

74AHC240; 74AHCT240

Octal buffer/line driver; inverting; 3-state

Rev. 4 — 25 September 2013

Product data sheet

1. General description

The 74AHC240 and 74AHCT240 are 8-bit inverting buffer/line drivers with 3-state outputs. These devices can be used as two 4-bit buffers or one 8-bit buffer. They feature two output enables ($1\overline{OE}$ and $2\overline{OE}$), each controlling four of the 3-state outputs. A HIGH on $n\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Inputs are over voltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

2. Features and benefits

- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than V_{CC}
- For 74AHC240 only: operates with CMOS input levels
- For 74AHCT240 only: operates with TTL input levels
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ CDM JESD22-C101D exceeds 1000 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 |
| 74AHC240D 74AHCT240D | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74AHC240PW 74AHCT240PW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74AHC240BQ 74AHCT240BQ | $-40\text{ }^{\circ}\text{C}$ 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 |



4. Functional diagram

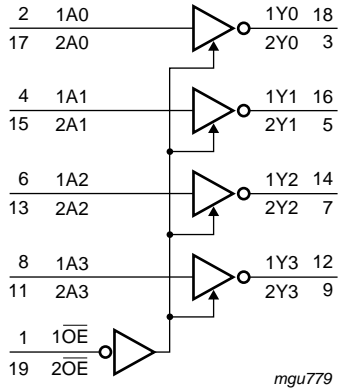


Fig 1. Logic symbol

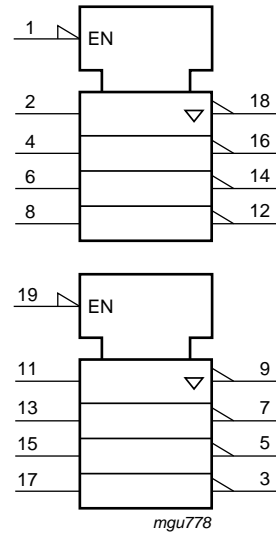


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning

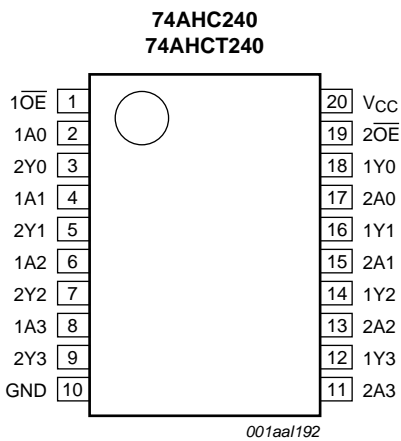
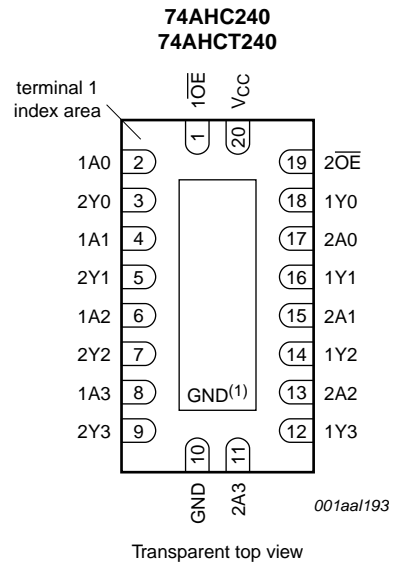


Fig 3. Pin configuration SO20 and TSSOP20



- (1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

Fig 4. Pin configuration DHVQFN20

5.2 Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table^[1]

| Control | Input | Output |
|------------------|-------|--------|
| \overline{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 | +7.0 | V |
| V _I | input voltage | | -0.5 | +7.0 | V |
| I _{IK} | input clamping current | V _I < -0.5 V | [1] -20 | - | mA |
| I _{OK} | output clamping current | V _O < -0.5 V or V _O > V _{CC} + 0.5 V | [1] - | ±20 | mA |
| I _O | output current | V _O = -0.5 V to (V _{CC} + 0.5 V) | - | ±25 | mA |
| I _{CC} | supply current | | - | 75 | mA |
| I _{GND} | ground current | | -75 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C | [2] - | 500 | mW |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SO20 package: above 70 °C the value of P_{tot} derates linearly with 8.0 mW/K.
 For TSSOP20 package: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN20 package: above 60 °C the value of 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 |
|---------------------|-------------------------------------|--|-----|-----|----------|------|
| 74AHC240 | | | | | | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ | - | - | 100 | ns/V |
| | | $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ | - | - | 20 | ns/V |
| 74AHCT240 | | | | | | |
| V_{CC} | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ | - | - | 20 | ns/V |

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 | |
| 74AHC240 | | | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0\text{ V}$ | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | $V_{CC} = 3.0\text{ V}$ | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | $V_{CC} = 5.5\text{ V}$ | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0\text{ V}$ | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | $V_{CC} = 3.0\text{ V}$ | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | $V_{CC} = 5.5\text{ V}$ | - | - | 1.65 | - | 1.65 | - | 1.65 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = -50\ \mu\text{A}; V_{CC} = 2.0\text{ V}$ | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | $I_O = -50\ \mu\text{A}; V_{CC} = 3.0\text{ V}$ | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | $I_O = -50\ \mu\text{A}; V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O = -4.0\text{ mA}; V_{CC} = 3.0\text{ V}$ | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| | $I_O = -8.0\text{ mA}; V_{CC} = 4.5\text{ V}$ | 3.94 | - | - | 3.80 | - | 3.70 | - | V | |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = 50\ \mu\text{A}; V_{CC} = 2.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 50\ \mu\text{A}; V_{CC} = 3.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 50\ \mu\text{A}; V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 4.0\text{ mA}; V_{CC} = 3.0\text{ V}$ | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| | $I_O = 8.0\text{ mA}; V_{CC} = 4.5\text{ V}$ | - | - | 0.36 | - | 0.44 | - | 0.55 | V | |

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 | |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.25 | - | ±2.5 | - | ±10.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 4.0 | - | 40 | - | 80 | μA |
| C _I | input capacitance | V _I = V _{CC} or GND | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4 | - | - | - | - | - | pF |

74AHCT240

| | | | | | | | | | | |
|------------------|---------------------------|--|------|-----|-------|------|------|------|-------|----|
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | - | 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 = -50 μA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -8.0 mA | 3.94 | - | - | 3.80 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 50 μA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND per input pin; other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | ±0.25 | - | ±2.5 | - | ±10.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 4.0 | - | 40 | - | 80 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _I = V _{CC} - 2.1 V; other pins at V _{CC} or GND; I _O = 0 A; V _{CC} = 4.5 V to 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| C _I | input capacitance | V _I = V _{CC} or GND | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | | Unit |
|------------------|-------------------------------|---|-------|--------------------|------|-------------------|-------------|--------------|------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Max (125 °C) | |
| 74AHC240 | | | | | | | | | |
| t _{pd} | propagation delay | nAn to nYn; see Figure 5 ^[2] | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF | - | 3.9 | 7.5 | 1.0 | 8.6 | 10.8 | ns |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF | - | 5.8 | 11.0 | 1.0 | 12.5 | 15.6 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 2.8 | 4.8 | 1.0 | 5.7 | 7.1 | ns |
| t _{en} | enable time | n $\overline{O}E$ to nYn; see Figure 6 ^[2] | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF | - | 4.4 | 10.0 | 1.0 | 12.0 | 19.4 | ns |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF | - | 5.8 | 13.5 | 1.0 | 15.5 | 19.4 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 3.1 | 6.5 | 1.0 | 7.7 | 12.5 | ns |
| t _{dis} | disable time | n $\overline{O}E$ to nYn; see Figure 6 ^[2] | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF | - | 5.3 | 9.0 | 1.0 | 10.0 | 18.1 | ns |
| | | V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF | - | 8.9 | 13.0 | 1.0 | 14.5 | 18.1 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 3.9 | 5.8 | 1.0 | 6.5 | 8.1 | ns |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; C _L = 50 pF; f _i = 1 MHz ^[3] | - | 9 | - | - | - | - | pF |

Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +125 °C | | | Unit |
|------------------|-------------------------------|---|-------|--------------------|-----|-------------------|-------------|--------------|------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Max (125 °C) | |
| 74AHCT240 | | | | | | | | | |
| t _{pd} | propagation delay | nAn to nYn; see Figure 5 ^[2] | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 3.0 | 5.8 | 1.0 | 6.8 | 8.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF | - | 4.4 | 8.4 | 1.0 | 9.5 | 11.9 | ns |
| t _{en} | enable time | n $\overline{\text{OE}}$ to nYn; see Figure 6 ^[2] | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 3.4 | 7.5 | 1.0 | 9.0 | 14.4 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF | - | 4.5 | 9.5 | 1.0 | 11.5 | 14.4 | ns |
| t _{dis} | disable time | n $\overline{\text{OE}}$ to nYn; see Figure 6 ^[2] | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF | - | 3.9 | 6.1 | 1.0 | 6.7 | 8.3 | ns |
| | | V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF | - | 6.2 | 8.7 | 1.0 | 9.2 | 11.5 | ns |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; C _L = 50 pF; f _i = 1 MHz ^[3] | - | 9 | - | - | - | - | pF |

[1] Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V and V_{CC} = 5.0 V).

[2] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{en} is the same as t_{PZH} and t_{PZL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[3] 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;

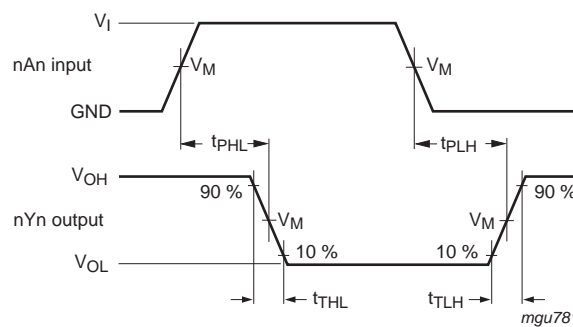
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

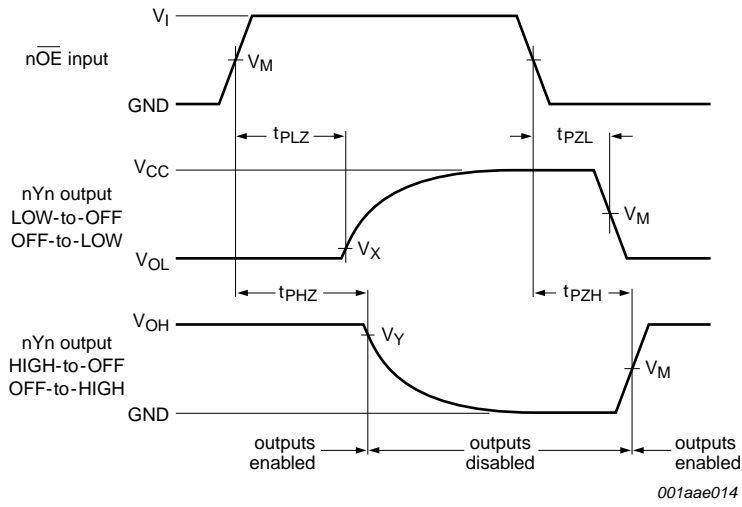
11. Waveforms



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. Propagation delay input (nAn) to output (nYn)



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. Enable and disable times

Table 8. Measurement points

| Type | Input | Output | | |
|-----------|-------------|-------------|------------------|------------------|
| | V_M | V_M | V_X | V_Y |
| 74AHC240 | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |
| 74AHCT240 | 1.5 V | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |

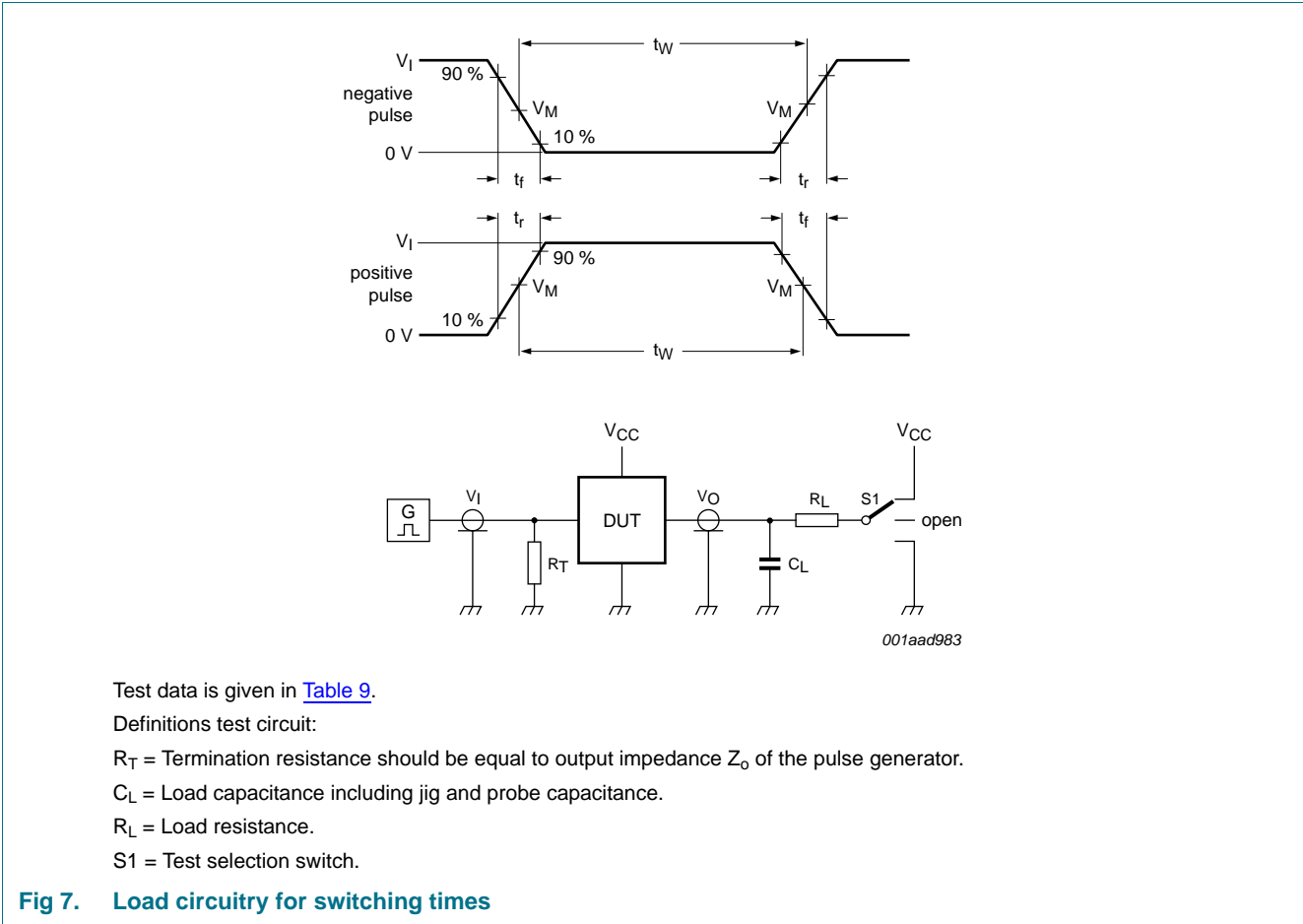


Table 9. Test data

| 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} |
| 74AHC240 | V_{CC} | 3.0 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74AHCT240 | 3.0 V | 3.0 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

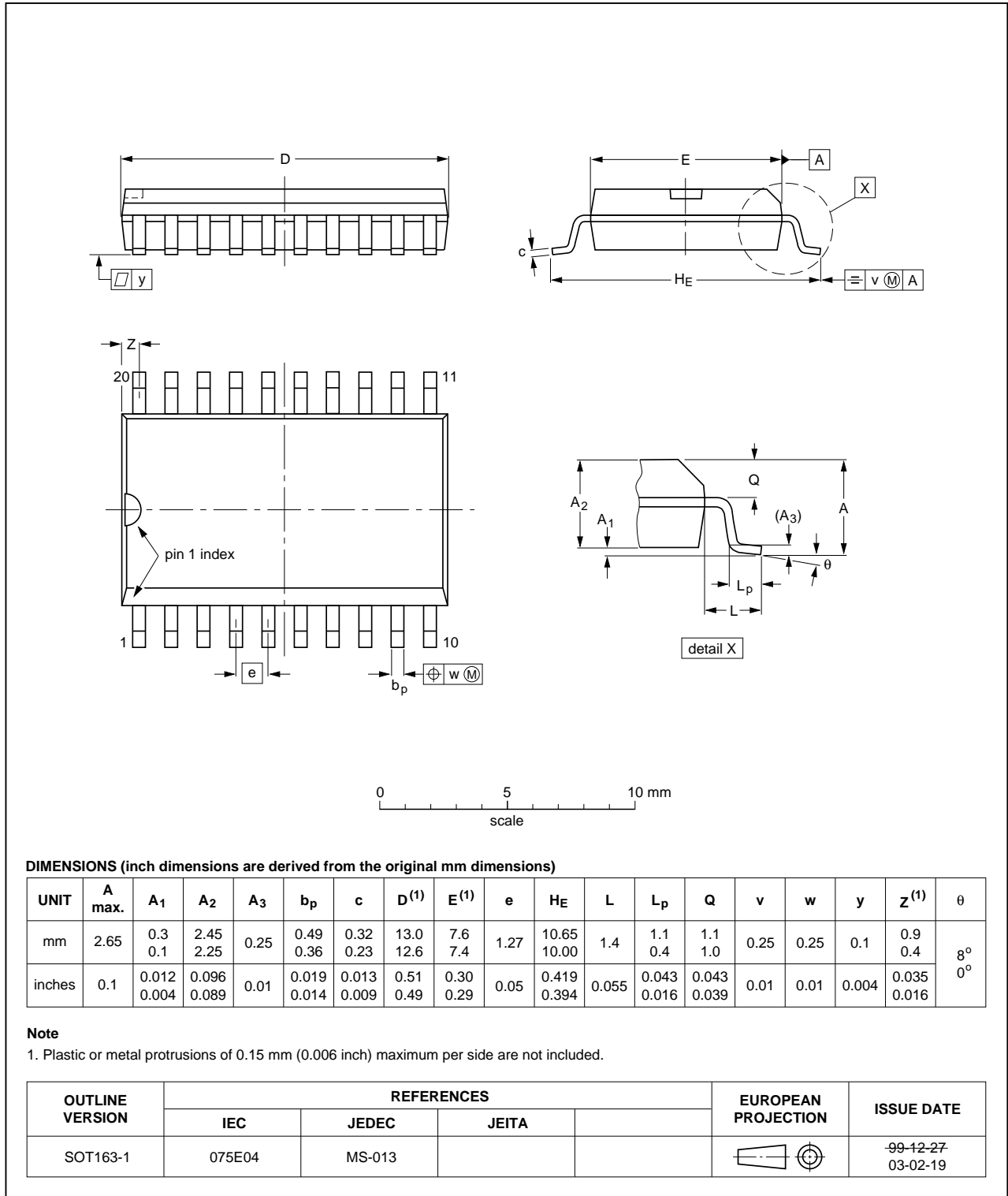


Fig 8. Package outline SOT163-1 (SO20)

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

SOT360-1

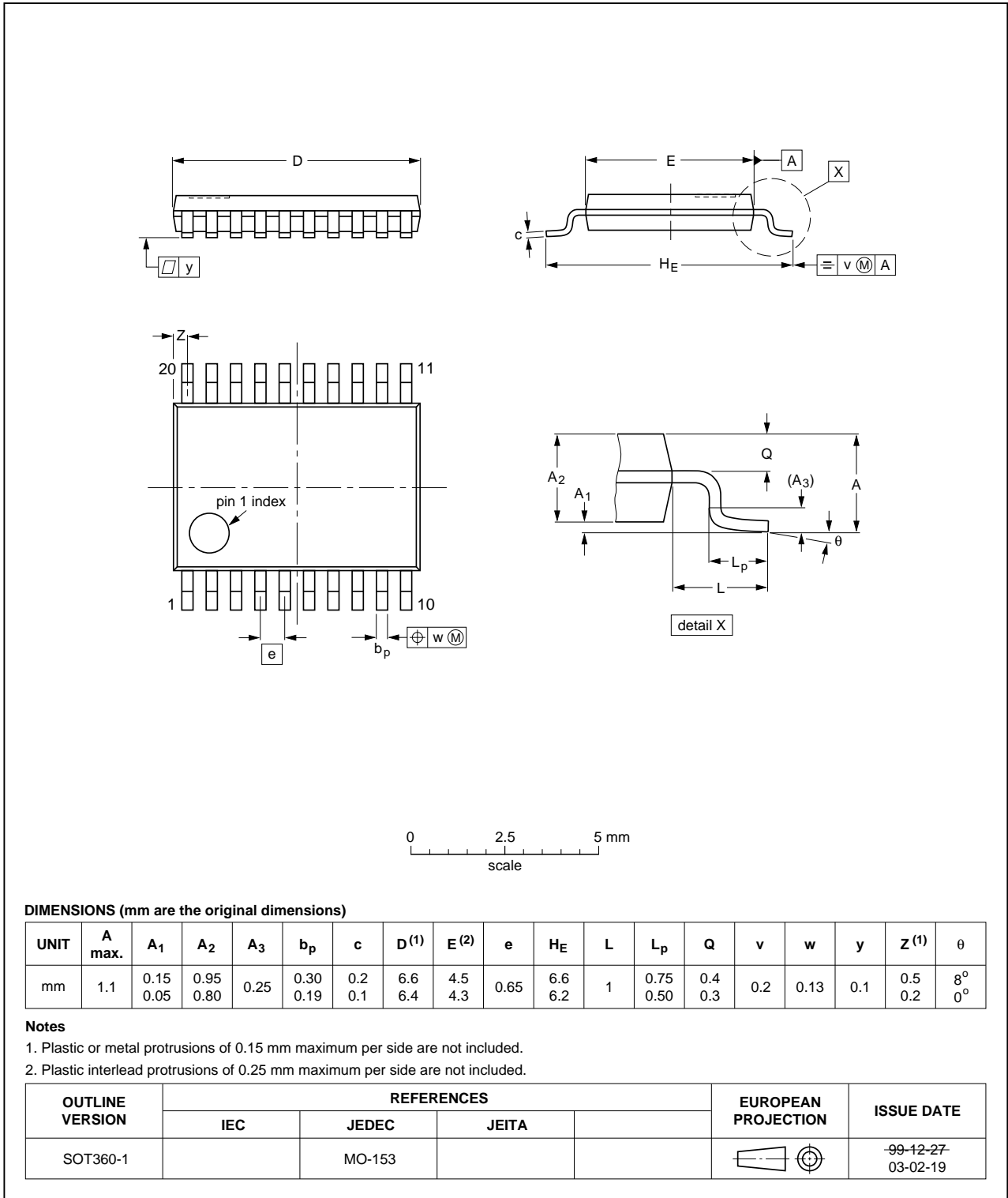


Fig 9. Package outline SOT360-1 (TSSOP20)

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

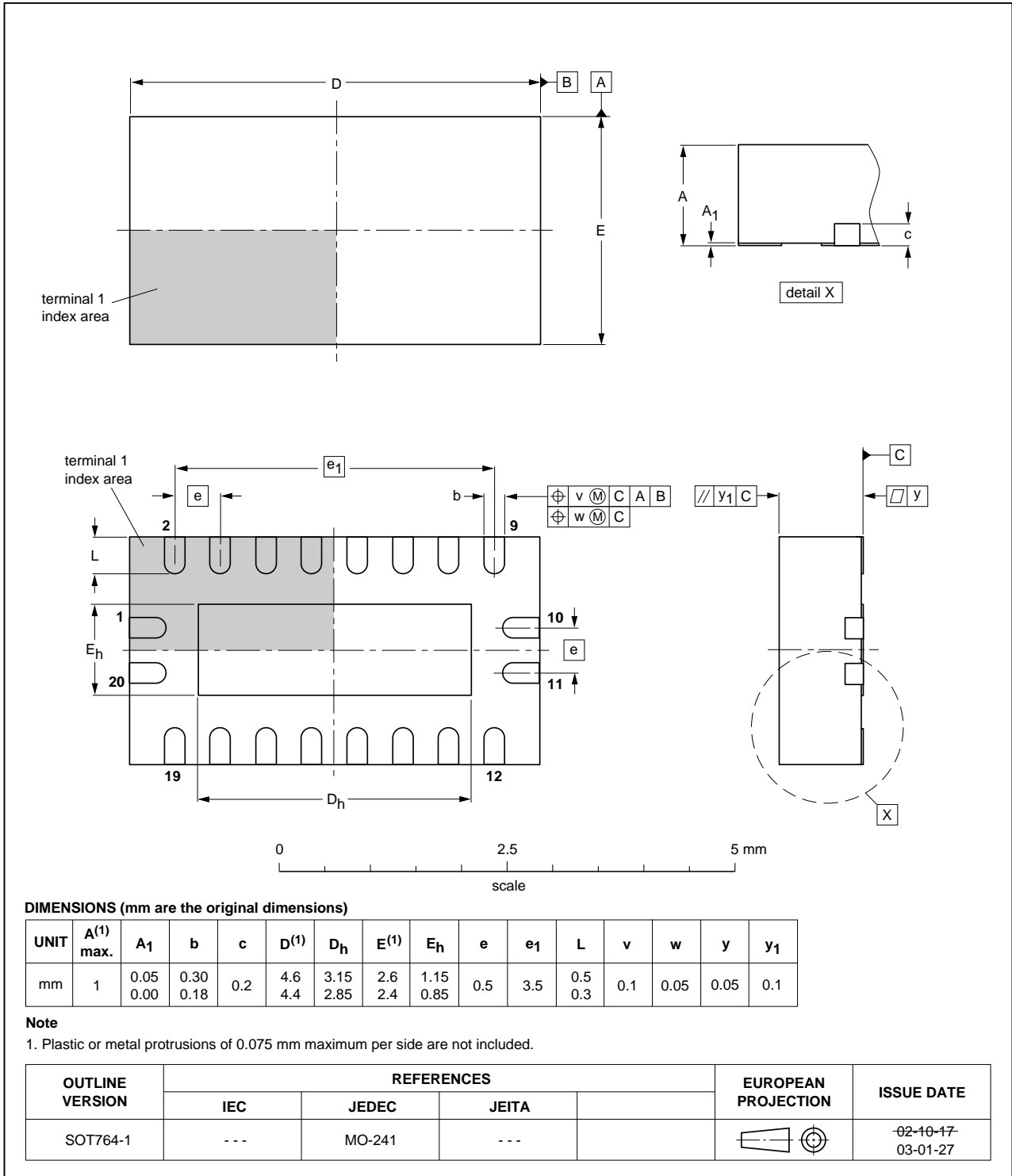


Fig 10. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 10. Abbreviations

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

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|---|--------------------|---------------|-------------------|
| 74AHC_AHCT240 v.4 | 20130925 | Product data sheet | - | 74AHC_AHCT240 v.3 |
| Modifications: | <ul style="list-style-type: none"> Figure 5 and 6 have been made visible (errata). | | | |
| 74AHC_AHCT240 v.3 | 20111108 | Product data sheet | - | 74AHC_AHCT240 v.2 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74AHC_AHCT240 v.2 | 20101126 | Product data sheet | - | 74AHC_AHCT240 v.1 |
| 74AHC_AHCT240 v.1 | 20100111 | 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.nxp.com>.

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