

74HC244; 74HCT244

Octal buffer/line driver; 3-state

Rev. 4 — 24 September 2012

Product data sheet

1. General description

The 74HC244; 74HCT244 is an 8-bit buffer/line driver with 3-state outputs. The device can be used as two 4-bit buffers or one 8-bit buffer. The device features 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 include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and benefits

- Input levels:
 - ◆ For 74HC244: CMOS level
 - ◆ For 74HCT244: TTL level
- Octal bus interface
- Non-inverting 3-state outputs
- Complies with JEDEC standard no. 7 A
- 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 $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------------------|---|----------|---|----------|
| | Temperature range | Name | Description | Version |
| 74HC244N 74HCT244N | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | DIP20 | plastic dual in-line package; 20 leads (300 mil) | SOT146-1 |
| 74HC244D 74HCT244D | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74HC244DB 74HCT244DB | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP20 | plastic shrink small outline package; 20 leads; body width 5.3 mm | SOT339-1 |
| 74HC244PW 74HCT244PW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74HC244BQ 74HCT244BQ | $-40\text{ }^{\circ}\text{C}$ 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

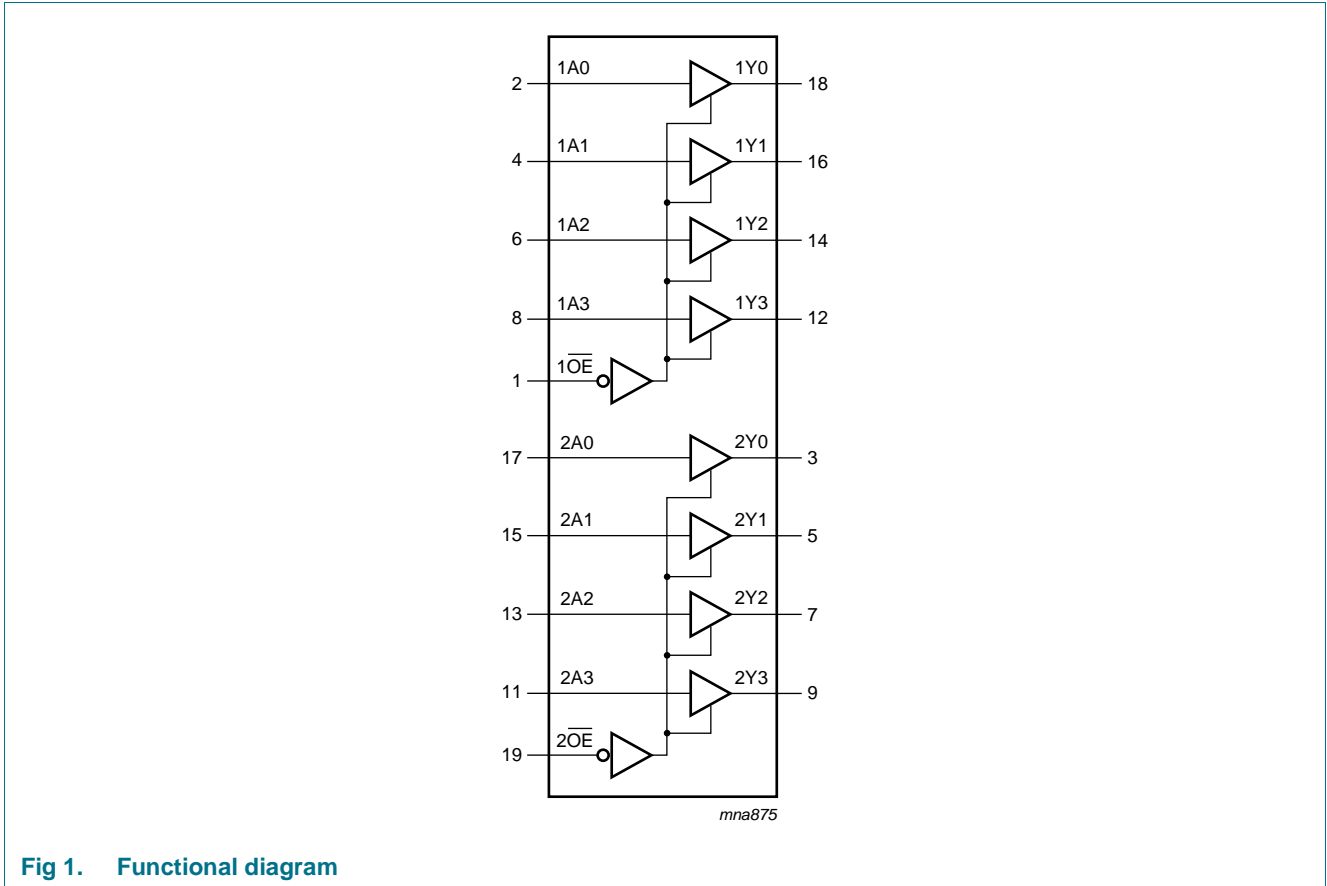


Fig 1. Functional diagram

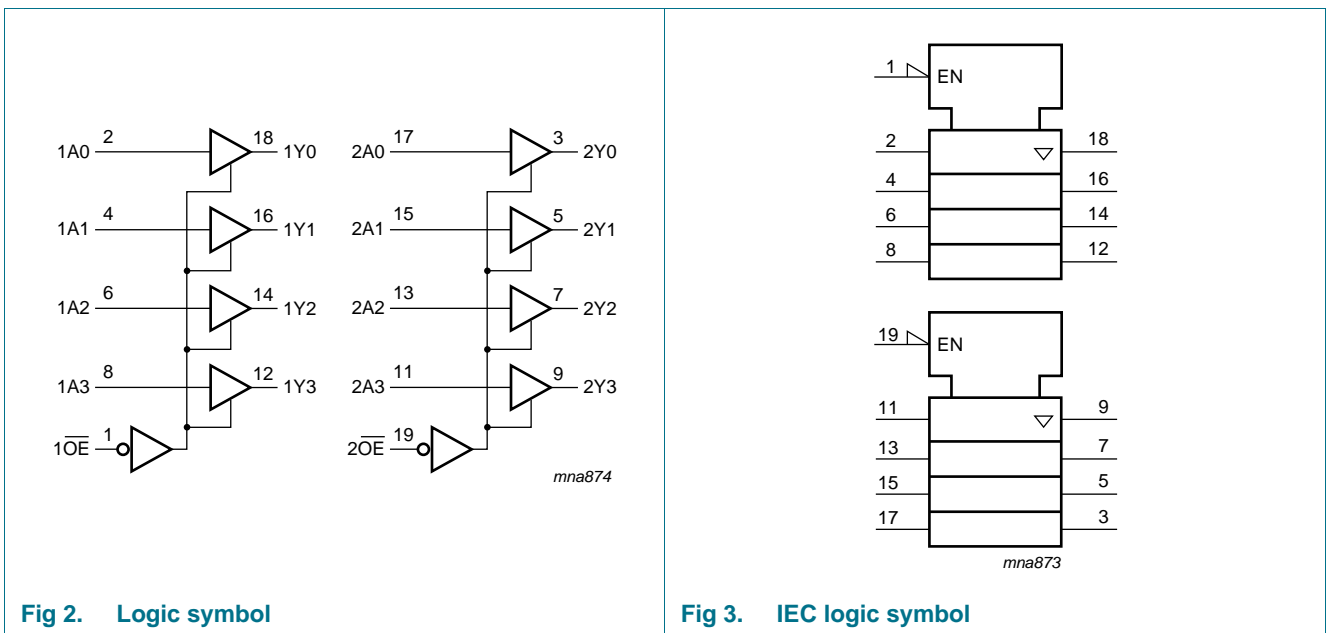
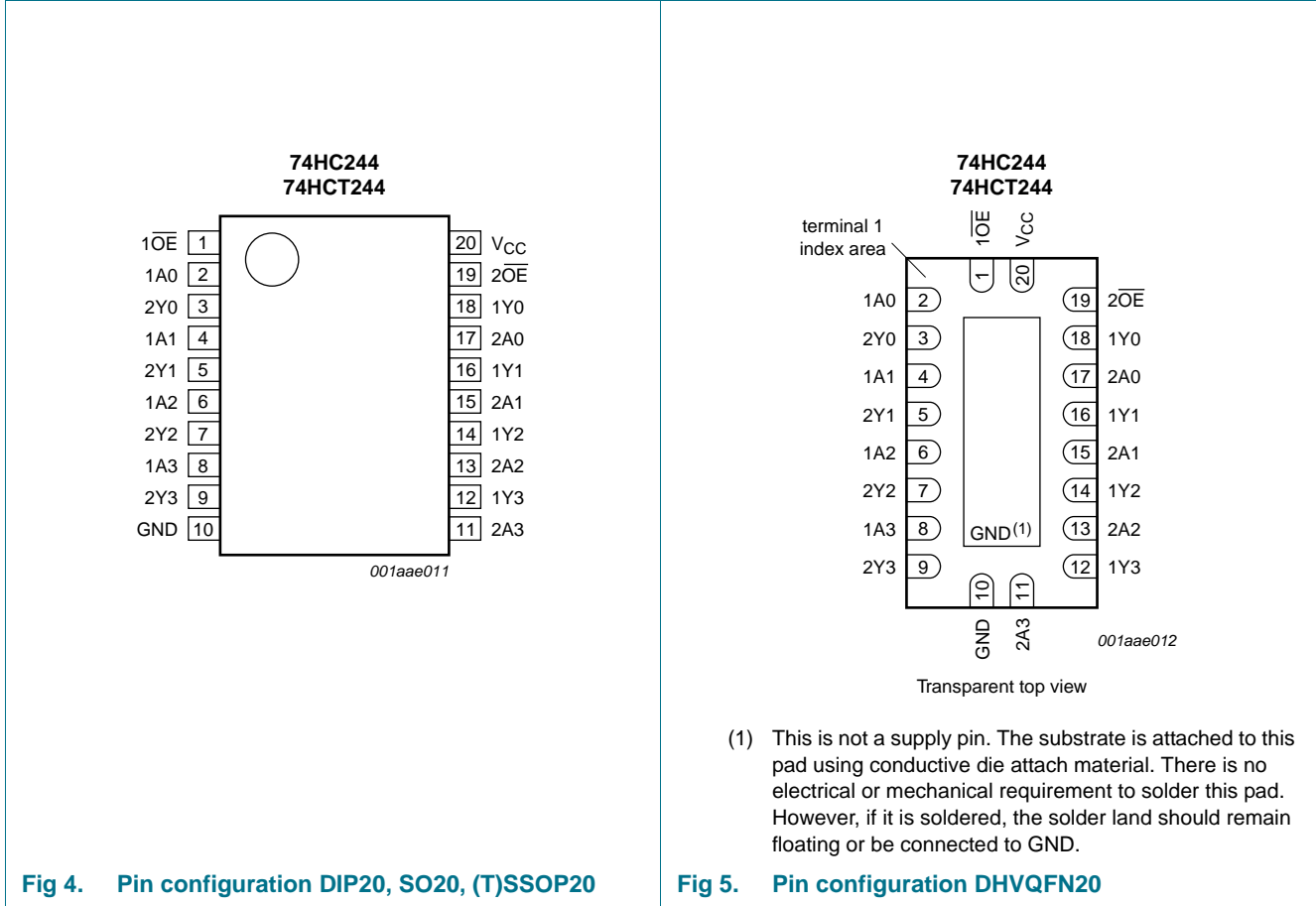


Fig 2. Logic symbol

Fig 3. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------|----------------|----------------------------------|
| 10E, 2OE | 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 | 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 | V |
| I _{IK} | input clamping current | V _I < -0.5 V or V _I > V _{CC} + 0.5 V | - | ±20 | mA |
| I _{OK} | output clamping current | V _O < -0.5 V or V _O > V _{CC} + 0.5 V | - | ±20 | mA |
| I _O | output current | -0.5 V < V _O < V _{CC} + 0.5 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 | DIP20 package | [1] - | 750 | mW |
| | | SO20, SSOP20, TSSOP20 and DHVQFN20 packages | [2] - | 500 | mW |

[1] For DIP20 package: P_{tot} derates linearly with 12 mW/K above 70 °C.

[2] For SO20 packages: P_{tot} derates linearly with 8 mW/K above 70 °C.

For SSOP20 and TSSOP20 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

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 |
|------------------|-------------------------------------|-------------------------|-----|------|-----------------|------|
| 74HC244 | | | | | | |
| 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 |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | - | - | 625 | ns/V |
| | | V _{CC} = 4.5 V | - | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 V | - | - | 83 | ns/V |
| T _{amb} | ambient temperature | | -40 | - | +125 | °C |

Table 5. Recommended operating conditions ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|-------------------------------------|-------------------------|-----|------|-----------------|------|
| 74HCT244 | | | | | | |
| 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 |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 4.5 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 | |
| 74HC244 | | | | | | | | | | |
| 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 |
| | I _O = -7.8 mA; V _{CC} = 6.0 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 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 _O = 7.8 mA; V _{CC} = 6.0 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 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 V; I _O = 0 A | - | - | ±0.5 | - | ±5.0 | - | ±10 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 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 | |
| 74HCT244 | | | | | | | | | | |
| 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 | - | 70 | 252 | - | 315 | - | 343 | μA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 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) | |
| 74HC244 | | | | | | | | |
| t _{pd} | propagation delay | nAn to nYn; see Figure 6 | | [1] | | | | |
| | | V _{CC} = 2.0 V | - | 30 | 110 | 145 | 165 | ns |
| | | V _{CC} = 4.5 V | - | 11 | 22 | 28 | 33 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 9 | - | - | - | ns |
| | | V _{CC} = 6.0 V | - | 9 | 19 | 24 | 28 | ns |

Table 7. Dynamic characteristics ...continued
GND = 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 | - | 36 | 150 | 190 | 225 | ns |
| | | V _{CC} = 4.5 V | - | 13 | 30 | 38 | 45 | ns |
| | | V _{CC} = 6.0 V | - | 10 | 26 | 33 | 38 | ns |
| t _{dis} | disable time | n $\overline{\text{OE}}$ to nYn or see Figure 7 [3] | | | | | | |
| | | 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 _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 buffer; V _I = GND to V _{CC} [5] | - | 35 | - | - | - | pF |

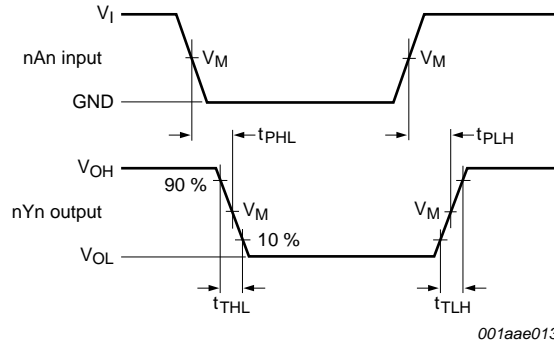
74HCT244

| | | | | | | | | |
|------------------|-------------------------------|--|---|----|----|----|----|----|
| t _{pd} | propagation delay | nAn to nYn; see Figure 6 [1] | | | | | | |
| | | V _{CC} = 4.5 V | - | 13 | 22 | 28 | 33 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 11 | - | - | - | ns |
| t _{en} | enable time | n $\overline{\text{OE}}$ to nYn; V _{CC} = 4.5 V; see Figure 7 [2] | - | 15 | 30 | 38 | 45 | ns |
| t _{dis} | disable time | n $\overline{\text{OE}}$ to nYn; V _{CC} = 4.5 V; see Figure 7 [3] | - | 15 | 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 buffer; V _I = GND to V _{CC} - 1.5 V [5] | - | 35 | - | - | - | 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):

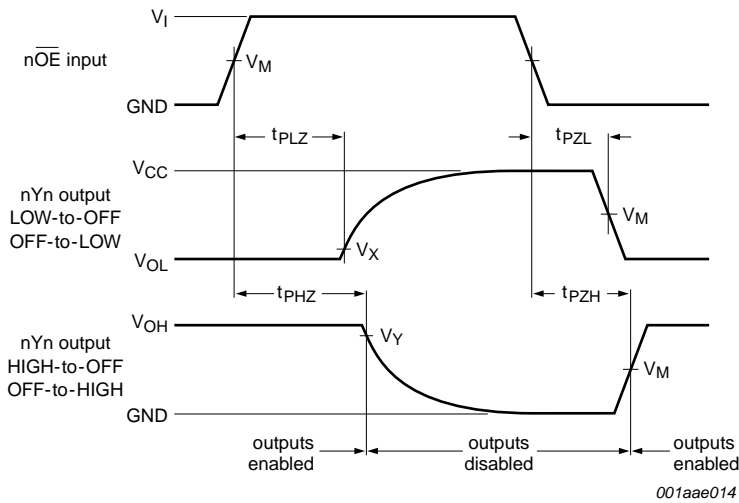
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 C_L = output load capacitance in pF;
 V_{CC} = supply voltage in V;
 N = number of inputs switching;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11. Waveforms



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

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

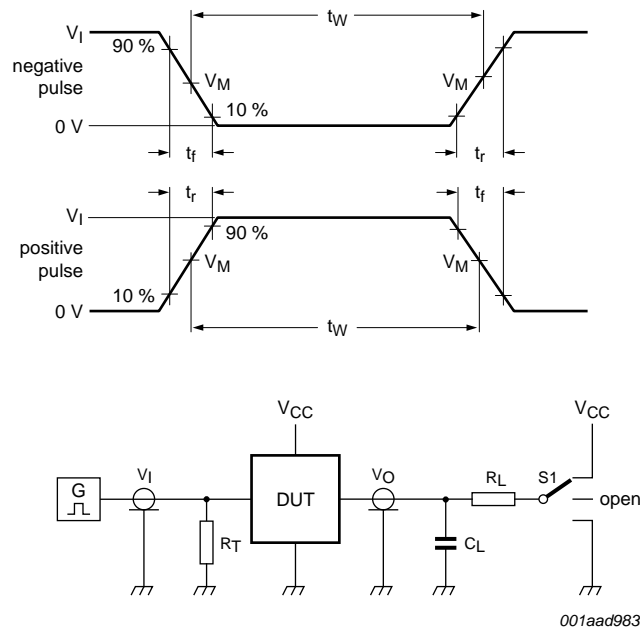


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 7. 3-state enable and disable times

Table 8. Measurement points

| Type | Input | Output | | |
|----------|---------------------|---------------------|---------------------|---------------------|
| | V_M | V_M | V_X | V_Y |
| 74HC244 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ | $0.9 \times V_{CC}$ |
| 74HCT244 | 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} |
| 74HC244 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT244 | 3 V | 6 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |

12. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1

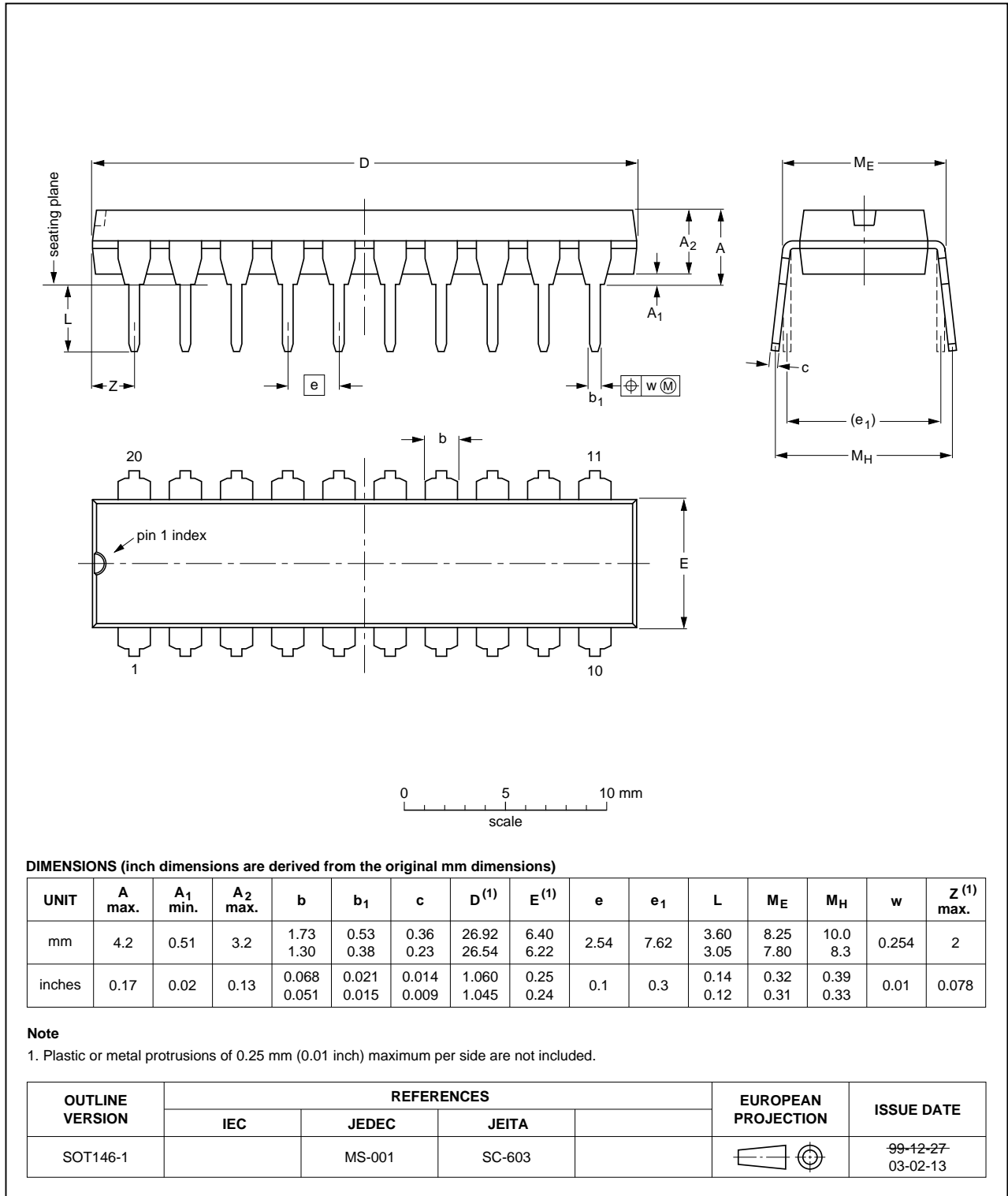


Fig 9. Package outline SOT146-1 (DIP20)

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

SOT163-1

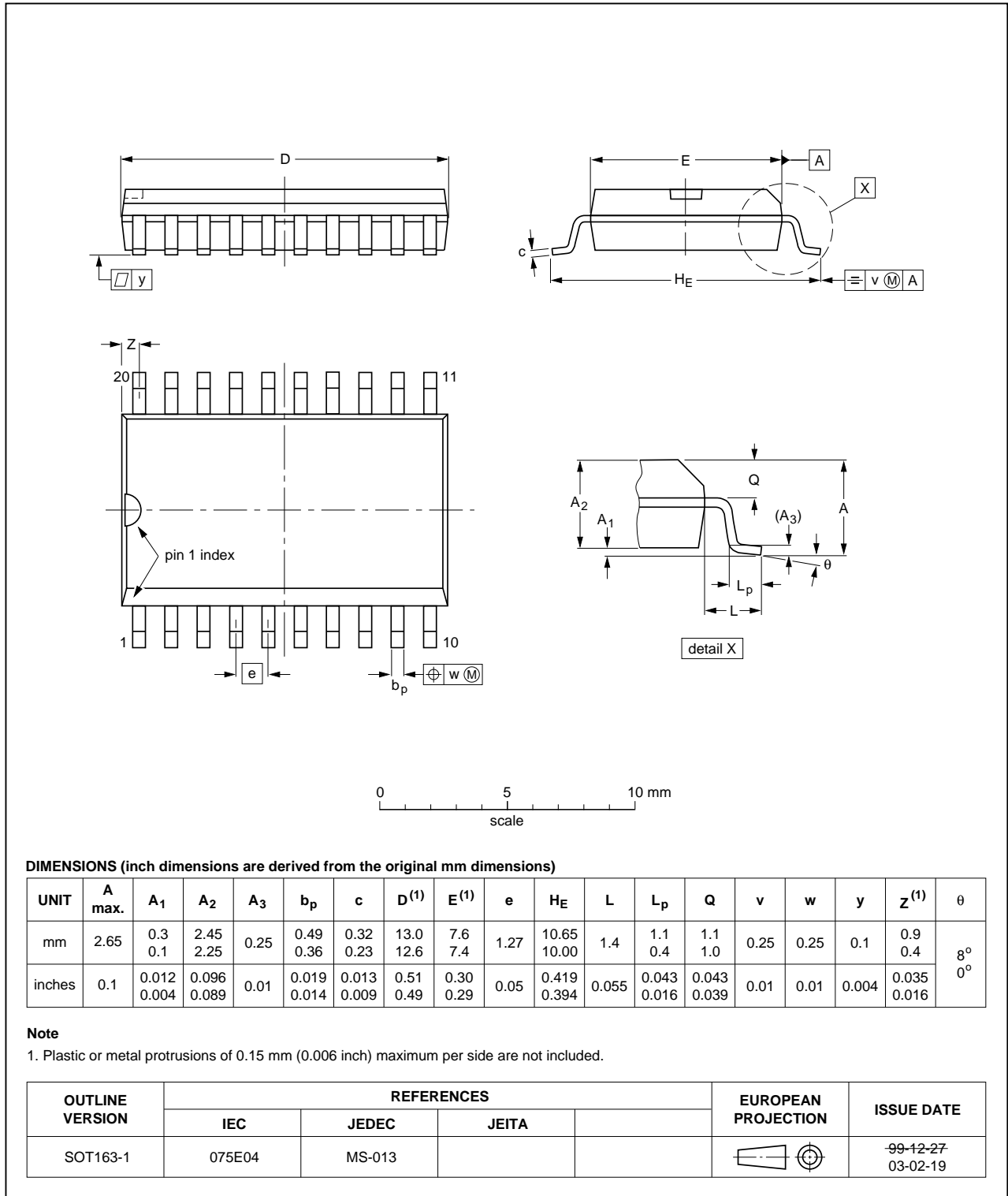


Fig 10. Package outline SOT163-1 (SO20)

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

SOT339-1

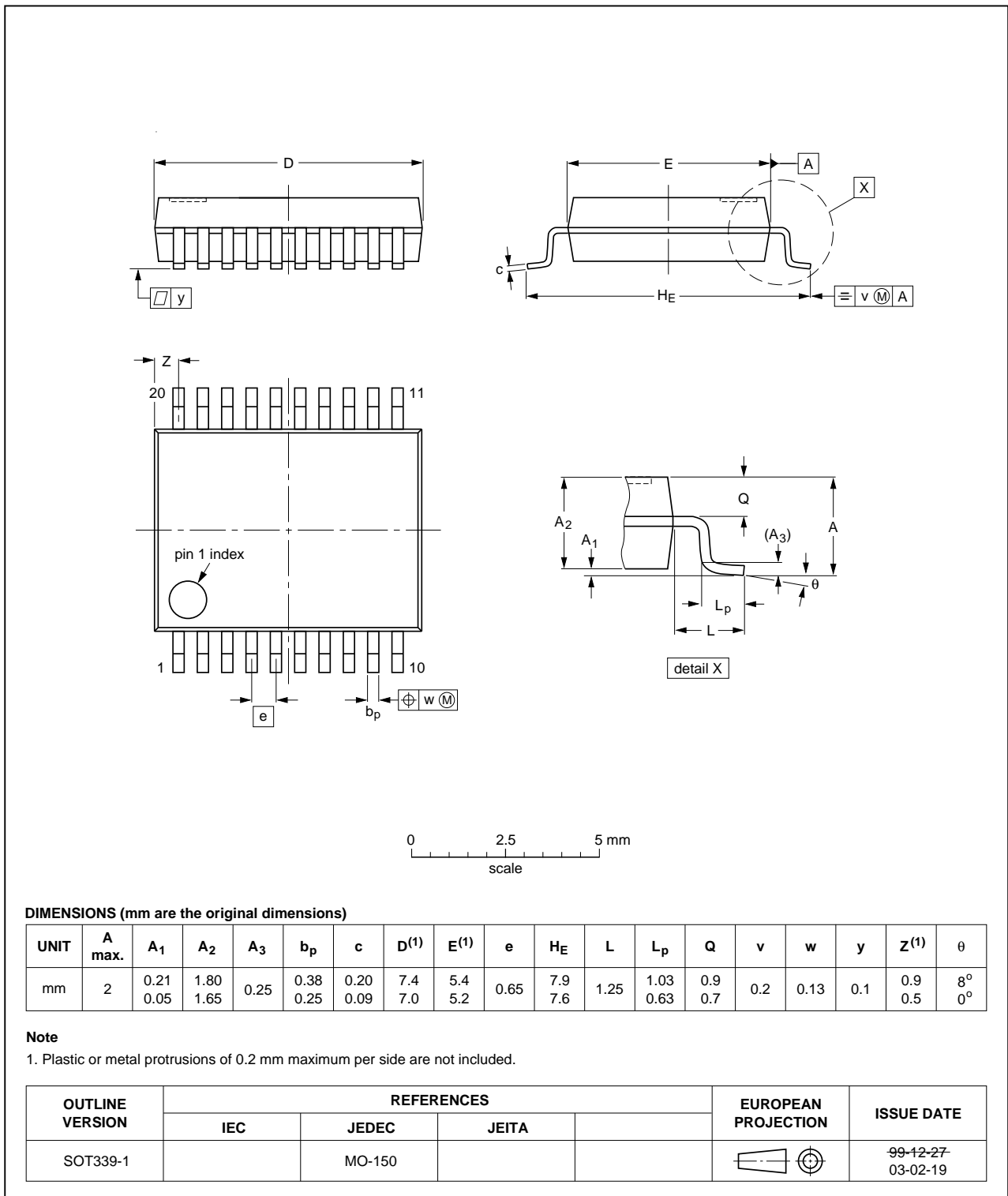


Fig 11. Package outline SOT339-1 (SSOP20)

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

SOT360-1

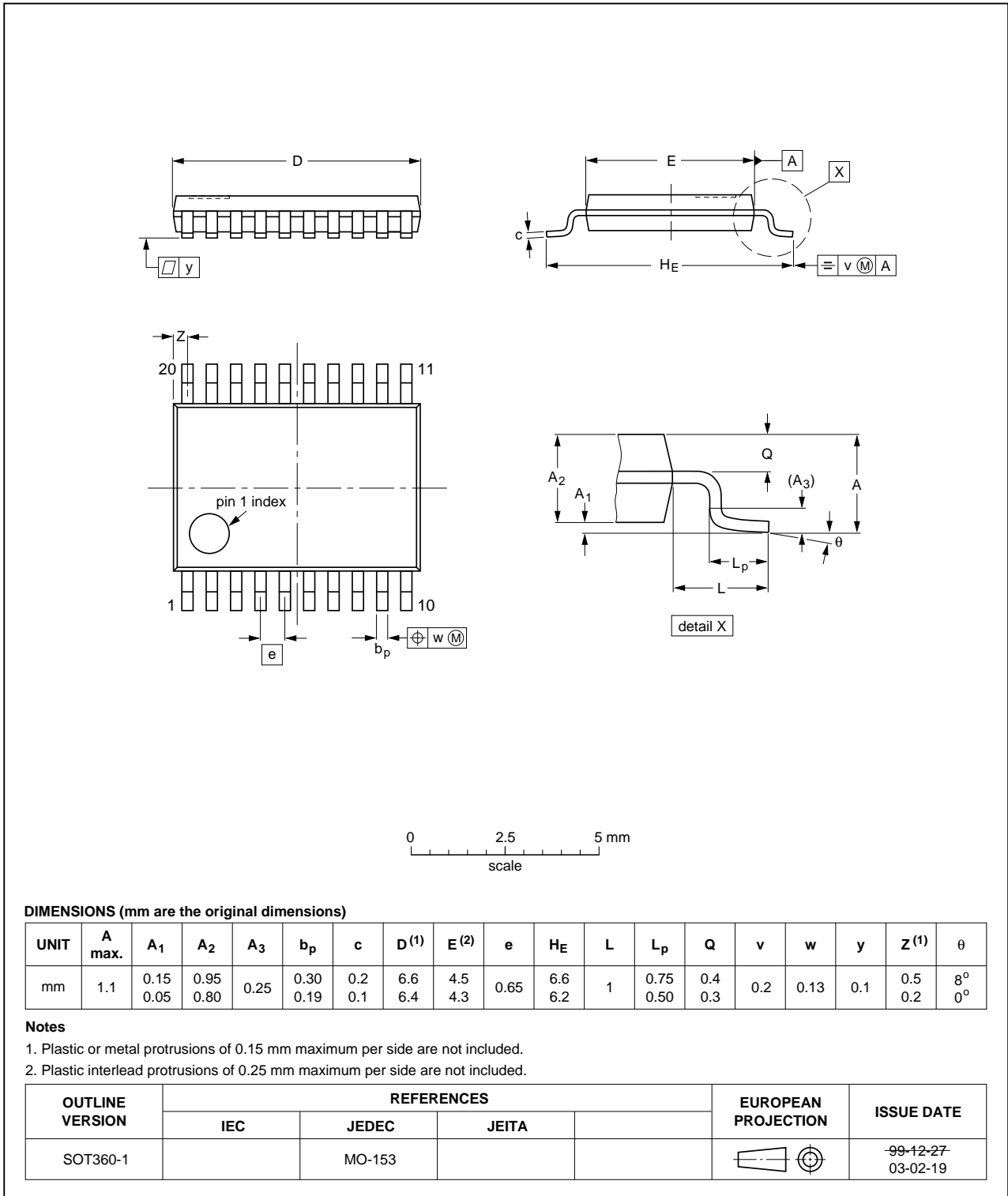


Fig 12. Package outline SOT360-1 (TSSOP20)

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

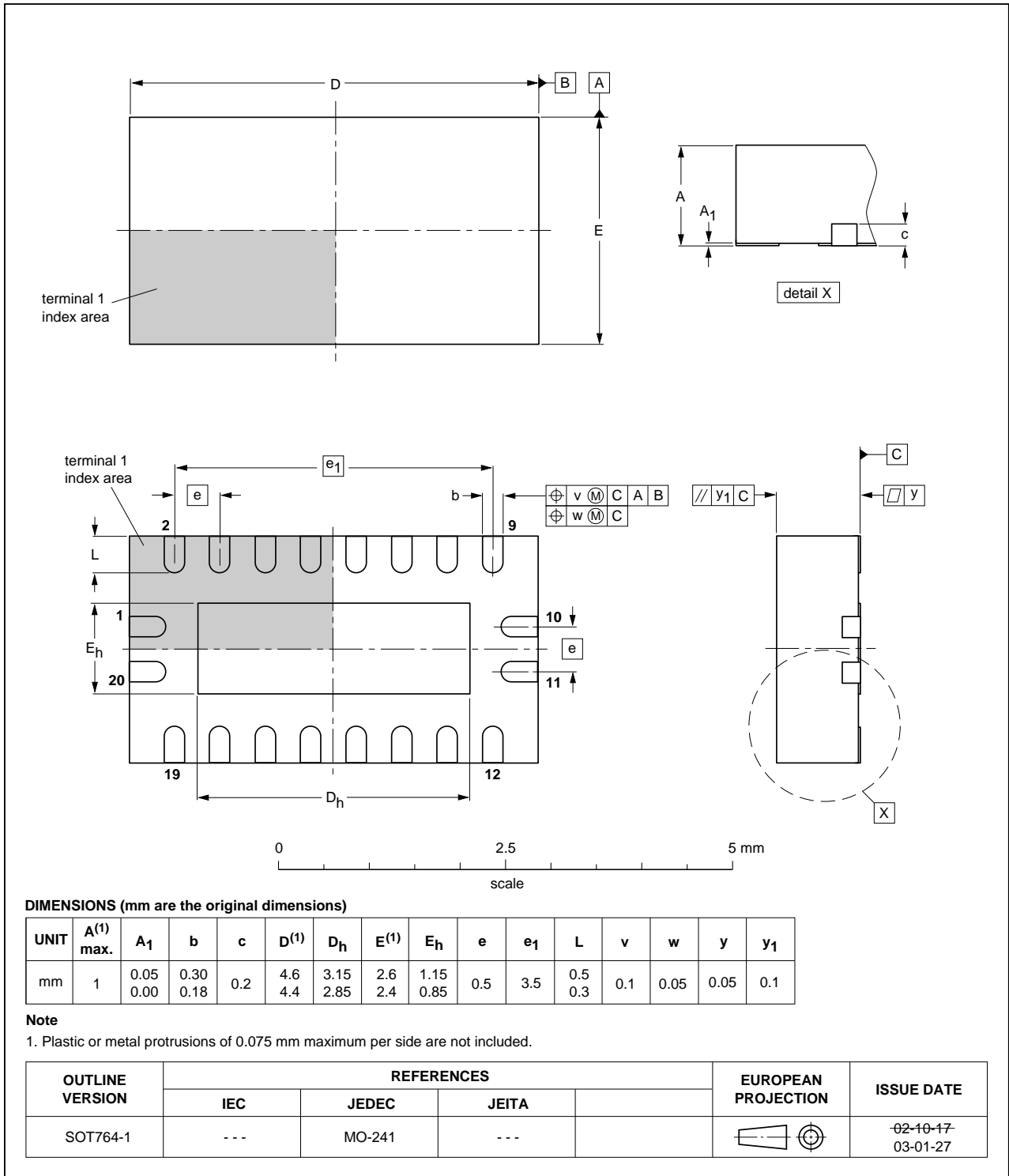


Fig 13. Package outline SOT764-1 (DHVQFN20)

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_HCT244 v.4 | 20120924 | Product data sheet | - | 74HC_HCT244 v.3 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. | | | |
| 74HC_HCT244 v.3 | 20051222 | Product data sheet | - | 74HC_HCT244_CNV v.2 |
| 74HC_HCT244_CNV v.2 | 19901201 | 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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