

74HC240-Q100; 74HCT240-Q100

Octal buffer/line driver; 3-state; inverting

Rev. 1 — 30 July 2012

Product data sheet

1. General description

The 74HC240-Q100; 74HCT240-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-Power Schottky TTL (LSTTL).

The 74HC240-Q100; 74HCT240-Q100 is a dual octal inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs $\overline{1OE}$ and $2OE$. A HIGH on nOE causes the outputs to assume a high impedance OFF-state.

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Inverting 3-state outputs
- Multiple package options
- Complies with JEDEC standard no. 7 A
- 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 Ω)

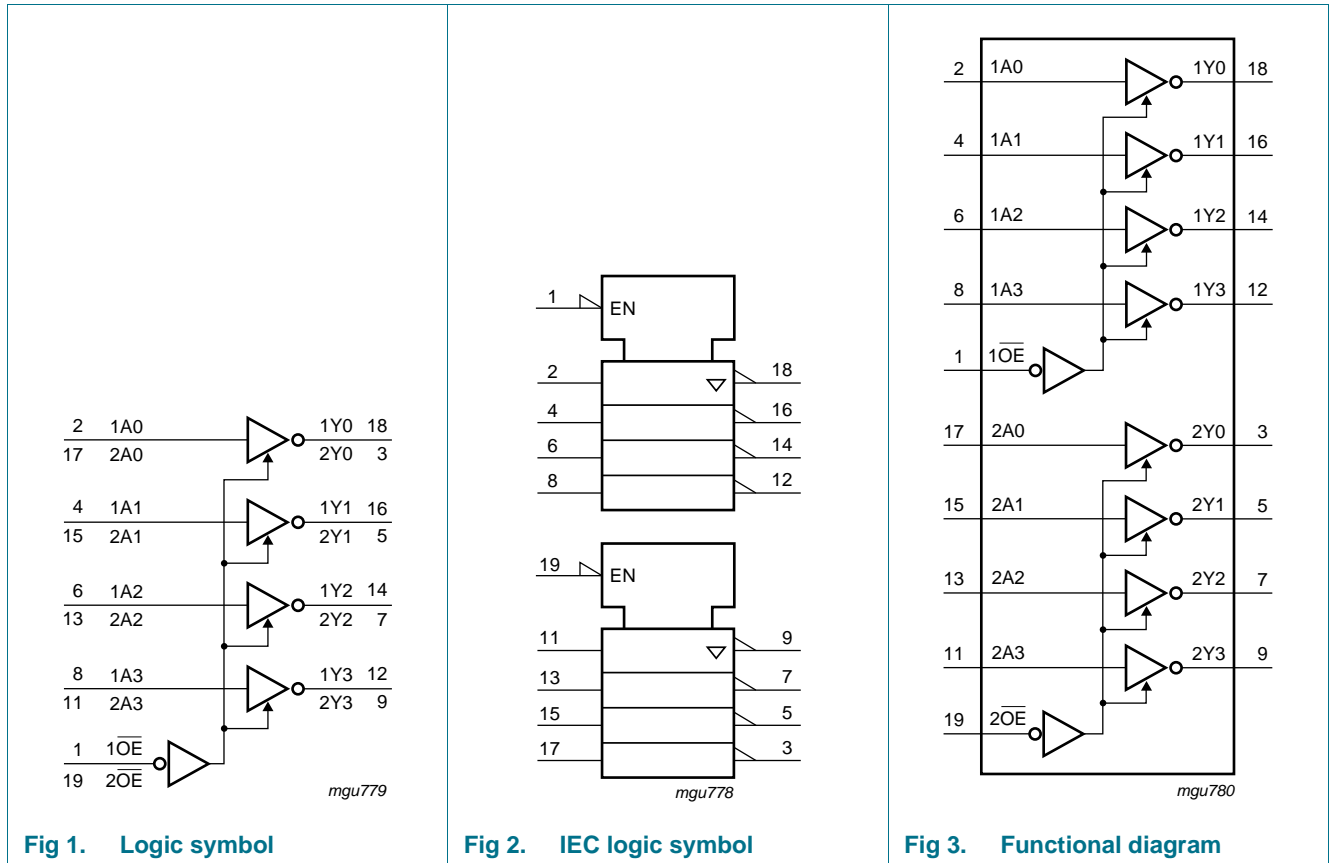
3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-----------------------------------|---|----------|--|----------|
| | Temperature range | Name | Description | Version |
| 74HC240D-Q100 74HCT240D-Q100 | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74HC240PW-Q100 74HCT240PW-Q100 | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74HC240BQ-Q100 74HCT240BQ-Q100 | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | DHVQFN20 | plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body $2.5 \times 4.5 \times 0.85$ mm | SOT764-1 |

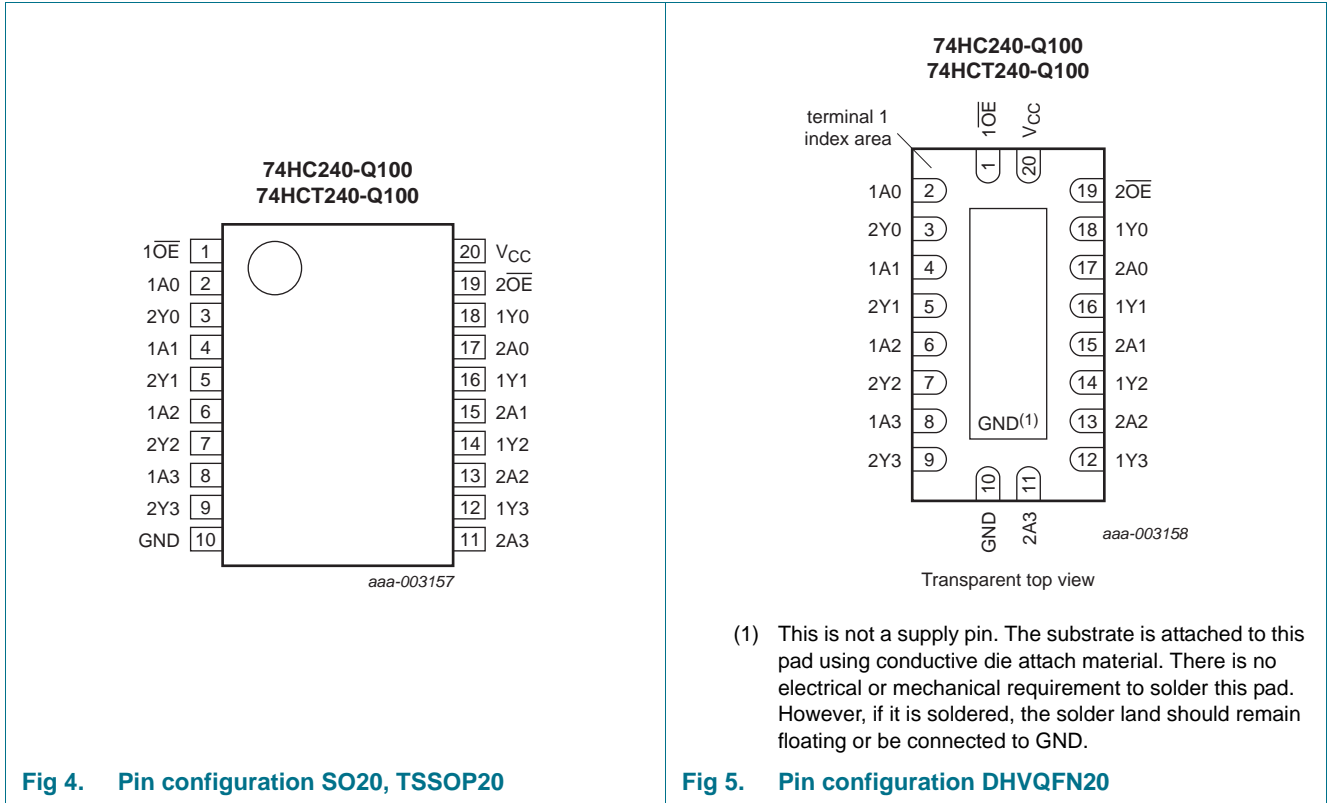
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4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|---|----------------|----------------------------------|
| 10 \overline{OE} , 20 \overline{OE} | 1, 19 | output enable input (active LOW) |
| 1A0, 1A1, 1A2, 1A3 | 2, 4, 6, 8 | data input |
| 2Y0, 2Y1, 2Y2, 2Y3 | 3, 5, 7, 9 | bus output |
| GND | 10 | ground (0 V) |
| 2A0, 2A1, 2A2, 2A3 | 17, 15, 13, 11 | data input |
| 1Y0, 1Y1, 1Y2, 1Y3 | 18, 16, 14, 12 | bus output |
| V _{CC} | 20 | supply voltage |

6. Functional description

Table 3. Function table^[1]

| Input | | Output |
|-------|-----|--------|
| nOE | nAn | nYn |
| L | L | H |
| L | H | L |
| H | X | 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 | | [1] - | 500 | mW |

[1] For SO20 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.
 For TSSOP20 package: 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 | Min | Typ | Max | Unit |
|---------------------|-------------------------------------|-------------------------|-----|------|----------|------|
| 74HC240-Q100 | | | | | | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | V |
| V_I | input voltage | | 0 | - | V_{CC} | V |
| V_O | output voltage | | 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 | ns/V |
| | | $V_{CC} = 6.0\text{ V}$ | - | - | 83 | ns/V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |

Table 5. Recommended operating conditions ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------|-------------------------------------|-------------------------|-----|------|----------|------|
| 74HCT240-Q100 | | | | | | |
| V_{CC} | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | V_{CC} | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 4.5\text{ V}$ | - | 1.67 | 139 | ns/V |
| T_{amb} | ambient temperature | | -40 | - | +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 | |
| 74HC240-Q100 | | | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0\text{ V}$ | 1.5 | 1.2 | - | 1.5 | - | 1.5 | - | V |
| | | $V_{CC} = 4.5\text{ V}$ | 3.15 | 2.4 | - | 3.15 | - | 3.15 | - | V |
| | | $V_{CC} = 6.0\text{ V}$ | 4.2 | 3.2 | - | 4.2 | - | 4.2 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0\text{ V}$ | - | 0.8 | 0.5 | - | 0.5 | - | 0.5 | V |
| | | $V_{CC} = 4.5\text{ V}$ | - | 2.1 | 1.35 | - | 1.35 | - | 1.35 | V |
| | | $V_{CC} = 6.0\text{ V}$ | - | 2.8 | 1.8 | - | 1.8 | - | 1.8 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$ | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | $I_O = -6.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | $I_O = -7.8\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | 5.48 | 5.81 | - | 5.34 | - | 5.2 | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 6.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | $I_O = 7.8\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$ | - | - | ± 0.1 | - | ± 1.0 | - | ± 1.0 | μA |
| I_{OZ} | OFF-state output current | per input pin; $V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; other inputs at V_{CC} or GND; $V_{CC} = 6.0\text{ V}$; $I_O = 0\text{ A}$ | - | - | ± 0.5 | - | ± 5.0 | - | ± 10 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 6.0\text{ V}$ | - | - | 8.0 | - | 80 | - | 160 | μA |
| C_I | input capacitance | | - | 3.5 | - | - | - | - | - | 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 | |
| 74HCT240-Q100 | | | | | | | | | | |
| 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 | - | 0.16 | 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 | per input pin; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; other inputs at V _{CC} or GND; V _{CC} = 5.5 V; I _O = 0 A | - | - | ±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 | per input pin; 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 | | | | | | | | |
| | | nAn or inputs | - | 150 | 540 | - | 675 | - | 735 | µA |
| | | nOE input | - | 70 | 252 | - | 315 | - | 343 | µA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristicsGND = 0 V; for load circuit see [Figure 8](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | Unit | |
|---------------------|-------------------|---|-------|---------------------|-----|-------------------|--------------|------|--|
| | | | Min | Typ | Max | Max (85 °C) | Max (125 °C) | | |
| 74HC240-Q100 | | | | | | | | | |
| t _{pd} | propagation delay | nAn to nYn; see Figure 6 | | [1] | | | | | |
| | | V _{CC} = 2.0 V | - | 30 | 100 | 125 | 150 | ns | |
| | | V _{CC} = 4.5 V | - | 11 | 20 | 25 | 30 | ns | |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 9 | - | - | - | ns | |
| | | V _{CC} = 6.0 V | - | 9 | 17 | 21 | 26 | ns | |

Table 7. Dynamic characteristics ...continuedGND = 0 V; for load circuit see [Figure 8](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | Unit |
|----------------------|-------------------------------|--|-------|-----|-----|-------------------|--------------|------|
| | | | Min | Typ | Max | Max (85 °C) | Max (125 °C) | |
| t _{en} | enable time | n $\overline{\text{OE}}$ to nYn; see Figure 7 [2] | | | | | | |
| | | V _{CC} = 2.0 V | - | 39 | 150 | 190 | 225 | ns |
| | | V _{CC} = 4.5 V | - | 14 | 30 | 38 | 45 | ns |
| | | V _{CC} = 6.0 V | - | 11 | 26 | 33 | 38 | ns |
| t _{dis} | disable time | n $\overline{\text{OE}}$ to nYn or see Figure 7 [3] | | | | | | |
| | | V _{CC} = 2.0 V | - | 41 | 150 | 190 | 225 | ns |
| | | V _{CC} = 4.5 V | - | 15 | 30 | 38 | 45 | ns |
| | | V _{CC} = 6.0 V | - | 12 | 26 | 33 | 38 | ns |
| t _t | transition time | see Figure 6 [4] | | | | | | |
| | | V _{CC} = 2.0 V | - | 14 | 60 | 75 | 90 | ns |
| | | V _{CC} = 4.5 V | - | 5 | 12 | 15 | 18 | ns |
| | | V _{CC} = 6.0 V | - | 4 | 10 | 13 | 15 | ns |
| C _{PD} | power dissipation capacitance | per transceiver; V _I = GND to V _{CC} [5] | - | 30 | - | - | - | pF |
| 74HCT240-Q100 | | | | | | | | |
| t _{pd} | propagation delay | nAn to nYn; see Figure 6 [1] | | | | | | |
| | | V _{CC} = 4.5 V | - | 11 | 20 | 25 | 30 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 9 | - | - | - | ns |
| t _{en} | enable time | n $\overline{\text{OE}}$ to nYn; V _{CC} = 4.5 V; see Figure 7 [2] | - | 13 | 30 | 38 | 45 | ns |
| t _{dis} | disable time | n $\overline{\text{OE}}$ to nYn; V _{CC} = 4.5 V; see Figure 7 [3] | - | 13 | 25 | 31 | 38 | ns |
| t _t | transition time | V _{CC} = 4.5 V; see Figure 6 [4] | - | 5 | 12 | 15 | 18 | ns |
| C _{PD} | power dissipation capacitance | per transceiver; V _I = GND to V _{CC} - 1.5 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):

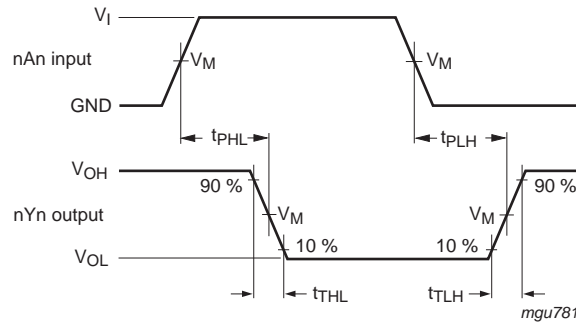
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

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;

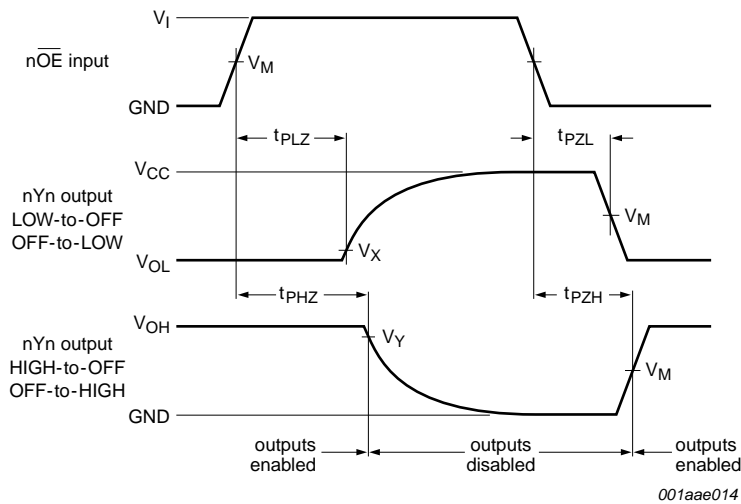
∑ (C_L × V_{CC}² × f_o) = sum of outputs.

11. Waveforms



Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 6. Input (nAn) to output (nYn) propagation delays and output transition times

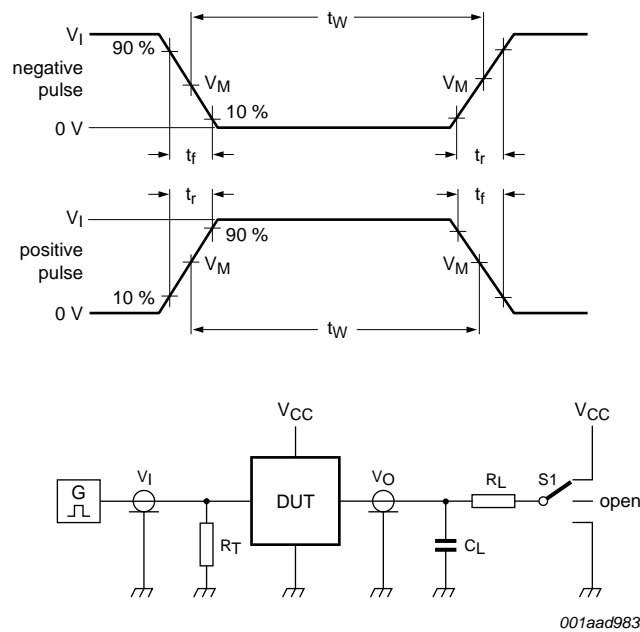


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 7. 3-state enable and disable times

Table 8. Measurement points

| Type | Input | Output | | |
|---------------|---------------------|---------------------|---------------------|---------------------|
| | V_M | V_M | V_X | V_Y |
| 74HC240-Q100 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ | $0.9 \times V_{CC}$ |
| 74HCT240-Q100 | 1.3 V | 1.3 V | $0.1 \times V_{CC}$ | $0.9 \times V_{CC}$ |



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 8. 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} |
| 74HC240-Q100 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT240-Q100 | 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

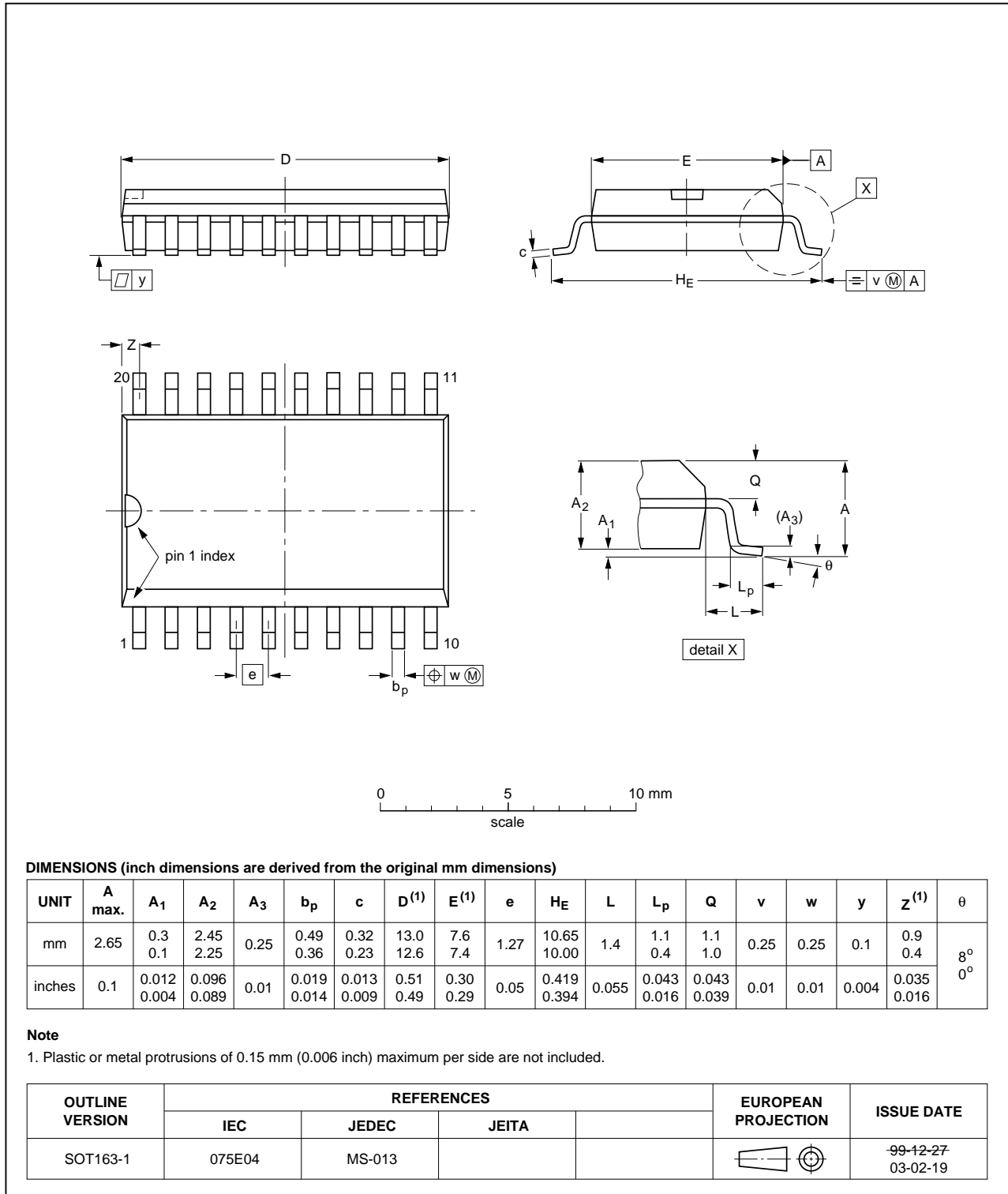


Fig 9. Package outline SOT163-1 (SO20)

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

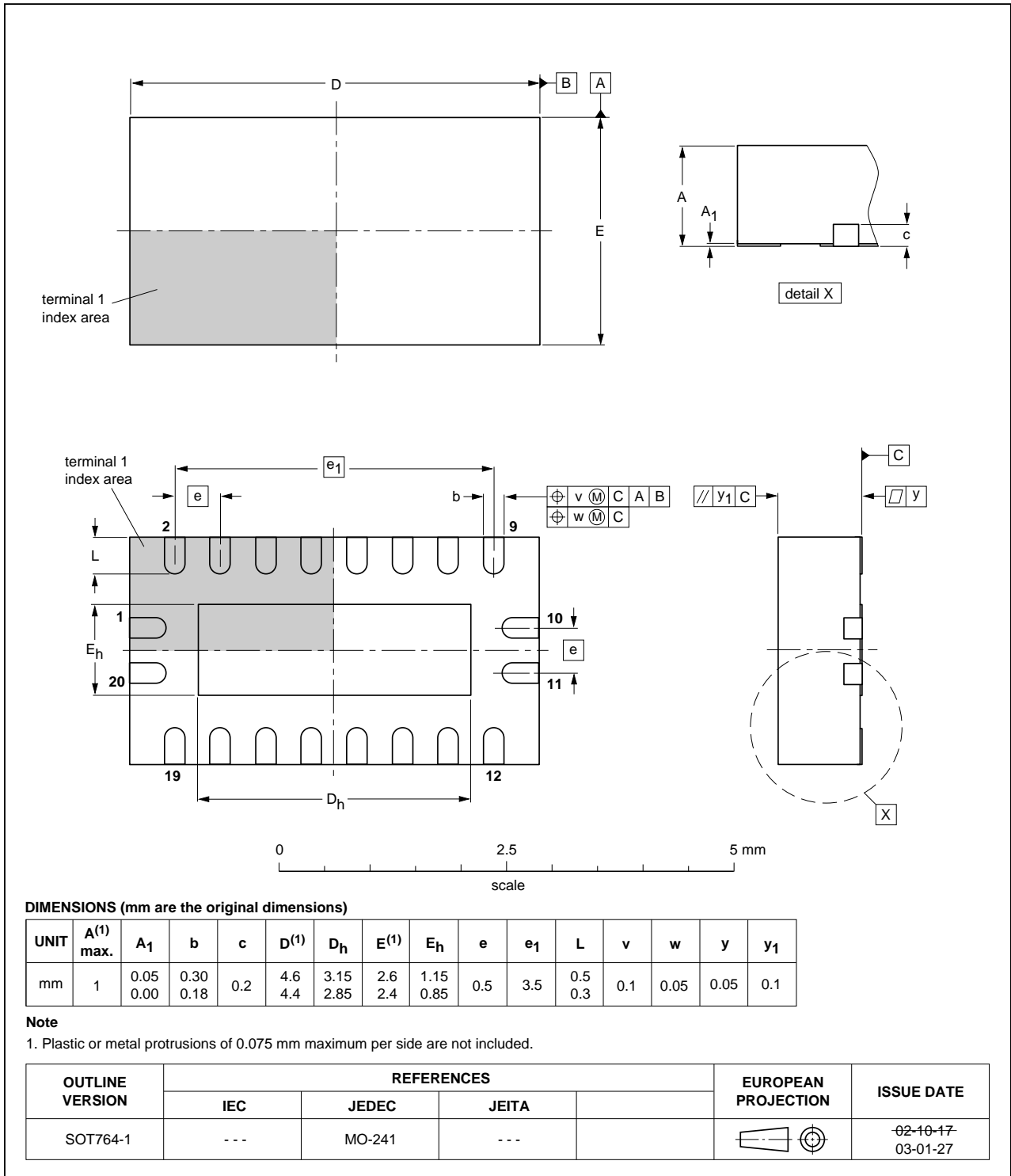


Fig 11. Package outline SOT764-1 (DHVQFN20)

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 |
| MIL | Military |

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------------|--------------|--------------------|---------------|------------|
| 74HC_HCT240_Q100 v.1 | 20120730 | Product data sheet | - | - |

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".

[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 URL <http://www.nexperia.com>.

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