



**THE DATASHEET OF
74VHC244D,118**



74VHC244; 74VHCT244

Octal buffer/line driver; 3-state

Rev. 01 — 17 August 2009

Product data sheet

1. General description

The 74VHC244; 74VHCT244 are a high-speed Si-gate CMOS devices.

The 74VHC244; 74VHCT244 have octal non-inverting buffer/line drivers with 3-state outputs. The 3-state outputs are controlled by the output enable inputs ($\overline{\text{nOE}}$). A HIGH on $\overline{\text{nOE}}$ causes the outputs to assume a high-impedance OFF-state.

2. Features

- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than V_{CC}
- Input levels:
 - ◆ The 74VHC244 operates with CMOS input level
 - ◆ The 74VHCT244 operates with TTL input level
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM JESD22-C101C 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 |
| 74VHC244D 74VHCT244D | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74VHC244PW 74VHCT244PW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74VHC244BQ 74VHCT244BQ | $-40\text{ }^{\circ}\text{C}$ 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 |

4. Functional diagram

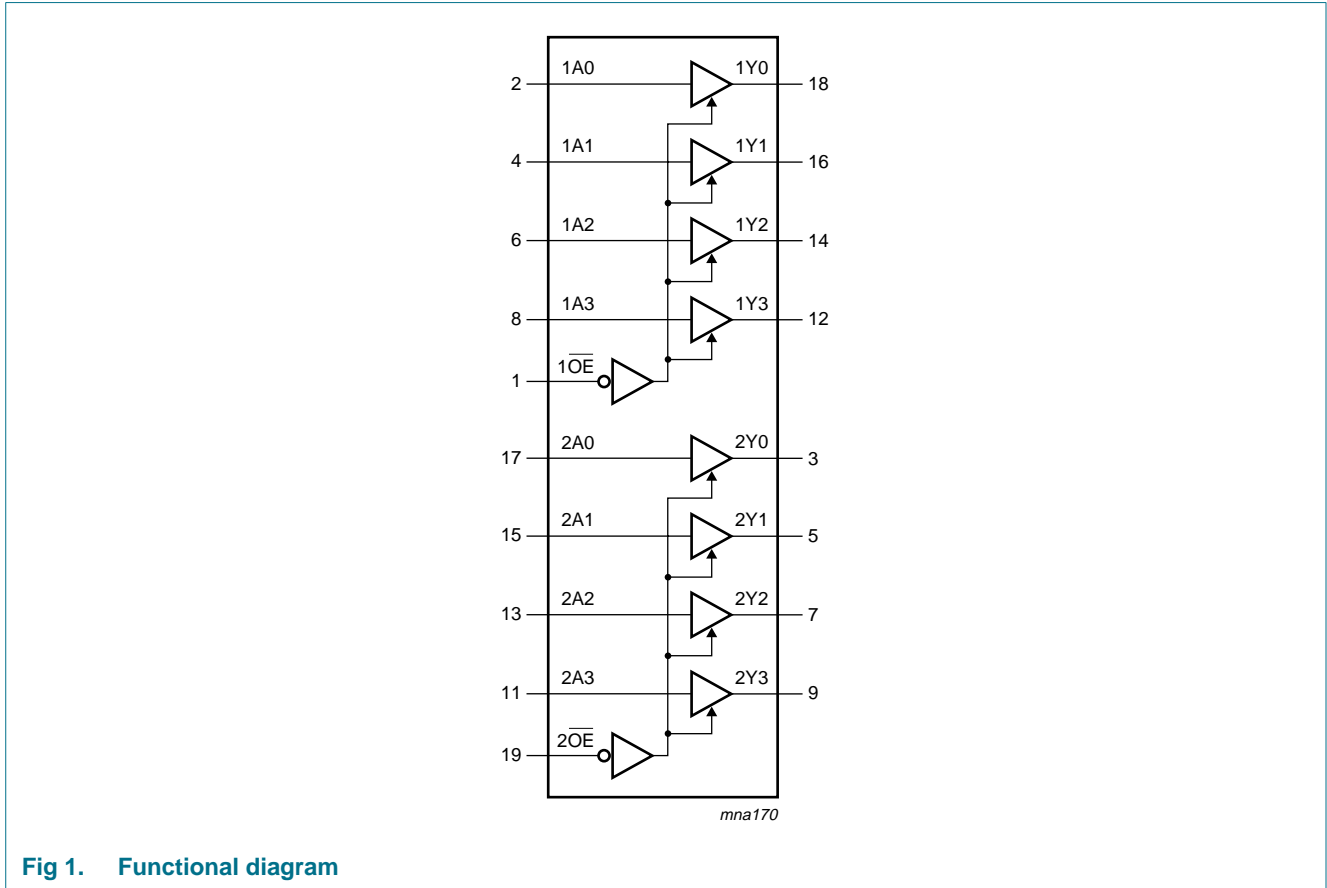


Fig 1. Functional diagram

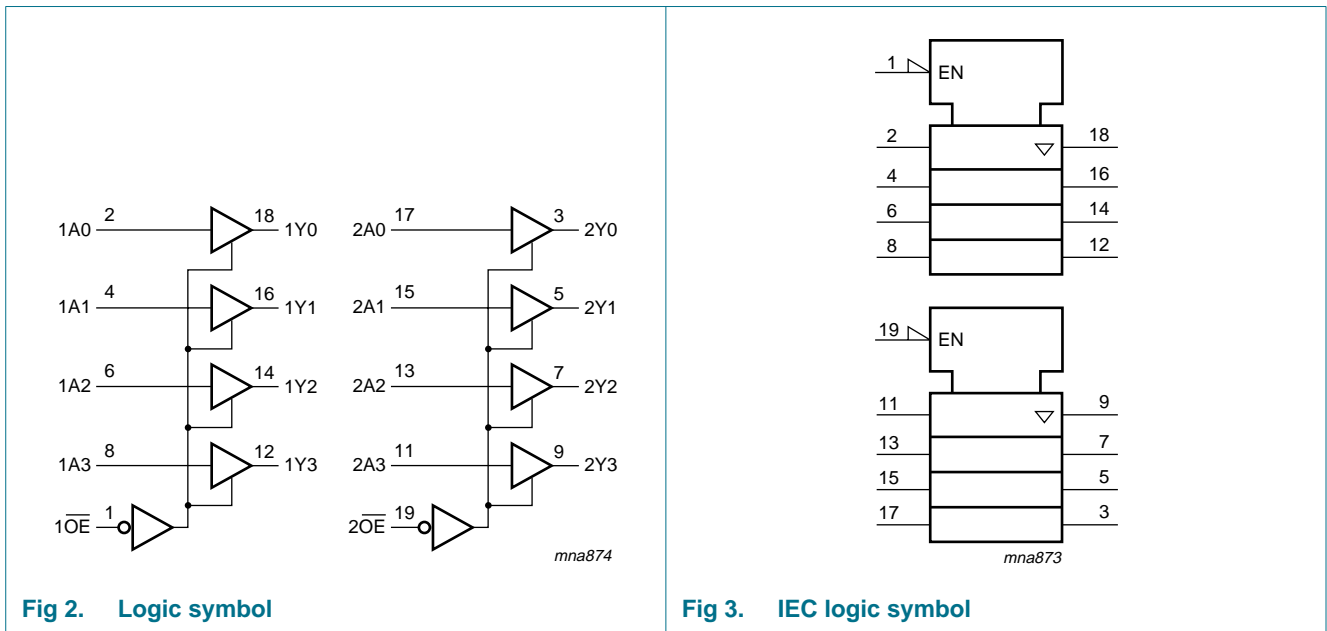
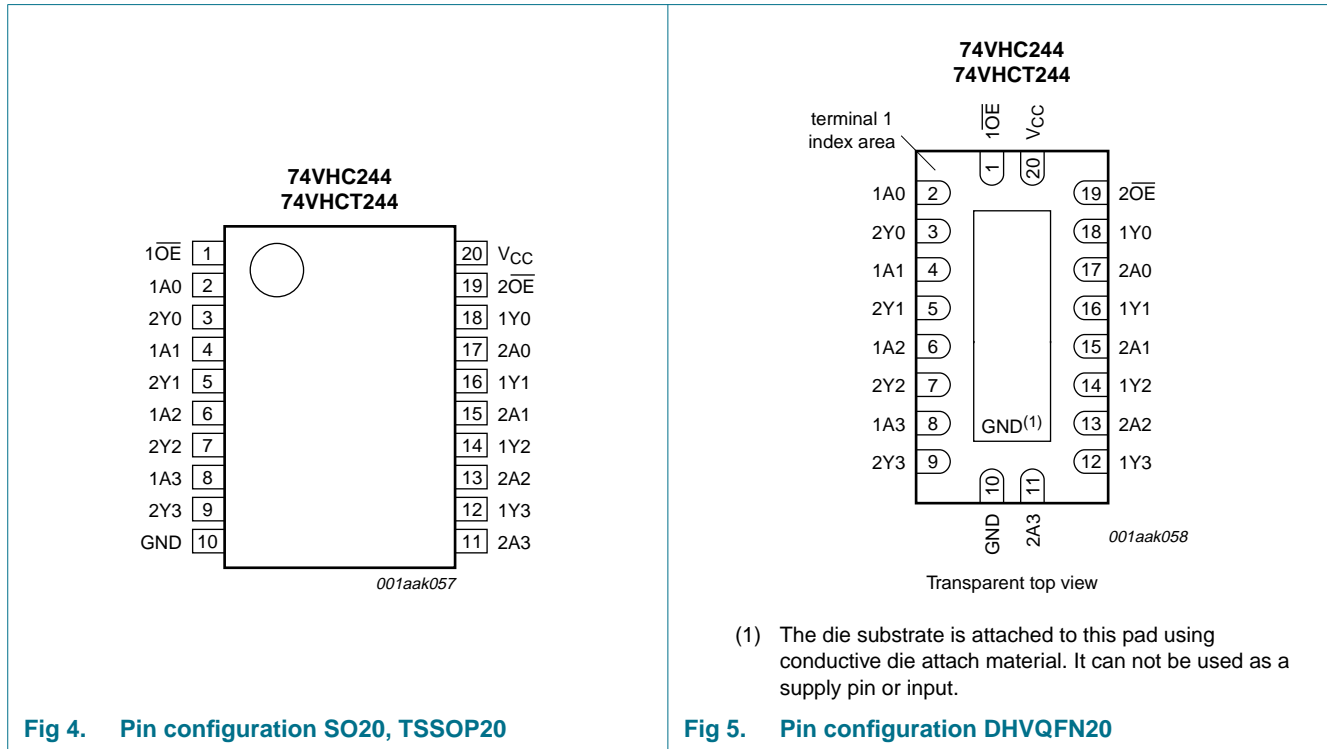


Fig 2. Logic symbol

Fig 3. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|------------------|----------------|----------------------------------|
| $1\overline{OE}$ | 1 | output enable input (active LOW) |
| 1A[0:3] | 2, 4, 6, 8 | data input |
| 2A[0:3] | 17, 15, 13, 11 | data input |
| 1Y[0:3] | 18, 16, 14, 12 | data output |
| 2Y[0:3] | 3, 5, 7, 9 | data output |
| GND | 10 | ground (0 V) |
| $2\overline{OE}$ | 19 | output enable input (active LOW) |
| V _{CC} | 20 | supply voltage |

6. Functional description

Table 3. Function table^[1]

| Control | Input | Output |
|-------------------------|-------|--------|
| $\overline{\text{nOE}}$ | nAn | nYn |
| L | L | L |
| | H | H |
| 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 | | | |
| | SO20 package | | [2] - | 500 | mW |
| | TSSOP20 package | | [3] - | 500 | mW |
| | DHVQFN20 package | | [4] - | 500 | mW |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 [2] P_{tot} derates linearly with 8 mW/K above 70 °C.
 [3] P_{tot} derates linearly with 5.5 mW/K above 60 °C.
 [4] P_{tot} derates linearly with 4.5 mW/K above 60 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 74VHC244 | | | 74VHCT244 | | | Unit |
|------------------|-------------------------------------|---------------------------------|----------|-----|-----------------|-----------|-----|-----------------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V _{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | 4.5 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | - | 5.5 | 0 | - | 5.5 | V |
| V _O | output voltage | | 0 | - | V _{CC} | 0 | - | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 3.3 V ± 0.3 V | - | - | 100 | - | - | - | ns/V |
| | | V _{CC} = 5.0 V ± 0.5 V | - | - | 20 | - | - | 20 | ns/V |

9. Static characteristics

Table 6. Static characteristics

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 | |
| For type 74VHC244 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 3.0 V | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | V _{CC} = 5.5 V | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 3.0 V | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | V _{CC} = 5.5 V | - | - | 1.65 | - | 1.65 | - | 1.65 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = -50 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 3.0 V | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 3.0 V | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| I _O = -8.0 mA; V _{CC} = 4.5 V | 3.94 | - | - | 3.8 | - | 3.70 | - | V | | |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 50 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 3.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 3.0 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _O = 8.0 mA; V _{CC} = 4.5 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V | | |
| 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 _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 _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 4.0 | - | 40 | - | 80 | μA |

Table 6. Static characteristics ...continued
 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 | |
| C _I | input capacitance | | - | 3.0 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4.0 | - | - | - | - | - | pF |
| For type 74VHCT244 | | | | | | | | | | |
| 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 | - | - | 3.8 | - | 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 _{OZ} | OFF-state output current | per input pin; V _I = V _{IH} or V _{IL} ; V _{CC} = 5.5 V; I _O = 0 A V _O = V _{CC} or GND; other pins at V _{CC} or GND | - | - | ±0.25 | - | ±2.5 | - | ±10.0 | µA |
| 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 _{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; I _O = 0 A; other pins at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| C _I | input capacitance | | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4.0 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics
GND = 0 V. For test circuit see Figure 8.

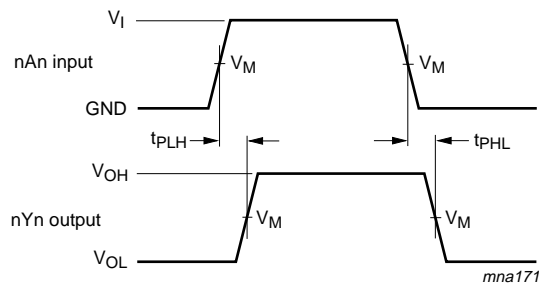
| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|--------------------------|-------------------------------|---|-------|--------------------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | Min | Max | |
| For type 74VHC244 | | | | | | | | | | |
| t_{pd} | propagation delay | nAn to nYn; see Figure 6 ^[2] | | | | | | | | |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 5.0 | 8.4 | 1.0 | 10.0 | 1.0 | 10.5 | ns |
| | | $C_L = 50\text{ pF}$ | - | 7.0 | 11.9 | 1.0 | 13.5 | 1.0 | 15.0 | ns |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.4 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| t_{en} | enable time | nOE to nYn; see Figure 7 ^[2] | | | | | | | | |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 6.5 | 10.6 | 1.0 | 12.5 | 1.0 | 13.5 | ns |
| | | $C_L = 50\text{ pF}$ | - | 7.5 | 14.1 | 1.0 | 16.0 | 1.0 | 18.0 | ns |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 4.0 | 7.3 | 1.0 | 8.5 | 1.0 | 9.5 | ns |
| t_{dis} | disable time | nOE to nYn; see Figure 7 ^[2] | | | | | | | | |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 5.5 | 9.7 | 1.0 | 11.0 | 1.0 | 12.5 | ns |
| | | $C_L = 50\text{ pF}$ | - | 10.0 | 14.0 | 1.0 | 16.0 | 1.0 | 17.5 | ns |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 4.8 | 7.2 | 1.0 | 8.5 | 1.0 | 9.0 | ns |
| C_{PD} | power dissipation capacitance | $C_L = 50\text{ pF}; f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ ^[3] | - | 10 | - | - | - | - | - | pF |

Table 7. Dynamic characteristics ...continued
GND = 0 V. For test circuit see Figure 8.

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|---------------------------|-------------------------------|--|----------------|--------------------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | Min | Max | |
| For type 74VHCT244 | | | | | | | | | | |
| t_{pd} | propagation delay | nAn to nYn; see Figure 6 ^[2] $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.5 | 7.4 | 1.0 | 8.5 | 1.0 | 9.5 | ns |
| | | $C_L = 50\text{ pF}$ | - | 5.0 | 8.4 | 1.0 | 9.5 | 1.0 | 10.5 | ns |
| t_{en} | enable time | nOE to nYn; see Figure 7 $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.5 | 10.4 | 1.0 | 12.0 | 1.0 | 13.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 5.5 | 11.4 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| t_{dis} | disable time | nOE to nYn; see Figure 7 ^[2] $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 5.0 | 9.4 | 1.0 | 10.0 | 1.0 | 12.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 7.0 | 11.4 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| C_{PD} | power dissipation capacitance | per buffer; $C_L = 50\text{ pF}; f = 1\text{ MHz};$ $V_I = \text{GND to }V_{CC}$ | ^[3] | 12 | - | - | - | - | - | pF |

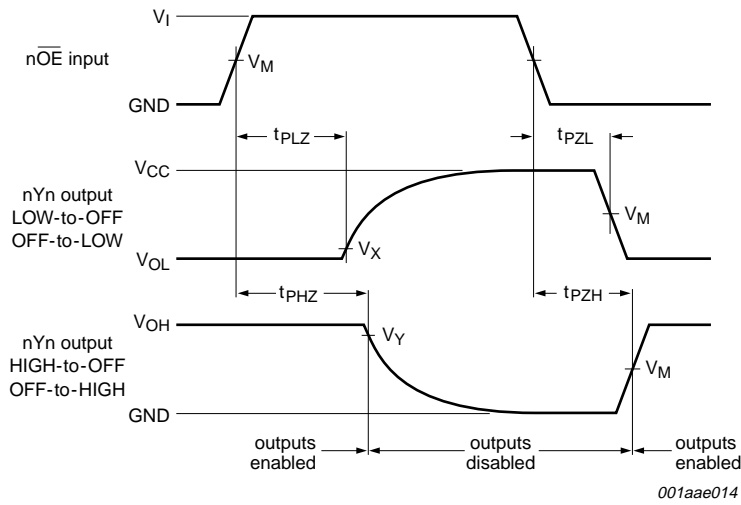
- [1] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3\text{ V}$ and $V_{CC} = 5.0\text{ V}$).
- [2] t_{pd} is the same as t_{PLH} and t_{PHL} .
 t_{en} is the same as t_{PZL} and t_{PZH} .
 t_{dis} is the same as t_{PLZ} and t_{PHZ} .
- [3] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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 Volts.

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



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. enable and disable times

Table 8. Measurement points

| Type | Input | Output | | |
|-----------|-------------|-------------|------------------|------------------|
| | V_M | V_M | V_X | V_Y |
| 74VHC244 | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |
| 74VHCT244 | 1.5 V | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |

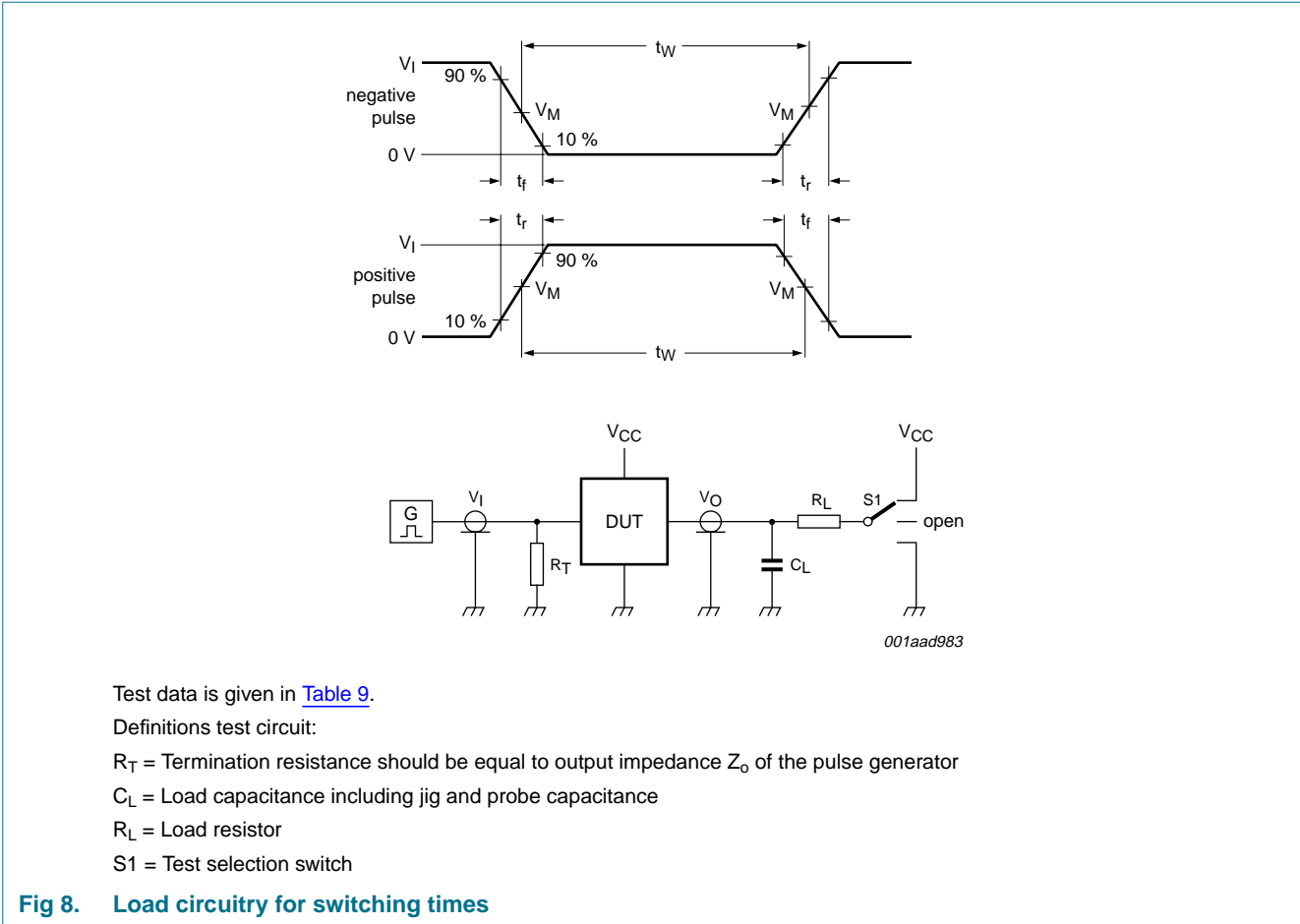


Fig 8. Load circuitry for switching times

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} |
| 74VHC244 | V_{CC} | 3.0 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74VHCT244 | 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

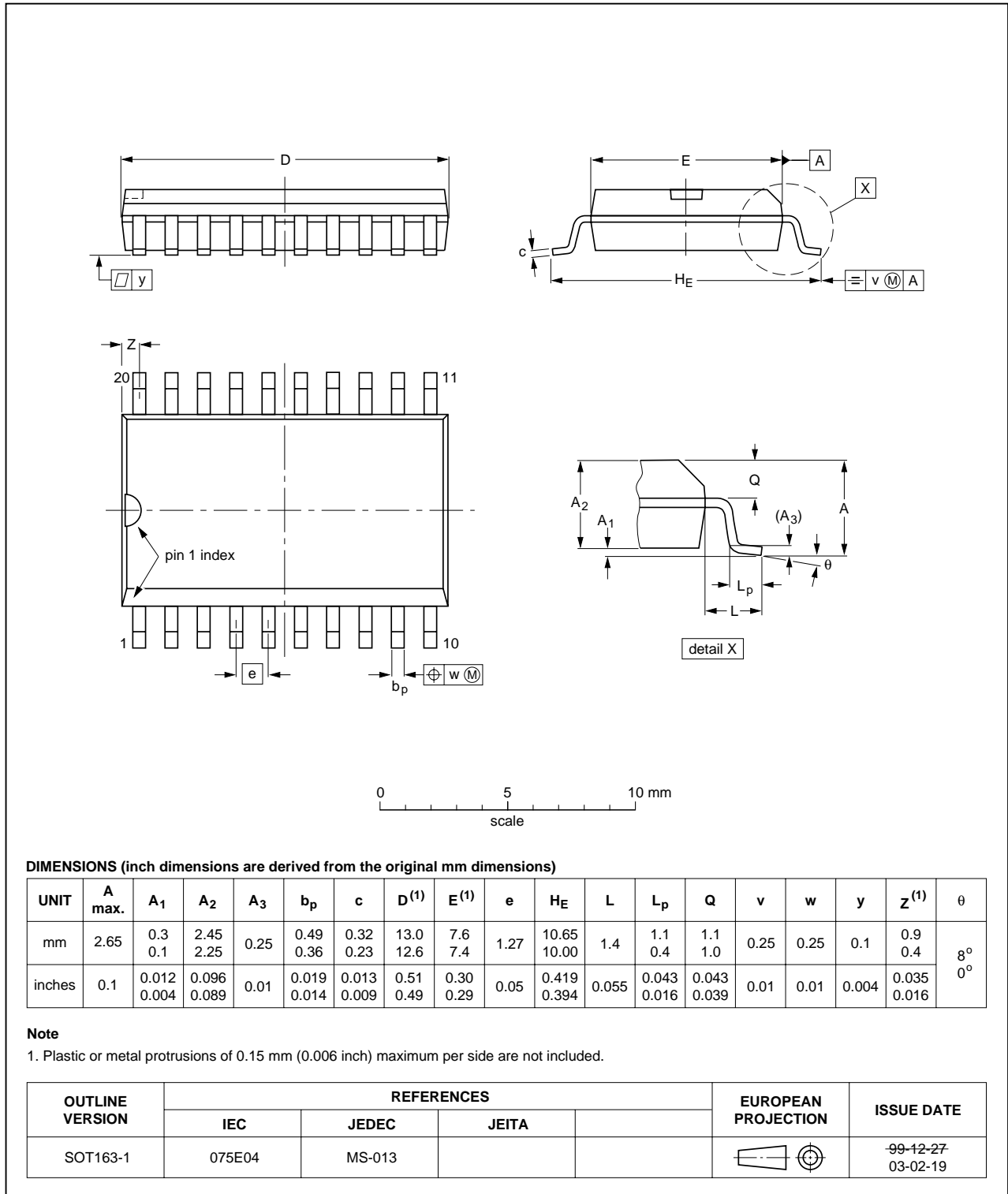


Fig 9. Package outline SOT163-1 (SO20)

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

SOT360-1

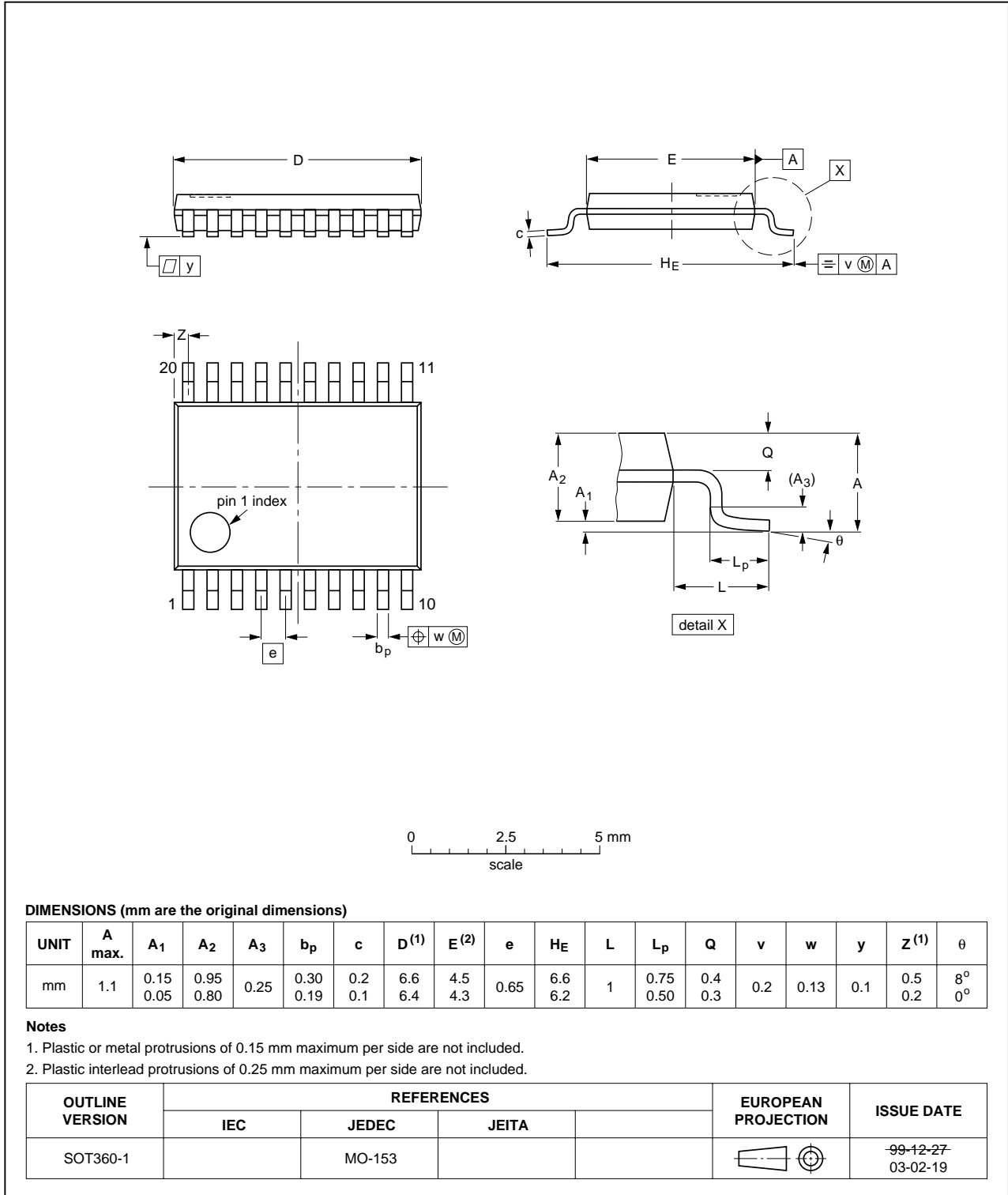


Fig 10. Package outline SOT360-1 (TSSOP20)

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

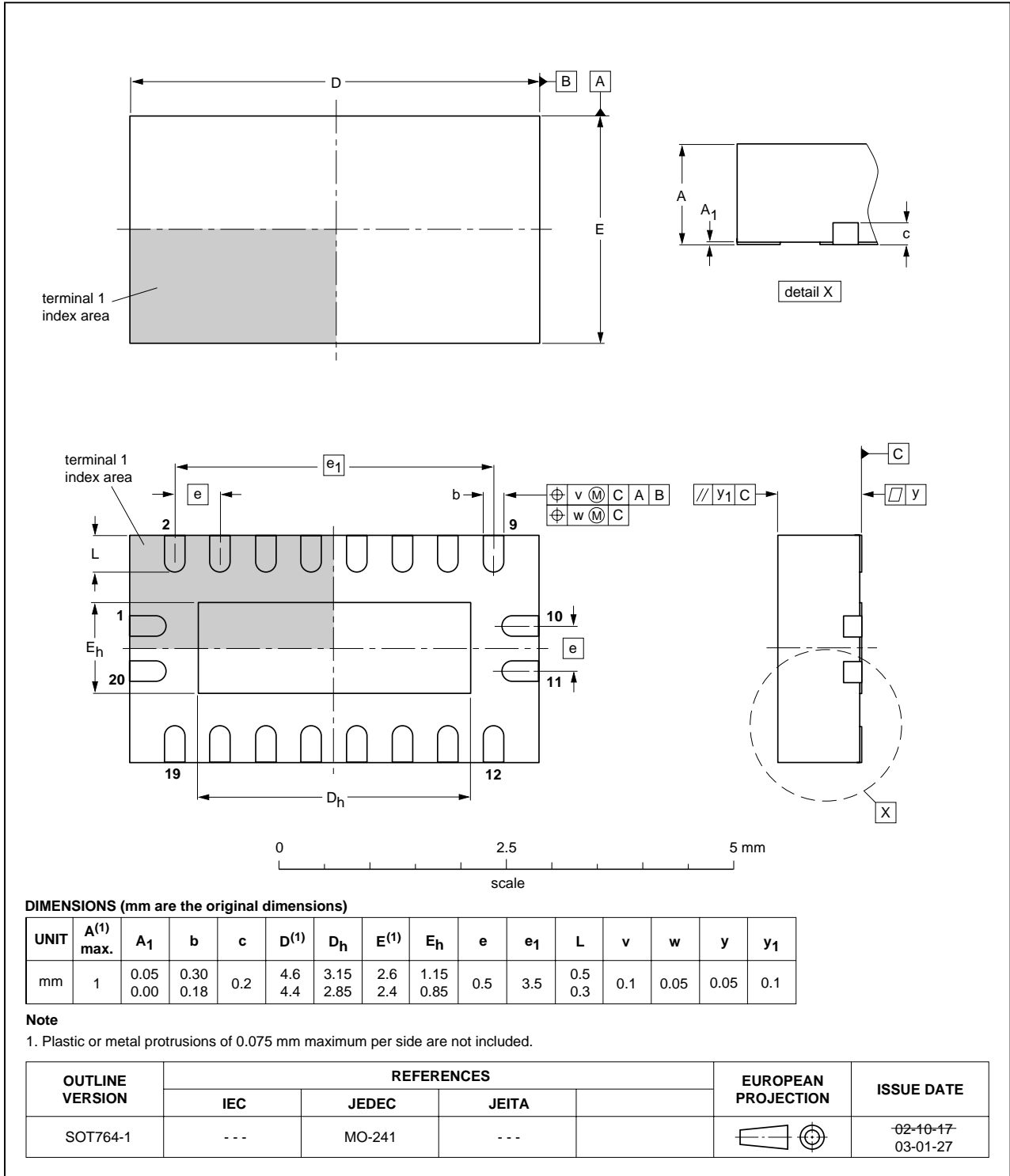


Fig 11. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|---|
| CDM | Charge Device Model |
| 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 |
|-----------------|--------------|--------------------|---------------|------------|
| 74VHC_VHCT244_1 | 20090817 | 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.

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