



**THE DATASHEET OF
74HC377DB,118**



74HC377; 74HCT377

Octal D-type flip-flop with data enable; positive-edge trigger

Rev. 4 — 24 February 2016

Product data sheet

1. General description

The 74HC377; 74HCT377 is an octal positive-edge triggered D-type flip-flop. The device features clock (CP) and data enable (\bar{E}) inputs. When \bar{E} is LOW, the outputs Qn assume the state of their corresponding Dn inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. Input \bar{E} must be stable one set-up time prior to the LOW-to-HIGH transition for predictable operation. 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

- Common clock and master reset
- Eight positive edge-triggered D-type flip-flops
- Complies with JEDEC standard no. 7A
- Input levels:
 - ◆ For 74HC377: CMOS level
 - ◆ For 74HCT377: TTL level
- 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 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 |
| 74HC377D | $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74HCT377D | | | | |
| 74HC377DB | $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ | SSOP20 | plastic shrink small outline package; 20 leads; body width 5.3 mm | SOT339-1 |
| 74HCT377DB | | | | |
| 74HC377PW | $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74HCT377PW | | | | |



4. Functional diagram

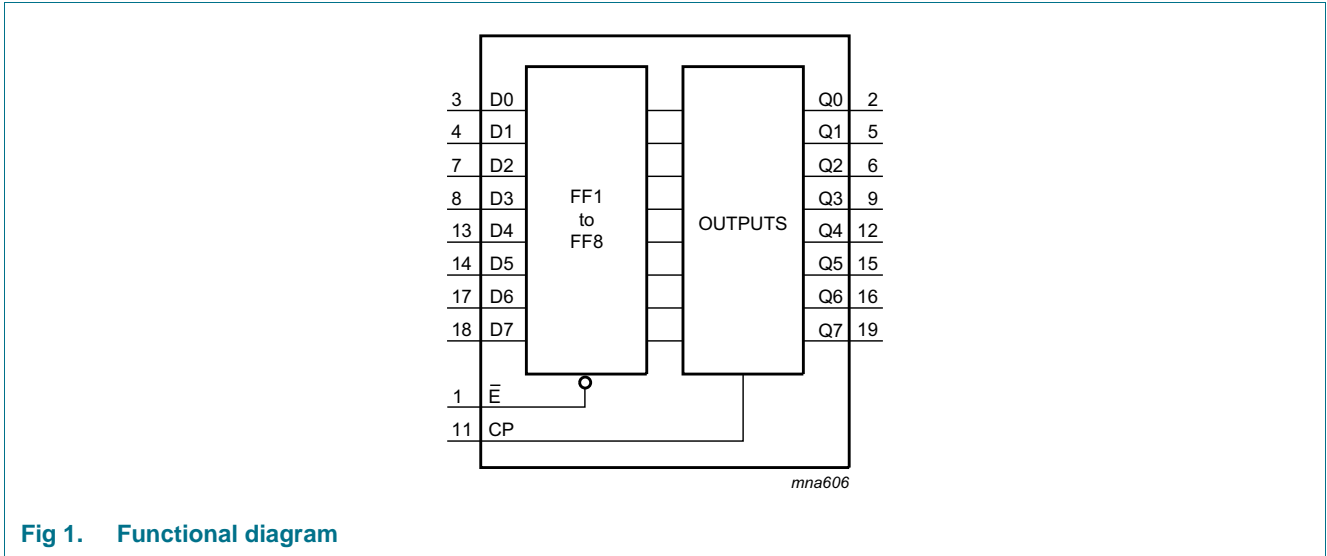


Fig 1. Functional diagram

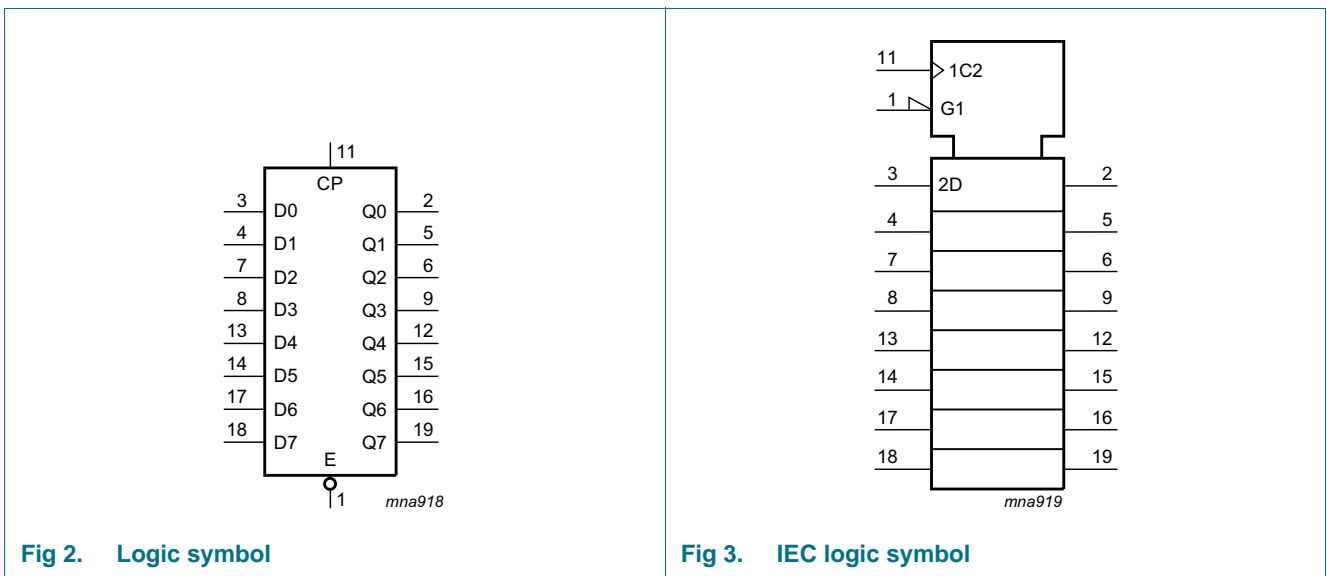


Fig 2. Logic symbol

Fig 3. IEC logic symbol

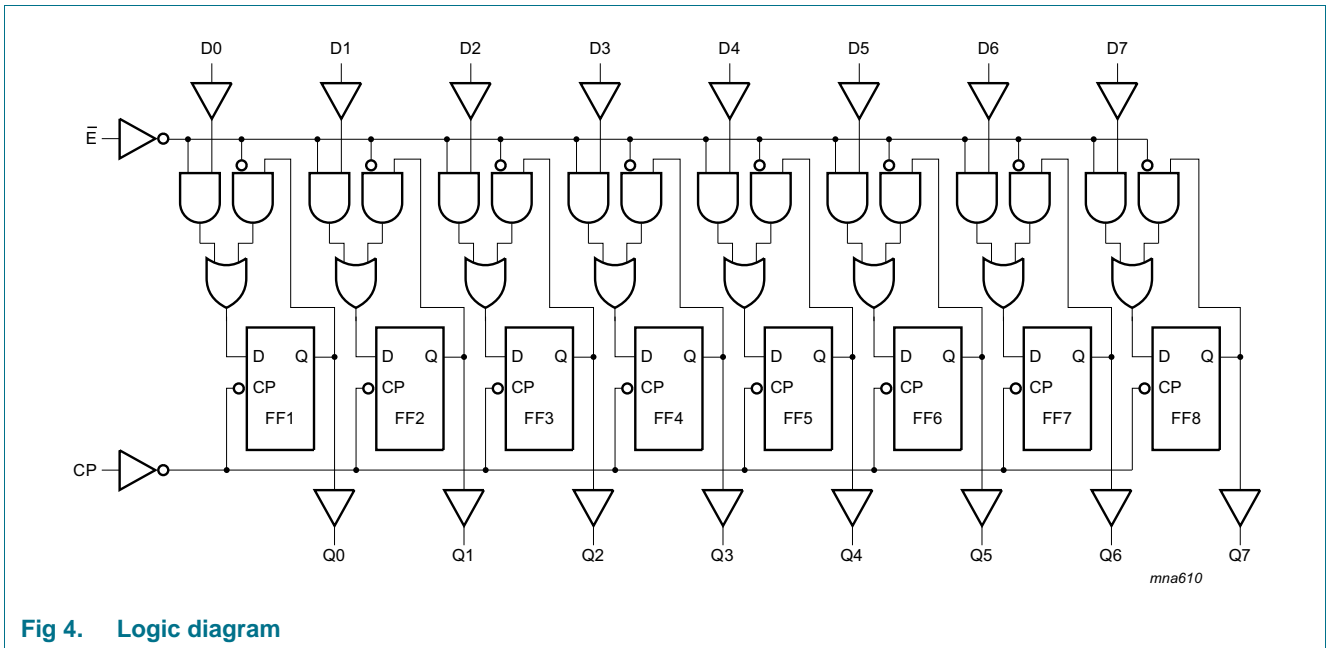


Fig 4. Logic diagram

5. Pinning information

5.1 Pinning

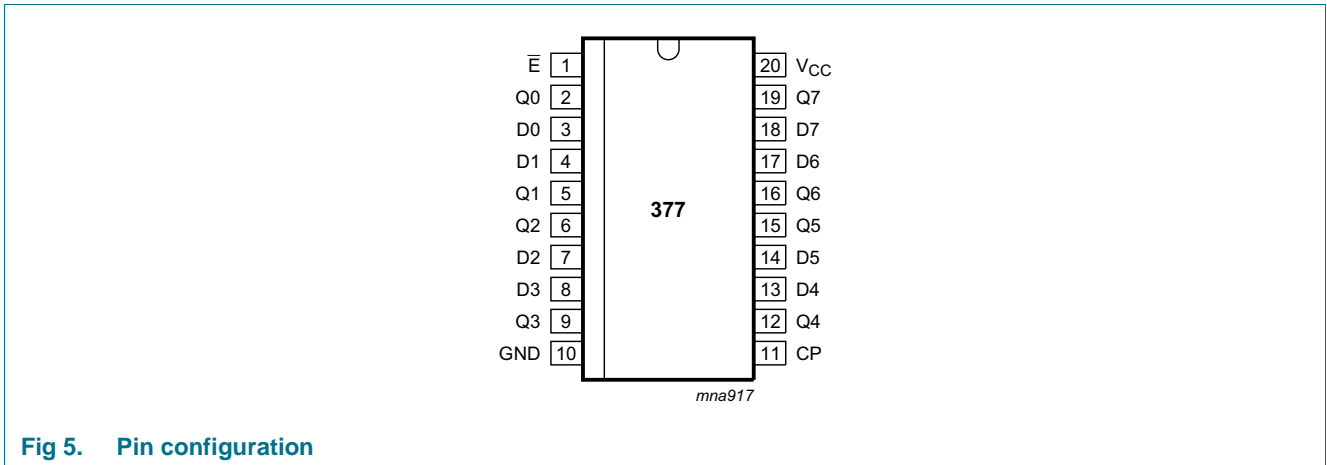


Fig 5. Pin configuration

5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------------------|----------------------------|---|
| \bar{E} | 1 | data enable 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) |
| V _{CC} | 20 | supply voltage |

6. Functional description

Table 3. Function table^[1]

| Operating modes | Inputs | | | Outputs |
|-------------------|--------|---|----------------|----------------|
| | CP | E | D _n | Q _n |
| load "1" | ↑ | l | h | H |
| load "0" | ↑ | l | l | L |
| hold (do nothing) | - | h | X | no change |
| | X | H | X | no change |

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

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 [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 | -0.5 V < V _O < V _{CC} + 0.5 V | - | ±25 | mA |
| I _{CC} | supply current | | - | 50 | mA |
| I _{GND} | ground current | | -50 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C | | | |
| | | SO20, SSOP20, TSSOP20 [2] | - | 500 | mW |

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

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

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

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol | Parameter | Conditions | 74HC377 | | | 74HCT377 | | | Unit |
|------------------|-------------------------------------|-------------------------|---------|------|-----------------|----------|------|-----------------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V _{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | - | V _{CC} | 0 | - | V _{CC} | V |
| V _O | output voltage | | 0 | - | V _{CC} | 0 | - | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | - | +125 | -40 | - | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | V _{CC} = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 V | - | - | 83 | - | - | - | 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 | |
| 74HC377 | | | | | | | | | | |
| 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 = -4.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | 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 = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 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 | - | ±1 | μA |
| | | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 8.0 | - | 80 | - | 160 | μA |
| | | | - | 3.5 | - | - | - | - | - | pF |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 74HCT377 | | | | | | | | | | |
| 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 = -4.0 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; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 5.2 mA; V _{CC} = 5.5 V | - | 0.15 | 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 | - | ±1 | μA |

Table 6. Static characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 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 | | | | | | | | |
| | | \bar{E} input | - | 150 | 540 | - | 675 | - | 735 | μA |
| | | CP input | - | 50 | 180 | - | 225 | - | 245 | μA |
| | | Dn input | - | 20 | 72 | - | 90 | - | 98 | μA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V); C_L = 50 pF unless otherwise specified; for test circuit, see [Figure 8](#)

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------|-------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HC377 | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Qn; see Figure 6 ^[1] | | | | | | | | |
| | | V _{CC} = 2.0 V | - | 44 | 160 | - | 200 | - | 240 | ns |
| | | V _{CC} = 4.5 V | - | 16 | 32 | - | 40 | - | 48 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 13 | - | - | - | - | - | - |
| | | V _{CC} = 6.0 V | - | 13 | 27 | - | 34 | - | 41 | ns |
| t _t | transition time | Qn output; see Figure 6 ^[2] | | | | | | | | |
| | | V _{CC} = 2.0 V | - | 19 | 75 | - | 95 | - | 110 | ns |
| | | V _{CC} = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | V _{CC} = 6.0 V | - | 6 | 13 | - | 16 | - | 19 | ns |
| t _w | pulse width | CP input HIGH or LOW; see Figure 6 | | | | | | | | |
| | | V _{CC} = 2.0 V | 80 | 14 | - | 100 | - | 120 | - | ns |
| | | V _{CC} = 4.5 V | 16 | 5 | - | 20 | - | 24 | - | ns |
| | | V _{CC} = 6.0 V | 14 | 4 | - | 17 | - | 20 | - | ns |
| t _{su} | set-up time | Dn to CP; see Figure 7 | | | | | | | | |
| | | V _{CC} = 2.0 V | 60 | 14 | - | 75 | - | 90 | - | ns |
| | | V _{CC} = 4.5 V | 12 | 5 | - | 15 | - | 18 | - | ns |
| | | V _{CC} = 6.0 V | 10 | 4 | - | 13 | - | 15 | - | ns |
| | | \bar{E} to CP; see Figure 7 | | | | | | | | |
| | | V _{CC} = 2.0 V | 60 | 6 | - | 75 | - | 90 | - | ns |
| | | V _{CC} = 4.5 V | 12 | 2 | - | 15 | - | 18 | - | ns |
| | | V _{CC} = 6.0 V | 10 | 2 | - | 13 | - | 15 | - | ns |

Table 7. Dynamic characteristics ...continued
 GND (ground = 0 V); $C_L = 50$ pF unless otherwise specified; for test circuit, see [Figure 8](#)

| Symbol | Parameter | Conditions | 25 °C | | | −40 °C to +85 °C | | −40 °C to +125 °C | | Unit |
|---------------------------------|-------------------------------|--|-------------------|---|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t_h | hold time | Dn to CP; see Figure 7 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 3 | −8 | - | 3 | - | 3 | - | ns |
| | | $V_{CC} = 4.5$ V | 3 | −3 | - | 3 | - | 3 | - | ns |
| | | $V_{CC} = 6.0$ V | 3 | −2 | - | 3 | - | 3 | - | ns |
| | | \bar{E} to CP; see Figure 7 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 4 | −3 | - | 4 | - | 4 | - | ns |
| | | $V_{CC} = 4.5$ V | 4 | −1 | - | 4 | - | 4 | - | ns |
| f_{max} | maximum frequency | CP input; see Figure 6 | | | | | | | | |
| | | $V_{CC} = 2.0$ V | 6 | 23 | - | 5 | - | 4 | - | MHz |
| | | $V_{CC} = 4.5$ V | 30 | 70 | - | 24 | - | 20 | - | MHz |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | - | 77 | - | - | - | - | - | MHz |
| C_{PD} | power dissipation capacitance | per package; $V_I = GND$ to V_{CC} ^[3] | - | 20 | - | - | - | - | - | pF |
| | | $V_{CC} = 6.0$ V | 35 | 83 | - | 28 | - | 24 | - | MHz |
| | | 74HCT377 | | | | | | | | |
| | | t_{pd} | propagation delay | CP to Qn; see Figure 6 ^[1] | | | | | | |
| $V_{CC} = 4.5$ V | - | | | 17 | 32 | - | 40 | - | 48 | ns |
| $V_{CC} = 5.0$ V; $C_L = 15$ pF | - | | | 14 | - | - | - | - | - | ns |
| t_t | transition time | Qn output; see Figure 6 ^[2] | | | | | | | | |
| | | $V_{CC} = 4.5$ V | - | 7 | 15 | - | 19 | - | 22 | ns |
| t_W | pulse width | CP input; see Figure 6 | | | | | | | | |
| | | $V_{CC} = 4.5$ V | 20 | 8 | - | 25 | - | 30 | - | ns |
| t_{su} | set-up time | Dn to CP; see Figure 7 | | | | | | | | |
| | | $V_{CC} = 4.5$ V | 12 | 4 | - | 15 | - | 18 | - | ns |
| | | \bar{E} to CP; see Figure 7 | | | | | | | | |
| t_h | hold time | $V_{CC} = 4.5$ V | 22 | 12 | - | 28 | - | 33 | - | ns |
| | | Dn to CP; see Figure 7 | | | | | | | | |
| | | $V_{CC} = 4.5$ V | 2 | −4 | - | 2 | - | 2 | - | ns |
| f_{max} | maximum frequency | \bar{E} to CP; see Figure 7 | | | | | | | | |
| | | $V_{CC} = 4.5$ V | 3 | −2 | - | 3 | - | 3 | - | ns |
| | | CP input; see Figure 6 | | | | | | | | |
| f_{max} | maximum frequency | $V_{CC} = 4.5$ V | 27 | 48 | - | 22 | - | 18 | - | MHz |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | - | 53 | - | - | - | - | - | MHz |

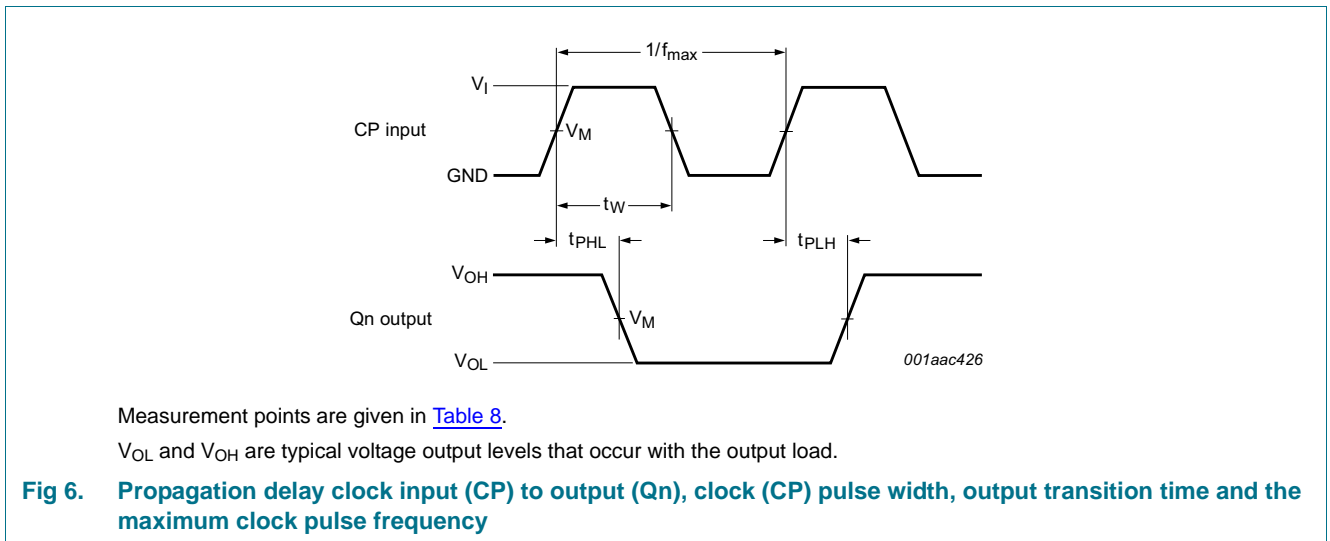
Table 7. Dynamic characteristics ...continued

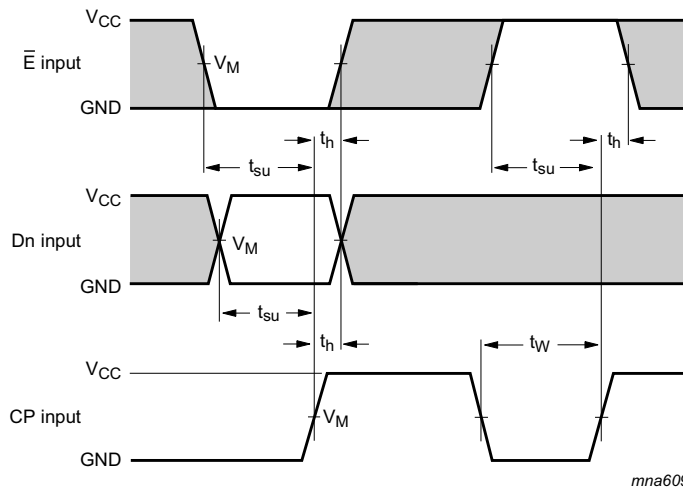
GND (ground = 0 V); $C_L = 50$ pF unless otherwise specified; for test circuit, see [Figure 8](#)

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|----------|-------------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| C_{PD} | power dissipation capacitance | per package; $V_I = \text{GND to } V_{CC} - 1.5 \text{ V}$ | - | 20 | - | - | - | - | - | pF |

- [1] t_{pd} is the same as t_{PHL} and t_{PLH} .
- [2] t_t is the same as t_{THL} and t_{TLH} .
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
 f_i = input frequency in MHz;
 f_o = output frequency in MHz;
 $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs;
 C_L = output load capacitance in pF;
 V_{CC} = supply voltage in V.

11. Waveforms





Measurement points are given in [Table 8](#).

The shaded areas indicate when the input is permitted to change for predictable output performance.

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 7. Data set-up and hold times data input (Dn)

Table 8. Measurement points

| Type | Input | | Output |
|----------|----------|-------------|-------------|
| | V_I | V_M | V_M |
| 74HC377 | V_{CC} | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74HCT377 | 3 V | 1.3 V | 1.3 V |

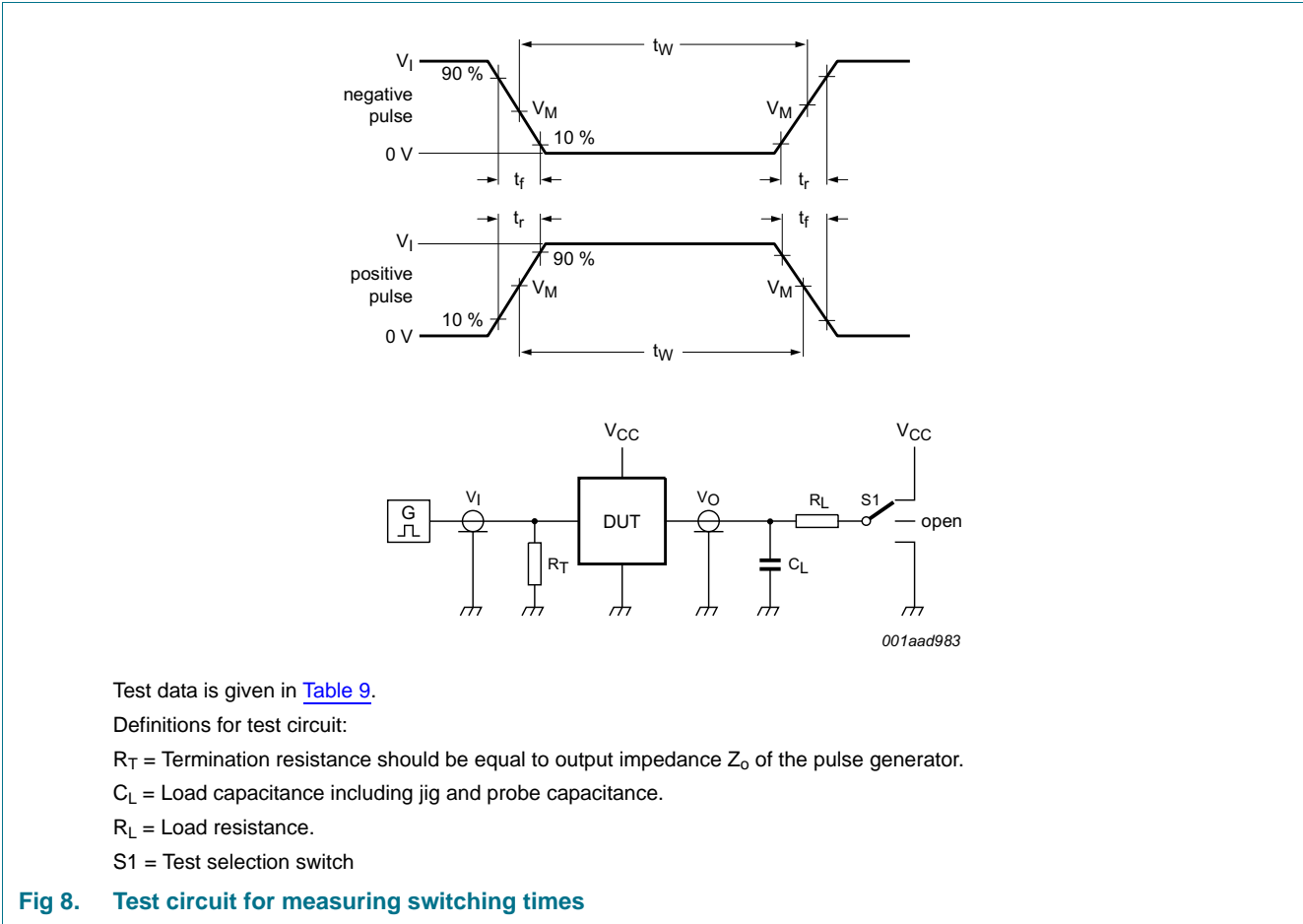


Table 9. Test data

| Type | Input | | Load | | S1 position |
|----------|----------|------------|--------------|--------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PHL}, t_{PLH} |
| 74HC377 | V_{CC} | 6 ns | 15 pF, 50 pF | 1 k Ω | open |
| 74HCT377 | 3 V | 6 ns | 15 pF, 50 pF | 1 k Ω | open |

12. Package outline

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

SOT163-1

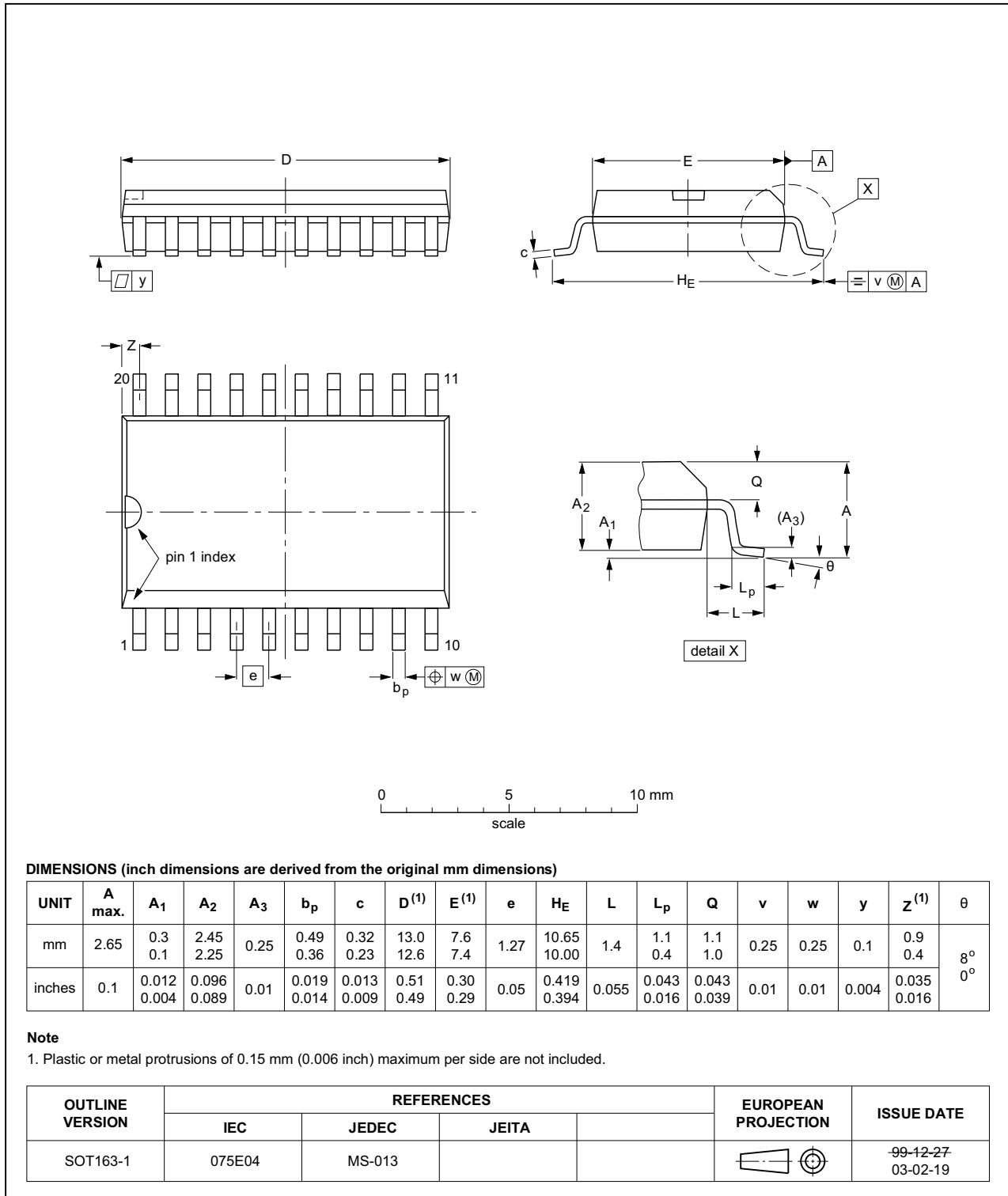


Fig 9. Package outline SOT163-1 (SO20)

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

SOT339-1

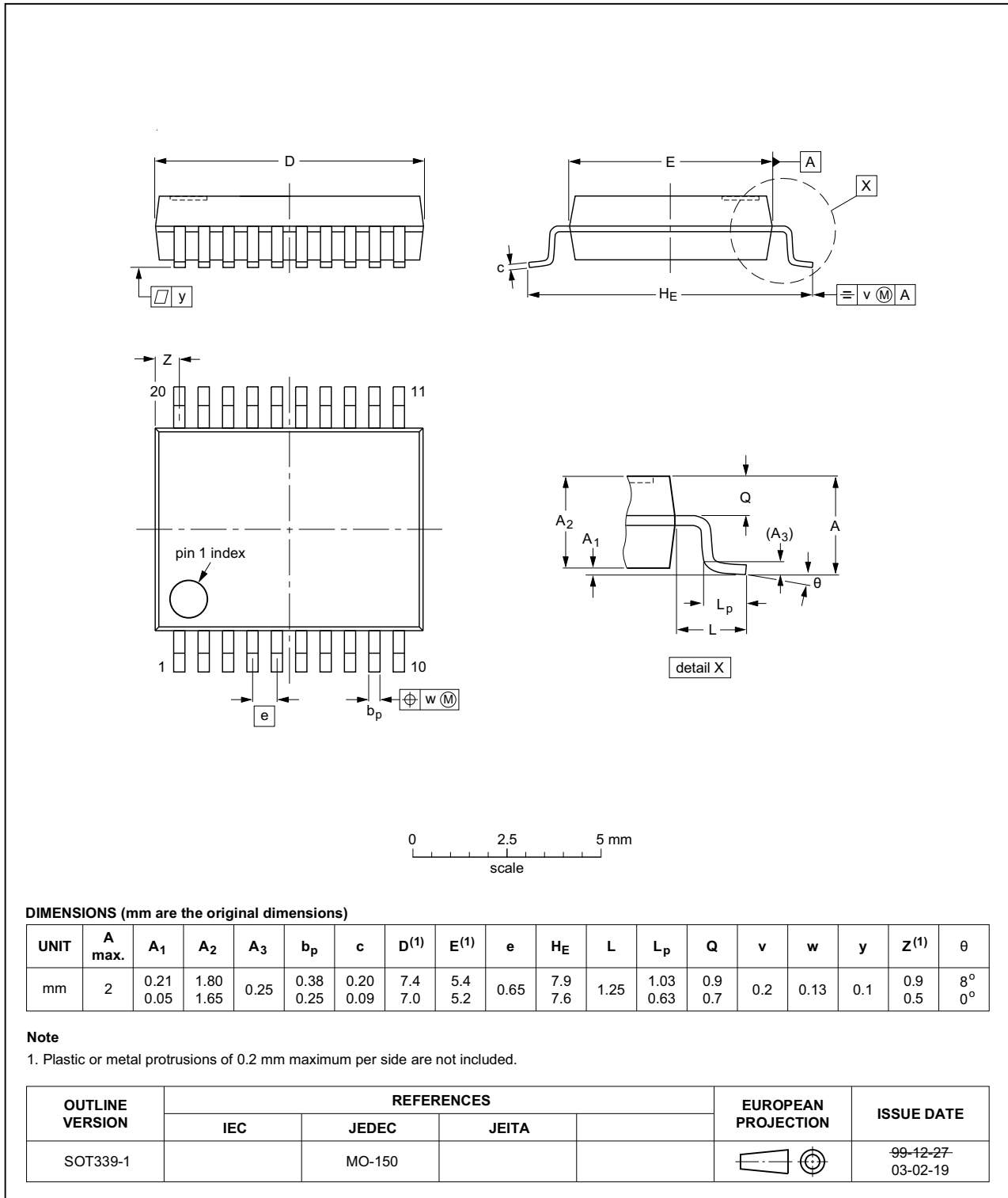


Fig 10. Package outline SOT339-1 (SSOP20)

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

SOT360-1

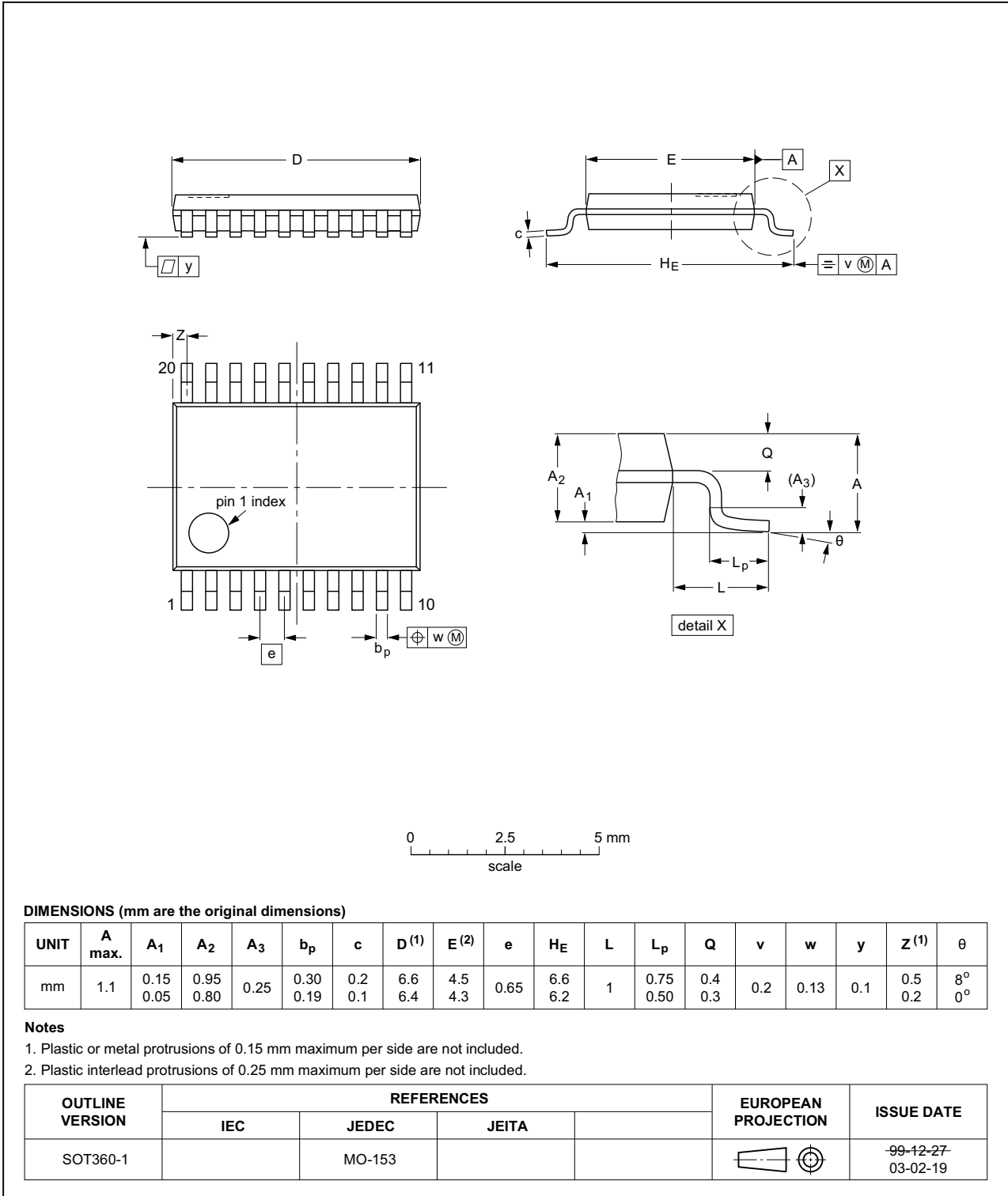


Fig 11. Package outline SOT360-1 (TSSOP20)

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_HCT377 v.4 | 20160224 | Product data sheet | - | 74HC_HCT377 v.3 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC377N and 74HCT377N (SOT146-1) removed. | | | |
| 74HC_HCT377 v.3 | 20130925 | Product data sheet | - | 74HC_HCT377_CNV v.2 |
| 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_HCT377_CNV v.2 | 19901227 | 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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Date of release: 24 February 2016
 Document identifier: 74HC_HCT377

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