

# 74AVCH4T245-Q100

4-bit dual supply translating transceiver with configurable voltage translation; 3-state

Rev. 2 — 17 December 2015

Product data sheet

## 1. General description

The 74AVCH4T245-Q100 is a 4-bit, dual supply transceiver that enables bidirectional level translation. The device can be used as two 2-bit transceivers or as a 4-bit transceiver. It features two 2-bit input-output ports (nAn and nBn), a direction control input (nDIR), an output enable input (nOE) and dual supply pins ( $V_{CC(A)}$  and  $V_{CC(B)}$ ). Both  $V_{CC(A)}$  and  $V_{CC(B)}$  can be supplied with any voltage between 0.8 V and 3.6 V. This feature makes the device suitable for translating between any of the low voltage nodes (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V). Pins nAn, nOE and nDIR are referenced to  $V_{CC(A)}$  and pins nBn are referenced to  $V_{CC(B)}$ . A HIGH on nDIR allows transmission from nAn to nBn and a LOW on nDIR allows transmission from nBn to nAn. The output enable input (nOE) can be used to disable the outputs so the buses are effectively isolated.

The device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing any damaging backflow current through the device when it is powered down. In suspend mode when either  $V_{CC(A)}$  or  $V_{CC(B)}$  are at GND level, both nAn and nBn outputs are in the high-impedance OFF-state. The bus hold circuitry on the powered-up side always stays active.

The 74AVCH4T245-Q100 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

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  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Wide supply voltage range:
  - ◆  $V_{CC(A)}$ : 0.8 V to 3.6 V
  - ◆  $V_{CC(B)}$ : 0.8 V to 3.6 V
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)

- ESD protection:
  - ◆ MIL-STD-883, method 3015 Class 3B exceeds 8000 V
  - ◆ HBM JESD22-A114E Class 3B exceeds 8000 V
  - ◆ MM JESD22-A115-A exceeds 200 V (C = 200 pf, R = 0  $\Omega$ )
- Maximum data rates:
  - ◆ 380 Mbit/s ( $\geq$  1.8 V to 3.3 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 3.3 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 2.5 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 1.8 V translation)
  - ◆ 150 Mbit/s ( $\geq$  1.1 V to 1.5 V translation)
  - ◆ 100 Mbit/s ( $\geq$  1.1 V to 1.2 V translation)
- Suspend mode
- Bus hold on data inputs
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- I<sub>OFF</sub> circuitry provides partial Power-down mode operation
- Multiple package options

### 3. Ordering information

Table 1. Ordering information

| Type number        | Package           |          |  |          |
|--------------------|-------------------|----------|--|----------|
|                    | Temperature range | Name     | Description  | Version  |
| 74AVCH4T245D-Q100  | -40 °C to +125 °C | SO16     | plastic small outline package; 16 leads; body width 3.9 mm   | SOT109-1 |
| 74AVCH4T245PW-Q100 | -40 °C to +125 °C | TSSOP16  | plastic thin shrink small outline package; 16 leads; body width 4.4 mm   | SOT403-1 |
| 74AVCH4T245BQ-Q100 | -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. Marking

Table 2. Marking codes

| Type number        | Marking code |
|--------------------|--------------|
| 74AVCH4T245D-Q100  | 74AVCH4T245D |
| 74AVCH4T245PW-Q100 | CH4T245      |
| 74AVCH4T245BQ-Q100 | H4T245       |

## 5. Functional diagram

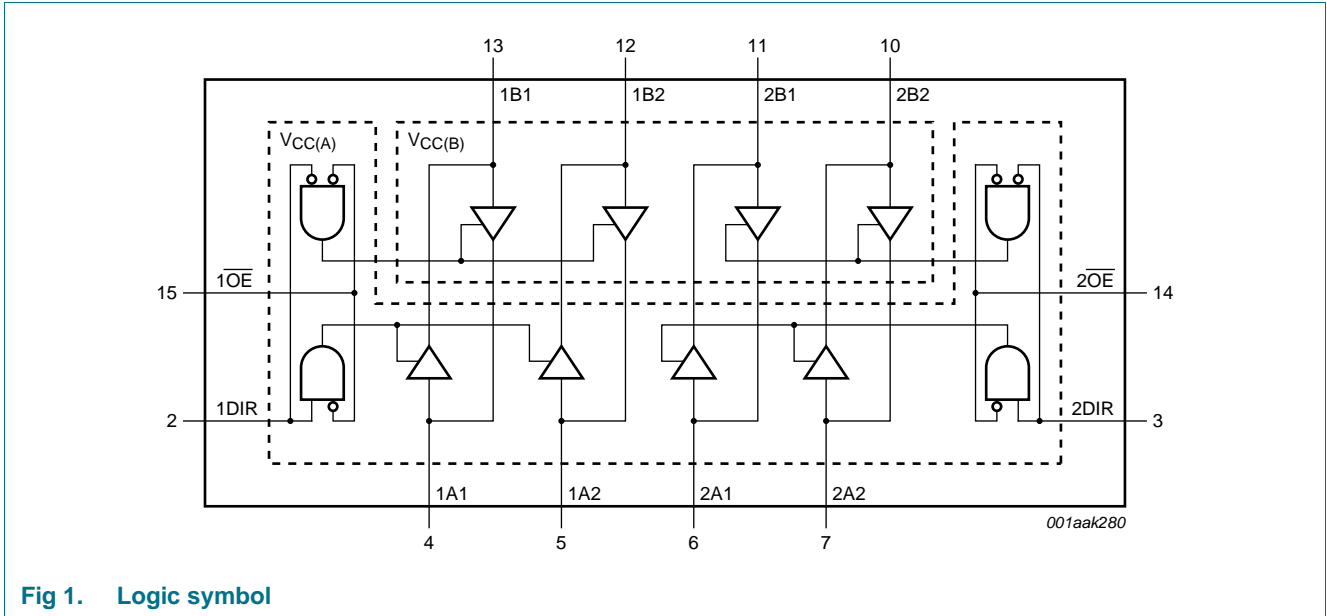


Fig 1. Logic symbol

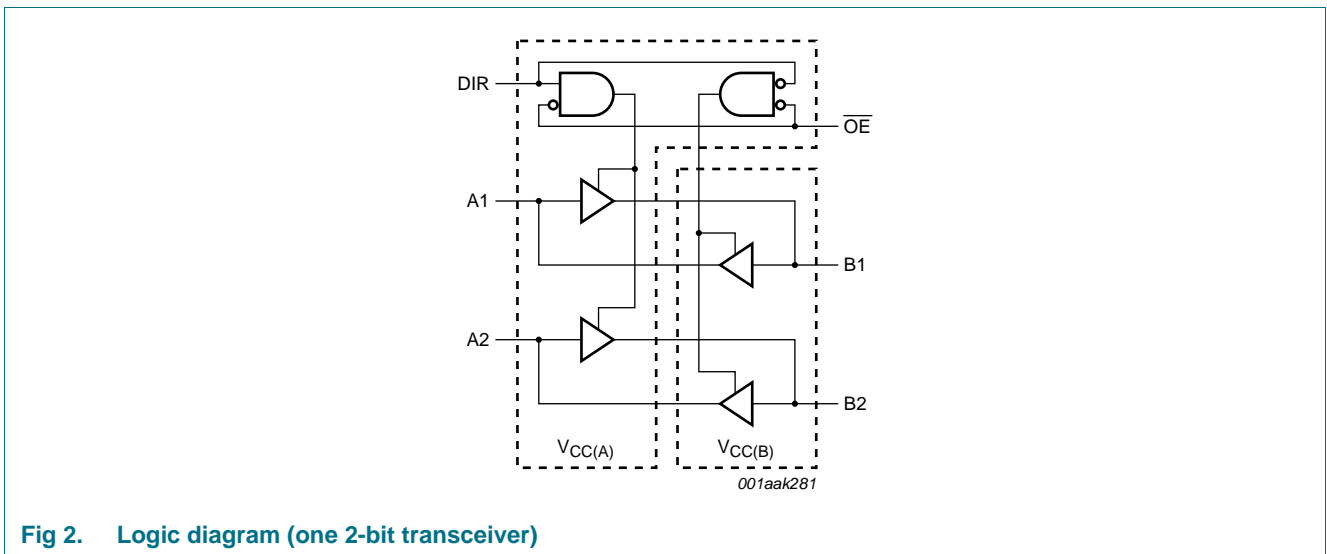
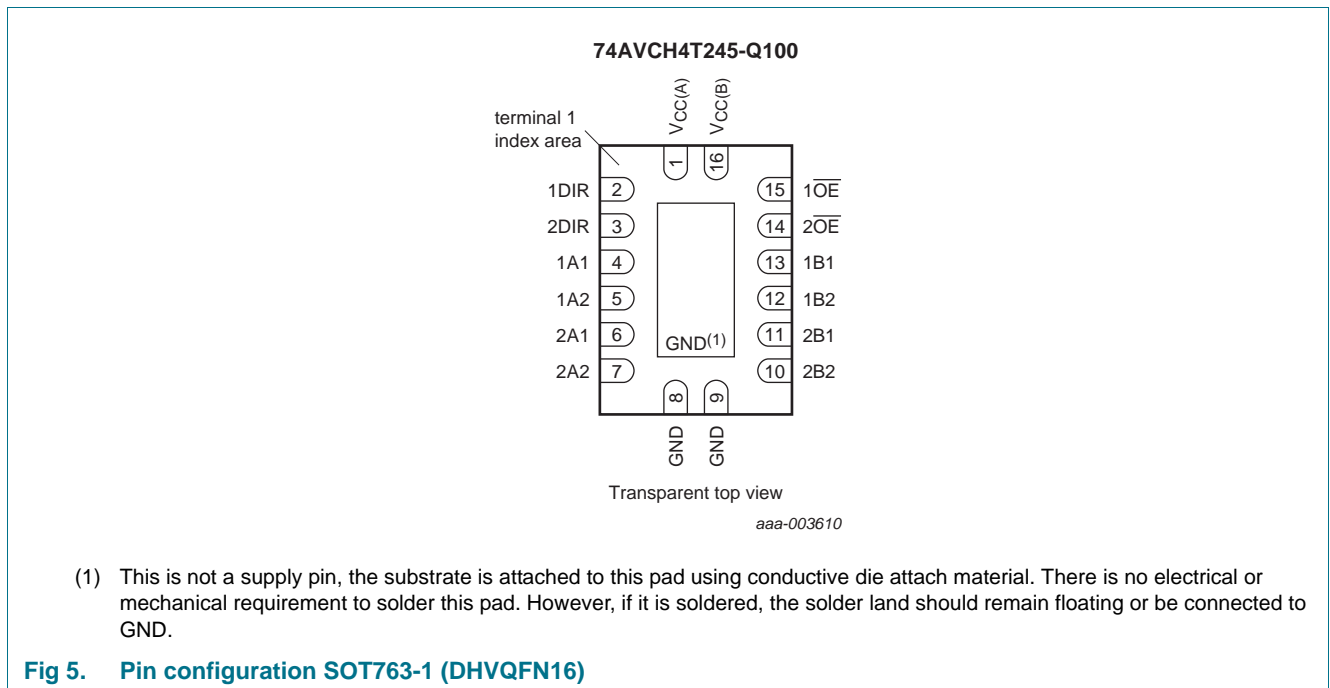
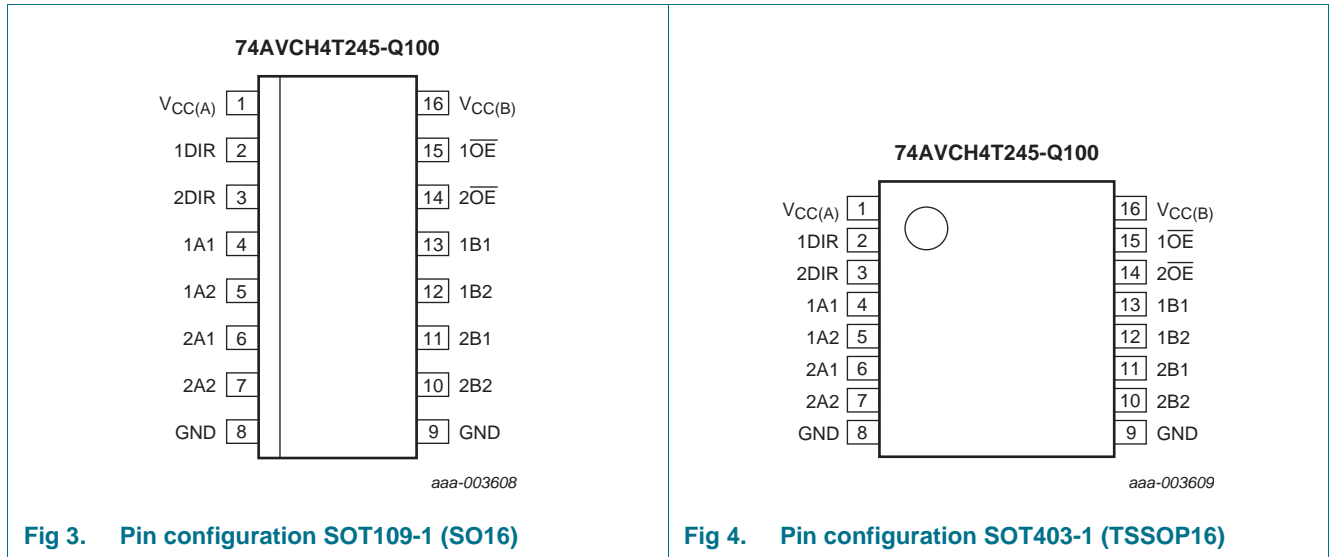


Fig 2. Logic diagram (one 2-bit transceiver)

## 6. Pinning information

### 6.1 Pinning



## 6.2 Pin description

Table 3. Pin description

| Symbol                              | Pin    | Description   |
|-------------------------------------|--------|---|
| $V_{CC(A)}$                         | 1      | supply voltage A (nAn, $\overline{nOE}$ and nDIR inputs are referenced to $V_{CC(A)}$ ) |
| 1DIR, 2DIR                          | 2, 3   | direction control   |
| 1A1, 1A2                            | 4, 5   | data input or output  |
| 2A1, 2A2                            | 6, 7   | data input or output  |
| GND <sup>[1]</sup>                  | 8, 9   | ground (0 V)  |
| 2B2, 2B1                            | 10, 11 | data input or output  |
| 1B2, 1B1                            | 12, 13 | data input or output  |
| $\overline{2OE}$ , $\overline{1OE}$ | 14, 15 | output enable input (active LOW)  |
| $V_{CC(B)}$                         | 16     | supply voltage B (nBn inputs are referenced to $V_{CC(B)}$ )                            |

[1] All GND pins must be connected to ground (0 V).

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

| Supply voltage     | Input                           |                     | Input/output <sup>[3]</sup> |                    |
|--------------------|---------------------------------|---------------------|-----------------------------|--------------------|
|                    | $\overline{nOE}$ <sup>[2]</sup> | nDIR <sup>[2]</sup> | nAn <sup>[2]</sup>          | nBn <sup>[2]</sup> |
| 0.8 V to 3.6 V     | L                               | L                   | nAn = nBn                   | input              |
| 0.8 V to 3.6 V     | L                               | H                   | input                       | nBn = nAn          |
| 0.8 V to 3.6 V     | H                               | X                   | Z                           | Z                  |
| GND <sup>[3]</sup> | X                               | X                   | Z                           | Z                  |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

[2] The nAn, nDIR and  $\overline{nOE}$  input circuit is referenced to  $V_{CC(A)}$ ; The nBn input circuit is referenced to  $V_{CC(B)}$ .

[3] If at least one of  $V_{CC(A)}$  or  $V_{CC(B)}$  is at GND level, the device goes into suspend mode.

## 8. Limiting values

**Table 5. 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 |
|-------------|-------------------------|------------------------------------|----------------|-----------------|------|
| $V_{CC(A)}$ | supply voltage A        |                                    | -0.5           | +4.6            | V    |
| $V_{CC(B)}$ | supply voltage B        |                                    | -0.5           | +4.6            | V    |
| $I_{IK}$    | input clamping current  | $V_I < 0$ V                        | -50            | -               | mA   |
| $V_I$       | input voltage           |                                    | [1] -0.5       | +4.6            | V    |
| $I_{OK}$    | output clamping current | $V_O < 0$ V                        | -50            | -               | mA   |
| $V_O$       | output voltage          | Active mode                        | [1][2][3] -0.5 | $V_{CCO} + 0.5$ | V    |
|             |                         | Suspend or 3-state mode            | [1] -0.5       | +4.6            | V    |
| $I_O$       | output current          | $V_O = 0$ V to $V_{CCO}$           | [2] -          | $\pm 50$        | mA   |
| $I_{CC}$    | supply current          | per $V_{CC(A)}$ or $V_{CC(B)}$ pin | -              | 100             | mA   |
| $I_{GND}$   | ground current          | per GND pin                        | -100           | -               | mA   |
| $T_{stg}$   | storage temperature     |                                    | -65            | +150            | °C   |
| $P_{tot}$   | total power dissipation | $T_{amb} = -40$ °C to +125 °C      |                |                 |      |
|             |                         | SO16, TSSOP16 and DHVQFN16         | [4] -          | 500             | mW   |

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

[2]  $V_{CCO}$  is the supply voltage associated with the output port.

[3]  $V_{CCO} + 0.5$  V should not exceed 4.6 V.

[4] For SO16 package: above 70 °C the value of  $P_{tot}$  derates linearly at 8 mW/K.

For TSSOP16 package: 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.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions                 | Min   | Max       | Unit |
|---------------------|-------------------------------------|----------------------------|-------|-----------|------|
| $V_{CC(A)}$         | supply voltage A                    |                            | 0.8   | 3.6       | V    |
| $V_{CC(B)}$         | supply voltage B                    |                            | 0.8   | 3.6       | V    |
| $V_I$               | input voltage                       |                            | 0     | 3.6       | V    |
| $V_O$               | output voltage                      | Active mode                | [1] 0 | $V_{CCO}$ | V    |
|                     |                                     | Suspend or 3-state mode    | 0     | 3.6       | V    |
| $T_{amb}$           | ambient temperature                 |                            | -40   | +125      | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CCI} = 0.8$ V to 3.6 V | [2] - | 5         | ns/V |

[1]  $V_{CCO}$  is the supply voltage associated with the output port.

[2]  $V_{CCI}$  is the supply voltage associated with the input port.

## 10. Static characteristics

**Table 7. Typical static characteristics at  $T_{amb} = 25\text{ °C}$  [1][2]**

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

| Symbol     | Parameter                       | Conditions   |     | Min | Typ         | Max        | Unit          |
|------------|---------------------------------|--|-----|-----|-------------|------------|---------------|
| $V_{OH}$   | HIGH-level output voltage       | $V_I = V_{IH}$ or $V_{IL}$   |     |     |             |            |               |
|            |                                 | $I_O = -1.5\text{ mA}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$  |     | -   | 0.69        | -          | V             |
| $V_{OL}$   | LOW-level output voltage        | $V_I = V_{IH}$ or $V_{IL}$   |     |     |             |            |               |
|            |                                 | $I_O = 1.5\text{ mA}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$   |     | -   | 0.07        | -          | V             |
| $I_I$      | input leakage current           | nDIR, nOE input; $V_I = 0\text{ V}$ or $3.6\text{ V}$ ;<br>$V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$ to $3.6\text{ V}$                |     | -   | $\pm 0.025$ | $\pm 0.25$ | $\mu\text{A}$ |
| $I_{BHL}$  | bus hold LOW current            | A or B port; $V_I = 0.42\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 1.2\text{ V}$  | [3] | -   | 26          | -          | $\mu\text{A}$ |
| $I_{BHH}$  | bus hold HIGH current           | A or B port; $V_I = 0.78\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 1.2\text{ V}$  | [4] | -   | -24         | -          | $\mu\text{A}$ |
| $I_{BHLO}$ | bus hold LOW overdrive current  | A or B port; $V_{CC(A)} = V_{CC(B)} = 1.2\text{ V}$  | [5] | -   | 27          | -          | $\mu\text{A}$ |
| $I_{BHHO}$ | bus hold HIGH overdrive current | A or B port; $V_{CC(A)} = V_{CC(B)} = 1.2\text{ V}$  | [6] | -   | -26         | -          | $\mu\text{A}$ |
| $I_{OZ}$   | OFF-state output current        | A or B port; $V_O = 0\text{ V}$ or $V_{CCO}$ ;<br>$V_{CC(A)} = V_{CC(B)} = 3.6\text{ V}$   | [7] | -   | $\pm 0.5$   | $\pm 2.5$  | $\mu\text{A}$ |
|            |                                 | suspend mode A port; $V_O = 0\text{ V}$ or $V_{CCO}$ ;<br>$V_{CC(A)} = 3.6\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$                    | [7] | -   | $\pm 0.5$   | $\pm 2.5$  | $\mu\text{A}$ |
|            |                                 | suspend mode B port; $V_O = 0\text{ V}$ or $V_{CCO}$ ;<br>$V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 3.6\text{ V}$                    | [7] | -   | $\pm 0.5$   | $\pm 2.5$  | $\mu\text{A}$ |
| $I_{OFF}$  | power-off leakage current       | A port; $V_I$ or $V_O = 0\text{ V}$ to $3.6\text{ V}$ ;<br>$V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 0.8\text{ V}$ to $3.6\text{ V}$ |     | -   | $\pm 0.1$   | $\pm 1$    | $\mu\text{A}$ |
|            |                                 | B port; $V_I$ or $V_O = 0\text{ V}$ to $3.6\text{ V}$ ;<br>$V_{CC(B)} = 0\text{ V}$ ; $V_{CC(A)} = 0.8\text{ V}$ to $3.6\text{ V}$ |     | -   | $\pm 0.1$   | $\pm 1$    | $\mu\text{A}$ |
| $C_I$      | input capacitance               | nDIR, nOE input; $V_I = 0\text{ V}$ or $3.3\text{ V}$ ;<br>$V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$                                  |     | -   | 1.0         | -          | pF            |
| $C_{I/O}$  | input/output capacitance        | A and B port; $V_O = 3.3\text{ V}$ or $0\text{ V}$ ;<br>$V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$                                     |     | -   | 4.0         | -          | pF            |

[1]  $V_{CCO}$  is the supply voltage associated with the output port.

[2]  $V_{CCI}$  is the supply voltage associated with the data input port.

[3] The bus hold circuit can sink at least the minimum low sustaining current at maximum  $V_{IL}$ .  $I_{BHL}$  should be measured after lowering  $V_I$  to GND and then raising it to maximum  $V_{IL}$ .

[4] The bus hold circuit can source at least the minimum high sustaining current at minimum  $V_{IH}$ .  $I_{BHH}$  should be measured after raising  $V_I$  to  $V_{CC}$  and then lowering it to minimum  $V_{IH}$ .

[5] An external driver must source at least  $I_{BHLO}$  to switch this node from LOW to HIGH.

[6] An external driver must sink at least  $I_{BHHO}$  to switch this node from HIGH to LOW.

[7] For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

**Table 8. Static characteristics** [1][2]

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                    | Max                    | Min                    | Max                    |      |
| V <sub>IH</sub> | HIGH-level input voltage  | data input   |                        |                        |                        |                        |      |
|                 |                           | V <sub>CCI</sub> = 0.8 V   | 0.70V <sub>CCI</sub>   | -                      | 0.70V <sub>CCI</sub>   | -                      | V    |
|                 |                           | V <sub>CCI</sub> = 1.1 V to 1.95 V   | 0.65V <sub>CCI</sub>   | -                      | 0.65V <sub>CCI</sub>   | -                      | V    |
|                 |                           | V <sub>CCI</sub> = 2.3 V to 2.7 V  | 1.6                    | -                      | 1.6                    | -                      | V    |
|                 |                           | V <sub>CCI</sub> = 3.0 V to 3.6 V  | 2                      | -                      | 2                      | -                      | V    |
|                 |                           | nDIR, n $\overline{\text{OE}}$ input   |                        |                        |                        |                        |      |
|                 |                           | V <sub>CC(A)</sub> = 0.8 V   | 0.70V <sub>CC(A)</sub> | -                      | 0.70V <sub>CC(A)</sub> | -                      | V    |
|                 |                           | V <sub>CC(A)</sub> = 1.1 V to 1.95 V   | 0.65V <sub>CC(A)</sub> | -                      | 0.65V <sub>CC(A)</sub> | -                      | V    |
| V <sub>IL</sub> | LOW-level input voltage   | data input   |                        |                        |                        |                        |      |
|                 |                           | V <sub>CCI</sub> = 0.8 V   | -                      | 0.30V <sub>CCI</sub>   | -                      | 0.30V <sub>CCI</sub>   | V    |
|                 |                           | V <sub>CCI</sub> = 1.1 V to 1.95 V   | -                      | 0.35V <sub>CCI</sub>   | -                      | 0.35V <sub>CCI</sub>   | V    |
|                 |                           | V <sub>CCI</sub> = 2.3 V to 2.7 V  | -                      | 0.7                    | -                      | 0.7                    | V    |
|                 |                           | V <sub>CCI</sub> = 3.0 V to 3.6 V  | -                      | 0.8                    | -                      | 0.8                    | V    |
|                 |                           | nDIR, n $\overline{\text{OE}}$ input   |                        |                        |                        |                        |      |
|                 |                           | V <sub>CC(A)</sub> = 0.8 V   | -                      | 0.30V <sub>CC(A)</sub> | -                      | 0.30V <sub>CC(A)</sub> | V    |
|                 |                           | V <sub>CC(A)</sub> = 1.1 V to 1.95 V   | -                      | 0.35V <sub>CC(A)</sub> | -                      | 0.35V <sub>CC(A)</sub> | 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 $\mu$ A;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V | V <sub>CCO</sub> - 0.1 | -                      | V <sub>CCO</sub> - 0.1 | -                      | V    |
|                 |                           | I <sub>O</sub> = -3 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.1 V                 | 0.85                   | -                      | 0.85                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -6 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V                 | 1.05                   | -                      | 1.05                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -8 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V                | 1.2                    | -                      | 1.2                    | -                      | V    |
|                 |                           | I <sub>O</sub> = -9 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V                 | 1.75                   | -                      | 1.75                   | -                      | V    |
|                 |                           | I <sub>O</sub> = -12 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V                | 2.3                    | -                      | 2.3                    | -                      | V    |



**Table 8. Static characteristics ...continued** [1][2]

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              | Max  | Min               | Max  |      |
| 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;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V                        | -                | 0.1  | -                 | 0.1  | V    |
|                   |                                 | I <sub>O</sub> = 3 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.1 V                                   | -                | 0.25 | -                 | 0.25 | V    |
|                   |                                 | I <sub>O</sub> = 6 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V                                   | -                | 0.35 | -                 | 0.35 | V    |
|                   |                                 | I <sub>O</sub> = 8 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V                                  | -                | 0.45 | -                 | 0.45 | V    |
|                   |                                 | I <sub>O</sub> = 9 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V                                   | -                | 0.55 | -                 | 0.55 | V    |
|                   |                                 | I <sub>O</sub> = 12 mA;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V                                  | -                | 0.7  | -                 | 0.7  | V    |
| I <sub>I</sub>    | input leakage current           | nDIR, nOE input; V <sub>I</sub> = 0 V or 3.6 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V | -                | ±1   | -                 | ±5   | μA   |
| I <sub>BHL</sub>  | bus hold LOW current            | A or B port [3]   |                  |      |                   |      |      |
|                   |                                 | V <sub>I</sub> = 0.49 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V                                 | 15               | -    | 15                | -    | μA   |
|                   |                                 | V <sub>I</sub> = 0.58 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V                                | 25               | -    | 25                | -    | μA   |
|                   |                                 | V <sub>I</sub> = 0.70 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V                                 | 45               | -    | 45                | -    | μA   |
|                   |                                 | V <sub>I</sub> = 0.80 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V                                 | 100              | -    | 90                | -    | μA   |
| I <sub>BHH</sub>  | bus hold HIGH current           | A or B port [4]   |                  |      |                   |      |      |
|                   |                                 | V <sub>I</sub> = 0.91 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V                                 | -15              | -    | -15               | -    | μA   |
|                   |                                 | V <sub>I</sub> = 1.07 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V                                | -25              | -    | -25               | -    | μA   |
|                   |                                 | V <sub>I</sub> = 1.60 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V                                 | -45              | -    | -45               | -    | μA   |
|                   |                                 | V <sub>I</sub> = 2.00 V;<br>V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V                                 | -100             | -    | -100              | -    | μA   |
| I <sub>BHLO</sub> | bus hold LOW overdrive current  | A or B port [5]   |                  |      |                   |      |      |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.6 V   | 125              | -    | 125               | -    | μA   |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.95 V  | 200              | -    | 200               | -    | μA   |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.7 V   | 300              | -    | 300               | -    | μA   |
| I <sub>BHHO</sub> | bus hold HIGH overdrive current | A or B port [6]   |                  |      |                   |      |      |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.6 V   | -125             | -    | -125              | -    | μA   |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.95 V  | -200             | -    | -200              | -    | μA   |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.7 V   | -300             | -    | -300              | -    | μA   |
|                   |                                 | V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.6 V   | -500             | -    | -500              | -    | μA   |

**Table 8. Static characteristics ...continued** [1][2]

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              | Max | Min               | Max |      |    |
| I <sub>OZ</sub>  | OFF-state output current  | A or B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.6 V   | [7]              | -   | ±5                | -   | ±30  | μA |
|                  |                           | suspend mode A port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V  | [7]              | -   | ±5                | -   | ±30  | μA |
|                  |                           | suspend mode B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V  | [7]              | -   | ±5                | -   | ±30  | μA |
| I <sub>OFF</sub> | power-off leakage current | A port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V  |                  | -   | ±5                | -   | ±30  | μA |
|                  |                           | B port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(B)</sub> = 0 V; V <sub>CC(A)</sub> = 0.8 V to 3.6 V  |                  | -   | ±5                | -   | ±30  | μA |
| I <sub>CC</sub>  | supply current            | A port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A   |                  |     |                   |     |      |    |
|                  |                           | V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V  |                  | -   | 10                | -   | 55   | μA |
|                  |                           | V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V  |                  | -   | 8                 | -   | 50   | μA |
|                  |                           | V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V  |                  | -   | 8                 | -   | 50   | μA |
|                  |                           | V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V  |                  | -2  | -                 | -12 | -    | μA |
|                  |                           | B port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A   |                  |     |                   |     |      |    |
|                  |                           | V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V  |                  | -   | 10                | -   | 55   | μA |
|                  |                           | V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V  |                  | -   | 8                 | -   | 50   | μA |
|                  |                           | V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V  |                  | -2  | -                 | -12 | -    | μA |
|                  |                           | V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V  |                  | -   | 8                 | -   | 50   | μA |
|                  |                           | A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V |                  | -   | 20                | -   | 70   | μA |
|                  |                           | A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V |                  | -   | 16                | -   | 65   | μA |

[1] V<sub>CCO</sub> is the supply voltage associated with the output port.[2] V<sub>CCI</sub> is the supply voltage associated with the data input port.[3] The bus hold circuit can sink at least the minimum low sustaining current at maximum V<sub>IL</sub>. I<sub>BHL</sub> should be measured after lowering V<sub>I</sub> to GND and then raising it to maximum V<sub>IL</sub>.[4] The bus hold circuit can source at least the minimum high sustaining current at minimum V<sub>IH</sub>. I<sub>BHH</sub> should be measured after raising V<sub>I</sub> to V<sub>CC</sub> and then lowering it to minimum V<sub>IH</sub>.[5] An external driver must source at least I<sub>BHLO</sub> to switch this node from LOW to HIGH.[6] An external driver must sink at least I<sub>BHHO</sub> to switch this node from HIGH to LOW.[7] For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

Table 9. Typical total supply current ( $I_{CC(A)} + I_{CC(B)}$ )

| $V_{CC(A)}$ | $V_{CC(B)}$ |       |       |       |       |       |       | Unit          |
|-------------|-------------|-------|-------|-------|-------|-------|-------|---------------|
|             | 0 V         | 0.8 V | 1.2 V | 1.5 V | 1.8 V | 2.5 V | 3.3 V |               |
| 0 V         | 0           | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | $\mu\text{A}$ |
| 0.8 V       | 0.1         | 0.1   | 0.1   | 0.1   | 0.1   | 0.3   | 1.6   | $\mu\text{A}$ |
| 1.2 V       | 0.1         | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.8   | $\mu\text{A}$ |
| 1.5 V       | 0.1         | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.4   | $\mu\text{A}$ |
| 1.8 V       | 0.1         | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.2   | $\mu\text{A}$ |
| 2.5 V       | 0.1         | 0.3   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | $\mu\text{A}$ |
| 3.3 V       | 0.1         | 1.6   | 0.8   | 0.4   | 0.2   | 0.1   | 0.1   | $\mu\text{A}$ |

## 11. Dynamic characteristics

Table 10. Typical power dissipation capacitance at  $V_{CC(A)} = V_{CC(B)}$  and  $T_{\text{amb}} = 25\text{ }^\circ\text{C}$  [\[1\]](#)[\[2\]](#)

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

| Symbol   | Parameter                     | Conditions                                      | $V_{CC(A)} = V_{CC(B)}$ |       |       |       |       |       | Unit |
|----------|-------------------------------|---|-------------------------|-------|-------|-------|-------|-------|------|
|          |                               |   | 0.8 V                   | 1.2 V | 1.5 V | 1.8 V | 2.5 V | 3.3 V |      |
| $C_{PD}$ | power dissipation capacitance | A port: (direction nAn to nBn); output enabled  | 0.2                     | 0.2   | 0.2   | 0.2   | 0.3   | 0.4   | pF   |
|          |                               | A port: (direction nAn to nBn); output disabled | 0.2                     | 0.2   | 0.2   | 0.2   | 0.3   | 0.4   | pF   |
|          |                               | A port: (direction nBn to nAn); output enabled  | 9.5                     | 9.7   | 9.8   | 9.9   | 10.7  | 11.9  | pF   |
|          |                               | A port: (direction nBn to nAn); output disabled | 0.6                     | 0.6   | 0.6   | 0.6   | 0.7   | 0.7   | pF   |
|          |                               | B port: (direction nAn to nBn); output enabled  | 9.5                     | 9.7   | 9.8   | 9.9   | 10.7  | 11.9  | pF   |
|          |                               | B port: (direction nAn to nBn); output disabled | 0.6                     | 0.6   | 0.6   | 0.6   | 0.7   | 0.7   | pF   |
|          |                               | B port: (direction nBn to nAn); output enabled  | 0.2                     | 0.2   | 0.2   | 0.2   | 0.3   | 0.4   | pF   |
|          |                               | B port: (direction nBn to nAn); output disabled | 0.2                     | 0.2   | 0.2   | 0.2   | 0.3   | 0.4   | pF   |

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

[2]  $f_i = 10\text{ MHz}$ ;  $V_i = \text{GND to } V_{CC}$ ;  $t_r = t_f = 1\text{ ns}$ ;  $C_L = 0\text{ pF}$ ;  $R_L = \infty\ \Omega$ .

**Table 11. Typical dynamic characteristics at  $V_{CC(A)} = 0.8\text{ V}$  and  $T_{amb} = 25\text{ °C}$** 

Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 8](#); for wave forms, see [Figure 6](#) and [Figure 7](#)

| Symbol    | Parameter         | Conditions              | $V_{CC(B)}$ |       |       |       |       |       | Unit |
|-----------|-------------------|-------------------------|-------------|-------|-------|-------|-------|-------|------|
|           |                   |                         | 0.8 V       | 1.2 V | 1.5 V | 1.8 V | 2.5 V | 3.3 V |      |
| $t_{pd}$  | propagation delay | nAn to nBn              | 14.5        | 7.3   | 6.5   | 6.2   | 5.9   | 6.0   | ns   |
|           |                   | nBn to nAn              | 14.5        | 12.7  | 12.4  | 12.3  | 12.1  | 12.0  | ns   |
| $t_{dis}$ | disable time      | $\overline{nOE}$ to nAn | 14.3        | 14.3  | 14.3  | 14.3  | 14.3  | 14.3  | ns   |
|           |                   | $\overline{nOE}$ to nBn | 17.0        | 9.9   | 9.0   | 9.4   | 9.0   | 9.7   | ns   |
| $t_{en}$  | enable time       | $\overline{nOE}$ to nAn | 18.2        | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | ns   |
|           |                   | $\overline{nOE}$ to nBn | 19.2        | 10.7  | 9.8   | 9.6   | 9.7   | 10.2  | ns   |

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

**Table 12. Typical dynamic characteristics at  $V_{CC(B)} = 0.8\text{ V}$  and  $T_{amb} = 25\text{ °C}$** 

Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 8](#); for wave forms, see [Figure 6](#) and [Figure 7](#)

| Symbol    | Parameter         | Conditions              | $V_{CC(A)}$ |       |       |       |       |       | Unit |
|-----------|-------------------|-------------------------|-------------|-------|-------|-------|-------|-------|------|
|           |                   |                         | 0.8 V       | 1.2 V | 1.5 V | 1.8 V | 2.5 V | 3.3 V |      |
| $t_{pd}$  | propagation delay | nAn to nBn              | 14.5        | 12.7  | 12.4  | 12.3  | 12.1  | 12.0  | ns   |
|           |                   | nBn to nAn              | 14.5        | 7.3   | 6.5   | 6.2   | 5.9   | 6.0   | ns   |
| $t_{dis}$ | disable time      | $\overline{nOE}$ to nAn | 14.3        | 5.5   | 4.1   | 4.0   | 3.0   | 3.5   | ns   |
|           |                   | $\overline{nOE}$ to nBn | 17.0        | 13.8  | 13.4  | 13.1  | 12.9  | 12.7  | ns   |
| $t_{en}$  | enable time       | $\overline{nOE}$ to nAn | 18.2        | 5.6   | 4.0   | 3.2   | 2.4   | 2.2   | ns   |
|           |                   | $\overline{nOE}$ to nBn | 19.2        | 14.6  | 14.1  | 13.9  | 13.7  | 13.6  | ns   |

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

**Table 13. Dynamic characteristics for temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  [1]**Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 8](#); for wave forms, see [Figure 6](#) and [Figure 7](#).

| Symbol   | Parameter         | Conditions                     | $V_{CC(B)}$                     |      |                                 |      |                                  |      |                                 |      |                                 |      | Unit |
|--|-------------------|--------------------------------|---------------------------------|------|---------------------------------|------|----------------------------------|------|---------------------------------|------|---------------------------------|------|------|
|  |                   |                                | $1.2\text{ V} \pm 0.1\text{ V}$ |      | $1.5\text{ V} \pm 0.1\text{ V}$ |      | $1.8\text{ V} \pm 0.15\text{ V}$ |      | $2.5\text{ V} \pm 0.2\text{ V}$ |      | $3.3\text{ V} \pm 0.3\text{ V}$ |      |      |
|  |                   |                                | Min                             | Max  | Min                             | Max  | Min                              | Max  | Min                             | Max  | Min                             | Max  |      |
| <b><math>V_{CC(A)} = 1.1\text{ V to }1.3\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.5                             | 9.4  | 0.5                             | 7.1  | 0.5                              | 6.2  | 0.5                             | 5.2  | 0.5                             | 5.1  | ns   |
|  |                   | nBn to nAn                     | 0.5                             | 9.4  | 0.5                             | 8.9  | 0.5                              | 8.7  | 0.5                             | 8.4  | 0.5                             | 8.2  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 10.9 | 1.8                             | 10.9 | 1.8                              | 10.9 | 1.8                             | 10.9 | 1.8                             | 10.9 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.9                             | 12.4 | 1.9                             | 9.6  | 1.9                              | 9.5  | 1.4                             | 8.1  | 1.2                             | 9.1  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.4                             | 12.8 | 1.4                             | 12.8 | 1.4                              | 12.8 | 1.4                             | 12.8 | 1.4                             | 12.8 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.1                             | 13.3 | 1.1                             | 10.0 | 1.1                              | 8.9  | 1.0                             | 7.9  | 1.0                             | 7.7  | ns   |
| <b><math>V_{CC(A)} = 1.4\text{ V to }1.6\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.3                             | 8.9  | 0.3                             | 6.3  | 0.3                              | 5.2  | 0.3                             | 4.2  | 0.3                             | 4.2  | ns   |
|  |                   | nBn to nAn                     | 0.7                             | 7.1  | 0.7                             | 6.3  | 0.5                              | 6.0  | 0.4                             | 5.7  | 0.3                             | 5.6  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 10.2 | 1.8                             | 10.2 | 1.5                              | 10.2 | 1.3                             | 10.2 | 1.6                             | 10.2 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.9                             | 11.3 | 1.9                             | 10.3 | 1.9                              | 9.1  | 1.4                             | 7.4  | 1.2                             | 7.6  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.1                             | 9.4  | 1.4                             | 9.4  | 1.1                              | 9.4  | 0.7                             | 9.4  | 0.4                             | 9.4  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.4                             | 12.1 | 1.4                             | 9.6  | 1.1                              | 7.7  | 0.9                             | 5.8  | 0.9                             | 5.6  | ns   |
| <b><math>V_{CC(A)} = 1.65\text{ V to }1.95\text{ V}</math></b> |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 8.7  | 0.1                             | 6.0  | 0.1                              | 4.9  | 0.1                             | 3.9  | 0.3                             | 3.9  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 6.2  | 0.6                             | 5.3  | 0.5                              | 4.9  | 0.3                             | 4.6  | 0.3                             | 4.5  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 8.6  | 1.6                             | 8.6  | 1.8                              | 8.6  | 1.3                             | 8.6  | 1.6                             | 8.6  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.7                             | 10.9 | 1.7                             | 9.9  | 1.6                              | 8.7  | 1.2                             | 6.9  | 1.0                             | 6.9  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.0                             | 7.2  | 1.0                             | 7.2  | 1.0                              | 7.2  | 0.6                             | 7.2  | 0.4                             | 7.2  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.2                             | 11.7 | 1.2                             | 9.2  | 1.0                              | 7.4  | 0.8                             | 5.3  | 0.8                             | 4.6  | ns   |
| <b><math>V_{CC(A)} = 2.3\text{ V to }2.7\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 8.4  | 0.1                             | 5.7  | 0.1                              | 4.6  | 0.2                             | 3.5  | 0.1                             | 3.6  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 5.2  | 0.6                             | 4.2  | 0.4                              | 3.9  | 0.2                             | 3.4  | 0.2                             | 3.3  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.0                             | 6.2  | 1.0                             | 6.2  | 1.0                              | 6.2  | 1.0                             | 6.2  | 1.0                             | 6.2  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.5                             | 10.4 | 1.5                             | 8.8  | 1.3                              | 8.2  | 1.1                             | 6.2  | 0.9                             | 5.2  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 0.7                             | 4.8  | 0.7                             | 4.8  | 0.7                              | 4.8  | 0.6                             | 4.8  | 0.4                             | 4.8  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 0.9                             | 11.3 | 0.9                             | 8.8  | 0.8                              | 7.0  | 0.6                             | 4.8  | 0.6                             | 4.0  | ns   |
| <b><math>V_{CC(A)} = 3.0\text{ V to }3.6\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 8.2  | 0.1                             | 5.6  | 0.1                              | 4.5  | 0.1                             | 3.3  | 0.1                             | 2.9  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 5.1  | 0.6                             | 4.2  | 0.4                              | 3.4  | 0.2                             | 3.0  | 0.1                             | 2.8  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 0.7                             | 5.6  | 0.7                             | 5.6  | 0.7                              | 5.6  | 0.7                             | 5.6  | 0.7                             | 5.6  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.4                             | 10.2 | 1.4                             | 9.3  | 1.2                              | 8.1  | 1.0                             | 6.4  | 0.8                             | 6.2  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 0.6                             | 3.8  | 0.6                             | 3.8  | 0.6                              | 3.8  | 0.6                             | 3.8  | 0.4                             | 3.8  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 0.8                             | 11.3 | 0.8                             | 8.7  | 0.6                              | 6.8  | 0.5                             | 4.7  | 0.5                             | 3.8  | ns   |

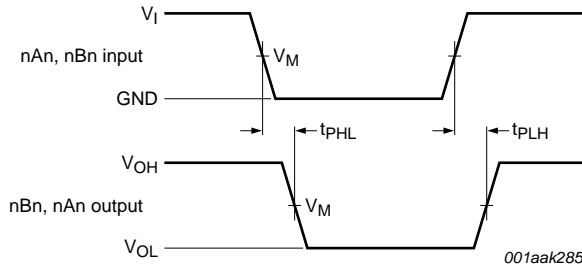
[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

**Table 14. Dynamic characteristics for temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$  [1]**Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 8](#); for wave forms, see [Figure 6](#) and [Figure 7](#)

| Symbol   | Parameter         | Conditions                     | $V_{CC(B)}$                     |      |                                 |      |                                  |      |                                 |      |                                 |      | Unit |
|--|-------------------|--------------------------------|---------------------------------|------|---------------------------------|------|----------------------------------|------|---------------------------------|------|---------------------------------|------|------|
|  |                   |                                | $1.2\text{ V} \pm 0.1\text{ V}$ |      | $1.5\text{ V} \pm 0.1\text{ V}$ |      | $1.8\text{ V} \pm 0.15\text{ V}$ |      | $2.5\text{ V} \pm 0.2\text{ V}$ |      | $3.3\text{ V} \pm 0.3\text{ V}$ |      |      |
|  |                   |                                | Min                             | Max  | Min                             | Max  | Min                              | Max  | Min                             | Max  | Min                             | Max  |      |
| <b><math>V_{CC(A)} = 1.1\text{ V to }1.3\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.5                             | 10.4 | 0.5                             | 7.9  | 0.5                              | 6.9  | 0.5                             | 5.8  | 0.5                             | 5.7  | ns   |
|  |                   | nBn to nAn                     | 0.5                             | 10.4 | 0.5                             | 9.8  | 0.5                              | 9.6  | 0.5                             | 9.3  | 0.5                             | 9.1  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 12.0 | 1.8                             | 12.0 | 1.8                              | 12.0 | 1.8                             | 12.0 | 1.8                             | 12.0 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.9                             | 13.7 | 1.9                             | 10.6 | 1.9                              | 10.5 | 1.4                             | 9.0  | 1.2                             | 10.1 | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.4                             | 14.1 | 1.4                             | 14.1 | 1.4                              | 14.1 | 1.4                             | 14.1 | 1.4                             | 14.1 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.1                             | 14.7 | 1.1                             | 11.0 | 1.1                              | 9.8  | 1.0                             | 8.7  | 1.0                             | 8.5  | ns   |
| <b><math>V_{CC(A)} = 1.4\text{ V to }1.6\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.3                             | 9.8  | 0.3                             | 7.0  | 0.3                              | 5.8  | 0.3                             | 4.7  | 0.3                             | 4.7  | ns   |
|  |                   | nBn to nAn                     | 0.7                             | 7.9  | 0.7                             | 7.0  | 0.5                              | 6.6  | 0.4                             | 6.3  | 0.3                             | 6.2  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 11.3 | 1.8                             | 11.3 | 1.5                              | 11.3 | 1.3                             | 11.3 | 1.6                             | 11.3 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.9                             | 12.5 | 1.9                             | 11.4 | 1.9                              | 10.1 | 1.4                             | 8.2  | 1.2                             | 8.4  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.1                             | 10.4 | 1.4                             | 10.4 | 1.1                              | 10.4 | 0.7                             | 10.4 | 0.4                             | 10.4 | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.4                             | 13.3 | 1.4                             | 10.6 | 1.1                              | 8.5  | 0.9                             | 6.4  | 0.9                             | 6.2  | ns   |
| <b><math>V_{CC(A)} = 1.65\text{ V to }1.95\text{ V}</math></b> |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 9.6  | 0.1                             | 6.6  | 0.1                              | 5.4  | 0.1                             | 4.3  | 0.3                             | 4.3  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 6.9  | 0.6                             | 5.9  | 0.5                              | 5.4  | 0.3                             | 5.1  | 0.3                             | 5.0  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.8                             | 9.5  | 1.6                             | 9.5  | 1.8                              | 9.5  | 1.3                             | 9.5  | 1.6                             | 9.5  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.7                             | 12.0 | 1.7                             | 10.9 | 1.6                              | 9.6  | 1.2                             | 7.6  | 1.0                             | 7.6  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 1.0                             | 8.0  | 1.0                             | 8.0  | 1.0                              | 8.0  | 0.6                             | 8.0  | 0.4                             | 8.0  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.2                             | 12.9 | 1.2                             | 10.2 | 1.0                              | 8.2  | 0.8                             | 5.9  | 0.8                             | 5.1  | ns   |
| <b><math>V_{CC(A)} = 2.3\text{ V to }2.7\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 9.3  | 0.1                             | 6.3  | 0.1                              | 5.1  | 0.2                             | 4.0  | 0.1                             | 4.0  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 5.8  | 0.6                             | 4.7  | 0.4                              | 4.3  | 0.2                             | 3.9  | 0.2                             | 3.8  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 1.0                             | 6.9  | 1.0                             | 6.9  | 1.0                              | 6.9  | 1.0                             | 6.9  | 1.0                             | 6.9  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.5                             | 11.5 | 1.5                             | 10.4 | 1.3                              | 9.1  | 1.1                             | 6.9  | 0.9                             | 5.8  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 0.7                             | 5.3  | 0.7                             | 5.3  | 0.7                              | 5.3  | 0.6                             | 5.3  | 0.4                             | 5.3  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 0.9                             | 12.4 | 0.9                             | 9.7  | 0.8                              | 7.7  | 0.6                             | 5.3  | 0.6                             | 4.4  | ns   |
| <b><math>V_{CC(A)} = 3.0\text{ V to }3.6\text{ V}</math></b>   |                   |                                |                                 |      |                                 |      |                                  |      |                                 |      |                                 |      |      |
| $t_{pd}$   | propagation delay | nAn to nBn                     | 0.1                             | 9.1  | 0.1                             | 6.2  | 0.1                              | 5.0  | 0.1                             | 3.8  | 0.1                             | 3.3  | ns   |
|  |                   | nBn to nAn                     | 0.6                             | 5.7  | 0.6                             | 4.7  | 0.4                              | 3.9  | 0.2                             | 3.4  | 0.1                             | 3.3  | ns   |
| $t_{dis}$  | disable time      | $\overline{\text{nOE}}$ to nAn | 0.7                             | 6.2  | 0.7                             | 6.2  | 0.7                              | 6.2  | 0.7                             | 6.2  | 0.7                             | 6.2  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 1.4                             | 11.3 | 1.4                             | 10.3 | 1.2                              | 9.0  | 1.0                             | 7.1  | 0.8                             | 6.9  | ns   |
| $t_{en}$   | enable time       | $\overline{\text{nOE}}$ to nAn | 0.6                             | 4.2  | 0.6                             | 4.2  | 0.6                              | 4.2  | 0.6                             | 4.2  | 0.4                             | 4.2  | ns   |
|  |                   | $\overline{\text{nOE}}$ to nBn | 0.8                             | 12.4 | 0.8                             | 9.6  | 0.6                              | 7.5  | 0.5                             | 5.2  | 0.5                             | 4.2  | ns   |

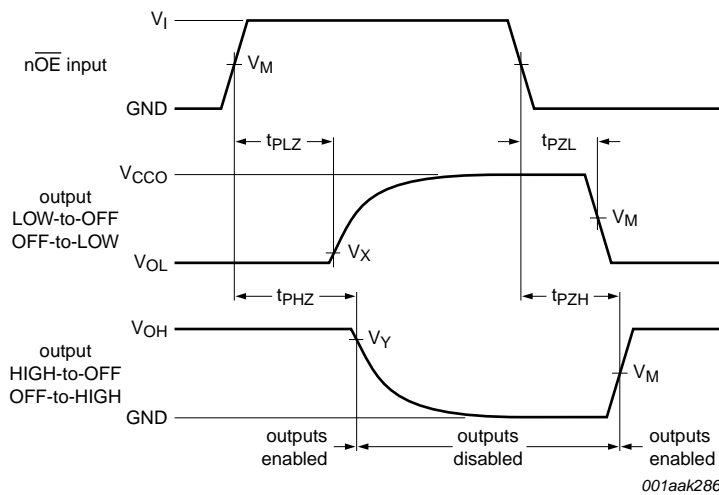
[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

12. Waveforms



Measurement points are given in [Table 15](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 6. The data input (nAn, nBn) to output (nBn, nAn) propagation delay times**



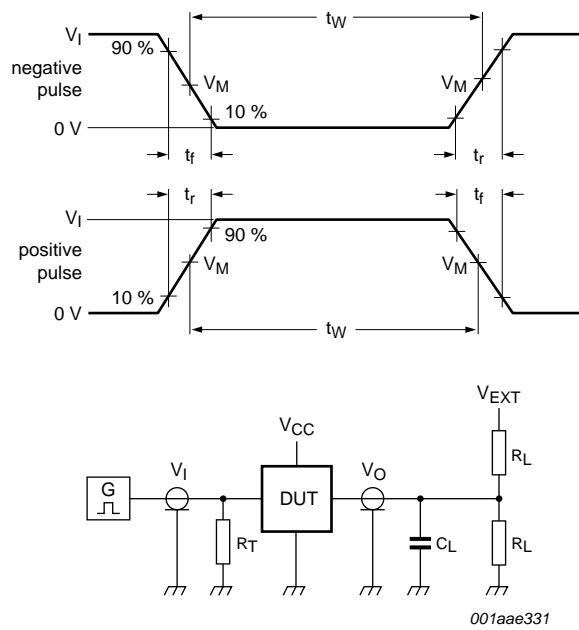
Measurement points are given in [Table 15](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 7. Enable and disable times**

**Table 15. Measurement points**

| Supply voltage         | Input <sup>[1]</sup> | Output <sup>[2]</sup> |                   |                   |
|------------------------|----------------------|-----------------------|-------------------|-------------------|
| $V_{CC(A)}, V_{CC(B)}$ | $V_M$                | $V_M$                 | $V_X$             | $V_Y$             |
| 0.8 V to 1.6 V         | $0.5V_{CCI}$         | $0.5V_{CCO}$          | $V_{OL} + 0.1 V$  | $V_{OH} - 0.1 V$  |
| 1.65 V to 2.7 V        | $0.5V_{CCI}$         | $0.5V_{CCO}$          | $V_{OL} + 0.15 V$ | $V_{OH} - 0.15 V$ |
| 3.0 V to 3.6 V         | $0.5V_{CCI}$         | $0.5V_{CCO}$          | $V_{OL} + 0.3 V$  | $V_{OH} - 0.3 V$  |

[1]  $V_{CCI}$  is the supply voltage associated with the data input port.  
 [2]  $V_{CCO}$  is the supply voltage associated with the output port.



Test data is given in [Table 16](#).  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance.  
 $V_{EXT}$  = External voltage for measuring switching times.

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

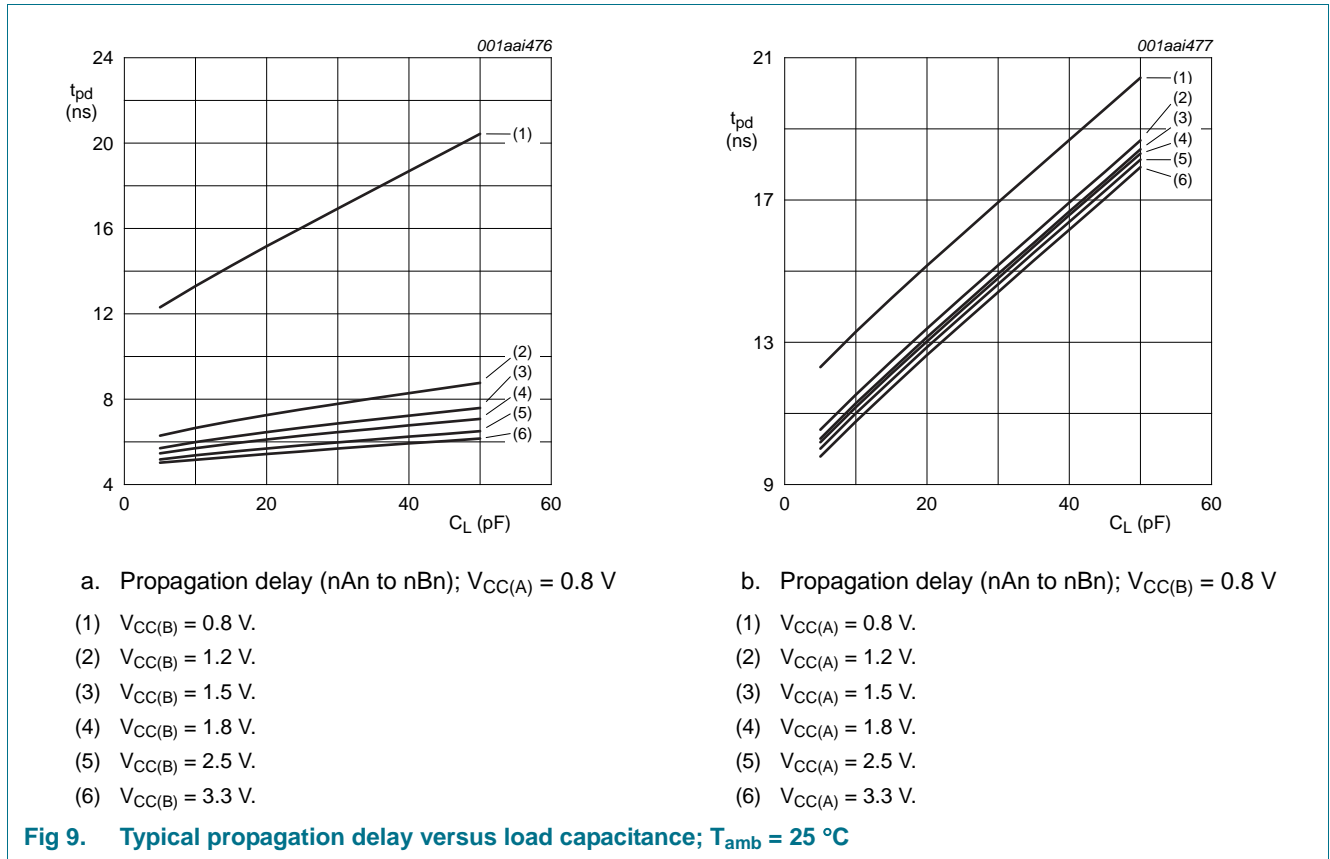
**Table 16. Test data**

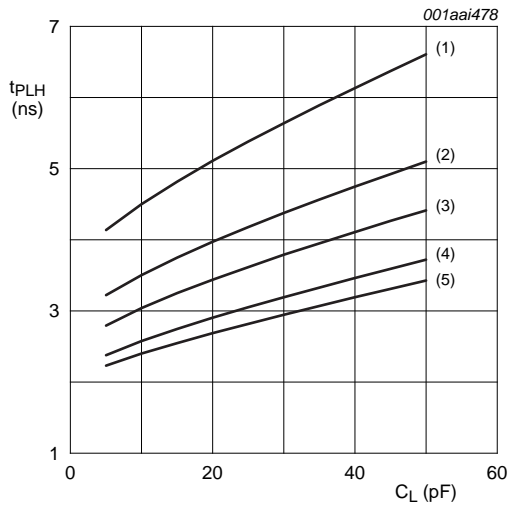
| Supply voltage  | Input                     |                      | Load                               |              | $V_{EXT}$ |                       |                       |
|-----------------|---------------------------|----------------------|------------------------------------|--------------|-----------|-----------------------|-----------------------|
|                 | $V_{CC(A)}$ , $V_{CC(B)}$ | $V_I$ <sup>[1]</sup> | $\Delta t/\Delta V$ <sup>[2]</sup> | $C_L$        | $R_L$     | $t_{PLH}$ , $t_{PHL}$ | $t_{PZH}$ , $t_{PHZ}$ |
| 0.8 V to 1.6 V  | $V_{CCI}$                 | $\leq 1.0$ ns/V      | 15 pF                              | 2 k $\Omega$ | open      | GND                   | $2V_{CCO}$            |
| 1.65 V to 2.7 V | $V_{CCI}$                 | $\leq 1.0$ ns/V      | 15 pF                              | 2 k $\Omega$ | open      | GND                   | $2V_{CCO}$            |
| 3.0 V to 3.6 V  | $V_{CCI}$                 | $\leq 1.0$ ns/V      | 15 pF                              | 2 k $\Omega$ | open      | GND                   | $2V_{CCO}$            |

- [1]  $V_{CCI}$  is the supply voltage associated with the data input port.
- [2]  $dV/dt \geq 1.0$  V/ns
- [3]  $V_{CCO}$  is the supply voltage associated with the output port.

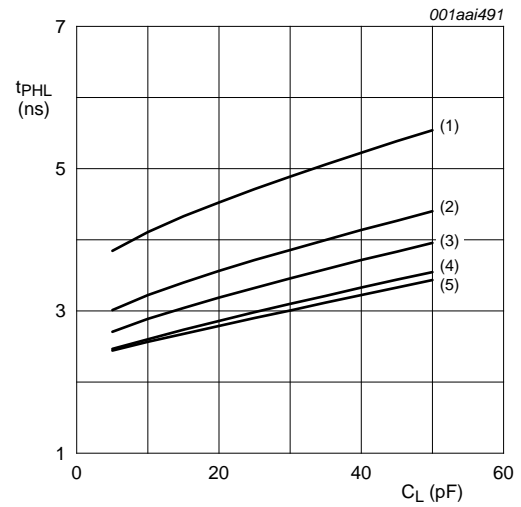


13. Typical propagation delay characteristics

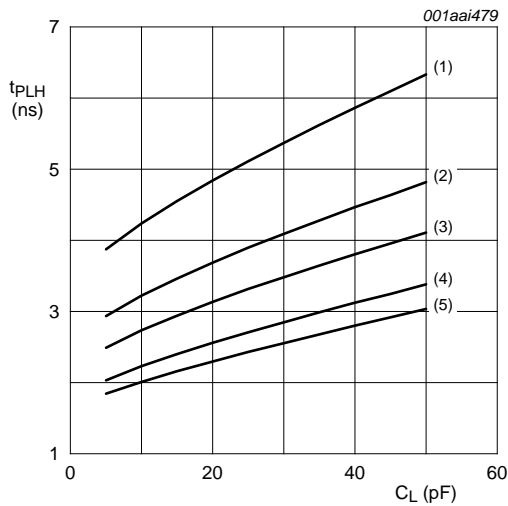




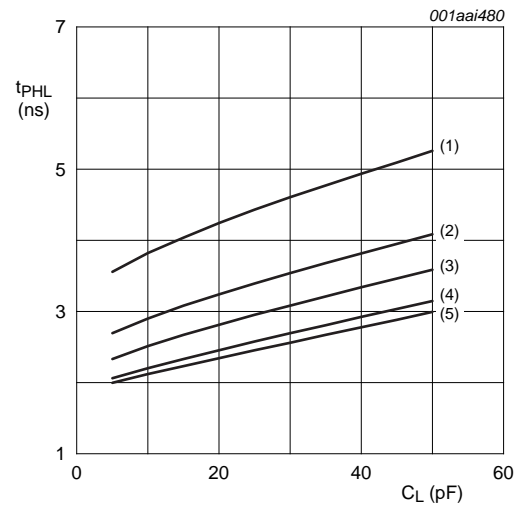
a. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.2\text{ V}$



b. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.2\text{ V}$



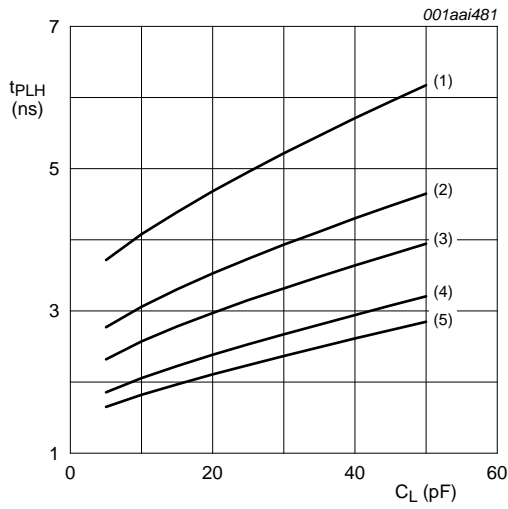
c. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.5\text{ V}$



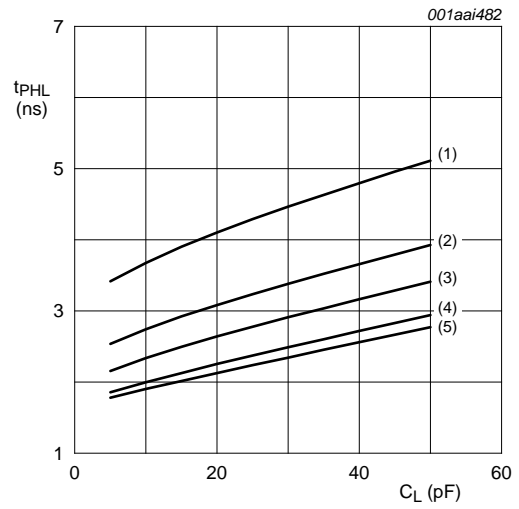
d. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.5\text{ V}$

- (1)  $V_{CC(B)} = 1.2\text{ V}$ .
- (2)  $V_{CC(B)} = 1.5\text{ V}$ .
- (3)  $V_{CC(B)} = 1.8\text{ V}$ .
- (4)  $V_{CC(B)} = 2.5\text{ V}$ .
- (5)  $V_{CC(B)} = 3.3\text{ V}$ .

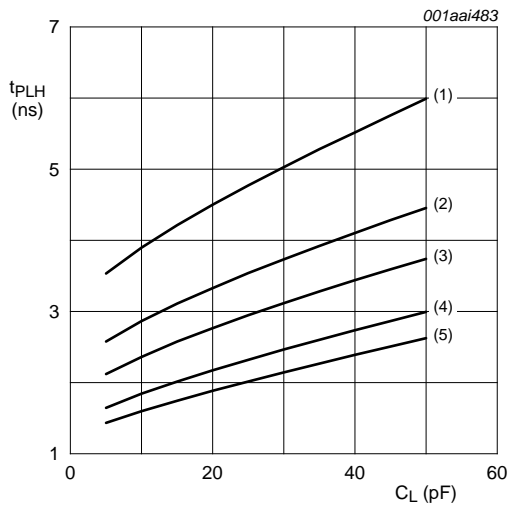
Fig 10. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$



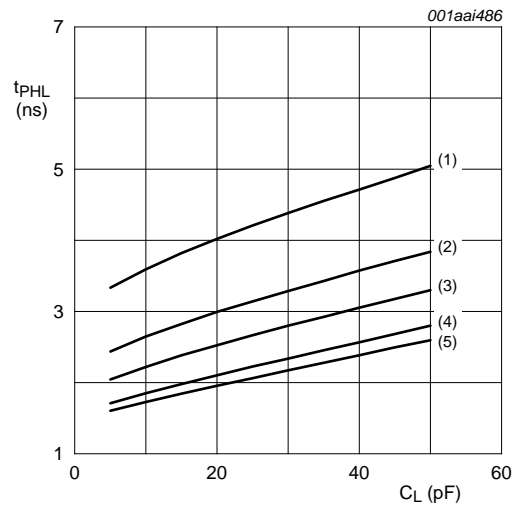
a. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.8\text{ V}$



b. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.8\text{ V}$



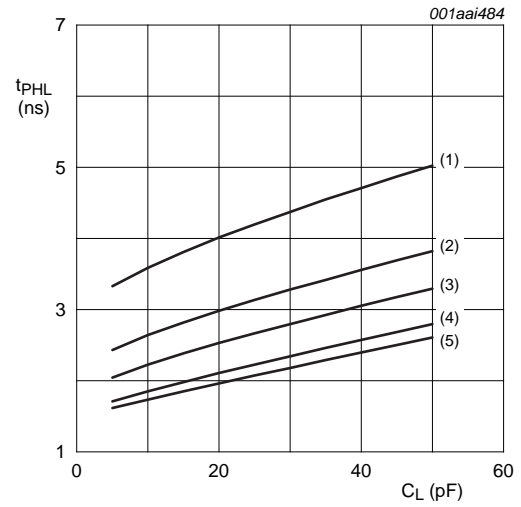
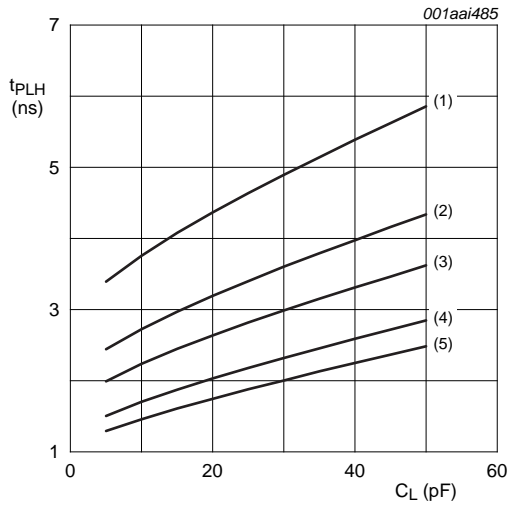
c. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 2.5\text{ V}$



d. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 2.5\text{ V}$

- (1)  $V_{CC(B)} = 1.2\text{ V}$ .
- (2)  $V_{CC(B)} = 1.5\text{ V}$ .
- (3)  $V_{CC(B)} = 1.8\text{ V}$ .
- (4)  $V_{CC(B)} = 2.5\text{ V}$ .
- (5)  $V_{CC(B)} = 3.3\text{ V}$ .

Fig 11. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$



a. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 3.3\text{ V}$

- (1)  $V_{CC(B)} = 1.2\text{ V}$ .
- (2)  $V_{CC(B)} = 1.5\text{ V}$ .
- (3)  $V_{CC(B)} = 1.8\text{ V}$ .
- (4)  $V_{CC(B)} = 2.5\text{ V}$ .
- (5)  $V_{CC(B)} = 3.3\text{ V}$ .

b. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 3.3\text{ V}$

Fig 12. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$

14. Package outline

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

SOT109-1

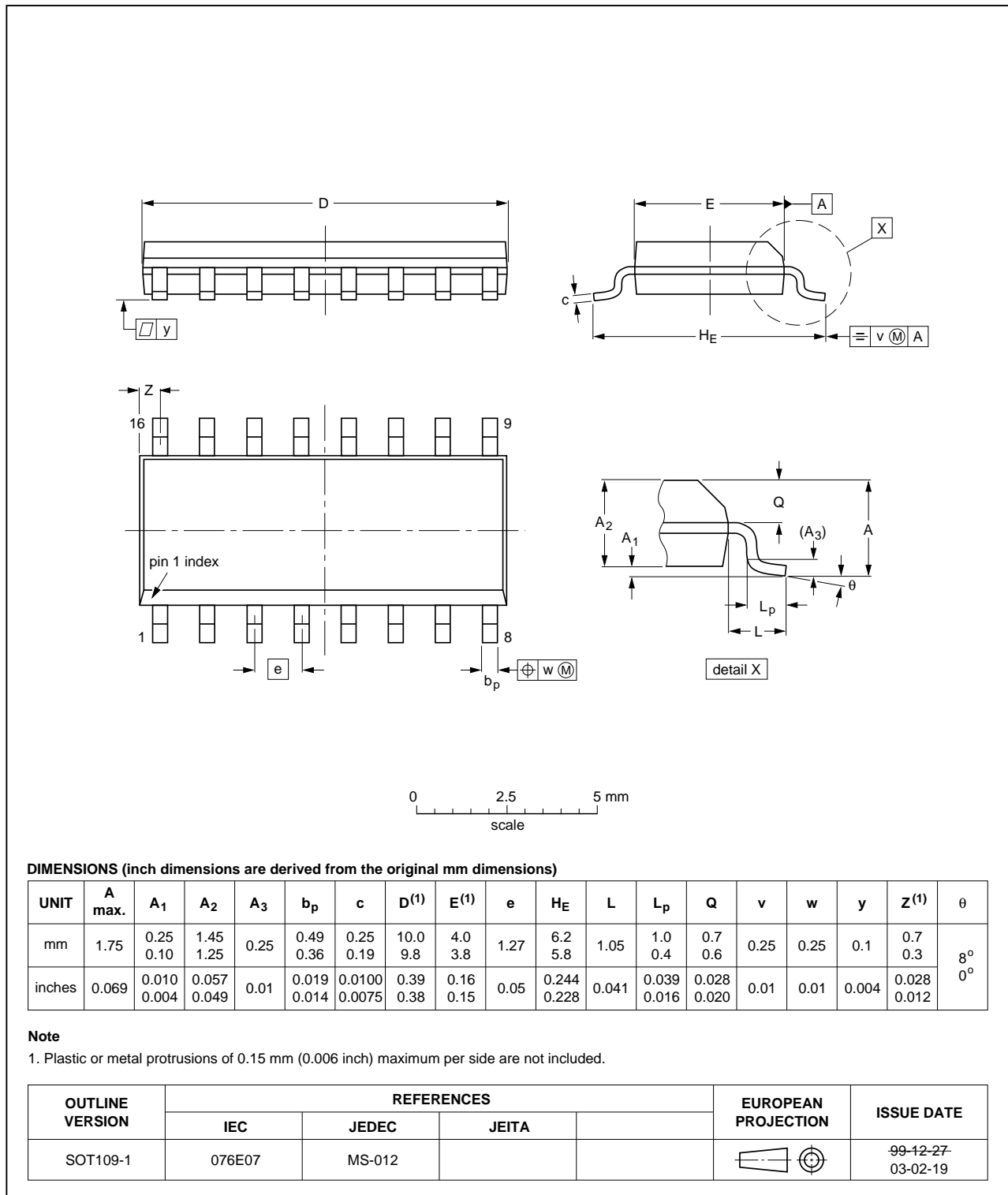


Fig 13. Package outline SOT109-1 (SO16)

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

SOT403-1

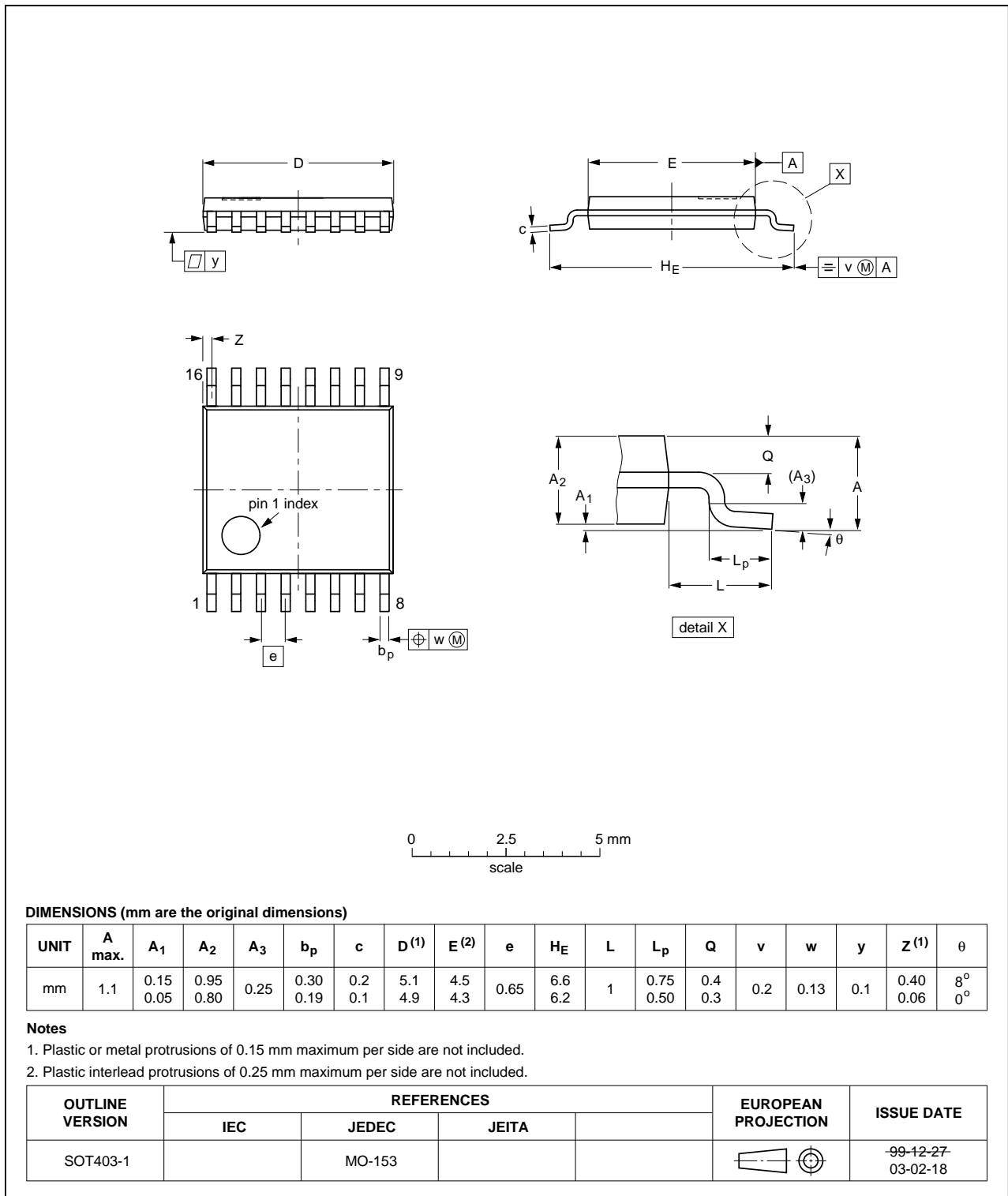


Fig 14. Package outline SOT403-1 (TSSOP16)

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

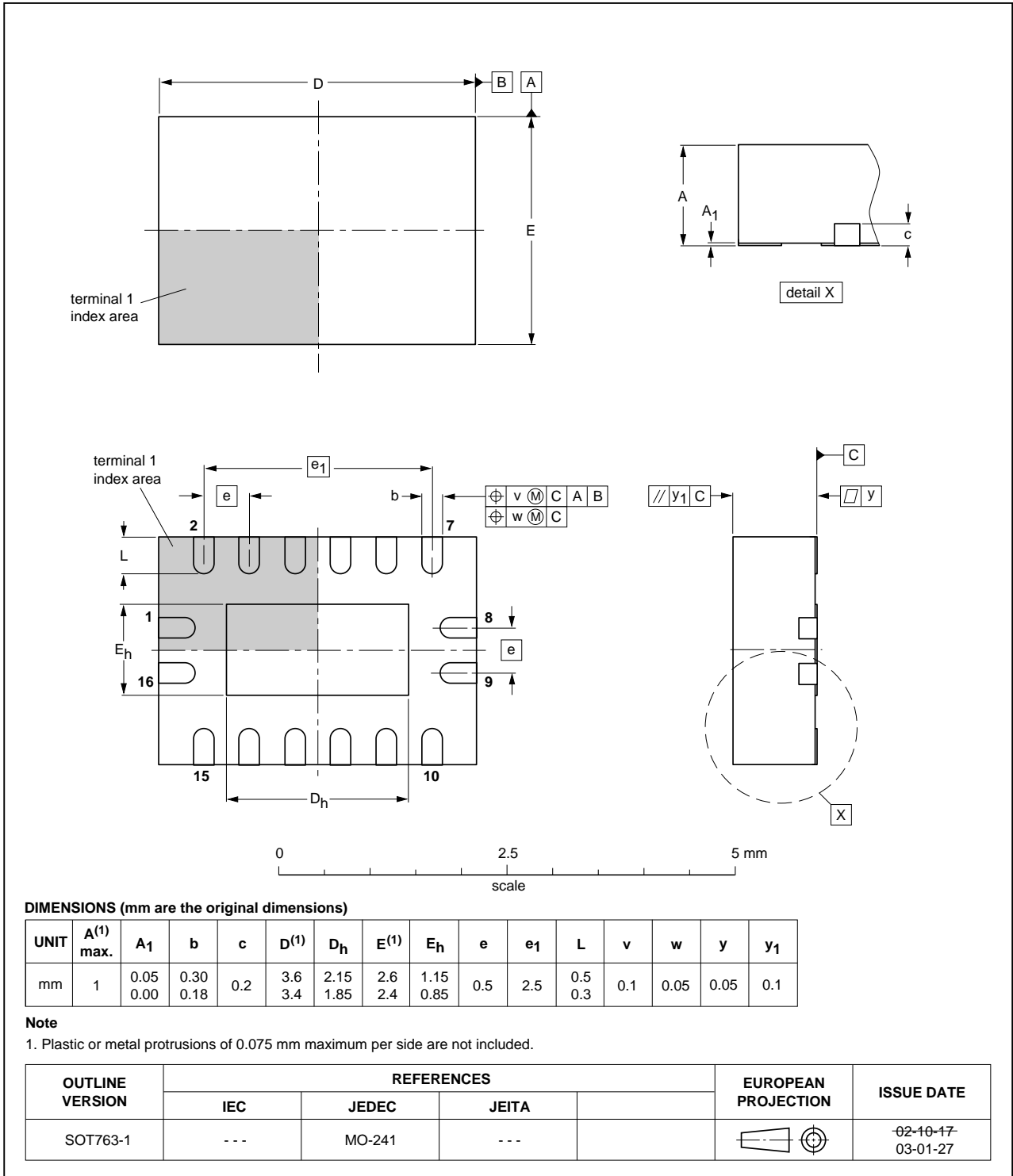


Fig 15. Package outline SOT763-1 (DHVQFN16)

## 15. Abbreviations

Table 17. Abbreviations

| Acronym | Description             |
|---------|-------------------------|
| CDM     | Charged Device Model    |
| DUT     | Device Under Test       |
| ESD     | ElectroStatic Discharge |
| HBM     | Human Body Model        |
| MM      | Machine Model           |
| MIL     | Military                |

## 16. Revision history

Table 18. Revision history

| Document ID          | Release date   | Data sheet status  | Change notice | Supersedes           |
|----------------------|--|--------------------|---------------|----------------------|
| 74AVCH4T245_Q100 v.2 | 20151217   | Product data sheet | -             | 74AVCH4T245_Q100 v.1 |
| Modifications:       | <ul style="list-style-type: none"> <li><a href="#">Table 5</a>: conditions I<sub>CC</sub> and I<sub>GND</sub> changed (errata).</li> </ul> |                    |               |                      |
| 74AVCH4T245_Q100 v.1 | 20130916   | Product data sheet | -             | -                    |



## 17. Legal information

### 17.1 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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## 18. Contact information

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