

# 74HC238; 74HCT238

## 3-to-8 line decoder/demultiplexer

Rev. 4 — 27 January 2016

Product data sheet

### 1. General description

The 74HC238; 74HCT238 decodes three binary weighted address inputs (A0, A1 and A2) to eight mutually exclusive outputs (Y0 to Y7). The device features three enable inputs ( $\bar{E}1$  and  $\bar{E}2$  and E3). Every output will be LOW unless  $\bar{E}1$  and  $\bar{E}2$  are LOW and E3 is HIGH. This multiple enable function allows easy parallel expansion to a 1-of-32 (5 to 32 lines) decoder with just four '238 ICs and one inverter. The '238 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. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### 2. Features and benefits

- Demultiplexing capability
- Multiple input enable for easy expansion
- Ideal for memory chip select decoding
- Active HIGH mutually exclusive outputs
- Multiple package options
- Complies with JEDEC standard no. 7A
- Input levels:
  - ◆ For 74HC238: CMOS level
  - ◆ For 74HCT238: TTL level
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- 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

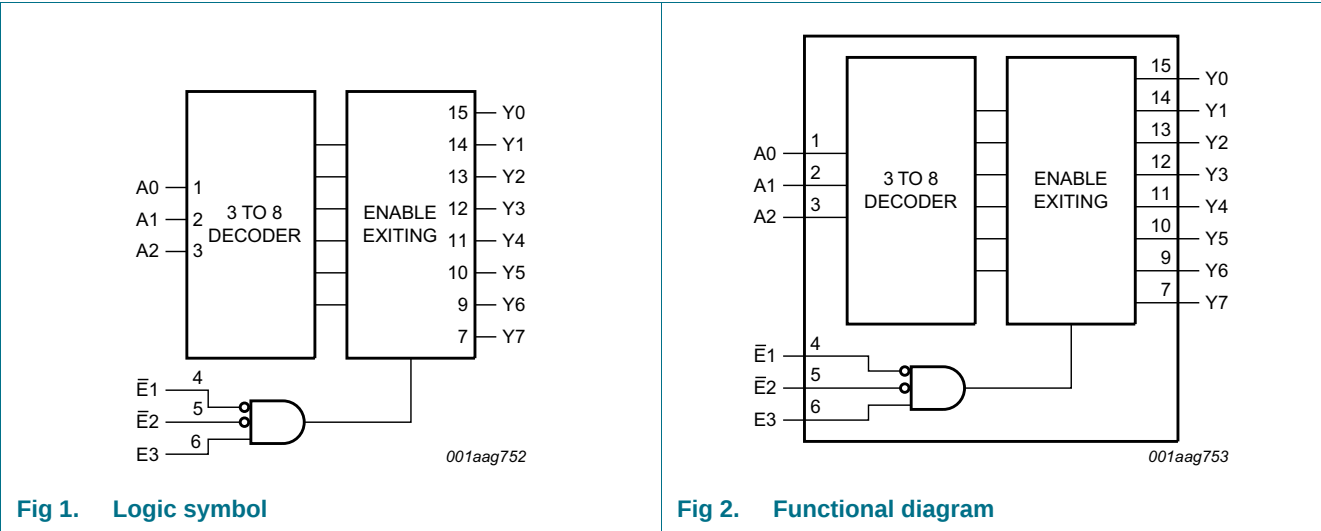
Table 1. Ordering information

| Type number | Package                                                         |        |                                                                      |          |
|-------------|-----------------------------------------------------------------|--------|----------------------------------------------------------------------|----------|
|             | Temperature range                                               | Name   | Description                                                          | Version  |
| 74HC238D    | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO16   | plastic small outline package; 16 leads;<br>body width 3.9 mm        | SOT109-1 |
| 74HCT238D   |                                                                 |        |                                                                      |          |
| 74HC238DB   | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SSOP16 | plastic shrink small outline package; 16 leads;<br>body width 5.3 mm | SOT338-1 |
| 74HCT238DB  |                                                                 |        |                                                                      |          |

Table 1. Ordering information ...continued

| Type number | Package           |          |                                                                                                                                      |          |
|-------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range | Name     | Description                                                                                                                          | Version  |
| 74HC238PW   | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads;<br>body width 4.4 mm                                                            | SOT403-1 |
| 74HCT238PW  |                   |          |                                                                                                                                      |          |
| 74HC238BQ   | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin<br>quad flat package; no leads; 16 terminals;<br>body 2.5 × 3.5 × 0.85 mm | SOT763-1 |
| 74HCT238BQ  |                   |          |                                                                                                                                      |          |

4. Functional diagram



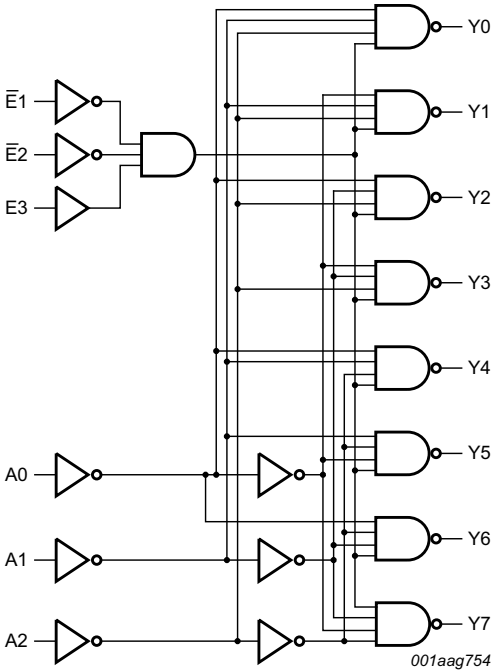
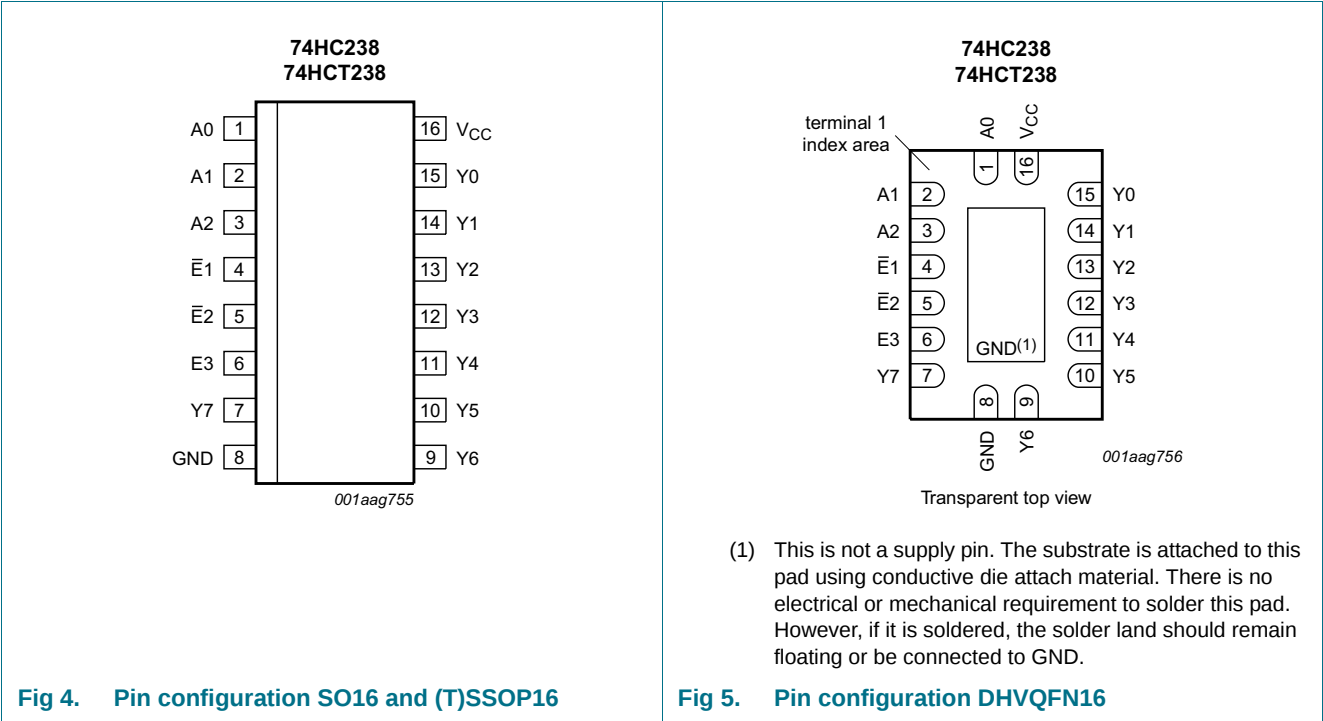


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

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

## 6. Functional description

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

| Inputs |    |    |    |    |    | Outputs |    |    |    |    |    |    |    |
|--------|----|----|----|----|----|---------|----|----|----|----|----|----|----|
| E1     | E2 | E3 | A0 | A1 | A2 | Y0      | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| H      | X  | X  | X  | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  |
| X      | H  | X  | X  | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  |
| X      | X  | L  | X  | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  |
| L      | L  | H  | L  | L  | L  | H       | L  | L  | L  | L  | L  | L  | L  |
| L      | L  | H  | H  | L  | L  | L       | H  | L  | L  | L  | L  | L  | L  |
| L      | L  | H  | L  | H  | L  | L       | L  | H  | L  | L  | L  | L  | L  |
| L      | L  | H  | H  | H  | L  | L       | L  | L  | H  | L  | L  | L  | L  |
| L      | L  | H  | L  | L  | H  | L       | L  | L  | L  | H  | L  | L  | L  |
| L      | L  | H  | H  | L  | H  | L       | L  | L  | L  | L  | H  | L  | L  |
| L      | L  | H  | L  | H  | H  | L       | L  | L  | L  | L  | L  | H  | L  |
| L      | L  | H  | H  | H  | H  | L       | L  | L  | L  | L  | L  | L  | H  |

- [1] H = HIGH voltage level;  
 L = LOW voltage level;  
 X = don't care.

## 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  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ <sup>[1]</sup> | -    | ±20  | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ <sup>[1]</sup> | -    | ±20  | mA   |
| $I_O$     | output current          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$                         | -    | ±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 | SO16, (T)SSOP16 and DHVQFN16 packages <sup>[2]</sup>                  | -    | 500  | mW   |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 [2] For SO16 package: above 70 °C the value of  $P_{tot}$  derates linearly at 8 mW/K.  
 For SSOP16 and TSSOP16 packages: above 60 °C the value of  $P_{tot}$  derates linearly at 5.5 mW/K.  
 For DHVQFN16 package: above 60 °C the value of  $P_{tot}$  derates linearly at 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

| Symbol              | Parameter                           | Conditions              | 74HC238 |      |                 | 74HCT238 |      |                 | Unit |
|---------------------|-------------------------------------|-------------------------|---------|------|-----------------|----------|------|-----------------|------|
|                     |                                     |                         | Min     | Typ  | Max             | Min      | Typ  | Max             |      |
| V <sub>CC</sub>     | supply voltage                      |                         | 2.0     | 5.0  | 6.0             | 4.5      | 5.0  | 5.5             | V    |
| V <sub>I</sub>      | input voltage                       |                         | 0       | -    | V <sub>CC</sub> | 0        | -    | V <sub>CC</sub> | 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     | -    | +125            | -40      | -    | +125            | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V | -       | -    | 625             | -        | -    | -               | ns/V |
|                     |                                     | V <sub>CC</sub> = 4.5 V | -       | 1.67 | 139             | -        | 1.67 | 139             | ns/V |
|                     |                                     | V <sub>CC</sub> = 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  |      |
| 74HC238         |                           |                                                                                           |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                   | 1.5   | 1.2  | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                   | 3.15  | 2.4  | -    | 3.15             | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                   | 4.2   | 3.2  | -    | 4.2              | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                   | -     | 0.8  | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                   | -     | 2.1  | 1.35 | -                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                   | -     | 2.8  | 1.8  | -                | 1.8  | -                 | 1.8  | 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> = −20 μA; V <sub>CC</sub> = 2.0 V                                          | 1.9   | 2.0  | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 4.5 V                                          | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 6.0 V                                          | 5.9   | 6.0  | -    | 5.9              | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = −4.0 mA; V <sub>CC</sub> = 4.5 V                                         | 3.98  | 4.32 | -    | 3.84             | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = −5.2 mA; V <sub>CC</sub> = 6.0 V                                         | 5.48  | 5.81 | -    | 5.34             | -    | 5.2               | -    | 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> = 20 μA; V <sub>CC</sub> = 2.0 V                                           | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                           | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                           | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                          | -     | 0.15 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                          | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 6.0 V                       | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | 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> = 6.0 V | -     | -    | 8.0  | -                | 80   | -                 | 160  | 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  |      |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                     | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |
| <b>74HCT238</b>  |                           |                                                                                                                                                                     |       |      |      |                  |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                    | 2.0   | 1.6  | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                                                                                    | -     | 1.2  | 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> = –20 µA                                                                                                                                             | 4.4   | 4.5  | -    | 4.4              | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = –4.0 mA                                                                                                                                            | 3.98  | 4.32 | -    | 3.84             | -    | 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> = 20 µA                                                                                                                                              | -     | 0    | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA                                                                                                                                             | -     | 0.16 | 0.26 | -                | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 5.5 V                                                                                                 | -     | -    | ±0.1 | -                | ±1.0 | -                 | ±1.0 | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A                                                                           | -     | -    | 8.0  | -                | 80   | -                 | 160  | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin;<br>V <sub>I</sub> = V <sub>CC</sub> – 2.1 V;<br>other inputs at V <sub>CC</sub> or GND;<br>V <sub>CC</sub> = 4.5 V to 5.5 V;<br>I <sub>O</sub> = 0 A |       |      |      |                  |      |                   |      |      |
|                  |                           | A <sub>n</sub> inputs                                                                                                                                               | -     | 70   | 252  | -                | 315  | -                 | 343  | µA   |
|                  |                           | $\overline{E}1$ , $\overline{E}2$ inputs                                                                                                                            | -     | 40   | 144  | -                | 180  | -                 | 196  | µA   |
|                  |                           | E3 input                                                                                                                                                            | -     | 145  | 522  | -                | 653  | -                 | 711  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                                                     | -     | 3.5  | -    | -                | -    | -                 | -    | pF   |

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ ; test circuit see [Figure 8](#).

| Symbol          | Parameter                     | Conditions                                                                            | 25 °C |     |     | −40 °C to +125 °C |                 | Unit |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------|-------|-----|-----|-------------------|-----------------|------|
|                 |                               |                                                                                       | Min   | Typ | Max | Max<br>(85 °C)    | Max<br>(125 °C) |      |
| 74HC238         |                               |                                                                                       |       |     |     |                   |                 |      |
| t <sub>pd</sub> | propagation delay             | An to Y <sub>n</sub> ; see <a href="#">Figure 6</a> <a href="#">[1]</a>               |       |     |     |                   |                 |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                               | -     | 47  | 150 | 190               | 225             | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 17  | 30  | 38                | 45              | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                       | -     | 14  | -   | -                 | -               | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                               | -     | 14  | 26  | 33                | 38              | ns   |
|                 |                               | E3 to Y <sub>n</sub> ; see <a href="#">Figure 6</a> <a href="#">[1]</a>               |       |     |     |                   |                 |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                               | -     | 52  | 160 | 200               | 240             | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 19  | 32  | 40                | 48              | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                       | -     | 16  | -   | -                 | -               | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                               | -     | 15  | 27  | 34                | 41              | ns   |
|                 |                               | $\overline{E}n$ to Y <sub>n</sub> or see <a href="#">Figure 7</a> <a href="#">[1]</a> |       |     |     |                   |                 |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                               | -     | 50  | 155 | 195               | 235             | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 18  | 31  | 39                | 47              | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                       | -     | 17  | -   | -                 | -               | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                               | -     | 14  | 26  | 33                | 40              | ns   |
| t <sub>t</sub>  | transition time               | see <a href="#">Figure 6</a> and <a href="#">Figure 7</a> <a href="#">[2]</a>         |       |     |     |                   |                 |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                                                               | -     | 19  | 75  | 95                | 110             | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                                                               | -     | 7   | 15  | 19                | 22              | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                                                               | -     | 6   | 13  | 16                | 19              | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per package; V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[3]</a>              | -     | 72  | -   | -                 | -               | pF   |

**Table 7. Dynamic characteristics**GND = 0 V; test circuit see [Figure 8](#).

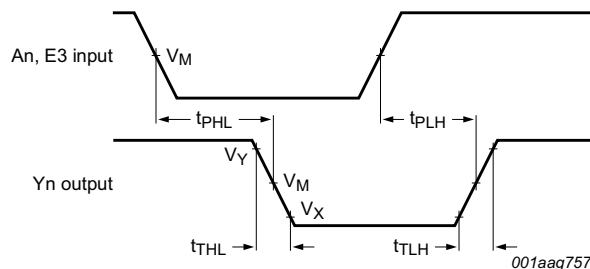
| Symbol          | Parameter                        | Conditions                                                                                           | 25 °C |     |     | −40 °C to +125 °C |                 | Unit |
|-----------------|----------------------------------|------------------------------------------------------------------------------------------------------|-------|-----|-----|-------------------|-----------------|------|
|                 |                                  |                                                                                                      | Min   | Typ | Max | Max<br>(85 °C)    | Max<br>(125 °C) |      |
| 74HCT238        |                                  |                                                                                                      |       |     |     |                   |                 |      |
| t <sub>pd</sub> | propagation delay                | An to Y <sub>n</sub> ; see <a href="#">Figure 6</a> <sup>[1]</sup>                                   |       |     |     |                   |                 |      |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                              | -     | 19  | 35  | 44                | 53              | ns   |
|                 |                                  | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                                      | -     | 18  | -   | -                 | -               | ns   |
|                 |                                  | E3 to Y <sub>n</sub> ; see <a href="#">Figure 6</a> <sup>[1]</sup>                                   |       |     |     |                   |                 |      |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                              | -     | 20  | 37  | 46                | 56              | ns   |
|                 |                                  | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                                      | -     | 20  | -   | -                 | -               | ns   |
|                 |                                  | $\overline{\text{E}}$ n to Y <sub>n</sub> or see <a href="#">Figure 7</a> <sup>[1]</sup>             |       |     |     |                   |                 |      |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                                              | -     | 20  | 35  | 44                | 53              | ns   |
|                 |                                  | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF                                                      | -     | 21  | -   | -                 | -               | ns   |
| t <sub>t</sub>  | transition time                  | V <sub>CC</sub> = 4.5 V;<br>see <a href="#">Figure 6</a> and <a href="#">Figure 7</a> <sup>[2]</sup> | -     | 7   | 15  | 19                | 22              | ns   |
| C <sub>PD</sub> | power dissipation<br>capacitance | per package;<br>V <sub>I</sub> = GND to V <sub>CC</sub> − 1.5 V <sup>[3]</sup>                       | -     | 76  | -   | -                 | -               | pF   |

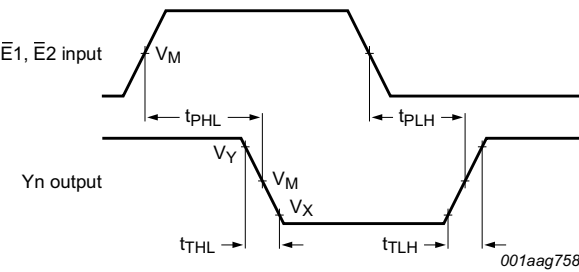
[1]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

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

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

## 11. Waveforms

Measurement points are given in [Table 8](#). $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.**Fig 6. Input (An, E3) to output (Yn) propagation delays and output transition times**



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

**Fig 7. Input ( $\bar{E}1, \bar{E}2$ ) to output ( $Y_n$ ) propagation delays and output transition times**

**Table 8. Measurement points**

| Type     | Input       | Output      |             |             |
|----------|-------------|-------------|-------------|-------------|
|          | $V_M$       | $V_M$       | $V_X$       | $V_Y$       |
| 74HC238  | $0.5V_{CC}$ | $0.5V_{CC}$ | $0.1V_{CC}$ | $0.9V_{CC}$ |
| 74HCT238 | 1.3 V       | 1.3 V       | $0.1V_{CC}$ | $0.9V_{CC}$ |

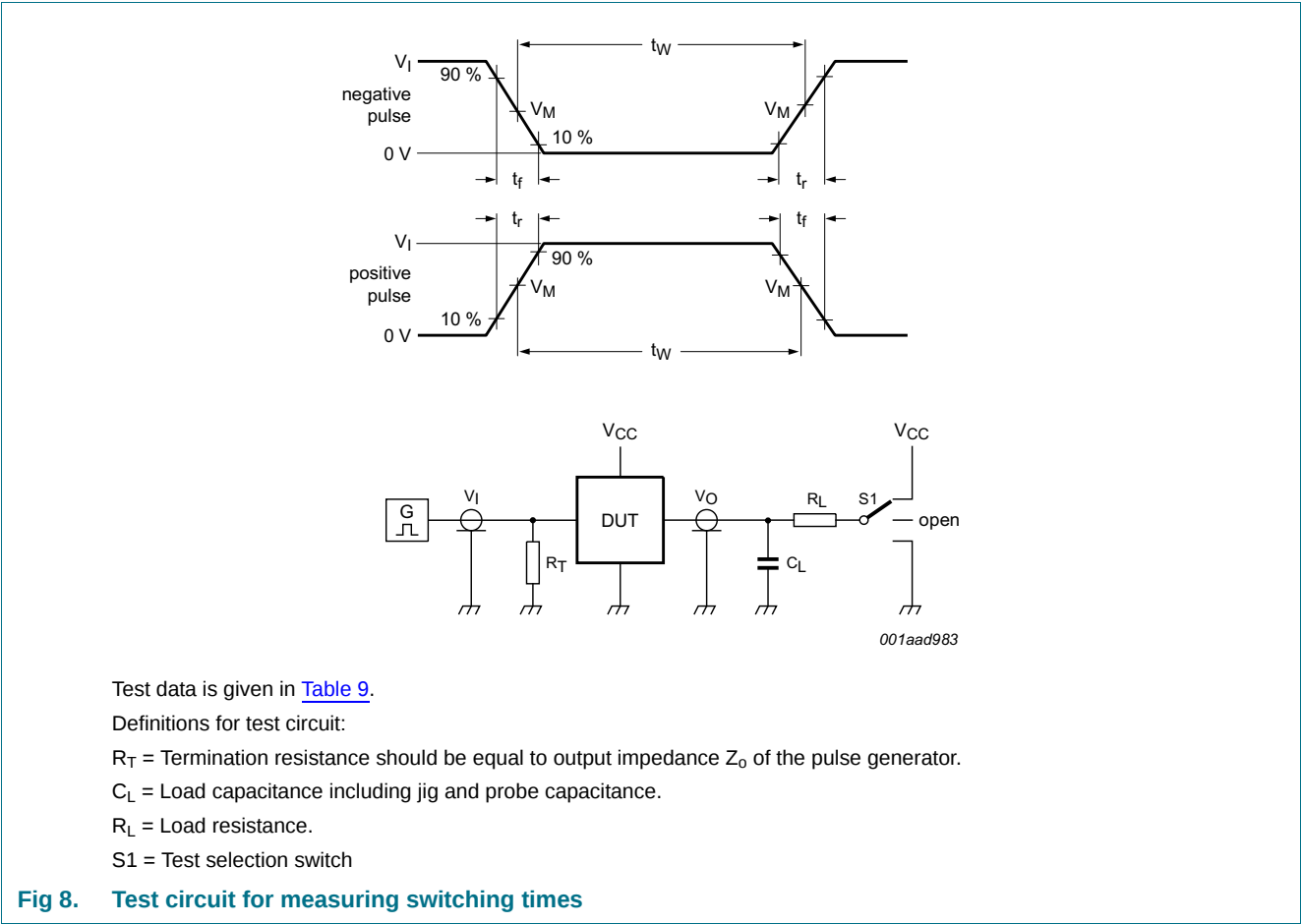


Table 9. Test data

| Type     | Input    |            | Load         |              | S1 position        |
|----------|----------|------------|--------------|--------------|--------------------|
|          | $V_I$    | $t_r, t_f$ | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ |
| 74HC238  | $V_{CC}$ | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               |
| 74HCT238 | 3 V      | 6 ns       | 15 pF, 50 pF | 1 k $\Omega$ | open               |

12. Package outline

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

SOT109-1

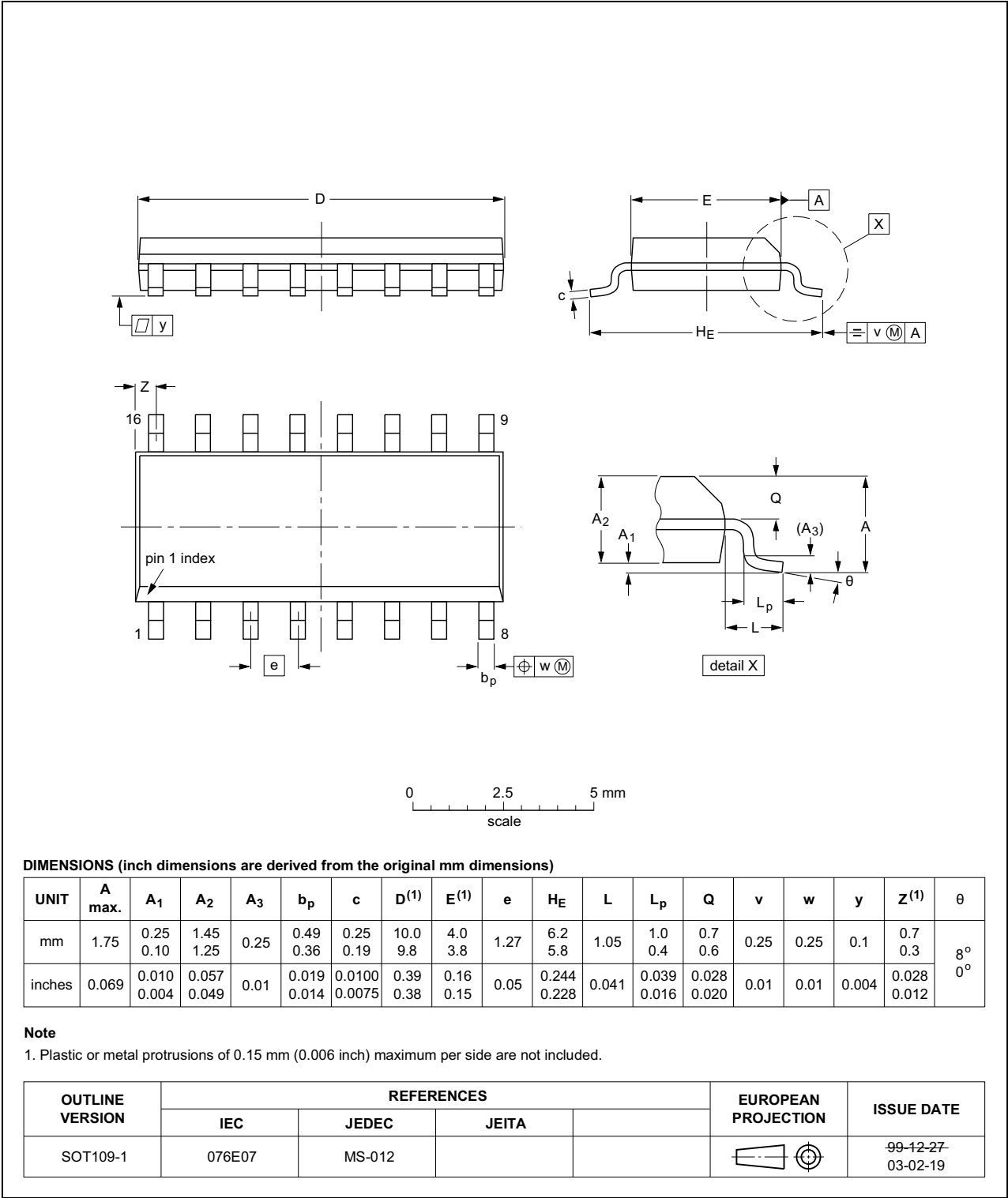


Fig 9. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

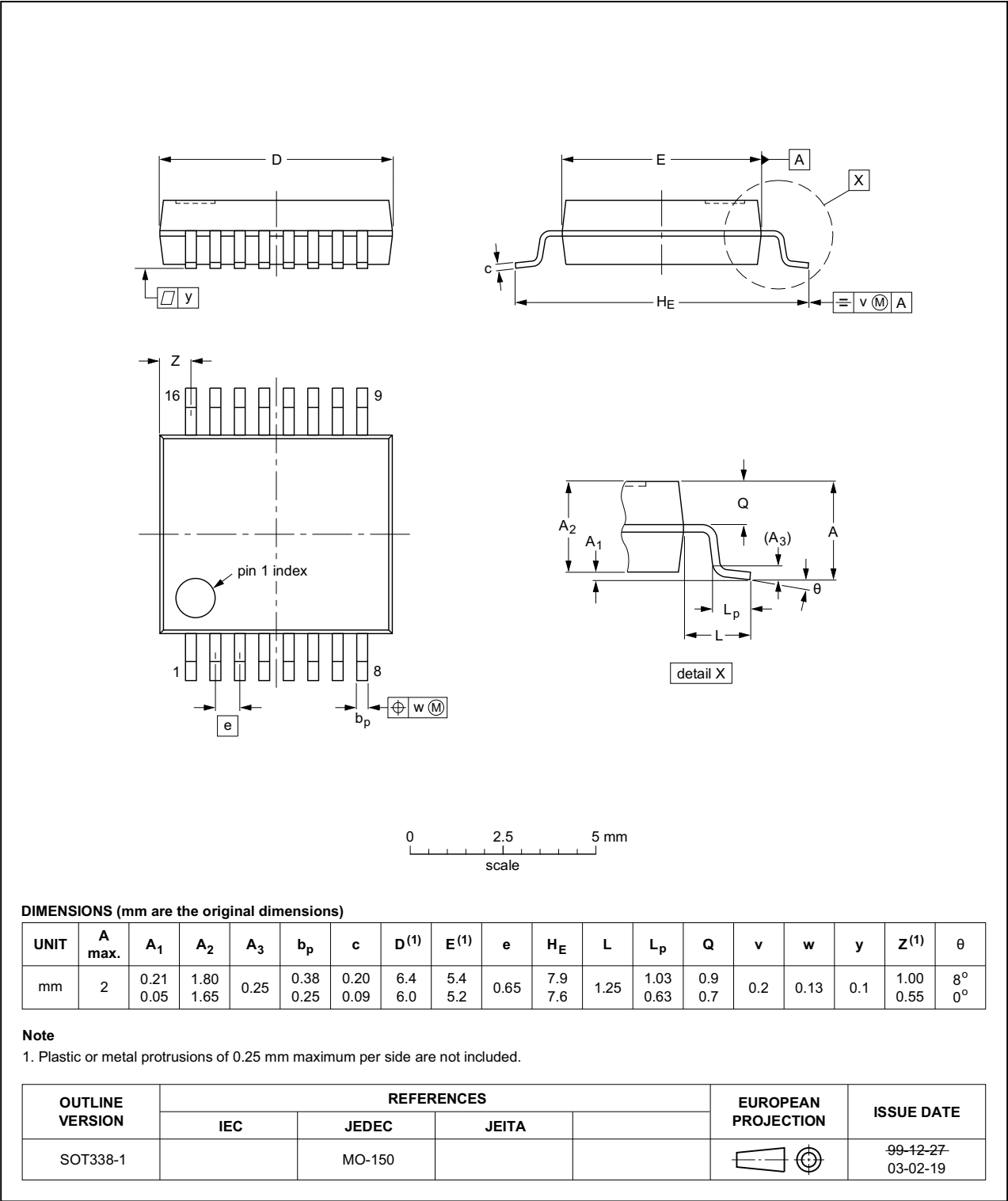


Fig 10. Package outline SOT338-1 (SSOP16)

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

SOT403-1

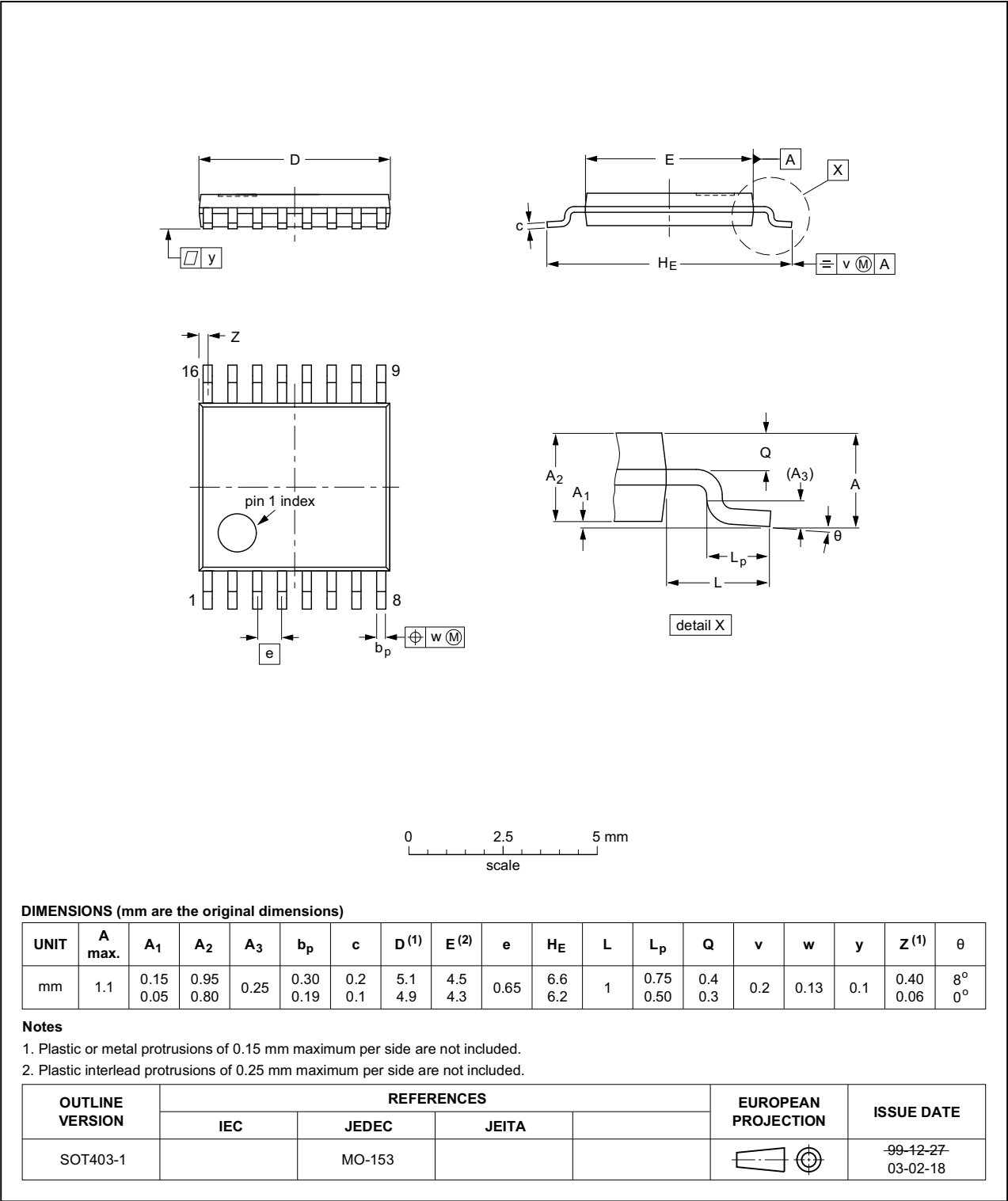
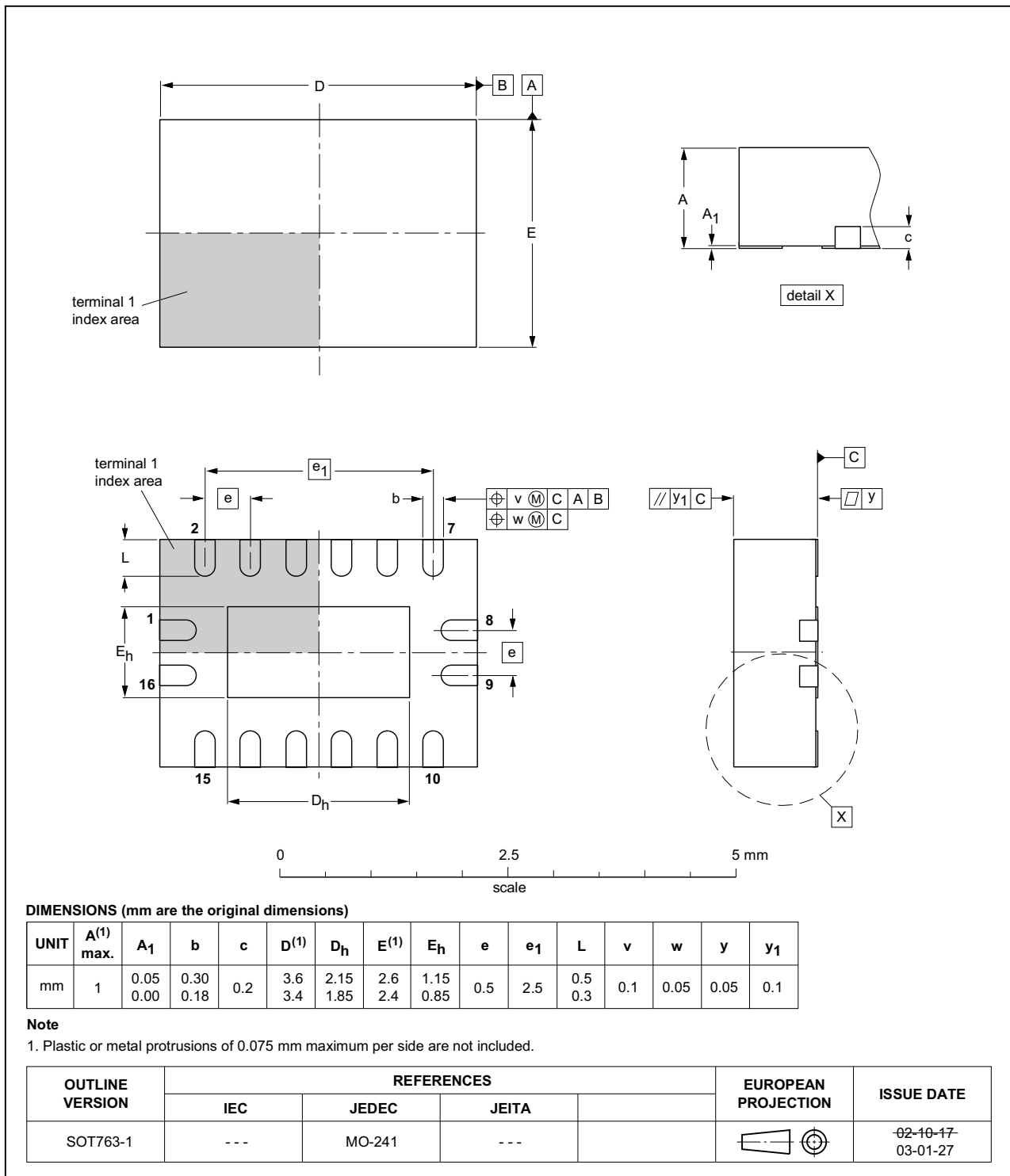


Fig 11. Package outline SOT403-1 (TSSOP16)

**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 12. Package outline SOT763-1 (DHVQFN16)**

## 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_HCT238 v.4     | 20160127                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT238 v.3     |
| Modifications:      | <ul style="list-style-type: none"><li>Type numbers 74HC238N and 74HCT238N (SOT38-4) removed.</li></ul>                                                                                                                                                                                                                     |                       |               |                     |
| 74HC_HCT238 v.3     | 20070716                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT238_CNV v.2 |
| Modifications:      | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Added type number 74HC238BQ and 74HCT238BQ (DHVQFN16 package)</li></ul> |                       |               |                     |
| 74HC_HCT238_CNV v.2 | 19970828                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -                   |

## 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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