

# 74AHC138-Q100; 74AHCT138-Q100

3-to-8 line decoder/demultiplexer; inverting

Rev. 5 — 29 February 2024

Product data sheet

## 1. General description

The 74AHC138-Q100; 74AHCT138-Q100 are high-speed Si-gate CMOS devices and are pin compatible with Low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard No. 7A.

The 74AHC138-Q100; 74AHCT138-Q100 is a 3-to-8 line decoder/demultiplexer. It accepts three binary weighted address inputs (A0, A1 and A2) and, when enabled, provides eight mutually exclusive outputs (Y0 to Y7) that are LOW when selected.

There are three enable inputs: two active LOW ( $\overline{E1}$  and  $\overline{E2}$ ) and one active HIGH (E3). Every output will be HIGH unless  $\overline{E1}$  and  $\overline{E2}$  are LOW and E3 is HIGH.

This multiple enable function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four 74AHC138-Q100; 74AHCT138-Q100 devices and one inverter. The 74AHC138-Q100; 74AHCT138-Q100 can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Unused enable inputs must be permanently tied to their appropriate active HIGH or LOW 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

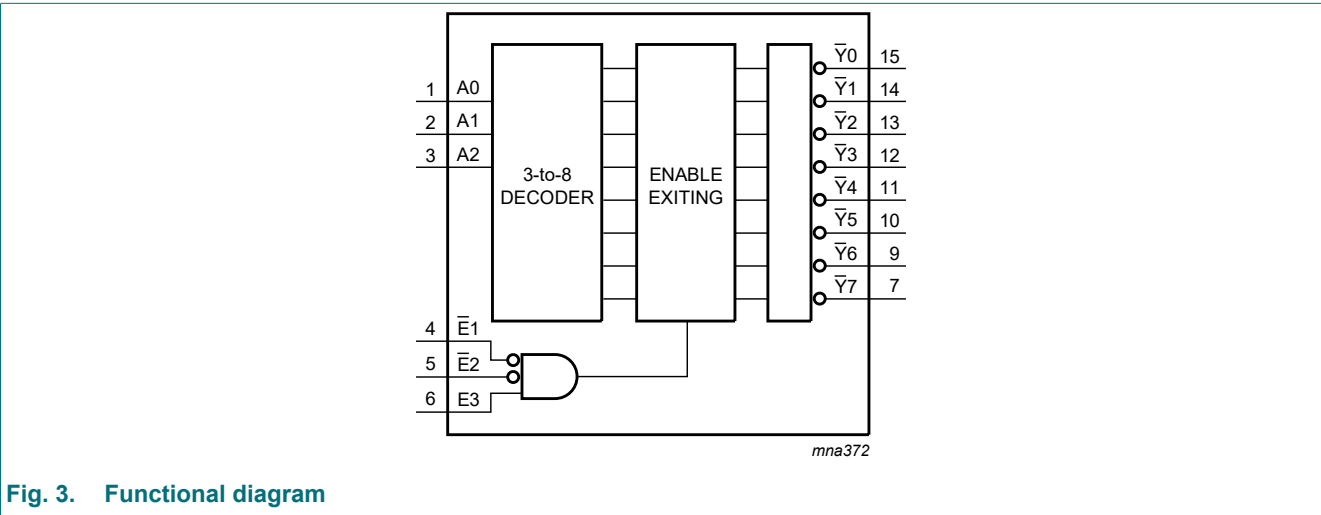
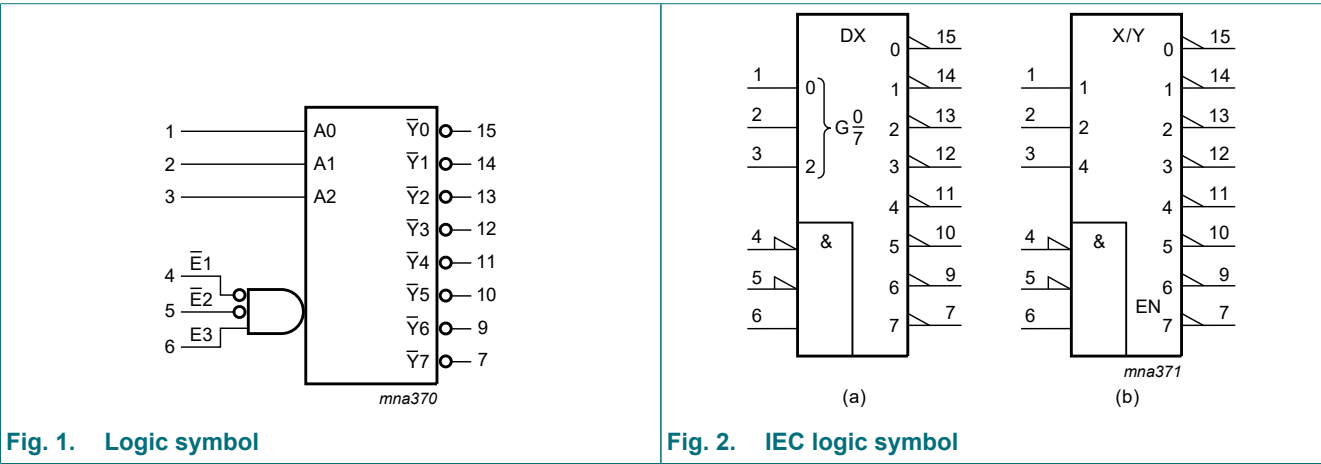
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Balanced propagation delays
- All inputs have Schmitt-trigger action
- Demultiplexing capability
- Multiple input enable for easy expansion
- Ideal for memory chip select decoding
- Inputs accepts voltages higher than  $V_{CC}$
- For 74AHC138-Q100 only: operates with CMOS input levels
- For 74AHCT138-Q100 only: operates with TTL input levels
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

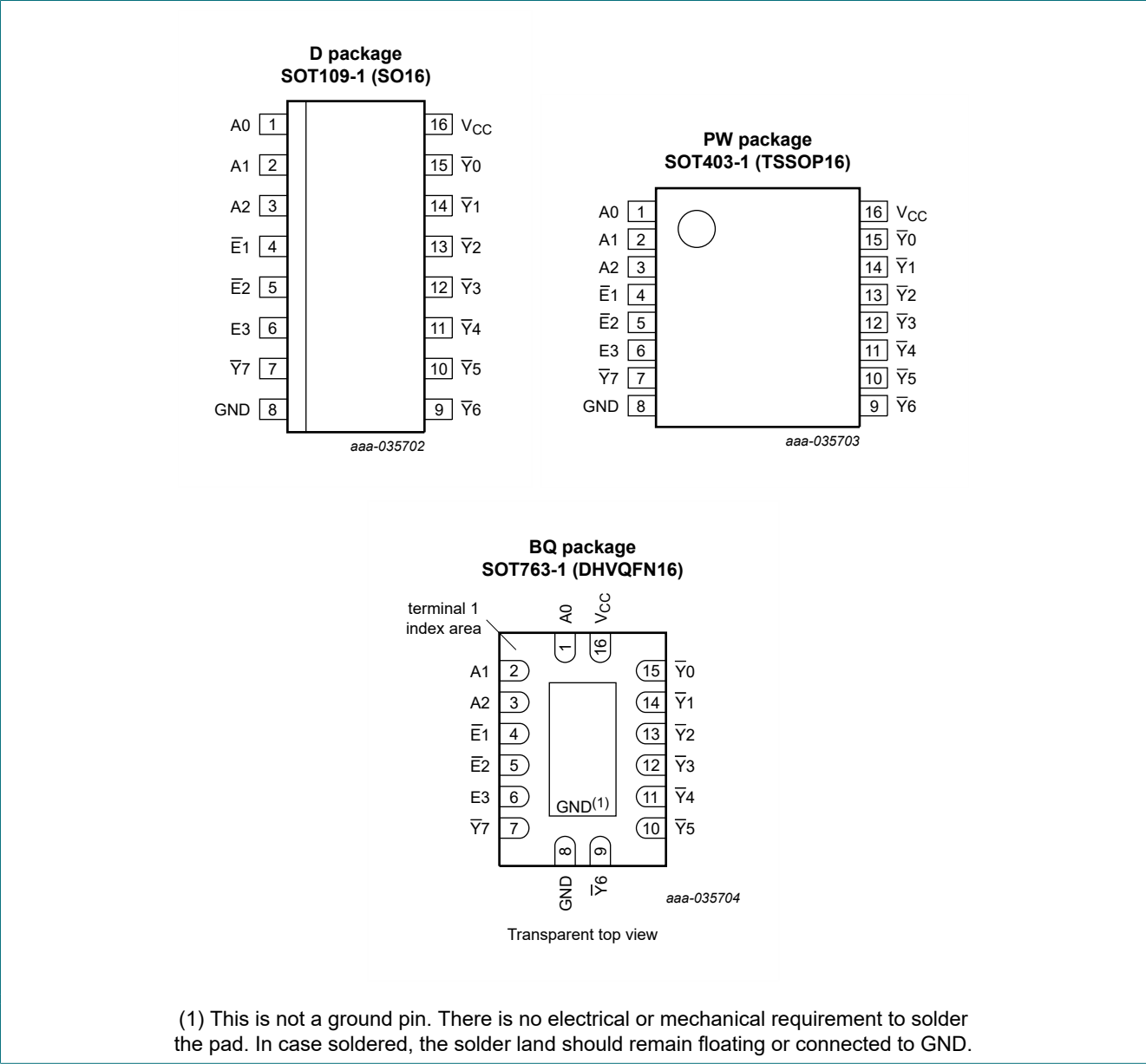
| Type number                                                         | Package           |          |                                                                                                                                         |                          |
|---------------------------------------------------------------------|-------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                                                     | Temperature range | Name     | Description                                                                                                                             | Version                  |
| <a href="#">74AHC138D-Q100</a><br><a href="#">74AHCT138D-Q100</a>   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads;<br>body width 3.9 mm                                                                           | <a href="#">SOT109-1</a> |
| <a href="#">74AHC138PW-Q100</a><br><a href="#">74AHCT138PW-Q100</a> | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package;<br>16 leads; body width 4.4 mm                                                               | <a href="#">SOT403-1</a> |
| <a href="#">74AHC138BQ-Q100</a><br><a href="#">74AHCT138BQ-Q100</a> | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible<br>thermal enhanced very thin quad<br>flat package; no leads; 16 terminals;<br>body 2.5 × 3.5 × 0.85 mm | <a href="#">SOT763-1</a> |

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol                         | Pin                          | Description                |
|--------------------------------|------------------------------|----------------------------|
| A0                             | 1                            | address input              |
| A1                             | 2                            | address input              |
| A2                             | 3                            | address input              |
| E1                             | 4                            | enable input (active LOW)  |
| E2                             | 5                            | enable input (active LOW)  |
| E3                             | 6                            | enable input (active HIGH) |
| GND                            | 8                            | ground (0 V)               |
| Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7 | 15, 14, 13, 12, 11, 10, 9, 7 | output                     |
| V <sub>CC</sub>                | 16                           | supply voltage             |

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care.

| Input |    |    |    |    |    | Output |    |    |    |    |    |    |    |
|-------|----|----|----|----|----|--------|----|----|----|----|----|----|----|
| E1    | E2 | E3 | A0 | A1 | A2 | Y0     | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| H     | X  | X  | X  | X  | X  | H      | H  | H  | H  | H  | H  | H  | H  |
| X     | H  | X  | X  | X  | X  | H      | H  | H  | H  | H  | H  | H  | H  |
| X     | X  | L  | X  | X  | X  | H      | H  | H  | H  | H  | H  | H  | H  |
| L     | L  | H  | L  | L  | L  | L      | H  | H  | H  | H  | H  | H  | H  |
| L     | L  | H  | H  | L  | L  | H      | L  | H  | H  | H  | H  | H  | H  |
| L     | L  | H  | L  | H  | L  | H      | H  | L  | H  | H  | H  | H  | H  |
| L     | L  | H  | H  | H  | L  | H      | H  | H  | L  | H  | H  | H  | H  |
| L     | L  | H  | L  | L  | H  | H      | H  | H  | H  | L  | H  | H  | H  |
| L     | L  | H  | H  | L  | H  | H      | H  | H  | H  | H  | L  | H  | H  |
| L     | L  | H  | L  | H  | H  | H      | H  | H  | H  | H  | H  | L  | H  |
| L     | L  | H  | H  | H  | H  | H      | H  | H  | H  | H  | H  | H  | 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 <sub>CC</sub>  | supply voltage          |                                                                         | -0.5 | +7.0 | V    |
| V <sub>I</sub>   | input voltage           |                                                                         | -0.5 | +7.0 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V [1]                                             | -20  | -    | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1] | -    | ±20  | mA   |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = -0.5 V to (V <sub>CC</sub> + 0.5 V)                    | -    | ±25  | mA   |
| I <sub>CC</sub>  | supply current          |                                                                         | -    | 75   | mA   |
| I <sub>GND</sub> | ground current          |                                                                         | -75  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                         | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °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 SOT109-1 (SO16) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package: P<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.  
For SOT763-1 (DHVQFN16) package: P<sub>tot</sub> derates linearly with 11.2 mW/K above 106 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

| Symbol           | Parameter                           | Conditions                      | 74AHC138-Q100 |     |                 | 74AHCT138-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   |
| Δt/ΔV            | 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  |      |
| 74AHC138-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    |

| Symbol           | Parameter                 | Conditions                                                                                                                                                     | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                  |                           |                                                                                                                                                                | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 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             | -    | 2.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V                                                                                                              | 3.94  | -   | -    | 3.8              | -    | 3.7               | -    | V    |
| V <sub>OL</sub>  | LOW-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                                                                                                                | -     | 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>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    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V or 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;<br>V <sub>CC</sub> = 5.5 V                                                                      | -     | -   | 4.0  | -                | 40   | -                 | 80   | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                | -     | 3.0 | 10   | -                | 10   | -                 | 10   | pF   |
| 74AHCT138-Q100   |                           |                                                                                                                                                                |       |     |      |                  |      |                   |      |      |
| 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              | -    | 3.7               | -    | 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>I</sub>   | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V or 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;<br>V <sub>CC</sub> = 5.5 V                                                                      | -     | -   | 4.0  | -                | 40   | -                 | 80   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin;<br>V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A;<br>other pins at V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 4.5 V to 5.5 V | -     | -   | 1.35 | -                | 1.5  | -                 | 1.5  | mA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                | -     | 3.0 | 10   | -                | 10   | -                 | 10   | pF   |

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; for test circuit see Fig. 6.

| Symbol          | Parameter                     | Conditions                                                                                  | 25 °C |        |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------------|-------|--------|------|------------------|------|-------------------|------|------|
|                 |                               |                                                                                             | Min   | Typ[1] | Max  | Min              | Max  | Min               | Max  |      |
| 74AHC138-Q100   |                               |                                                                                             |       |        |      |                  |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | An to $\overline{Y}_n$ ; see Fig. 4 [2]                                                     |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 6.0    | 11.4 | 1.0              | 13.0 | 1.0               | 14.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 8.6    | 15.8 | 1.0              | 18.0 | 1.0               | 20.0 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.4    | 8.1  | 1.0              | 9.5  | 1.0               | 10.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.3    | 10.1 | 1.0              | 11.5 | 1.0               | 13.0 | ns   |
|                 |                               | E3 to $\overline{Y}_n$ ; see Fig. 4 [2]                                                     |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 5.8    | 12.8 | 1.0              | 15.0 | 1.0               | 16.0 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 8.2    | 16.3 | 1.0              | 18.5 | 1.0               | 20.5 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.2    | 8.1  | 1.0              | 9.5  | 1.0               | 10.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.0    | 10.1 | 1.0              | 11.5 | 1.0               | 13.0 | ns   |
|                 |                               | E1, E2 to $\overline{Y}_n$ ; see Fig. 5 [2]                                                 |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 5.7    | 11.4 | 1.0              | 13.5 | 1.0               | 14.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 8.2    | 14.9 | 1.0              | 17.0 | 1.0               | 19.0 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.2    | 8.1  | 1.0              | 9.5  | 1.0               | 10.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.0    | 10.1 | 1.0              | 11.5 | 1.0               | 13.0 | 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> [3] | -     | 18.0   | -    | -                | -    | -                 | -    | pF   |
| 74AHCT138-Q100  |                               |                                                                                             |       |        |      |                  |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | An to $\overline{Y}_n$ ; see Fig. 4 [2]                                                     |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.4    | 10.4 | 1.0              | 12.0 | 1.0               | 13.0 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.2    | 11.4 | 1.0              | 13.0 | 1.0               | 14.5 | ns   |
|                 |                               | E3 to $\overline{Y}_n$ ; see Fig. 4 [2]                                                     |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.3    | 9.1  | 1.0              | 10.5 | 1.0               | 11.5 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.2    | 10.1 | 1.0              | 11.5 | 1.0               | 13.0 | ns   |
|                 |                               | E1, E2 to $\overline{Y}_n$ ; see Fig. 5 [2]                                                 |       |        |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                            |       |        |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                      | -     | 4.3    | 9.6  | 1.0              | 11.0 | 1.0               | 12.0 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                      | -     | 6.2    | 10.6 | 1.0              | 12.0 | 1.0               | 13.5 | ns   |

| Symbol          | Parameter                     | Conditions                                                                                  | 25 °C |        |     | -40 °C to +85 °C |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------------|-------|--------|-----|------------------|-----|-------------------|-----|------|
|                 |                               |                                                                                             | Min   | Typ[1] | Max | Min              | Max | Min               | Max |      |
| 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> [3] | -     | 23.0   | -   | -                | -   | -                 | -   | pF   |

- [1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V and V<sub>CC</sub> = 5.0 V).
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
f<sub>i</sub> = input frequency in MHz, f<sub>o</sub> = output frequency in MHz  
C<sub>L</sub> = output load capacitance in pF  
V<sub>CC</sub> = supply voltage in V  
N = number of inputs switching  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

10.1. Waveforms and test circuit

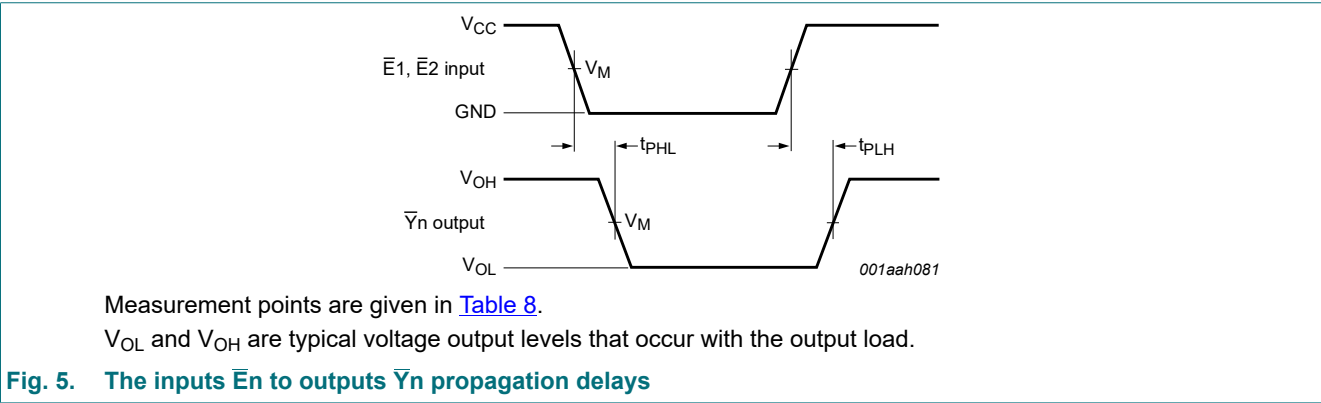
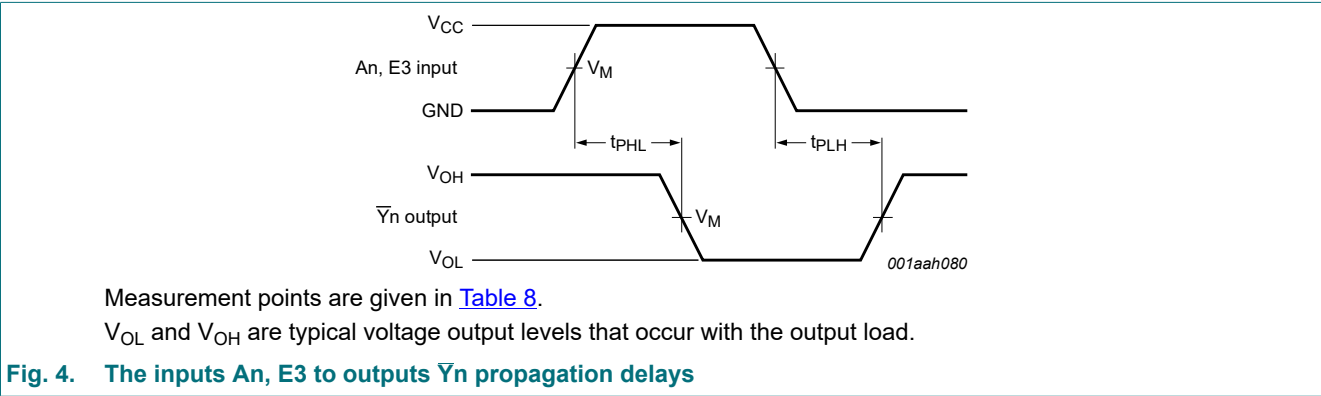


Table 8. Measurement points

| Type           | Input                 | Output                |
|----------------|-----------------------|-----------------------|
|                | V <sub>M</sub>        | V <sub>M</sub>        |
| 74AHC138-Q100  | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> |
| 74AHCT138-Q100 | 1.5 V                 | 0.5 × V <sub>CC</sub> |

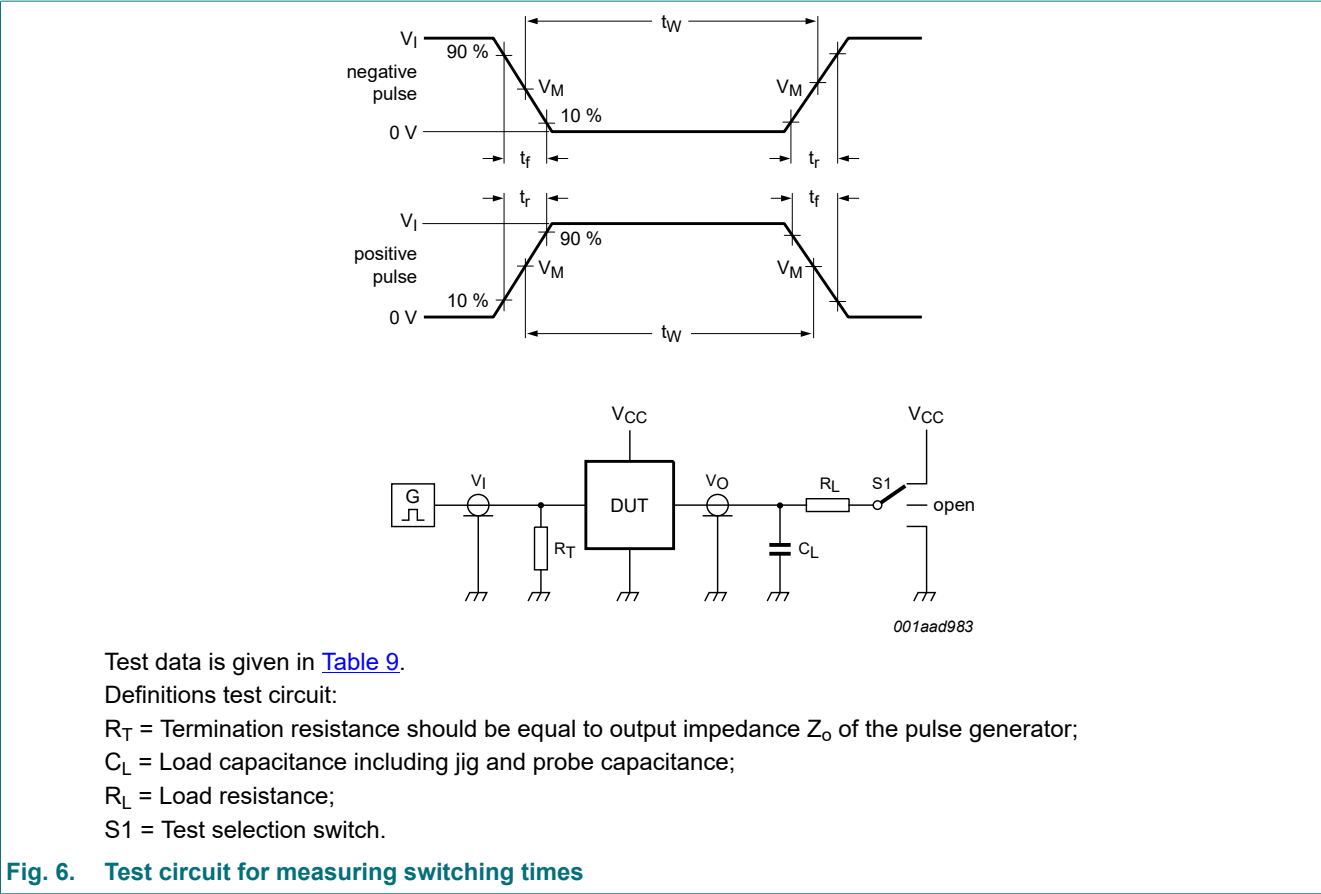


Table 9. Test data

| Type           | Input    |               | Load         |              | S1 position        |                    |                    |
|----------------|----------|---------------|--------------|--------------|--------------------|--------------------|--------------------|
|                | $V_I$    | $t_r, t_f$    | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 74AHC138-Q100  | $V_{CC}$ | $\leq 3.0$ ns | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74AHCT138-Q100 | 3.0 V    | $\leq 3.0$ ns | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

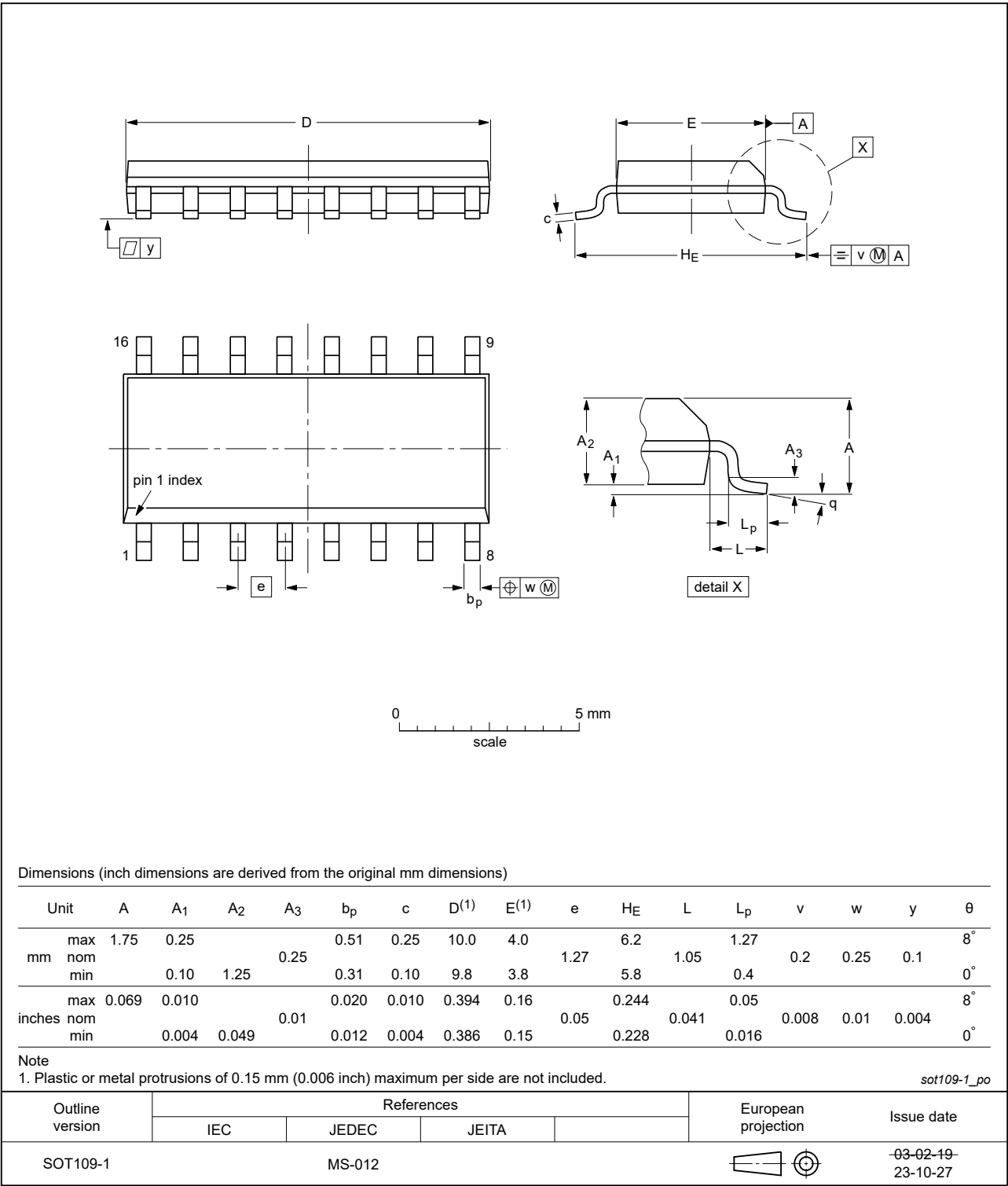


Fig. 7. Package outline SOT109-1 (SO16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

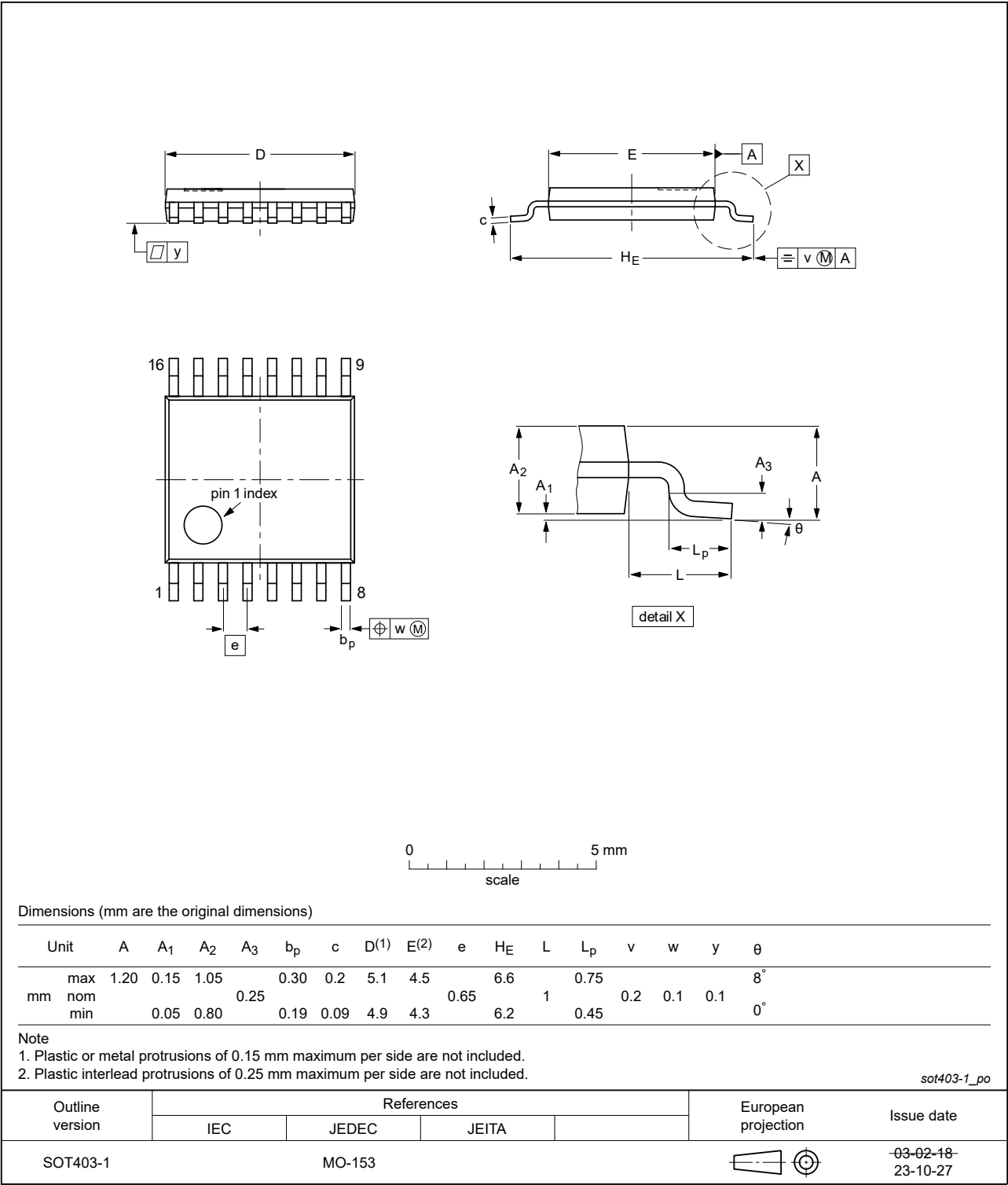


Fig. 8. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;  
16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

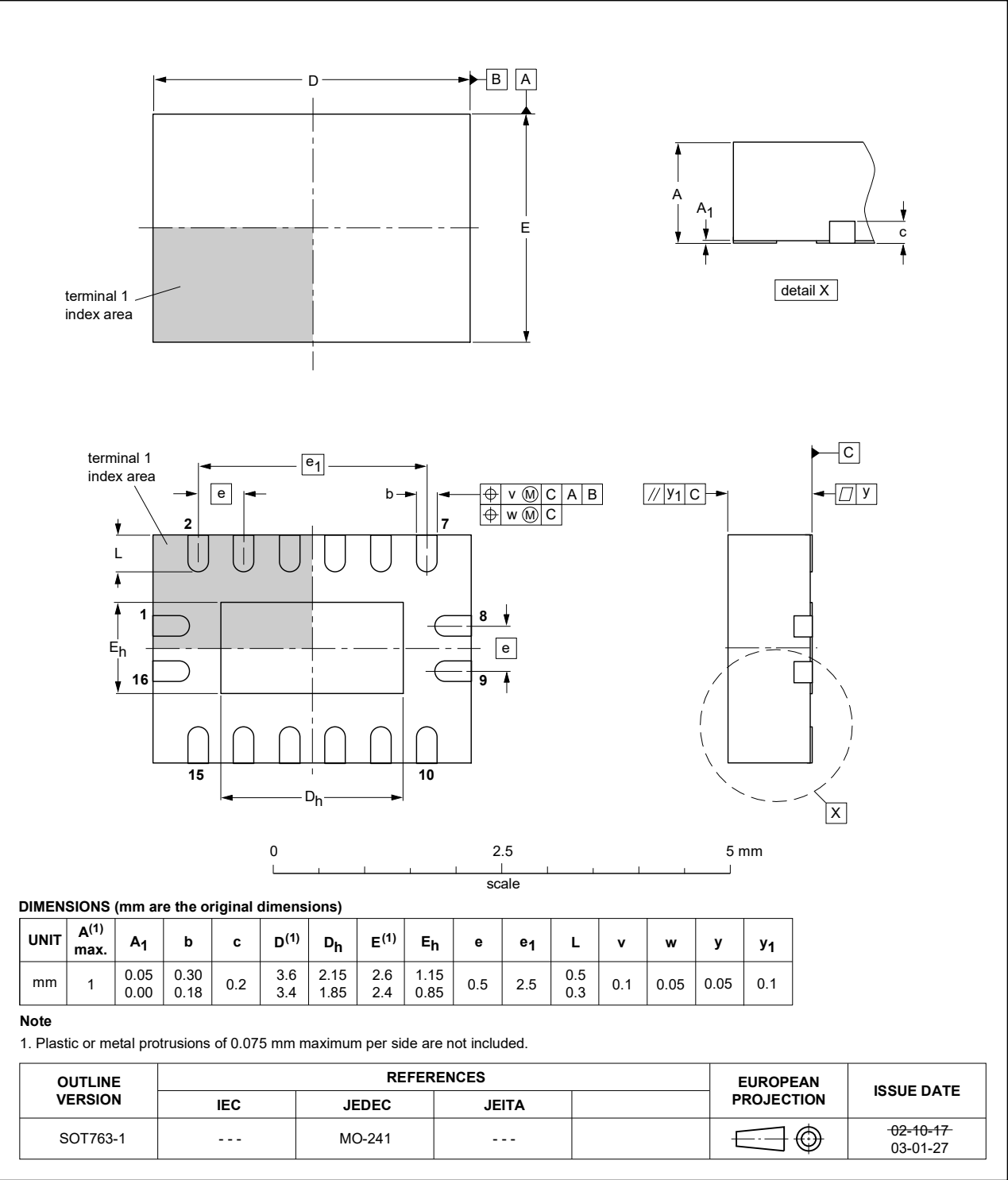


Fig. 9. Package outline SOT763-1 (DHVQFN16)

12. Abbreviations

Table 10. Abbreviations

| Acronym | Description                                    |
|---------|------------------------------------------------|
| CDM     | Charged-Device Model                           |
| CMOS    | Complementary Metal Oxide Semiconductor        |
| LSTTL   | Low-power Schottky Transistor-Transistor Logic |
| ESD     | ElectroStatic Discharge                        |
| HBM     | Human Body Model                               |
| TTL     | Transistor-Transistor Logic                    |

13. Revision history

Table 11. Revision history

| Document ID            | Release date                                                                                                                                                                                                                                                                                                                                                                                      | Data sheet status  | Change notice | Supersedes             |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|------------------------|
| 74AHC_AHCT138_Q100 v.5 | 20240229                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT138_Q100 v.4 |
| Modifications:         | <ul style="list-style-type: none"><li><a href="#">Fig. 7</a>, <a href="#">Fig. 8</a>: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li></ul>                                                                                                                                                                                                                         |                    |               |                        |
| 74AHC_AHCT138_Q100 v.4 | 20230904                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT138_Q100 v.3 |
| Modifications:         | <ul style="list-style-type: none"><li><a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>                                                                                                                                                                                                                                                      |                    |               |                        |
| 74AHC_AHCT138_Q100 v.3 | 20200910                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT138_Q100 v.2 |
| Modifications:         | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li><a href="#">Section 2</a> updated.</li><li><a href="#">Table 4</a>: Derating values for P<sub>tot</sub> total power dissipation have been updated.</li></ul> |                    |               |                        |
| 74AHC_AHCT138_Q100 v.2 | 20140402                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT138_Q100 v.1 |
| Modifications:         | <ul style="list-style-type: none"><li>Description for t<sub>pd</sub> for the 74AHCT138-Q100 corrected (errata) in <a href="#">Table 7</a>.</li></ul>                                                                                                                                                                                                                                              |                    |               |                        |
| 74AHC_AHCT138_Q100 v.1 | 20130326                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | -                      |

## 14. Legal information

### Data sheet status

| Document status<br>[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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