

# 74HC245-Q100; 74HCT245-Q100

Octal bus transceiver; 3-state

Rev. 2 — 14 July 2020

Product data sheet

## 1. General description

The 74HC245-Q100; 74HCT245-Q100 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  $V_{CC}$ .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Complies with JEDEC standard JESD7A
- Input levels:
  - For 74HC245-Q100: CMOS level
  - For 74HCT245-Q100: TTL level
- Octal bidirectional bus interface
- Non-inverting 3-state outputs
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

## 3. Ordering information

Table 1. Ordering information

| Type number     | Package           |          |  |          |
|-----------------|-------------------|----------|--|----------|
|                 | Temperature range | Name     | Description  | Version  |
| 74HC245D-Q100   | -40 °C to +125 °C | SO20     | plastic small outline package; 20 leads; body width 7.5 mm   | SOT163-1 |
| 74HCT245D-Q100  |                   |          |  |          |
| 74HC245PW-Q100  | -40 °C to +125 °C | TSSOP20  | plastic thin shrink small outline package; 20 leads; body width 4.4 mm   | SOT360-1 |
| 74HCT245PW-Q100 |                   |          |  |          |
| 74HC245BQ-Q100  | -40 °C to +125 °C | DHVQFN20 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |
| 74HCT245BQ-Q100 |                   |          |  |          |

### 4. Functional diagram



Fig. 1. Logic symbol

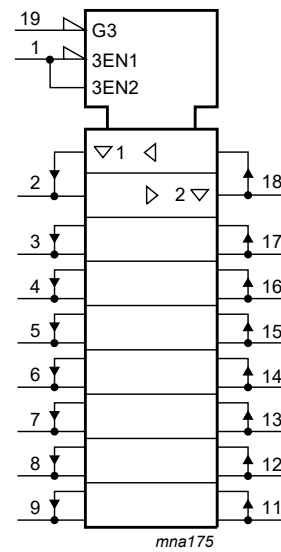


Fig. 2. IEC logic symbol

## 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                |
| OE                             | 19                             | output enable input (active LOW) |
| VCC                            | 20                             | supply voltage                   |

## 6. Functional description

Table 3. Function table

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

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

## 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 $V_I > V_{CC} + 0.5\text{ V}$ | -    | $\pm 20$ | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$          | -    | $\pm 35$ | 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 | [1]  | -    | 500      | mW   |

- [1] For SOT163-1 (SO20) package:  $P_{tot}$  derates linearly with 12.3 mW/K above 109 °C.  
 For SOT360-1 (TSSOP20) package:  $P_{tot}$  derates linearly with 10.0 mW/K above 100 °C.  
 For SOT764-1 (DHVQFN20) package:  $P_{tot}$  derates linearly with 12.9 mW/K above 111 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions              | 74HC245-Q100 |      |          | 74HCT245-Q100 |      |          | 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  |      |
| <b>74HC245-Q100</b> |  |  |                       |  |      |                  |      |                   |      |      |
| V <sub>IH</sub>     | HIGH-level input voltage                         | V <sub>CC</sub> = 2.0 V  | 1.5                   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                     |  | V <sub>CC</sub> = 4.5 V  | 3.15                  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                     |  | V <sub>CC</sub> = 6.0 V  | 4.2                   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub>     | LOW-level input voltage                          | V <sub>CC</sub> = 2.0 V  | -                     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                     |  | V <sub>CC</sub> = 4.5 V  | -                     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                     |  | V <sub>CC</sub> = 6.0 V  | -                     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub>     | HIGH-level output voltage                        | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                       |  |      |                  |      |                   |      |      |
|                     |  | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V   | 1.9                   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                     |  | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V   | 4.4                   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                     |  | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V   | 5.9                   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                     |  | I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V  | 3.98                  | 4.32   | -    | 3.84             | -    | 3.7               | -    | V    |
| V <sub>OL</sub>     | LOW-level output voltage                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                       |  |      |                  |      |                   |      |      |
|                     |  | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V  | -                     | 0  | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                     |  | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V  | -                     | 0  | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                     |  | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V  | -                     | 0  | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                     |  | I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V   | -                     | 0.15   | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>O</sub>      | I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V |  | -                     | 0.16   | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                     |  | I <sub>I</sub>   | input leakage current | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V | -    | -                | ±0.1 | -                 | ±1.0 | -    |
| I <sub>OZ</sub>     | OFF-state output current                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 6.0 V; V <sub>O</sub> = V <sub>CC</sub> or GND | -                     | -  | ±0.5 | -                | ±5.0 | -                 | ±10  | μA   |
| I <sub>CC</sub>     | supply current                                   | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V                                 | -                     | -  | 8.0  | -                | 80   | -                 | 160  | μA   |
| C <sub>I</sub>      | input capacitance                                |  | -                     | 3.5  | -    | -                | -    | -                 | -    | pF   |
| C <sub>I/O</sub>    | input/output capacitance                         |  | -                     | 10   | -    | -                | -    | -                 | -    | pF   |

| Symbol               | Parameter                 | Conditions   | 25 °C |      |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|----------------------|---------------------------|--|-------|------|------|------------------|------|-------------------|------|------|
|                      |                           |  | Min   | Typ  | Max  | Min              | Max  | Min               | Max  |      |
| <b>74HCT245-Q100</b> |                           |  |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>      | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>      | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -     | 1.2  | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OH</sub>      | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V  |       |      |      |                  |      |                   |      |      |
|                      |                           | I <sub>O</sub> = -20 µA  | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                      |                           | I <sub>O</sub> = -6 mA   | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
| V <sub>OL</sub>      | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V  |       |      |      |                  |      |                   |      |      |
|                      |                           | I <sub>O</sub> = 20 µA   | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                      |                           | I <sub>O</sub> = 6.0 mA  | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>       | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V   | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | µA   |
| I <sub>OZ</sub>      | OFF-state output current  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 5.5 V;<br>V <sub>O</sub> = V <sub>CC</sub> or GND                | -     | -    | ±0.5 | -                | ±5.0 | -                 | ±10  | µA   |
| I <sub>CC</sub>      | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A  | -     | -    | 8.0  | -                | 80   | -                 | 160  | µA   |
| ΔI <sub>CC</sub>     | additional supply current | V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A |       |      |      |                  |      |                   |      |      |
|                      |                           | An or Bn inputs  | -     | 40   | 144  | -                | 180  | -                 | 196  | µA   |
|                      |                           | OE input   | -     | 150  | 540  | -                | 675  | -                 | 735  | µA   |
|                      |                           | DIR input  | -     | 90   | 324  | -                | 405  | -                 | 441  | µA   |
| C <sub>I</sub>       | input capacitance         |  | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |
| C <sub>I/O</sub>     | input/output capacitance  |  | -     | 10   | -    | -                | -    | -                 | -    | pF   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ ; for test circuit see Fig. 7.

| Symbol               | Parameter                     | Conditions  | 25 °C |     |     | -40 °C to +125 °C |              | Unit |
|----------------------|-------------------------------|---|-------|-----|-----|-------------------|--------------|------|
|                      |                               |   | Min   | Typ | Max | Max (85 °C)       | Max (125 °C) |      |
| <b>74HC245-Q100</b>  |                               |   |       |     |     |                   |              |      |
| $t_{pd}$             | propagation delay             | An to Bn or Bn to An; see Fig. 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 Fig. 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 Fig. 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 Fig. 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 transceiver; $V_I = GND$ to $V_{CC}$ [5]                | -     | 30  | -   | -                 | -            | pF   |
| <b>74HCT245-Q100</b> |                               |   |       |     |     |                   |              |      |
| $t_{pd}$             | propagation delay             | An to Bn or Bn to An; see Fig. 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 Fig. 6 [2]                 | -     | 16  | 30  | 38                | 45           | ns   |
| $t_{dis}$            | disable time                  | $\overline{OE}$ to An or Bn; see Fig. 6 [3]                 | -     | 16  | 30  | 38                | 45           | ns   |
| $t_t$                | transition time               | $V_{CC} = 4.5\text{ V}$ ; see Fig. 5 [4]                    | -     | 5   | 12  | 15                | 18           | ns   |
| $C_{PD}$             | power dissipation capacitance | per transceiver; $V_I = GND$ 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  $\mu\text{W}$ ):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = 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.

10.1. Waveforms and test circuit



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

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels 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 output voltage levels 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-Q100  | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT245-Q100 | 1.3 V       | 1.3 V       |



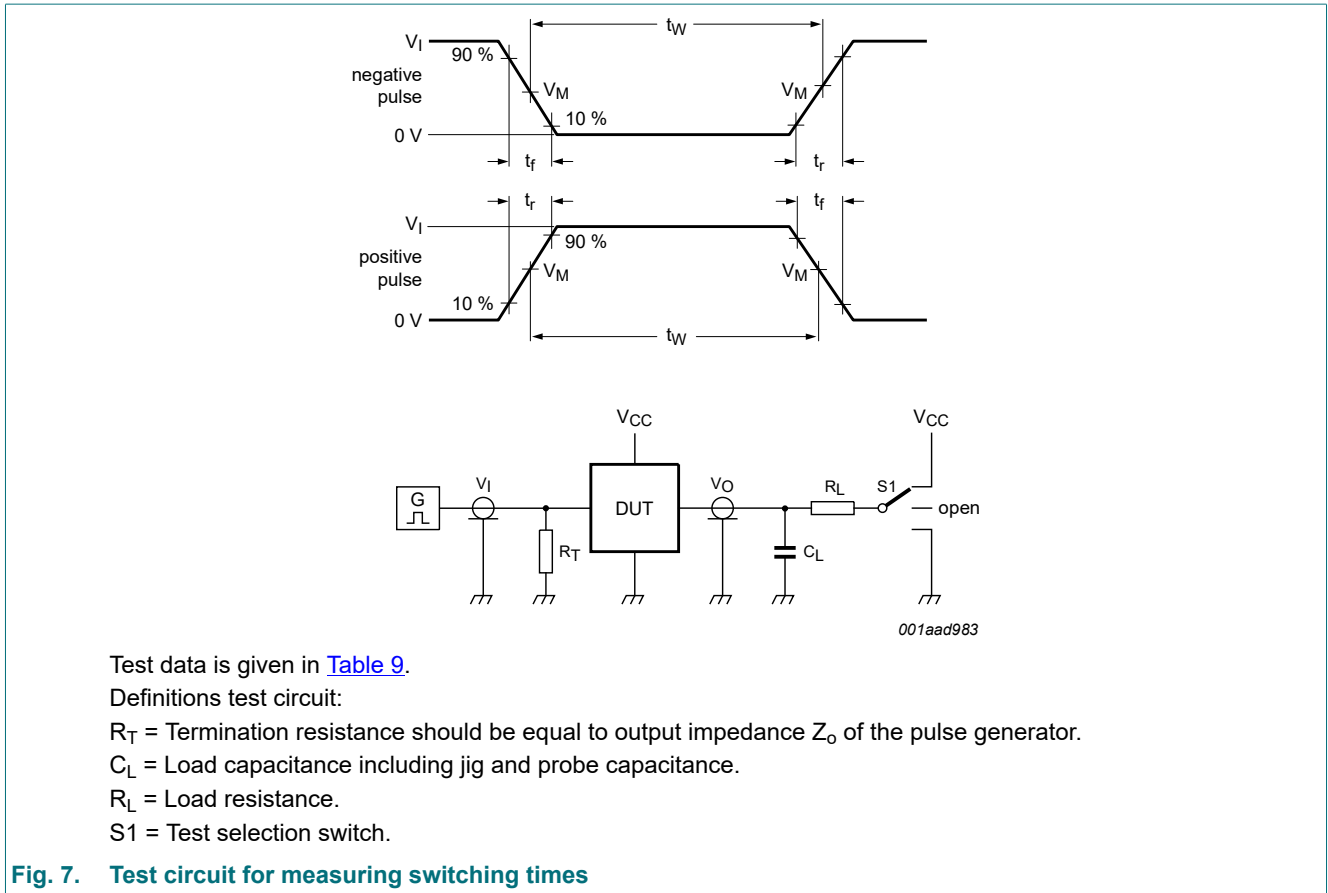


Fig. 7. Test circuit for measuring switching times

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-Q100  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74HCT245-Q100 | 3 V      | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

### 11. Package outline

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

SOT163-1



Fig. 8. Package outline SOT163-1 (SO20)

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

SOT360-1



Fig. 9. 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. 10. Package outline SOT764-1 (DHVQFN20)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

| Document ID          | Release date  | Data sheet status  | Change notice | Supersedes           |
|----------------------|---|--------------------|---------------|----------------------|
| 74HC_HCT245_Q100 v.2 | 20200714  | Product data sheet | -             | 74HC_HCT245_Q100 v.1 |
| Modifications:       | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li> <li>Package outline drawing of SOT762-1 (<a href="#">Fig. 10</a>) updated.</li> </ul> |                    |               |                      |
| 74HC_HCT245_Q100 v.1 | 20130722  | Product data sheet | -             | -                    |

## 14. Legal information

### 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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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