

# 74VHC541-Q100; 74VHCT541-Q100

Octal buffer/line driver; 3-state

Rev. 1 — 4 June 2013

Product data sheet

## 1. General description

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The 74VHC541-Q100; 74VHCT541-Q100 are high-speed Si-gate CMOS devices.

The 74VHC541-Q100; 74VHCT541-Q100 are octal non-inverting buffer/line drivers with 3-state bus compatible outputs.

The output enable inputs  $\overline{OE}0$  and  $\overline{OE}1$  control the 3-state outputs.

A HIGH on  $\overline{OE}n$  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

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- 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  $+125\text{ }^{\circ}\text{C}$
- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accept voltages higher than  $V_{CC}$
- The 74VHC541-Q100 operates with CMOS input level
- The 74VHCT541-Q100 operates with TTL input level
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\text{ }\Omega$ )
- Multiple package options

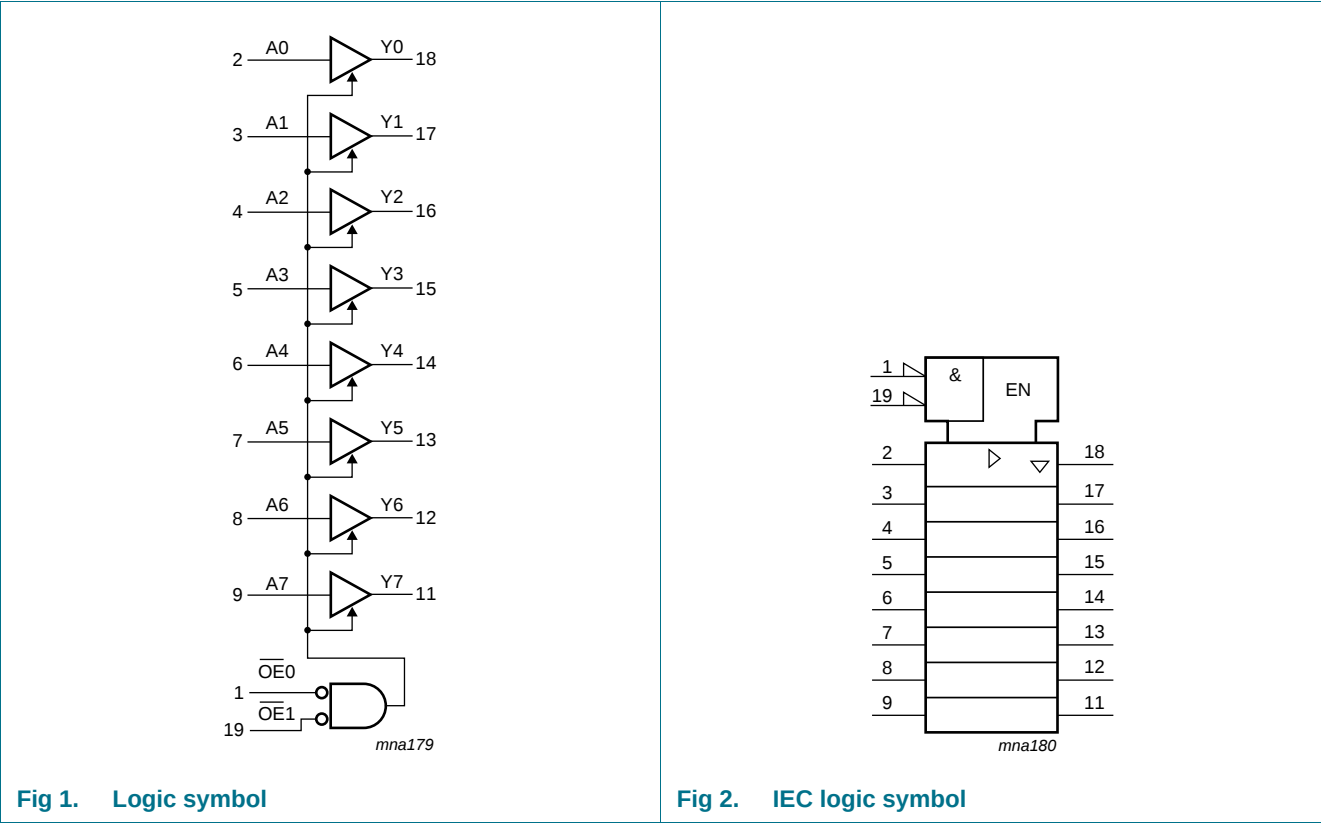


3. Ordering information

Table 1. Ordering information

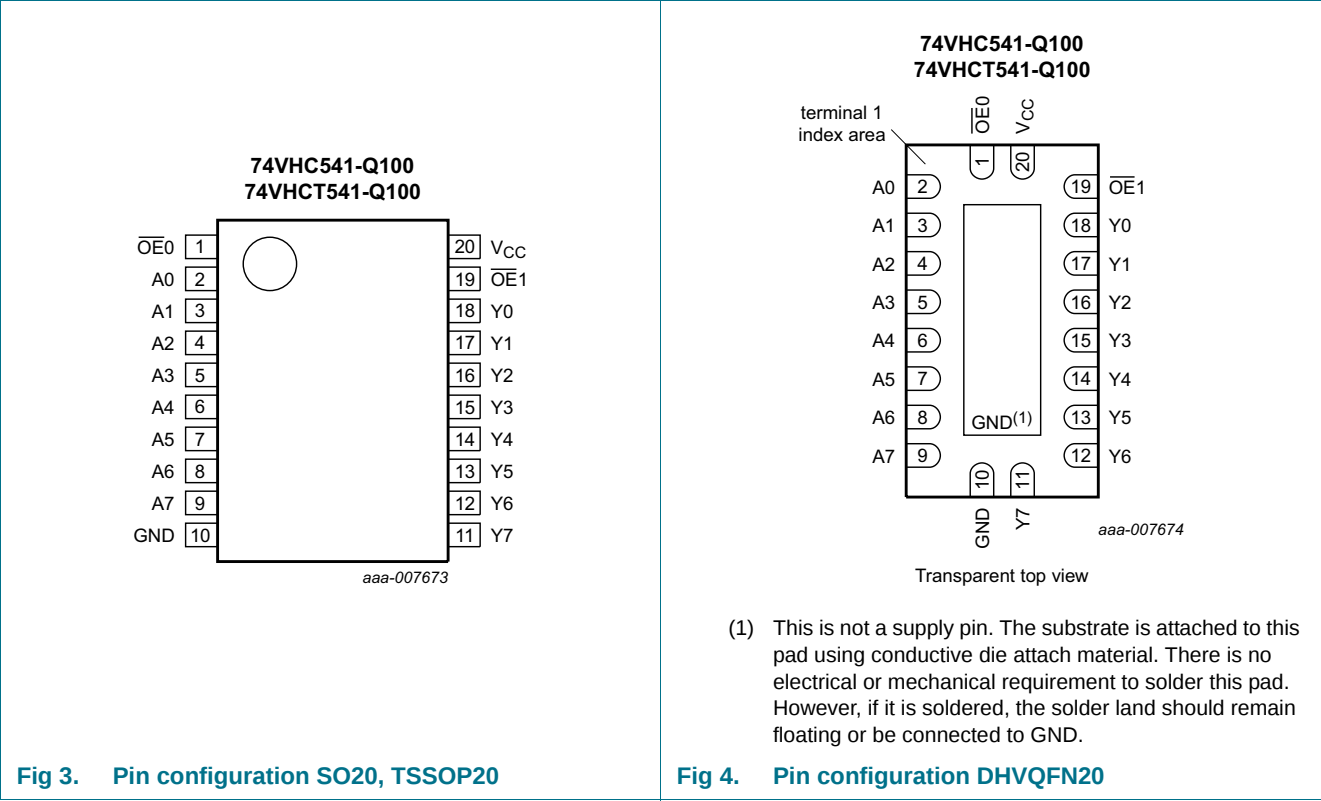
| Type number      | Package           |          |                                                                                                                                      |          |
|------------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
|                  | Temperature range | Name     | Description                                                                                                                          | Version  |
| 74VHC541D-Q100   | -40 °C to +125 °C | SO20     | plastic small outline package; 20 leads;<br>body width 7.5 mm                                                                        | SOT163-1 |
| 74VHCT541D-Q100  |                   |          |                                                                                                                                      |          |
| 74VHC541PW-Q100  | -40 °C to +125 °C | TSSOP20  | plastic thin shrink small outline package; 20 leads;<br>body width 4.4 mm                                                            | SOT360-1 |
| 74VHCT541PW-Q100 |                   |          |                                                                                                                                      |          |
| 74VHC541BQ-Q100  | -40 °C to +125 °C | DHVQFN20 | plastic dual-in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 20<br>terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |
| 74VHCT541BQ-Q100 |                   |          |                                                                                                                                      |          |

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

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

## 6. Functional description

Table 3. Functional table<sup>[1]</sup>

| Control |     | Input | Output |
|---------|-----|-------|--------|
| OE0     | OE1 | An    | Yn     |
| L       | L   | L     | L      |
| L       | L   | H     | H      |
| X       | H   | X     | Z      |
| H       | X   | 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                           | <sup>[1]</sup> -20 | -    | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V | <sup>[1]</sup> -   | ±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            |                                          | <sup>[2]</sup> -   | 500  | mW   |
|           | TSSOP20 package         |                                          | <sup>[3]</sup> -   | 500  | mW   |
|           | DHVQFN20 package        |                                          | <sup>[4]</sup> -   | 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                      | 74VHC541-Q100 |     |                 | 74VHCT541-Q100 |     |                 | Unit |
|---------------------|-------------------------------------|---------------------------------|---------------|-----|-----------------|----------------|-----|-----------------|------|
|                     |                                     |                                 | Min           | Typ | Max             | Min            | Typ | Max             |      |
| V <sub>CC</sub>     | supply voltage                      |                                 | 2.0           | 5.0 | 5.5             | 4.5            | 5.0 | 5.5             | V    |
| V <sub>I</sub>      | input voltage                       |                                 | 0             | -   | 5.5             | 0              | -   | 5.5             | V    |
| V <sub>O</sub>      | output voltage                      |                                 | 0             | -   | V <sub>CC</sub> | 0              | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub>    | ambient temperature                 |                                 | -40           | +25 | +125            | -40            | +25 | +125            | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | V <sub>CC</sub> = 3.3 V ± 0.3 V | -             | -   | 100             | -              | -   | -               | ns/V |
|                     |                                     | V <sub>CC</sub> = 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 74VHC541-Q100

|                 |                           |                                                                                                                        |      |     |       |      |      |      |       |    |
|-----------------|---------------------------|------------------------------------------------------------------------------------------------------------------------|------|-----|-------|------|------|------|-------|----|
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                                                | 1.5  | -   | -     | 1.5  | -    | 1.5  | -     | V  |
|                 |                           | V <sub>CC</sub> = 3.0 V                                                                                                | 2.1  | -   | -     | 2.1  | -    | 2.1  | -     | V  |
|                 |                           | V <sub>CC</sub> = 5.5 V                                                                                                | 3.85 | -   | -     | 3.85 | -    | 3.85 | -     | V  |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                                                | -    | -   | 0.5   | -    | 0.5  | -    | 0.5   | V  |
|                 |                           | V <sub>CC</sub> = 3.0 V                                                                                                | -    | -   | 0.9   | -    | 0.9  | -    | 0.9   | V  |
|                 |                           | V <sub>CC</sub> = 5.5 V                                                                                                | -    | -   | 1.65  | -    | 1.65 | -    | 1.65  | 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> = -50 µA; V <sub>CC</sub> = 2.0 V                                                                       | 1.9  | 2.0 | -     | 1.9  | -    | 1.9  | -     | V  |
|                 |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 3.0 V                                                                       | 2.9  | 3.0 | -     | 2.9  | -    | 2.9  | -     | V  |
|                 |                           | I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V                                                                       | 4.4  | 4.5 | -     | 4.4  | -    | 4.4  | -     | V  |
|                 |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                                                                      | 2.58 | -   | -     | 2.48 | -    | 2.40 | -     | V  |
| V <sub>OL</sub> | LOW-level output voltage  | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V                                                                      | 3.94 | -   | -     | 3.8  | -    | 3.70 | -     | V  |
|                 |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                    |      |     |       |      |      |      |       |    |
|                 |                           | I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V                                                                        | -    | 0   | 0.1   | -    | 0.1  | -    | 0.1   | V  |
|                 |                           | I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V                                                                        | -    | 0   | 0.1   | -    | 0.1  | -    | 0.1   | V  |
|                 |                           | I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V                                                                        | -    | 0   | 0.1   | -    | 0.1  | -    | 0.1   | V  |
| I <sub>OZ</sub> | OFF-state output current  | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                                                       | -    | -   | 0.36  | -    | 0.44 | -    | 0.55  | V  |
|                 |                           | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V                                                                       | -    | -   | 0.36  | -    | 0.44 | -    | 0.55  | V  |
|                 |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V | -    | -   | ±0.25 | -    | ±2.5 | -    | ±10.0 | µA |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 0 V to 5.5 V                                                | -    | -   | 0.1   | -    | 1.0  | -    | 2.0   | 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> = 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 <sub>I</sub>                 | input capacitance         |                                                                                                                                                                                                   | -     | 3.0 | 10    | -                | 10   | -                 | 10    | pF   |
| C <sub>O</sub>                 | output capacitance        |                                                                                                                                                                                                   | -     | 4.0 | -     | -                | -    | -                 | -     | pF   |
| <b>For type 74VHCT541-Q100</b> |                           |                                                                                                                                                                                                   |       |     |       |                  |      |                   |       |      |
| V <sub>IH</sub>                | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                                                  | 2.0   | -   | -     | 2.0              | -    | 2.0               | -     | V    |
| V <sub>IL</sub>                | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                                                  | -     | -   | 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> = –50 µA                                                                                                                                                                           | 4.4   | 4.5 | -     | 4.4              | -    | 4.4               | -     | V    |
|                                |                           | I <sub>O</sub> = –8.0 mA                                                                                                                                                                          | 3.94  | -   | -     | 3.8              | -    | 3.70              | -     | 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> = 50 µA                                                                                                                                                                            | -     | 0   | 0.1   | -                | 0.1  | -                 | 0.1   | V    |
|                                |                           | I <sub>O</sub> = 8.0 mA                                                                                                                                                                           | -     | -   | 0.36  | -                | 0.44 | -                 | 0.55  | V    |
| I <sub>OZ</sub>                | OFF-state output current  | per input pin; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A; V <sub>O</sub> = V <sub>CC</sub> or GND; other pins at V <sub>CC</sub> or GND | -     | -   | ±0.25 | -                | ±2.5 | -                 | ±10.0 | µA   |
| I <sub>I</sub>                 | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 0 V to 5.5 V                                                                                                                           | -     | -   | 0.1   | -                | 1.0  | -                 | 2.0   | 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> = 5.5 V                                                                                                            | -     | -   | 4.0   | -                | 40   | -                 | 80    | µA   |
| ΔI <sub>CC</sub>               | additional supply current | per input pin; V <sub>I</sub> = V <sub>CC</sub> – 2.1 V; I <sub>O</sub> = 0 A; other pins at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V                                             | -     | -   | 1.35  | -                | 1.5  | -                 | 1.5   | mA   |
| C <sub>I</sub>                 | input capacitance         |                                                                                                                                                                                                   | -     | 3   | 10    | -                | 10   | -                 | 10    | pF   |
| C <sub>O</sub>                 | output capacitance        |                                                                                                                                                                                                   | -     | 4.0 | -     | -                | -    | -                 | -     | pF   |

## 10. Dynamic characteristics

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

| Symbol                 | Parameter                     | Conditions                                                                              | 25 °C               |                    |      | −40 °C to +85 °C |      | −40 °C to +125 °C |      | Unit |
|------------------------|-------------------------------|-----------------------------------------------------------------------------------------|---------------------|--------------------|------|------------------|------|-------------------|------|------|
|                        |                               |                                                                                         | Min                 | Typ <sup>[1]</sup> | Max  | Min              | Max  | Min               | Max  |      |
| For type 74VHC541-Q100 |                               |                                                                                         |                     |                    |      |                  |      |                   |      |      |
| t <sub>pd</sub>        | propagation delay             | An to Yn; see <a href="#">Figure 5</a>                                                  | <a href="#">[2]</a> |                    |      |                  |      |                   |      |      |
|                        |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 5.0                | 7.0  | 1.0              | 8.5  | 1.0               | 9.0  | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  | -                   | 7.0                | 10.5 | 1.0              | 12.0 | 1.0               | 13.5 | ns   |
|                        |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 3.5                | 5.0  | 1.0              | 6.0  | 1.0               | 6.5  | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  |                     | 5.0                | 7.0  | 1.0              | 8.0  | 1.0               | 9.0  | ns   |
| t <sub>en</sub>        | enable time                   | OEn to Yn; see <a href="#">Figure 6</a>                                                 | <a href="#">[2]</a> |                    |      |                  |      |                   |      |      |
|                        |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 5.5                | 10.5 | 1.0              | 11.0 | 1.0               | 13.5 | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  | -                   | 7.5                | 14.0 | 1.0              | 16.0 | 1.0               | 17.5 | ns   |
|                        |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 3.5                | 7.2  | 1.0              | 8.5  | 1.0               | 9.0  | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  | -                   | 5.0                | 9.2  | 1.0              | 10.5 | 1.0               | 11.5 | ns   |
| t <sub>dis</sub>       | disable time                  | OEn to Yn; see <a href="#">Figure 6</a>                                                 | <a href="#">[2]</a> |                    |      |                  |      |                   |      |      |
|                        |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 6.0                | 11.0 | 1.0              | 12.0 | 1.0               | 14.0 | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  | -                   | 9.5                | 15.4 | 1.0              | 17.5 | 1.0               | 19.5 | ns   |
|                        |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                        |                     |                    |      |                  |      |                   |      |      |
|                        |                               | C <sub>L</sub> = 15 pF                                                                  | -                   | 4.5                | 7.5  | 1.0              | 8.0  | 1.0               | 9.5  | ns   |
|                        |                               | C <sub>L</sub> = 50 pF                                                                  | -                   | 6.5                | 8.8  | 1.0              | 10.0 | 1.0               | 11.0 | ns   |
| C <sub>PD</sub>        | power dissipation capacitance | C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> | <a href="#">[3]</a> | -                  | 10   | -                | -    | -                 | -    | pF   |

**Table 7. Dynamic characteristics ...continued**GND = 0 V. For test circuit, see [Figure 7](#).

| Symbol                  | Parameter                     | Conditions                                                                                   | 25 °C          |                    |      | –40 °C to +85 °C |      | –40 °C to +125 °C |      | Unit |
|-------------------------|-------------------------------|----------------------------------------------------------------------------------------------|----------------|--------------------|------|------------------|------|-------------------|------|------|
|                         |                               |                                                                                              | Min            | Typ <sup>[1]</sup> | Max  | Min              | Max  | Min               | Max  |      |
| For type 74VHCT541-Q100 |                               |                                                                                              |                |                    |      |                  |      |                   |      |      |
| t <sub>pd</sub>         | propagation delay             | An to Yn; see <a href="#">Figure 5</a>                                                       | <sup>[2]</sup> |                    |      |                  |      |                   |      |      |
|                         |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                             |                |                    |      |                  |      |                   |      |      |
|                         |                               | C <sub>L</sub> = 15 pF                                                                       | -              | 3.5                | 5.5  | 1.0              | 6.5  | 1.0               | 7.0  | ns   |
|                         |                               | C <sub>L</sub> = 50 pF                                                                       | -              | 5.0                | 8.5  | 1.0              | 9.5  | 1.0               | 11.0 | ns   |
| t <sub>en</sub>         | enable time                   | $\overline{O}E$ n to Yn; see <a href="#">Figure 6</a>                                        |                |                    |      |                  |      |                   |      |      |
|                         |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                             |                |                    |      |                  |      |                   |      |      |
|                         |                               | C <sub>L</sub> = 15 pF                                                                       | -              | 4.0                | 7.0  | 1.0              | 8.0  | 1.0               | 9.0  | ns   |
|                         |                               | C <sub>L</sub> = 50 pF                                                                       | -              | 5.5                | 10.0 | 1.0              | 12.0 | 1.0               | 12.5 | ns   |
| t <sub>dis</sub>        | disable time                  | $\overline{O}E$ n to Yn; see <a href="#">Figure 6</a>                                        | <sup>[2]</sup> |                    |      |                  |      |                   |      |      |
|                         |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                             |                |                    |      |                  |      |                   |      |      |
|                         |                               | C <sub>L</sub> = 15 pF                                                                       | -              | 5.0                | 7.0  | 1.0              | 8.0  | 1.0               | 9.0  | ns   |
|                         |                               | C <sub>L</sub> = 50 pF                                                                       | -              | 7.0                | 10.0 | 1.0              | 12.0 | 1.0               | 12.5 | ns   |
| C <sub>PD</sub>         | power dissipation capacitance | per buffer;<br>C <sub>L</sub> = 50 pF; f = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> | <sup>[3]</sup> | -                  | 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  $P_D$  ( $\mu\text{W}$ ).

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

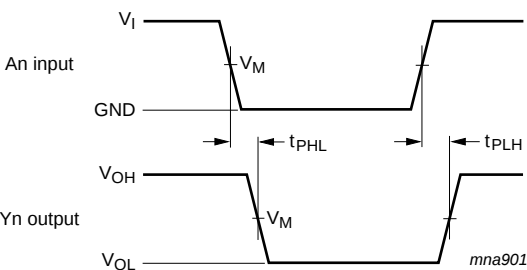
$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

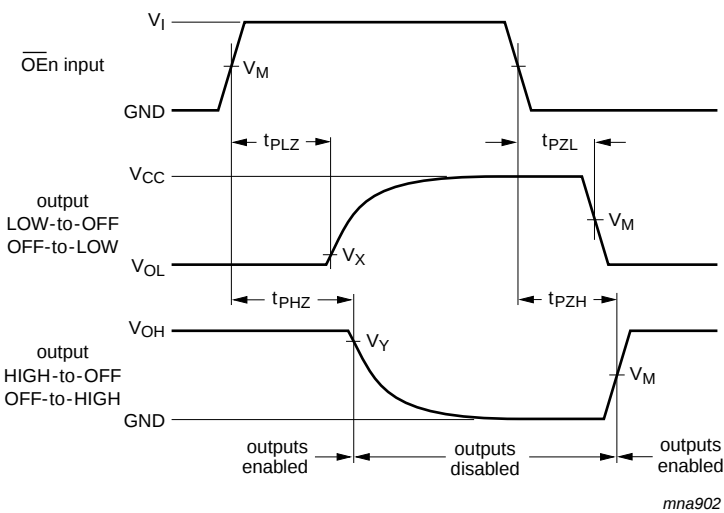
$V_{CC}$  = supply voltage in Volts.

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 5. Propagation delay input (An) to output (Yn)



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. Enable and disable times

Table 8. Measurement points

| Type           | Input       | Output      |                         |                         |
|----------------|-------------|-------------|-------------------------|-------------------------|
|                | $V_M$       | $V_M$       | $V_X$                   | $V_Y$                   |
| 74VHC541-Q100  | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3\text{ V}$ | $V_{OH} - 0.3\text{ V}$ |
| 74VHCT541-Q100 | 1.5 V       | $0.5V_{CC}$ | $V_{OL} + 0.3\text{ V}$ | $V_{OH} - 0.3\text{ V}$ |

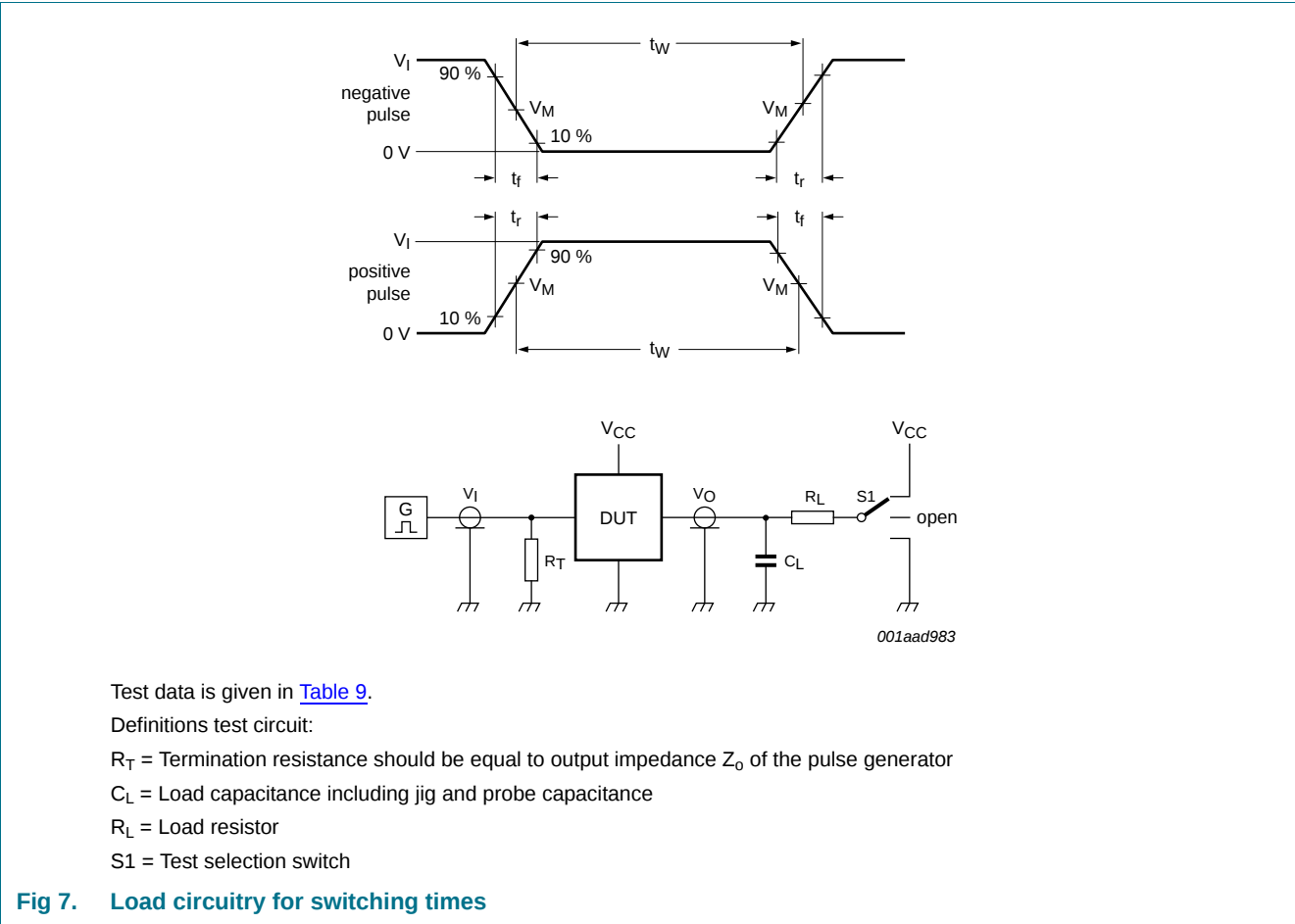


Table 9. Test data

| Type           | Input    |            | Load         |              | S1 position        |                    |                    |
|----------------|----------|------------|--------------|--------------|--------------------|--------------------|--------------------|
|                | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 74VHC541-Q100  | $V_{CC}$ | 3.0 ns     | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74VHCT541-Q100 | 3.0 V    | 3.0 ns     | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

## 12. Package outline

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

SOT163-1

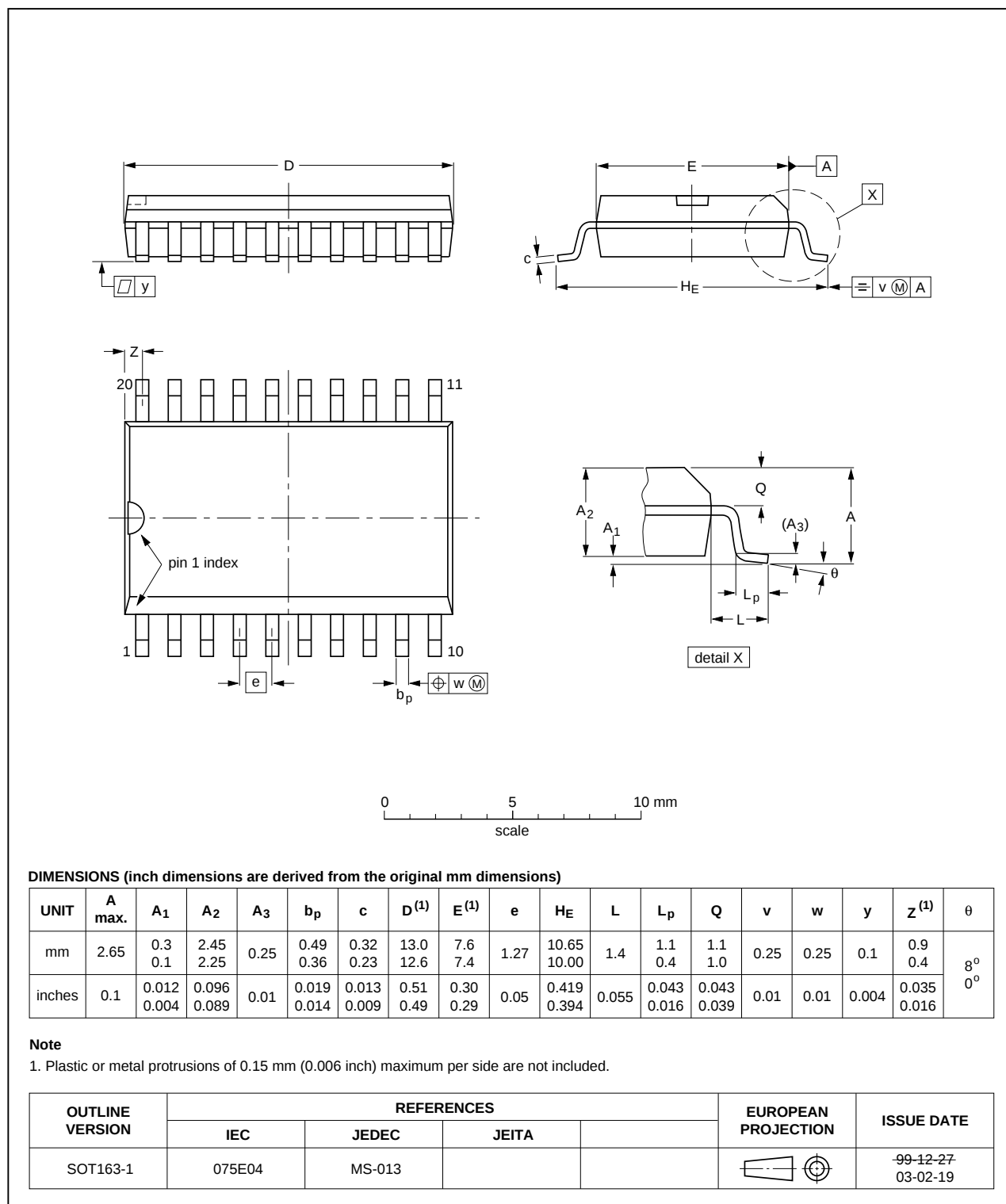


Fig 8. Package outline SOT163-1 (SO20)

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

SOT360-1

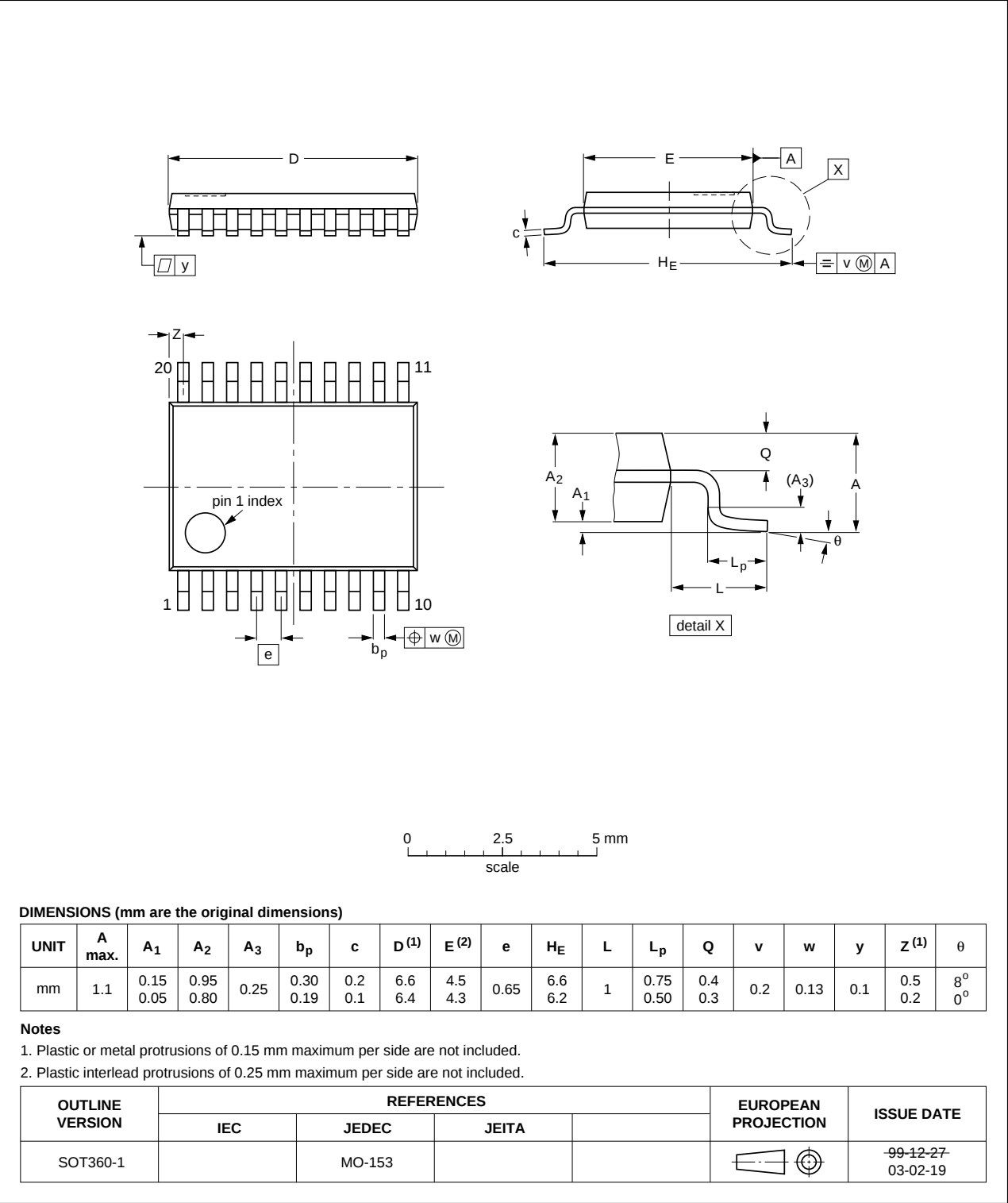


Fig 9. Package outline SOT360-1 (TSSOP20)

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

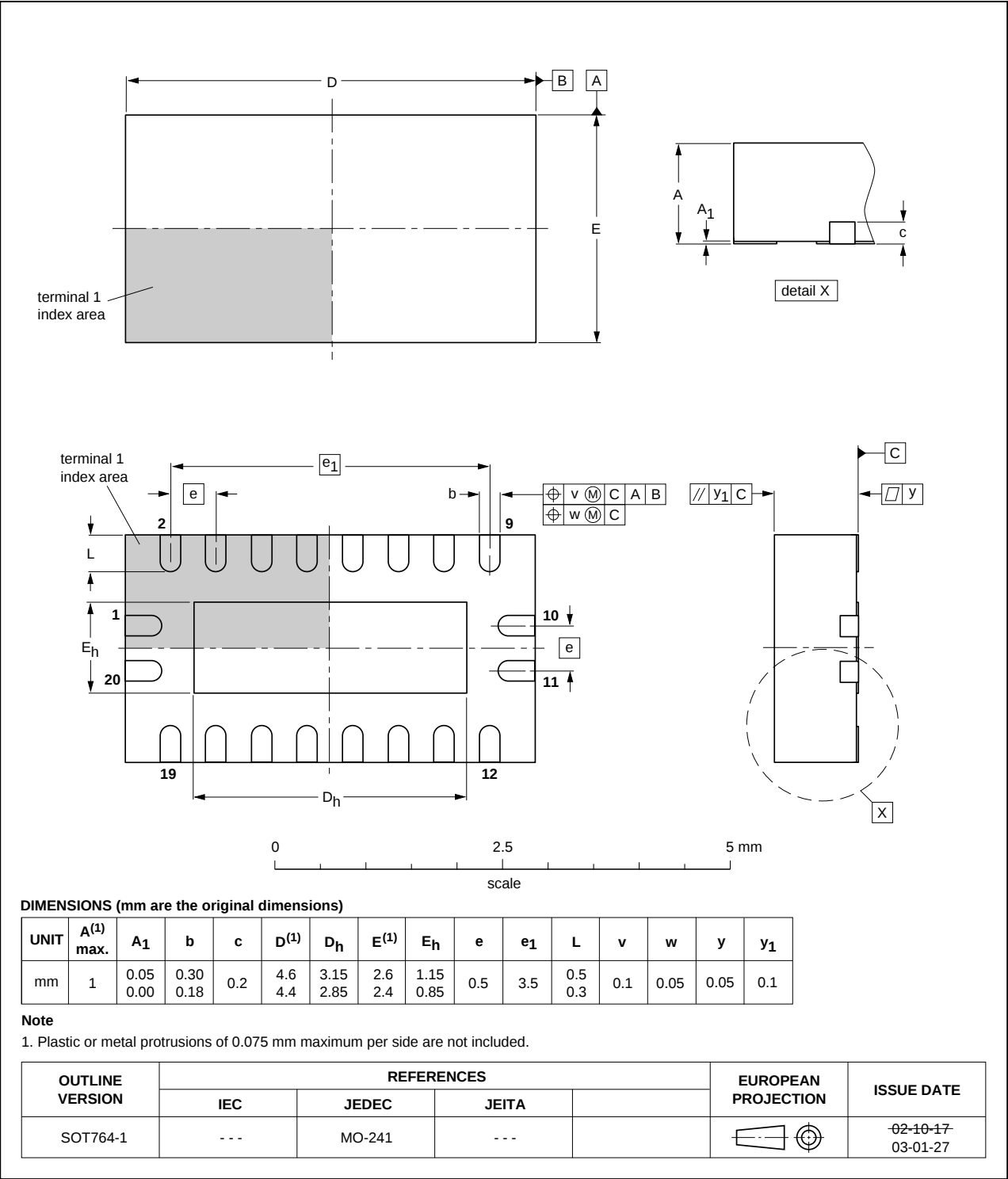


Fig 10. Package outline SOT764-1 (DHVQFN20)

## 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                             |
|---------|-----------------------------------------|
| CDM     | Charged Device Model                    |
| 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             |

## 14. Revision history

Table 11. Revision history

| Document ID       | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------|--------------|--------------------|---------------|------------|
| 74VHC_VHCT541 v.1 | 20130604     | Product data sheet | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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