

74AHC273-Q100; 74AHCT273-Q100

Octal D-type flip-flop with reset; positive-edge trigger

Rev. 2 — 23 September 2020

Product data sheet

1. General description

The 74AHC273-Q100; 74AHCT273-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard No. 7-A.

The 74AHC273-Q100; 74AHCT273-Q100 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common clock (CP) and master reset (\overline{MR}) inputs, load and reset (clear) all flip-flops simultaneously. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding output (Qn) of the flip-flop. All outputs will be forced LOW, independent of clock or data inputs, by a LOW on the MR input.

The device is useful for applications where only the true output is required and the clock and master reset are common to all storage elements.

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

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Balanced propagation delays
- All inputs have Schmitt-trigger actions
- Inputs accept voltages higher than V_{CC}
- Ideal buffer for MOS microcontroller or memory
- Common clock and master reset
- Input levels:
 - For 74AHC273-Q100: CMOS level
 - For 74AHCT273-Q100: TTL 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 pf, R = 0 Ω)
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|------------------|-------------------|----------|--|----------|
| | Temperature range | Name | Description | Version |
| 74AHC273D-Q100 | -40 °C to +125 °C | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74AHCT273D-Q100 | | | | |
| 74AHC273PW-Q100 | -40 °C to +125 °C | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74AHCT273PW-Q100 | | | | |
| 74AHC273BQ-Q100 | -40 °C to +125 °C | DHVQFN20 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |
| 74AHCT273BQ-Q100 | | | | |

4. Functional diagram

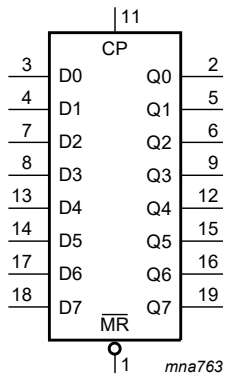


Fig. 1. Logic symbol

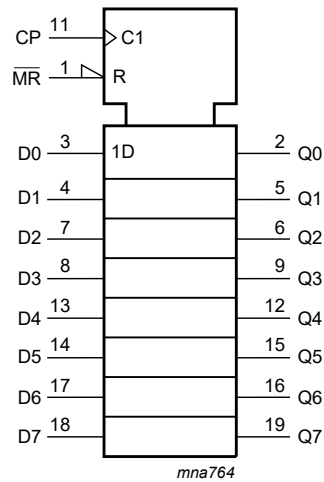


Fig. 2. IEC logic symbol

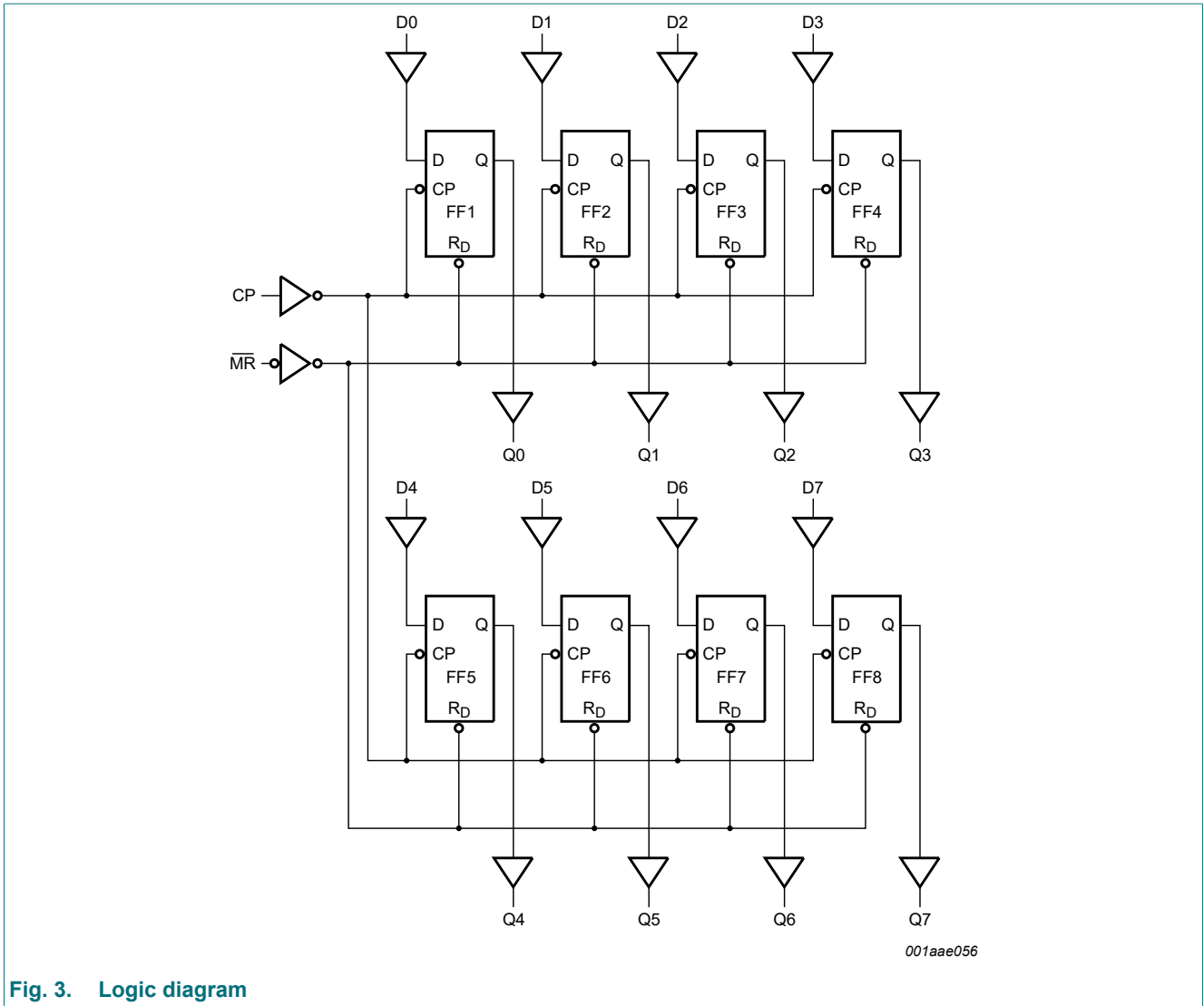


Fig. 3. Logic diagram

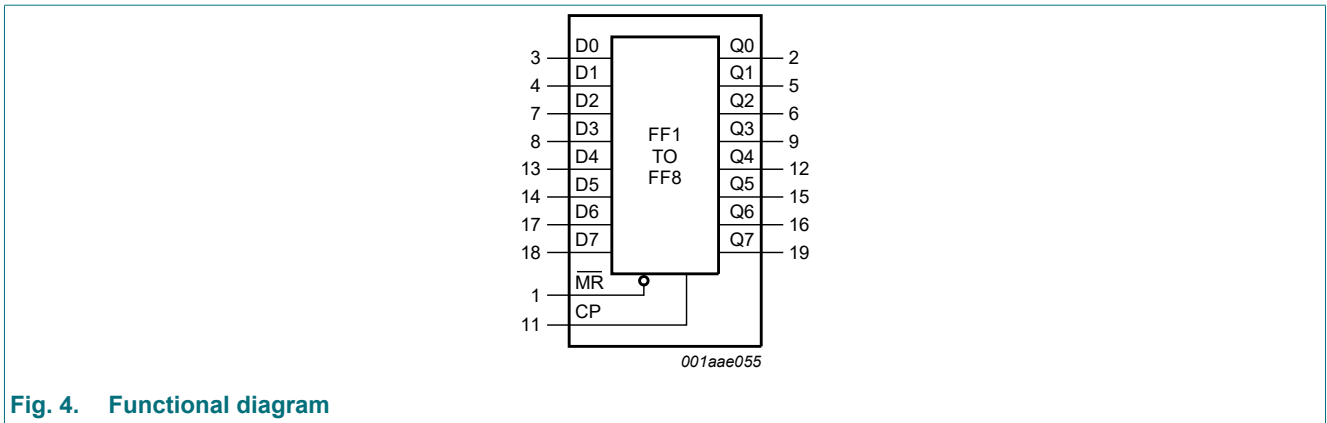
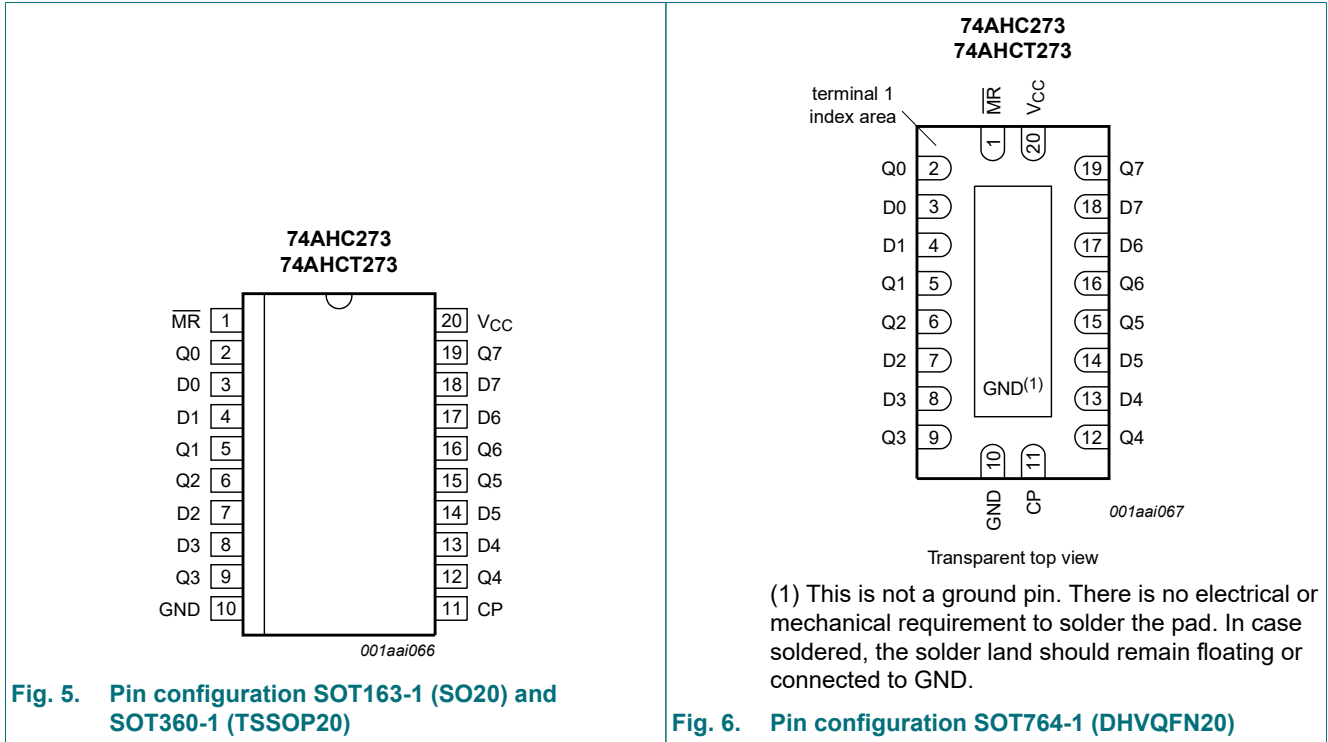


Fig. 4. Functional diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------------------|----------------------------|--|
| MR | 1 | master reset input (active LOW) |
| Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 | 2, 5, 6, 9, 12, 15, 16, 19 | flip-flop output |
| D0, D1, D2, D3, D4, D5, D6, D7 | 3, 4, 7, 8, 13, 14, 17, 18 | data input |
| GND | 10 | ground (0 V) |
| CP | 11 | clock input (LOW-to-HIGH edge-triggered) |
| VCC | 20 | supply voltage |

6. Functional description

Table 3. Function table

*H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
↑ = LOW-to-HIGH; X = don't care.*

| Operating mode | Control | | Input | Output |
|----------------|---------|----|-------|--------|
| | MR | CP | Dn | Qn |
| Reset (clear) | L | X | X | L |
| Load '1' | H | ↑ | h | H |
| Load '0' | H | ↑ | l | L |

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 | $V_I < -0.5\text{ V}$ [1] | -20 | - | mA |
| I_{OK} | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] | -20 | +20 | mA |
| I_O | output current | $V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$ | -25 | +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 | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2] | - | 500 | mW |

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

[2] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.

For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74AHC273-Q100 | | | 74AHCT273-Q100 | | | 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 |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ | - | - | 100 | - | - | - | ns/V |
| | | $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | - | - | 20 | - | - | 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 | |
| 74AHC273-Q100 | | | | | | | | | | |
| 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 |
| 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 _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 |
| | | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 4.0 | - | 40 | - | 80 | µA |
| C _I | input capacitance | | - | 3 | 10 | - | 10 | - | 10 | pF |
| C _O | output capacitance | | - | 4 | - | - | - | - | - | pF |

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------------|---------------------------|---|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74AHCT273-Q100 | | | | | | | | | | |
| 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 | - | - | 4.4 | - | 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 _{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 | | - | 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 Fig. 10.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|----------------------|-------------------|----------------------------------|-------|--------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| 74AHC273-Q100 | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Qn; see Fig. 7 [2] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | | | | | | | | |
| | | C _L = 15 pF | - | 6.0 | 13.6 | 1.0 | 16.0 | 1.0 | 17.0 | ns |
| | | C _L = 50 pF | - | 8.6 | 17.1 | 1.0 | 19.5 | 1.0 | 21.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | | | | | | | | |
| | | C _L = 15 pF | - | 4.2 | 9 | 1.0 | 10.5 | 1.0 | 11.5 | ns |
| | | C _L = 50 pF | - | 6.0 | 11.0 | 1.0 | 12.5 | 1.0 | 14.0 | ns |
| | | MR to Qn; see Fig. 8 [3] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | | | | | | | | |
| | | C _L = 15 pF | - | 5.1 | 13.6 | 1.0 | 16.0 | 1.0 | 17.0 | ns |
| | | C _L = 50 pF | - | 7.3 | 17.1 | 1.0 | 19.5 | 1.0 | 21.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | | | | | | | | |
| | | C _L = 15 pF | - | 3.7 | 8.5 | 1.0 | 10.0 | 1.0 | 11.0 | ns |
| | | C _L = 50 pF | - | 5.3 | 10.5 | 1.0 | 12.0 | 1.0 | 13.5 | ns |

Octal D-type flip-flop with reset; positive-edge trigger

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|---|-------|--------|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| f _{max} | maximum frequency | see Fig. 7 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | | | | | | | | |
| | | C _L = 15 pF | 75 | 120 | - | 65 | - | 65 | - | MHz |
| | | C _L = 50 pF | 50 | 75 | - | 45 | - | 45 | - | MHz |
| | | V _{CC} = 4.5 V to 5.5 V | | | | | | | | |
| t _w | pulse width | CP HIGH or LOW; see Fig. 7 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | 5.0 | - | - | 6.5 | - | 6.5 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 5.0 | - | - | 5.0 | - | 5.0 | - | ns |
| | | MR LOW; see Fig. 8 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | 5.0 | - | - | 6.0 | - | 6.0 | - | ns |
| t _{su} | set-up time | Dn to CP; see Fig. 9 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | 3.0 | - | - | 3.0 | - | 3.0 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 3.0 | - | - | 3.0 | - | 3.0 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | - | - | 1.0 | - | 1.0 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 1.0 | - | - | 1.0 | - | 1.0 | - | ns |
| t _{rec} | recovery time | MR to CP; see Fig. 8 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | 2.5 | - | - | 2.5 | - | 2.5 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | - | - | 1.0 | - | 1.0 | - | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 1.0 | - | - | 1.0 | - | 1.0 | - | ns |
| C _{PD} | power dissipation capacitance | f _i = 1 MHz; V _I = GND to V _{CC} [4] | - | 14 | - | - | - | - | - | pF |

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|--|-------------------------------|---|-------|--------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| 74AHCT273-Q100; V_{CC} = 4.5 V to 5.5 V | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Qn; see Fig. 7 [2] | | | | | | | | |
| | | C _L = 15 pF | - | 4.0 | 7.5 | 1.0 | 8.8 | 1.0 | 9.5 | ns |
| | | C _L = 50 pF | - | 5.8 | 9.2 | 1.0 | 10.5 | 1.0 | 11.5 | ns |
| | | MR to Qn; see Fig. 8 [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.9 | 10.0 | 1.0 | 11.6 | 1.0 | 12.5 | ns |
| | | C _L = 50 pF | - | 5.6 | 11.0 | 1.0 | 12.6 | 1.0 | 14.0 | ns |
| f _{max} | maximum frequency | see Fig. 7 | | | | | | | | |
| | | C _L = 15 pF | 75 | 120 | - | 65 | - | 65 | - | MHz |
| | | C _L = 50 pF | 50 | 75 | - | 45 | - | 45 | - | MHz |
| t _w | pulse width | CP HIGH or LOW; see Fig. 7 | 5.0 | - | - | 6.5 | - | 6.5 | - | ns |
| | | MR LOW; see Fig. 8 | 5.0 | - | - | 6.0 | - | 6.0 | - | ns |
| t _{su} | set-up time | Dn to CP; see Fig. 9 | 3.0 | - | - | 3.0 | - | 3.0 | - | ns |
| t _h | hold time | Dn to CP; see Fig. 9 | 1.0 | - | - | 1.0 | - | 1.0 | - | ns |
| t _{rec} | recovery time | MR to CP; see Fig. 8 | 2.5 | - | - | 2.5 | - | 2.5 | - | ns |
| C _{PD} | power dissipation capacitance | f _i = 1 MHz; V _I = GND to V _{CC} [4] | - | 18 | - | - | - | - | - | 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}.

[3] t_{pd} is the same as t_{PHL} only.

[4] 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;

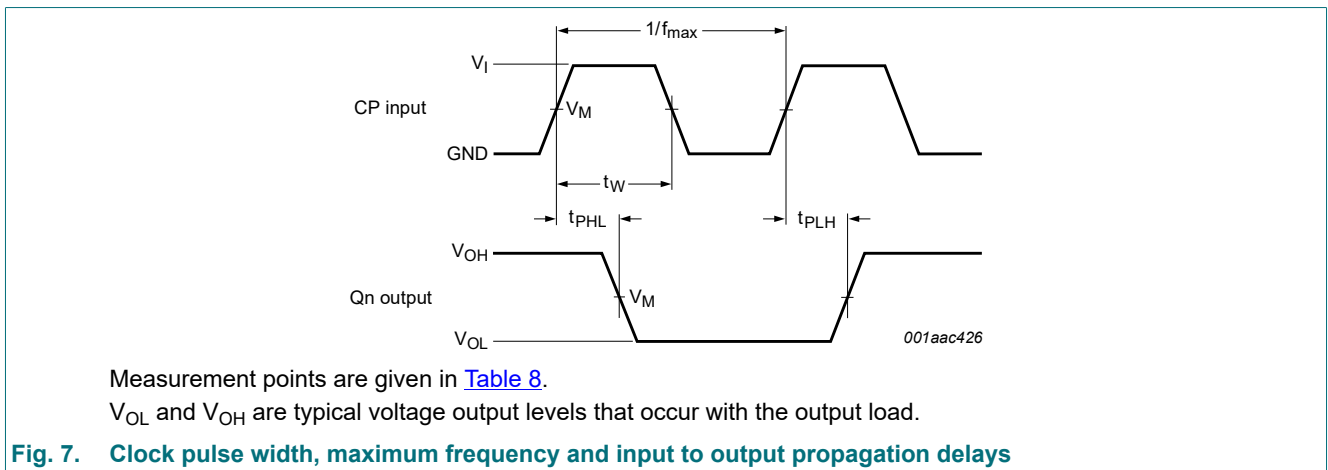
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

10.1. Waveforms and test circuit



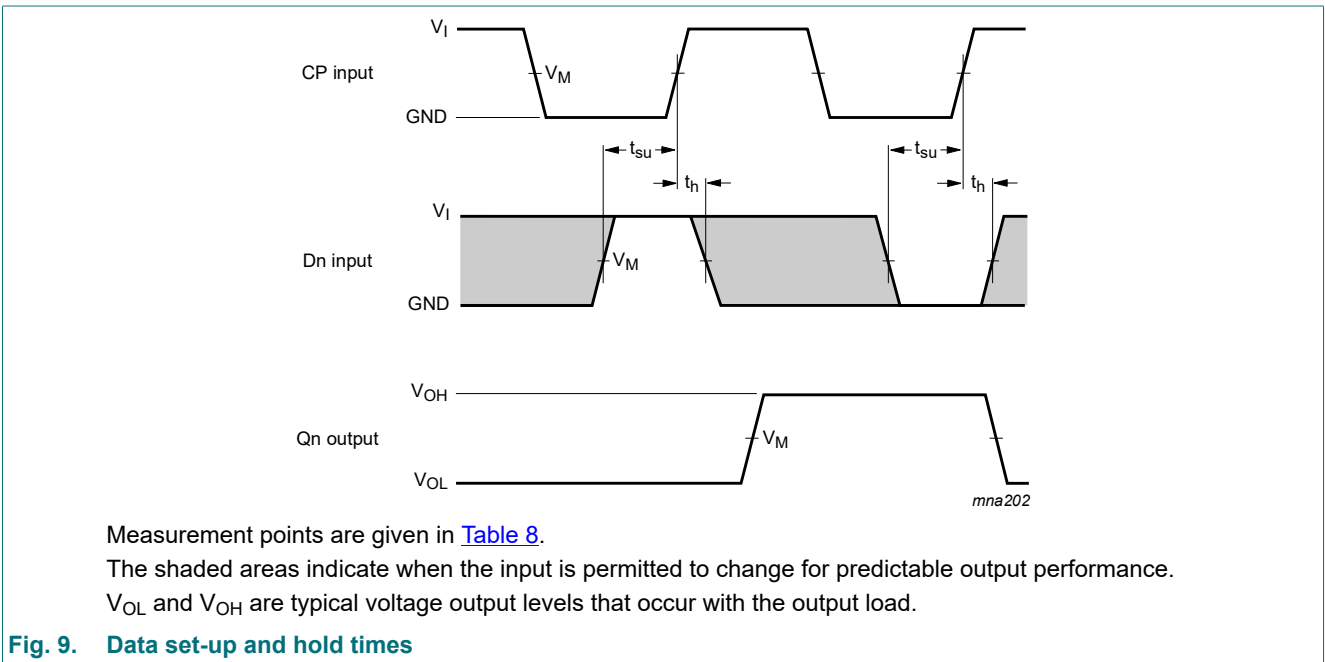
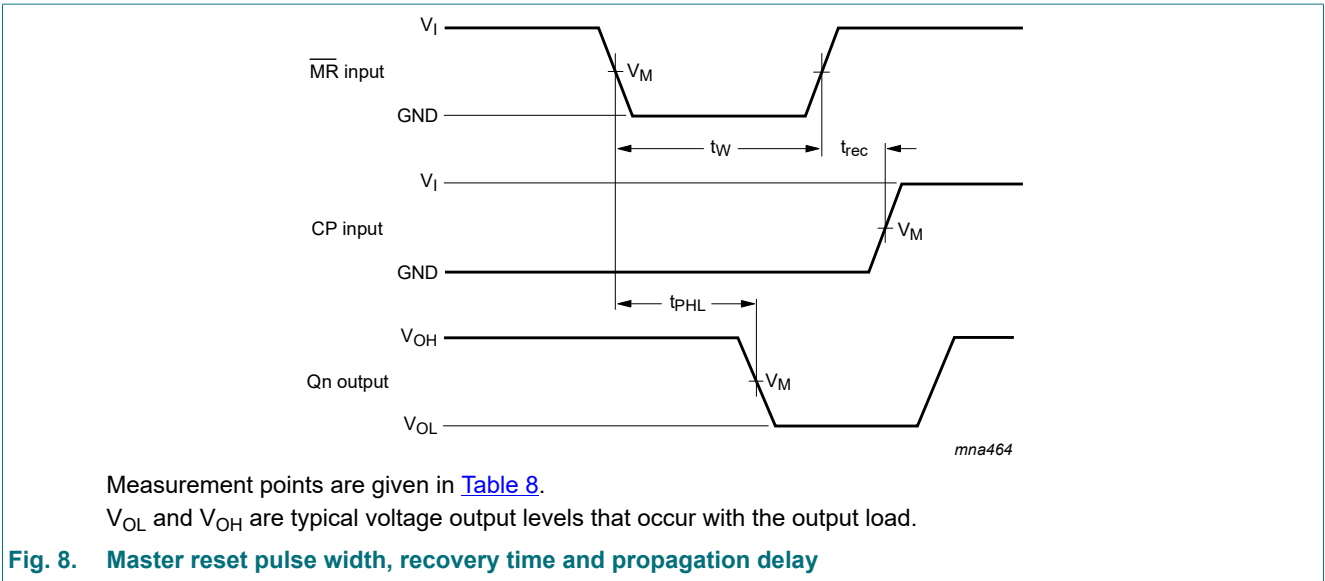
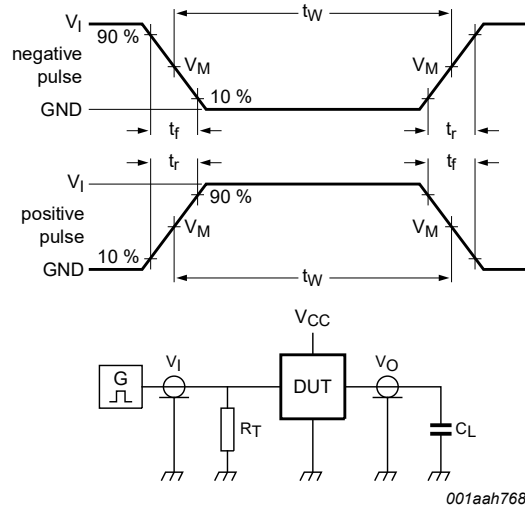


Table 8. Measurement points

| Type | Input | Output |
|----------------|---------------------|---------------------|
| | V_M | V_M |
| 74AHC273-Q100 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74AHCT273-Q100 | 1.5 V | $0.5 \times V_{CC}$ |



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.

Fig. 10. Test circuit for measuring switching times

Table 9. Test data

| Type | Input | | Load | Test |
|----------------|----------|---------------|--------------|--------------------|
| | V_I | t_r, t_f | C_L | |
| 74AHC273-Q100 | V_{CC} | ≤ 3.0 ns | 15 pF, 50 pF | t_{PLH}, t_{PHL} |
| 74AHCT273-Q100 | 3.0 V | ≤ 3.0 ns | 15 pF, 50 pF | t_{PLH}, t_{PHL} |

11. Package outline

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

SOT163-1

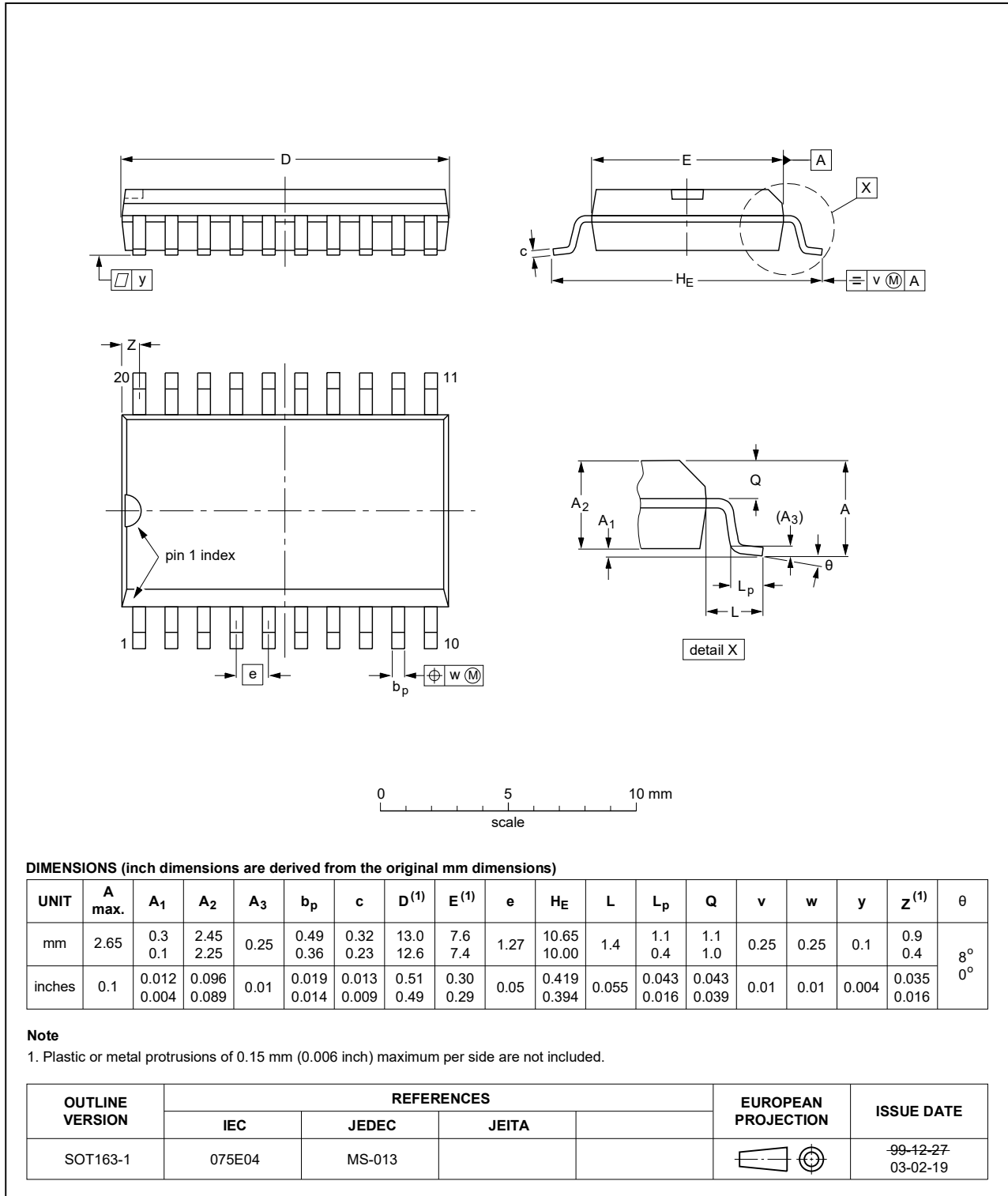


Fig. 11. Package outline SOT163-1 (SO20)

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

SOT360-1

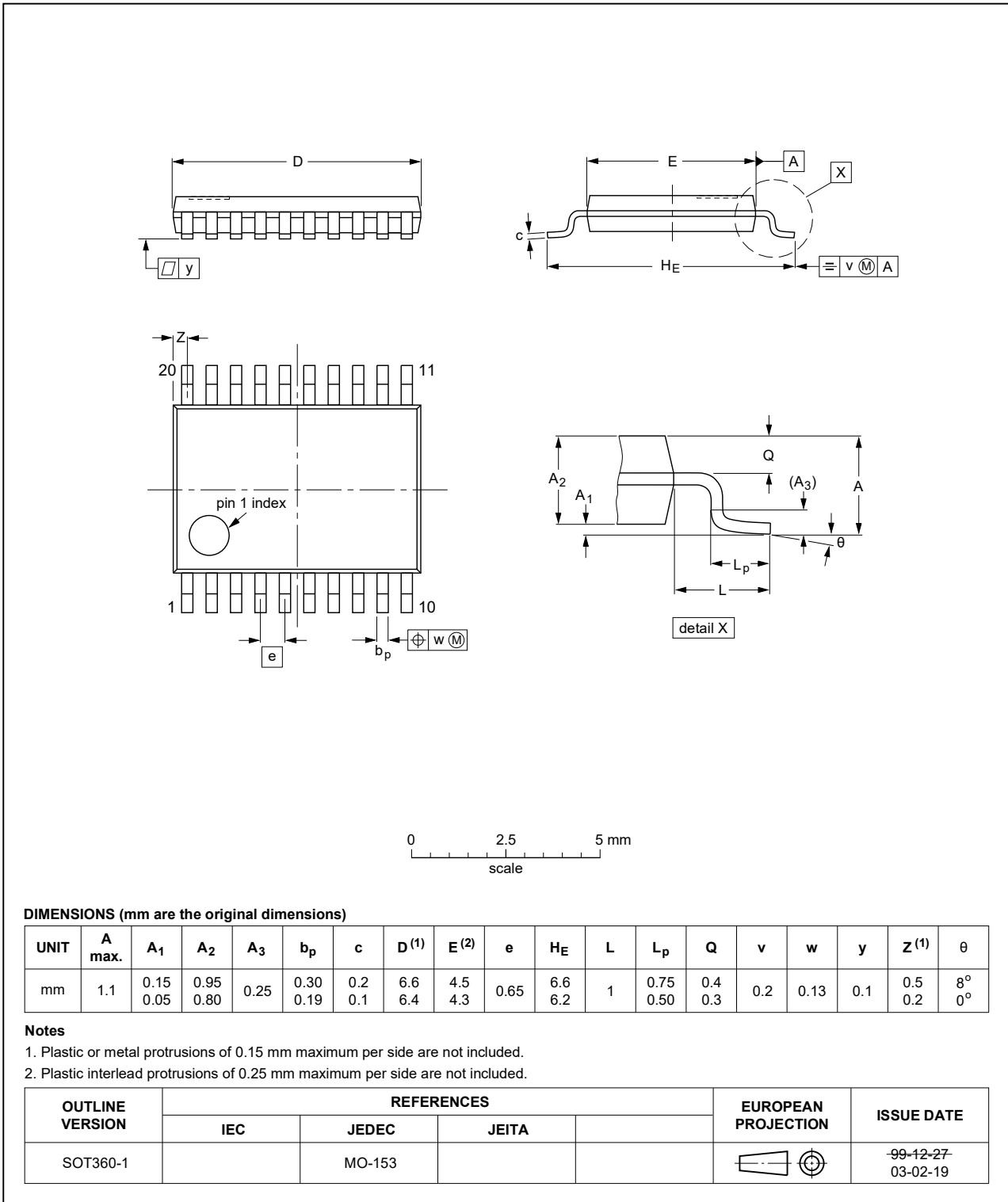


Fig. 12. Package outline SOT360-1 (TSSOP20)

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

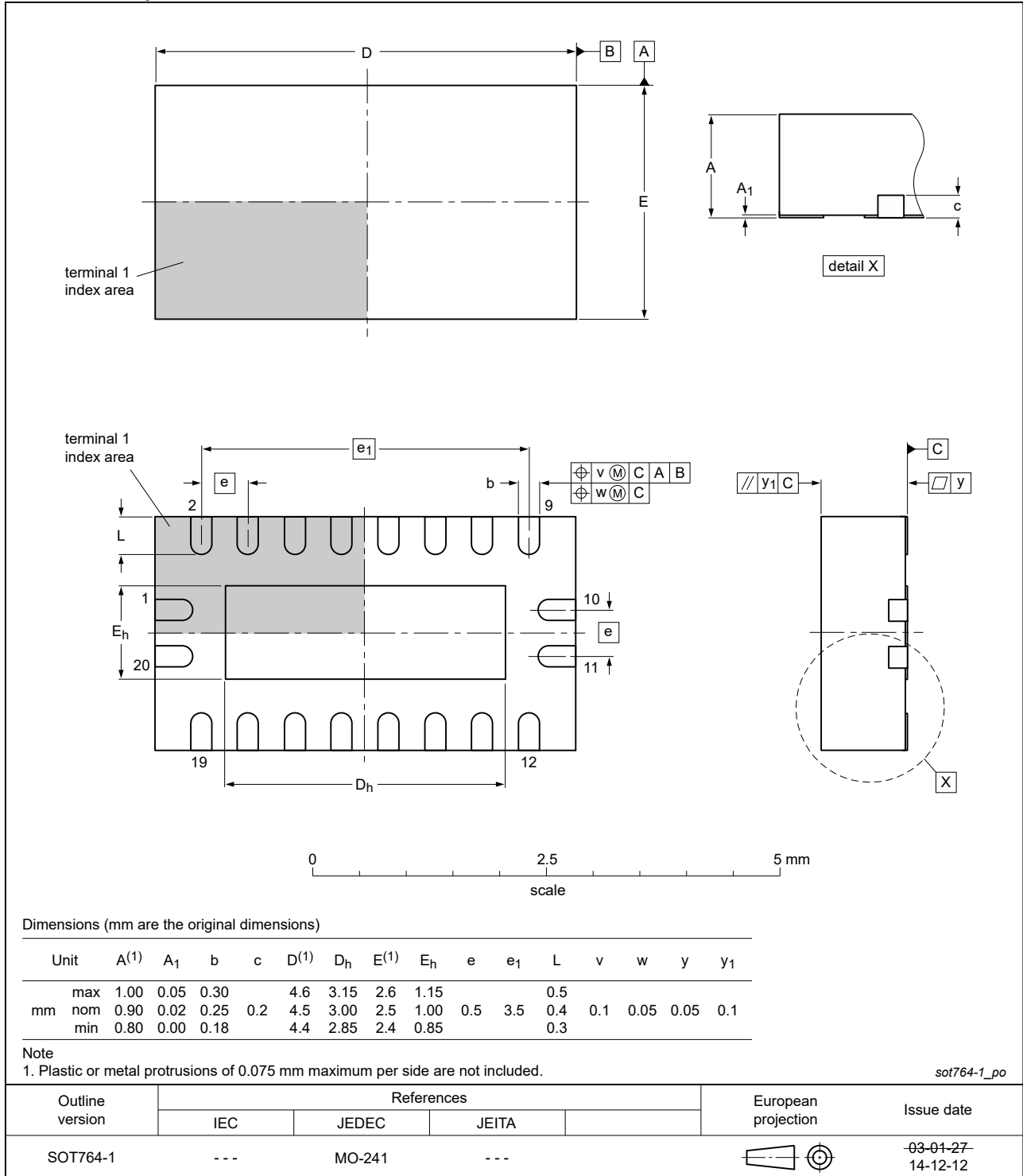


Fig. 13. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|--|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| LSTTL | Low-power Schottky Transistor-Transistor Logic |
| MIL | Military |
| MM | Machine Model |
| MOS | Metal-Oxide Semiconductor |

13. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------------|---|--------------------|---------------|------------------------|
| 74AHC_AHCT273_Q100 v.2 | 20200923 | Product data sheet | - | 74AHC_AHCT273_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation have been updated. Package outline drawing of SOT764-1 (Fig. 13) updated. | | | |
| 74AHC_AHCT273_Q100 v.1 | 20130327 | Product data sheet | - | - |

14. Legal information

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. |

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