

# 74LVC139

## Dual 2-to-4 line decoder/demultiplexer

Rev. 6 — 24 September 2021

Product data sheet

### 1. General description

The 74LVC139 decodes two binary weighted address inputs ( $nA0$ ,  $nA1$ ) to four mutually exclusive outputs ( $nY0$  to  $nY3$ ). Each decoder features an enable input ( $nE$ ). When  $nE$  is HIGH all outputs are forced HIGH. The enable input can be used as the data input for a 1-to-4 demultiplexer application. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

### 2. Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- CMOS low power dissipation
- Direct interface with TTL levels
- Demultiplexing capability
- Two independent 2-to-4 decoders
- Multifunction capability
- Mutually exclusive outputs
- Output drive capability 50  $\Omega$  transmission lines at 125 °C
- Complies with JEDEC standard:
  - JESD8-7A (1.65 V to 1.95 V)
  - JESD8-5A (2.3 V to 2.7 V)
  - JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-B exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Ordering information

Table 1. Ordering information

| Type number | Package           |          |  | Version  |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  |          |
| 74LVC139D   | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm   | SOT109-1 |
| 74LVC139PW  | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74LVC139BQ  | -40 °C to +125 °C | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |

### 4. Functional diagram

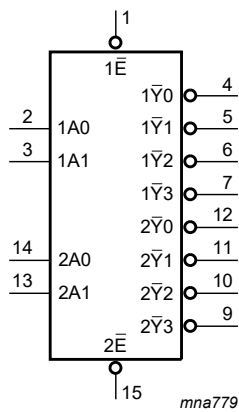
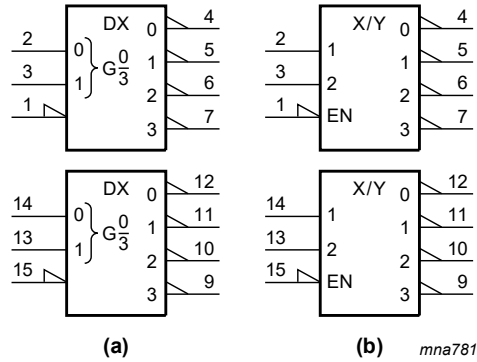


Fig. 1. Logic symbol



(a) demultiplexer  
(b) decoder

Fig. 2. IEC logic symbol

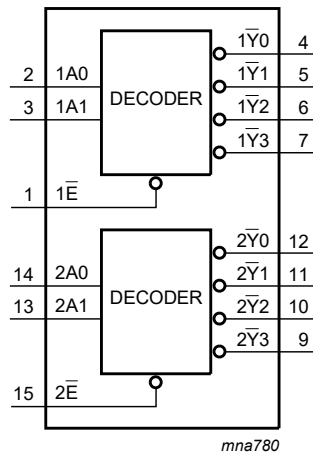
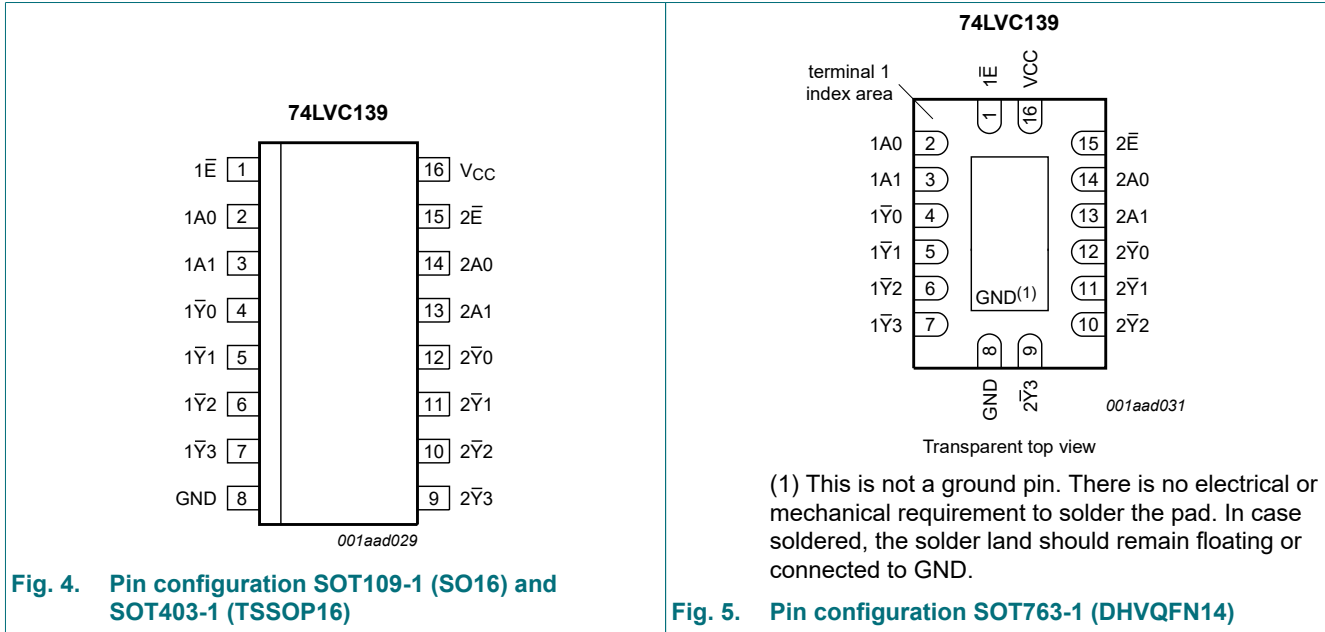


Fig. 3. Functional diagram

## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

| Name               | Pin           | Description               |
|--------------------|---------------|---------------------------|
| 1E                 | 1             | enable input (active LOW) |
| 2E                 | 15            | enable input (active LOW) |
| 1A0, 1A1           | 2, 3          | address input             |
| 2A0, 2A1           | 14, 13        | address input             |
| 1Y0, 1Y1, 1Y2, 1Y3 | 4, 5, 6, 7    | output                    |
| 2Y0, 2Y1, 2Y2, 2Y3 | 12, 11, 10, 9 | output                    |
| GND                | 8             | ground (0 V)              |
| VCC                | 16            | positive supply voltage   |

## 6. Functional description

Table 3. Function table

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

| Input |     |     | Output |     |     |     |
|-------|-----|-----|--------|-----|-----|-----|
| nE    | nA0 | nA1 | nY0    | nY1 | nY2 | nY3 |
| H     | X   | X   | H      | H   | H   | H   |
| L     | L   | L   | L      | H   | H   | H   |
| L     | H   | L   | H      | L   | H   | H   |
| L     | L   | H   | H      | H   | L   | H   |
| L     | 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 |
|-----------|-------------------------|-------------------------------|----------|----------------|------|
| $V_{CC}$  | supply voltage          |                               | -0.5     | +6.5           | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$                     | -50      | -              | mA   |
| $V_I$     | input voltage           |                               | [1] -0.5 | +6.5           | V    |
| $I_{OK}$  | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | -        | ±50            | mA   |
| $V_O$     | output voltage          |                               | [2] -0.5 | $V_{CC} + 0.5$ | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$       | -        | ±50            | mA   |
| $I_{CC}$  | supply current          |                               | -        | 100            | mA   |
| $I_{GND}$ | ground current          |                               | -100     | -              | mA   |
| $T_{stg}$ | storage temperature     |                               | -65      | +150           | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C | [3] -    | 500            | mW   |

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

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions                 | Min  | Typ | Max      | Unit |
|---------------------|-------------------------------------|----------------------------|------|-----|----------|------|
| $V_{CC}$            | supply voltage                      |                            | 1.65 | -   | 3.6      | V    |
|                     |                                     | functional                 | 1.2  | -   | -        | V    |
| $V_I$               | input voltage                       |                            | 0    | -   | 5.5      | V    |
| $V_O$               | output voltage                      |                            | 0    | -   | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 | in free air                | -40  |     | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65$ V to 2.7 V | 0    | -   | 20       | ns/V |
|                     |                                     | $V_{CC} = 2.7$ V to 3.6 V  | 0    | -   | 10       | ns/V |

## 9. Static characteristics

**Table 6. Static characteristics**

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

| Symbol          | Parameter                 | Conditions  | -40 °C to +85 °C          |   |                        | -40 °C to +125 °C      |                        | Unit |      |    |
|-----------------|---------------------------|---|---------------------------|---|------------------------|------------------------|------------------------|------|------|----|
|                 |                           |   | Min                       | Typ [1]   | Max                    | Min                    | Max                    |      |      |    |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 1.2 V                                     | 1.08                      | -   | -                      | 1.08                   | -                      | V    |      |    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | 0.65 × V <sub>CC</sub>    | -   | -                      | 0.65 × V <sub>CC</sub> | -                      | V    |      |    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | 1.7                       | -   | -                      | 1.7                    | -                      | V    |      |    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | 2.0                       | -   | -                      | 2.0                    | -                      | V    |      |    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 1.2 V                                     | -                         | -   | 0.12                   | -                      | 0.12                   | V    |      |    |
|                 |                           | V <sub>CC</sub> = 1.65 V to 1.95 V                          | -                         | -   | 0.35 × V <sub>CC</sub> | -                      | 0.35 × V <sub>CC</sub> | V    |      |    |
|                 |                           | V <sub>CC</sub> = 2.3 V to 2.7 V                            | -                         | -   | 0.7                    | -                      | 0.7                    | V    |      |    |
|                 |                           | V <sub>CC</sub> = 2.7 V to 3.6 V                            | -                         | -   | 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>         |                           |   |                        |                        |                        |      |      |    |
|                 |                           | I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V | V <sub>CC</sub> - 0.2     | -   | -                      | V <sub>CC</sub> - 0.3  | -                      | V    |      |    |
|                 |                           | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V            | 1.2                       | -   | -                      | 1.05                   | -                      | V    |      |    |
|                 |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V             | 1.8                       | -   | -                      | 1.65                   | -                      | V    |      |    |
|                 |                           | I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V            | 2.2                       | -   | -                      | 2.05                   | -                      | V    |      |    |
|                 |                           | I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V            | 2.4                       | -   | -                      | 2.25                   | -                      | 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> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V  | -                         | -   | 0.2                    | -                      | 0.3                    | V    |      |    |
|                 |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V             | -                         | -   | 0.45                   | -                      | 0.65                   | V    |      |    |
|                 |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V              | -                         | -   | 0.6                    | -                      | 0.8                    | V    |      |    |
|                 |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V             | -                         | -   | 0.4                    | -                      | 0.6                    | V    |      |    |
| I <sub>I</sub>  | input leakage current     | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V             | -                         | -   | 0.55                   | -                      | 0.8                    | V    |      |    |
|                 |                           | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND      | -                         | ±0.1  | ±5                     | -                      | ±20                    | μA   |      |    |
|                 |                           | I <sub>CC</sub>   | supply current            | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A                          | -                      | 0.1                    | 10                     | -    | 40   | μA |
|                 |                           | ΔI <sub>CC</sub>  | additional supply current | per input pin; V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A | -                      | 5                      | 500                    | -    | 5000 | μA |
|                 |                           | C <sub>I</sub>  | input capacitance         | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>   | -                      | 5.0                    | -                      | -    | -    | pF |

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 8.

| Symbol      | Parameter                     | Conditions                                  | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|-------------|-------------------------------|---|------------------|---------|------|-------------------|------|------|
|             |                               |   | Min              | Typ [1] | Max  | Min               | Max  |      |
| $t_{pd}$    | propagation delay             | nAn to $\bar{Y}n$ ; see Fig. 6 [2]          |                  |         |      |                   |      |      |
|             |                               | $V_{CC} = 1.2\text{ V}$                     | -                | 14      | -    | -                 | -    | ns   |
|             |                               | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$   | 0.5              | 4.7     | 10.4 | 0.5               | 11.3 | ns   |
|             |                               | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$     | 1.0              | 2.8     | 5.9  | 1.0               | 6.5  | ns   |
|             |                               | $V_{CC} = 2.7\text{ V}$                     | 1.0              | 3.0     | 6.3  | 1.0               | 8.0  | ns   |
|             |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$     | 1.0              | 2.5     | 5.3  | 1.0               | 7.0  | ns   |
|             |                               | n $\bar{E}$ to $\bar{Y}n$ ; see Fig. 7 [2]  |                  |         |      |                   |      |      |
|             |                               | $V_{CC} = 1.2\text{ V}$                     | -                | 14      | -    | -                 | -    | ns   |
|             |                               | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$   | 1.5              | 4.5     | 9.8  | 1.5               | 10.7 | ns   |
|             |                               | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$     | 2.1              | 2.7     | 5.6  | 2.1               | 6.1  | ns   |
|             |                               | $V_{CC} = 2.7\text{ V}$                     | 1.0              | 2.8     | 5.4  | 1.0               | 7.0  | ns   |
|             |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$     | 1.0              | 2.4     | 5.0  | 1.0               | 6.5  | ns   |
| $t_{sk(o)}$ | output skew time              | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [3] | -                | -       | 1.0  | -                 | 1.5  | ns   |
| $C_{PD}$    | power dissipation capacitance | $V_I = \text{GND to }V_{CC}$ [4]            |                  |         |      |                   |      |      |
|             |                               | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$   | -                | 5.6     | -    | -                 | -    | pF   |
|             |                               | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$     | -                | 11.3    | -    | -                 | -    | pF   |
|             |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$     | -                | 16.4    | -    | -                 | -    | pF   |

[1] Typical values are measured at  $T_{amb} = 25\text{ °C}$  and  $V_{CC} = 1.2\text{ V}, 1.8\text{ V}, 2.5\text{ V}, 2.7\text{ V},$  and  $3.3\text{ V}$  respectively.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4]  $C_{PD}$  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

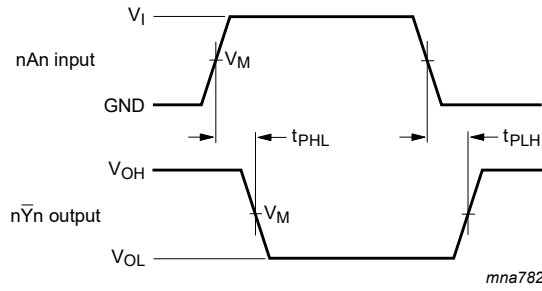
$C_L$  = output load capacitance in pF

$V_{CC}$  = supply voltage in V

$N$  = number of inputs switching,

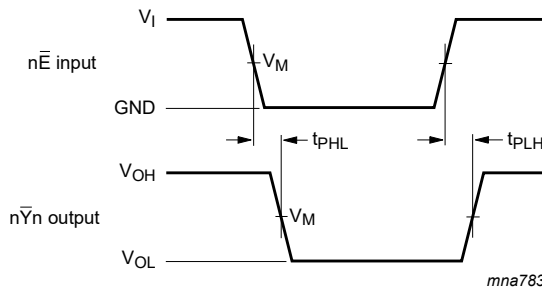
$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

10.1. Waveforms and test circuit



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

**Fig. 6. Input (nAn) to output (nYn) propagation delays**

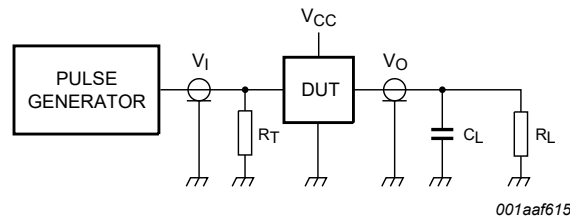
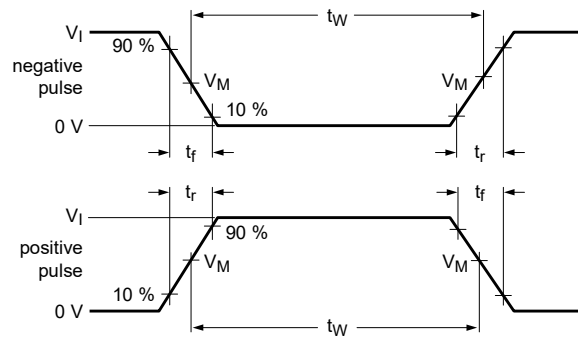


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage levels that occur with the output load.

**Fig. 7. Enable input (nE) to output (nYn) propagation delays**

**Table 8. Measurement points**

| Supply voltage   | Input    |                     | Output              |
|------------------|----------|---------------------|---------------------|
| $V_{CC}$         | $V_I$    | $V_M$               | $V_M$               |
| 1.2 V            | $V_{CC}$ | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 1.65 V to 1.95 V | $V_{CC}$ | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3 V to 2.7 V   | $V_{CC}$ | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7 V            | 2.7 V    | 1.5 V               | 1.5 V               |
| 3.0 V to 3.6 V   | 2.7 V    | 1.5 V               | 1.5 V               |



001aaf615

Test data is given in [Table 9](#).

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

**Fig. 8. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage   | Input    |               | Load  |              |
|------------------|----------|---------------|-------|--------------|
|                  | $V_I$    | $t_r, t_f$    | $C_L$ | $R_L$        |
| 1.2 V            | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 1 k $\Omega$ |
| 1.65 V to 1.95 V | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 1 k $\Omega$ |
| 2.3 V to 2.7 V   | $V_{CC}$ | $\leq 2$ ns   | 30 pF | 500 $\Omega$ |
| 2.7 V            | 2.7 V    | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ |
| 3.0 V to 3.6 V   | 2.7 V    | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ |



### 11. Package outline

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

SOT109-1

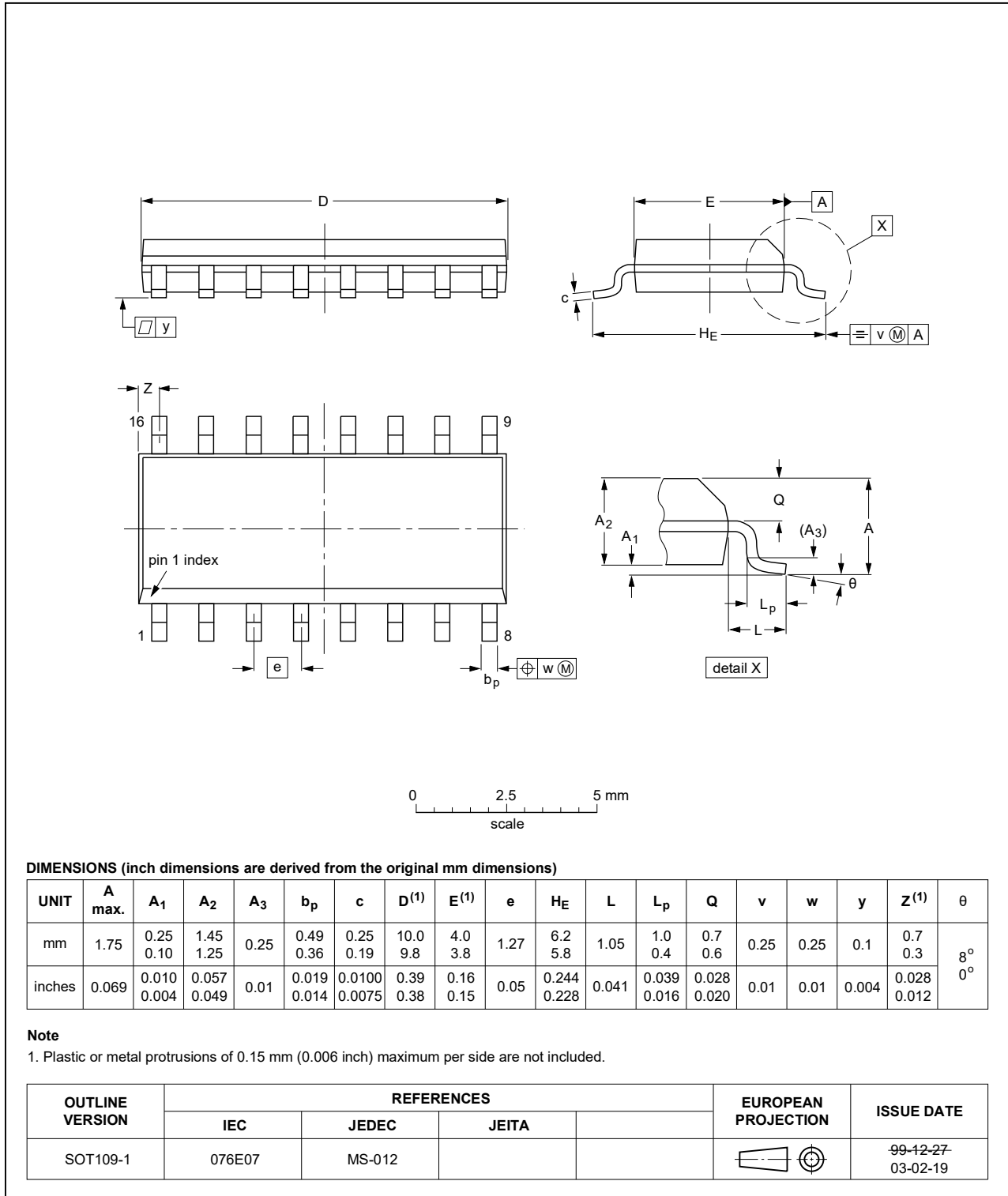


Fig. 9. Package outline SOT109-1 (SO16)

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

SOT403-1

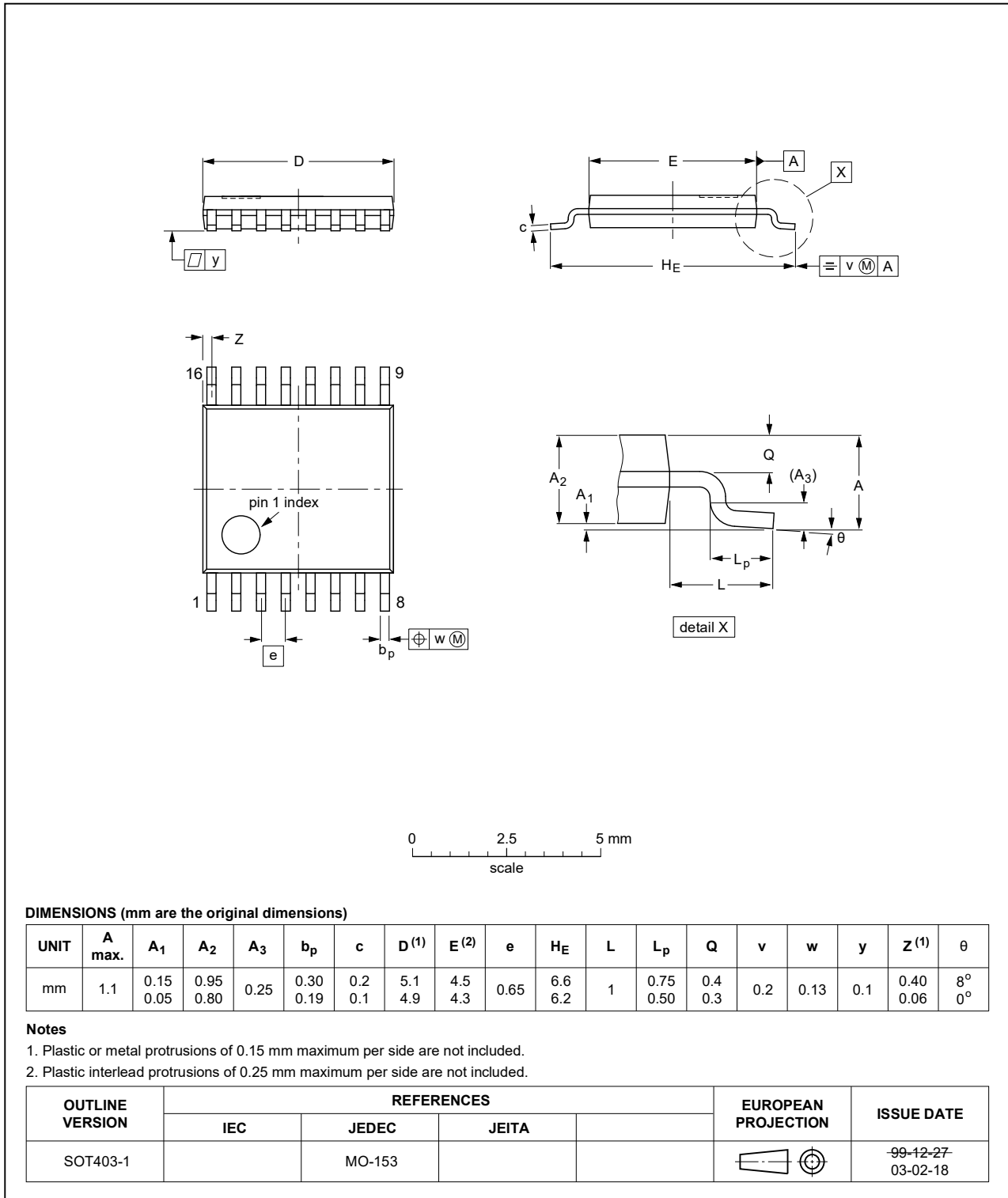


Fig. 10. Package outline SOT403-1 (TSSOP16)

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

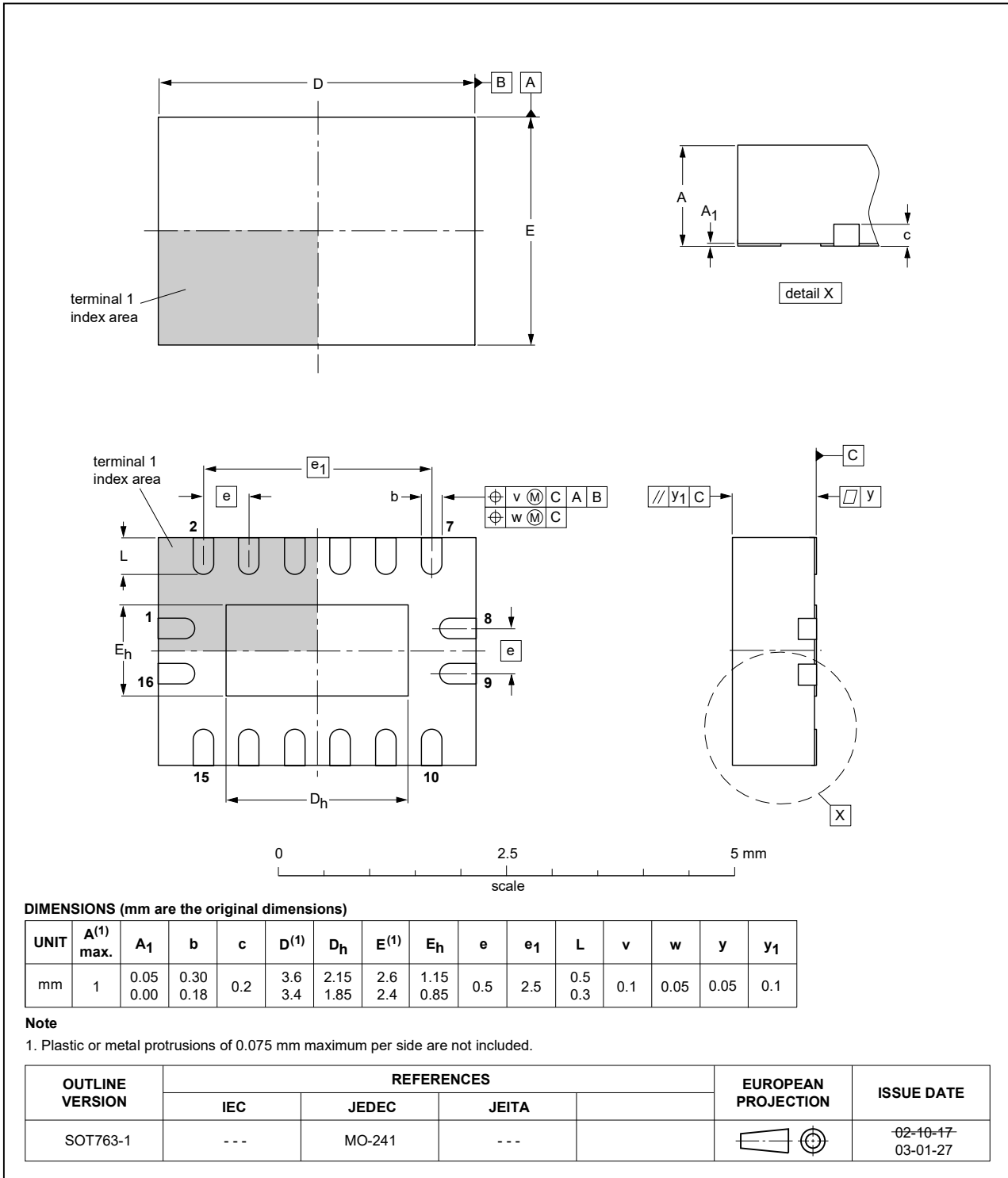


Fig. 11. Package outline SOT763-1 (DHVQFN16)

## 12. Abbreviations

Table 10. Abbreviations

| Acronym | Description                             |
|---------|---|
| CDM     | Charged Device Model                    |
| CMOS    | Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |
| TTL     | Transistor-Transistor Logic             |

## 13. Revision history

Table 11. Revision history

| Document ID    | Release date   | Data sheet status     | Change notice | Supersedes   |
|----------------|--|-----------------------|---------------|--------------|
| 74LVC139 v.6   | 20210924   | Product data sheet    | -             | 74LVC139 v.5 |
| 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 1</a> and <a href="#">Section 2</a> updated.</li> <li>Type number 74LVC139DB (SOT338-1/SSOP16) removed.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul> |                       |               |              |
| 74LVC139 v.5   | 20111019   | Product data sheet    | -             | 74LVC139 v.4 |
| 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><a href="#">Table 4</a>, <a href="#">Table 5</a>, <a href="#">Table 6</a>, <a href="#">Table 7</a> and <a href="#">Table 9</a>: values added for lower voltage ranges.</li> </ul>  |                       |               |              |
| 74LVC139 v.4   | 040315   | Product specification | -             | 74LVC139 v.3 |
| 74LVC139 v.3   | 030519   | Product specification | -             | 74LVC139 v.2 |
| 74LVC139 v.2   | 980428   | Product specification | -             | 74LVC139 v.1 |
| 74LVC139 v.1   | -  | -                     | -             | -            |

## 14. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [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 <https://www.nexperia.com>.

### Definitions

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