{IL} ; V _{CC} = 6.0 V; V _O = V _{CC} or GND | - | - | ±0.5 | - | ±5.0 | - | ±10 | μA |
| | | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 8.0 | - | 80 | - | 160 | μA |
| | | | - | 3.5 | - | - | - | - | - | pF |
| | | | - | 10 | - | - | - | - | - | pF |

Table 6. Static characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|---|-------|------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HCT245 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = -20 µA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -6 mA | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 20 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 6.0 mA | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | µA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _{CC} = 5.5 V; V _O = V _{CC} or GND | - | - | ±0.5 | - | ±5.0 | - | ±10 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; V _{CC} = 5.5 V; I _O = 0 A | - | - | 8.0 | - | 80 | - | 160 | µA |
| ΔI _{CC} | additional supply current | V _I = V _{CC} - 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V; I _O = 0 A | | | | | | | | |
| | | An or Bn inputs | - | 40 | 144 | - | 180 | - | 196 | µA |
| | | $\overline{\text{OE}}$ input | - | 150 | 540 | - | 675 | - | 735 | µA |
| | | DIR input | - | 90 | 324 | - | 405 | - | 441 | µA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |
| C _{I/O} | input/output capacitance | | - | 10 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics

$GND = 0\text{ V}$; for load circuit see [Figure 7](#).

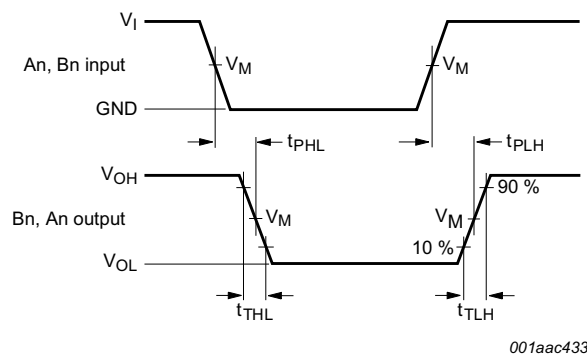
| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | Unit |
|----------------|-------------------------------|---|-------|-----|-----|-------------------|--------------|------|
| | | | Min | Typ | Max | Max (85 °C) | Max (125 °C) | |
| 74HC245 | | | | | | | | |
| t_{pd} | propagation delay | An to Bn or Bn to An; see Figure 5 [1] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 25 | 90 | 115 | 135 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 9 | 18 | 23 | 27 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$ | - | 7 | - | - | - | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 7 | 15 | 20 | 23 | ns |
| t_{en} | enable time | \overline{OE} to An or Bn; see Figure 6 [2] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 30 | 150 | 190 | 225 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 11 | 30 | 38 | 45 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 9 | 26 | 33 | 38 | ns |
| t_{dis} | disable time | \overline{OE} to An or Bn; see Figure 6 [3] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 41 | 150 | 190 | 225 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 15 | 30 | 38 | 45 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 12 | 26 | 33 | 38 | ns |
| t_t | transition time | see Figure 5 [4] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 14 | 60 | 75 | 90 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 5 | 12 | 15 | 18 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 4 | 10 | 13 | 15 | ns |
| C_{PD} | power dissipation capacitance | per buffer; $V_I = GND$ to V_{CC} [5] | - | 30 | - | - | - | pF |

Table 7. Dynamic characteristics ...continued
GND = 0 V; for load circuit see Figure 7.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|-------------------------------|--|-------|-----|-----|-------------------|--------------|------|
| | | | Min | Typ | Max | Max (85 °C) | Max (125 °C) | |
| 74HCT245 | | | | | | | | |
| t_{pd} | propagation delay | An to Bn or Bn to An; see Figure 5 [1] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | - | 12 | 22 | 28 | 33 | ns |
| | | $V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$ | - | 10 | - | - | - | ns |
| t_{en} | enable time | \overline{OE} to An or Bn; see Figure 6 [2] | - | 16 | 30 | 38 | 45 | ns |
| t_{dis} | disable time | \overline{OE} to An or Bn; see Figure 6 [3] | - | 16 | 30 | 38 | 45 | ns |
| t_t | transition time | $V_{CC} = 4.5\text{ V}$; see Figure 5 [4] | - | 5 | 12 | 15 | 18 | ns |
| C_{PD} | power dissipation capacitance | per buffer; $V_1 = GND$ to $V_{CC} - 1.5\text{ V}$ [5] | - | 30 | - | - | - | pF |

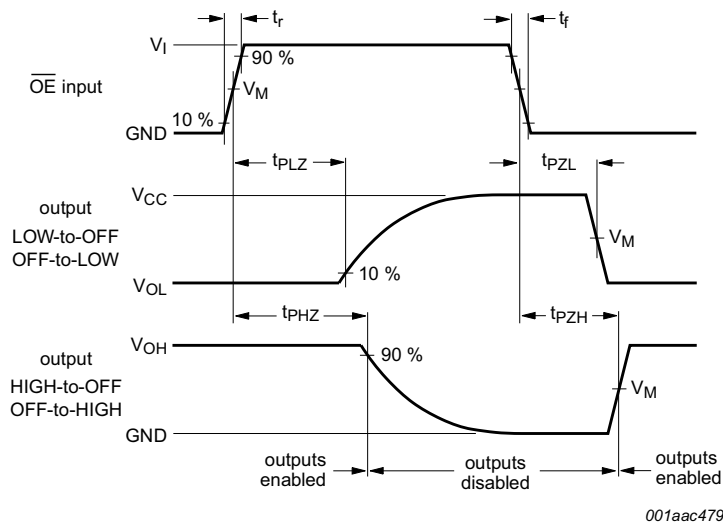
- [1] t_{pd} is the same as t_{PHL} and t_{PLH} .
- [2] t_{en} is the same as t_{PZH} and t_{PZL} .
- [3] t_{dis} is the same as t_{PHZ} and t_{PLZ} .
- [4] t_t is the same as t_{THL} and t_{TLH} .
- [5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 C_L = output load capacitance in pF;
 V_{CC} = supply voltage in V;
 N = number of inputs switching;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11. Waveforms



Measurement points are given in Table 8.
 V_{OL} and V_{OH} are typical voltage output drop that occur with the output load.

Fig 5. Input (An, Bn) to output (Bn, An) propagation delays and output transition times



Measurement points are given in [Table 8](#).

V_{OL} and V_{OH} are typical voltage output drop that occur with the output load.

Fig 6. 3-state output enable and disable times

Table 8. Measurement points

| Type | Input | Output |
|----------|-------------|-------------|
| | V_M | V_M |
| 74HC245 | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT245 | 1.3 V | 1.3 V |



001aad983

Test data is given in [Table 9](#).

Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistance.

S1 = Test selection switch.

Fig 7. Test circuit for measuring switching times

Table 9. Test data

| Type | Input | | Load | | S1 position | | |
|----------|----------|------------|--------------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PHL}, t_{PLH} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| 74HC245 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT245 | 3 V | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |

12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



Fig 8. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



Fig 9. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



Fig 10. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1



Fig 11. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------------|--|-----------------------|---------------|---------------------|
| 74HC_HCT245 v.4 | 20160226 | Product data sheet | - | 74HC_HCT245 v.3 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC245N and 74HCT245N (SOT146-1) removed. | | | |
| 74HC_HCT245 v.3 | 20050131 | Product data sheet | - | 74HC_HCT245_CNV v.2 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet is redesigned to comply with the new presentation and information standard of Philips Semiconductors Section 3 "Ordering information", Section 5 "Pinning information" and Section 12 "Package outline" are modified to include the DHVQFN20 package. | | | |
| 74HC_HCT245_CNV v.2 | 19930930 | Product specification | - | - |

15. Legal information

15.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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