# CBT3253A

## Dual 1-of-4 FET multiplexer/demultiplexer

Rev. 5 — 9 May 2017 Product data sheet

## 1 General description

The CBT3253A is a dual 1-of-4 high-speed TTL-compatible FET multiplexer/demultiplexer. The low ON-resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise.

When the output enable input ($n\overline{OE}$) is LOW, the 1-of-4 multiplexer/demultiplexer is enabled. The data path is selected by the select control inputs (S0, S1). When $n\overline{OE}$ is HIGH, the 1-of-4 multiplexer/demultiplexer is disabled. The switch terminals are in the high impedance OFF-state, independent of S0 and S1.

The CBT3253A is characterized for operation from -40 °C to +85 °C.

## 2 Features and benefits

- 5 Ω switch connection between two ports
- TTL-compatible input levels
- Minimal propagation delay through the switch
- Latch-up protection exceeds 100 mA per JEDEC standard JESD78 class II level A
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C

## 3 Ordering information

**Table 1. Ordering information**

| Type number | Temperature range | Package | | |
|---|---|---|---|---|
| | | Name | Description | Version |
| CBT3253AD | -40 °C to +85 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| CBT3253ADB | -40 °C to +85 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| CBT3253ADS | -40 °C to +85 °C | SSOP16 [1] | plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm | SOT519-1 |
| CBT3253APW | -40 °C to +85 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

[1] Also known as QSOP16.

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# 4 Functional diagram

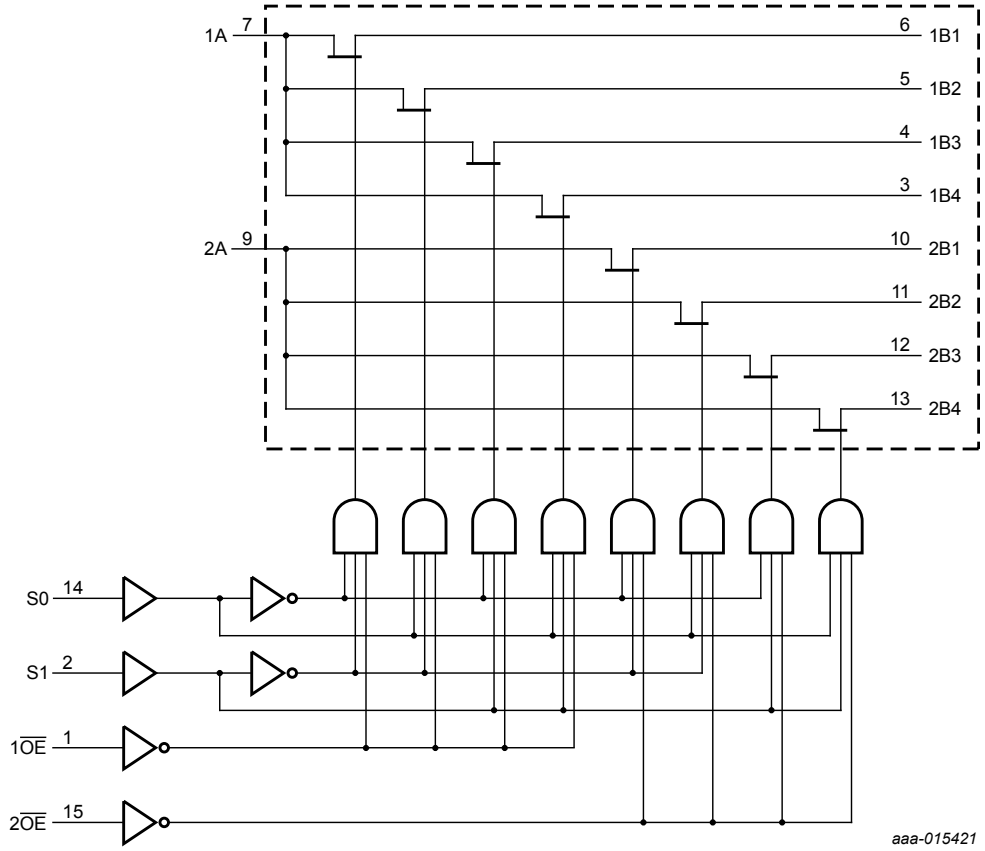


**Figure 1. Logic diagram**


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# 5 Pinning information

## 5.1 Pinning

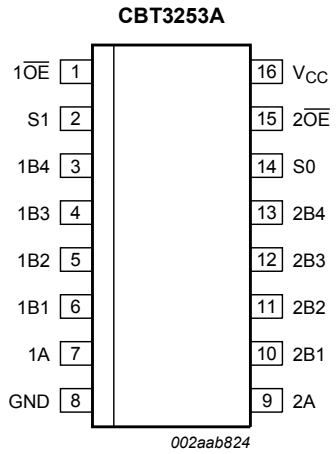


**Figure 2. Pin configuration SOT109-1 (SO16) and SOT519-1 (SSOP16)**

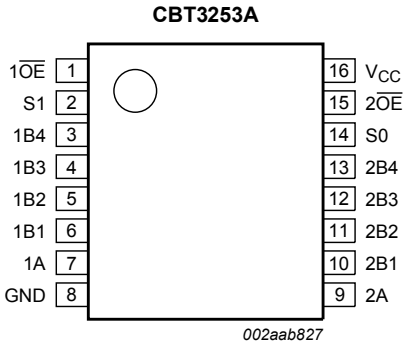


**Figure 3. Pin configuration SOT338-1 (SSOP16) and SOT403-1 (TSSOP16)**

## 5.2 Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| $1\overline{OE}$, $2\overline{OE}$ | 1, 15 | output enable (active LOW) |
| S1, S0 | 2, 14 | select control input |
| 1B4, 1B3, 1B2, 1B1 | 3, 4, 5, 6 | 1B outputs/inputs |
| 1A | 7 | 1A input/output |
| GND | 8 | ground (0 V) |
| 2A | 9 | 2A input/output |
| 2B1, 2B2, 2B3, 2B4 | 10, 11, 12, 13 | 2B outputs/inputs |
| $V_{CC}$ | 16 | positive supply voltage |


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# 6 Functional description

**Table 3. Function selection [1]**

| Inputs | | | | Switch |
|---|---|---|---|---|
| $1\overline{OE}$ | $2\overline{OE}$ | S1 | S0 | |
| X | H | X | X | disconnect 2A to 2Bn |
| H | X | X | X | disconnect 1A to 1Bn |
| L | L | L | L | 1A to 1B1 and 2A to 2B1 |
| L | L | L | H | 1A to 1B2 and 2A to 2B2 |
| L | L | H | L | 1A to 1B3 and 2A to 2B3 |
| L | L | H | H | 1A to 1B4 and 2A to 2B4 |

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

# 7 Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | | -0.5 | +7.0 | V |
| $V_I$ | input voltage | | [1] | -0.5 | +7.0 | V |
| $I_{SW}$ | switch current | continuous current through each switch | | - | 128 | mA |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | | -50 | - | mA |
| $T_{stg}$ | storage temperature | | | -65 | +150 | °C |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = -40 °C to +85 °C | | | | |
| | | SO16 package | [2] | - | 500 | mW |
| | | SSOP16 package | [3] | - | 500 | mW |
| | | TSSOP16 package | [3] | - | 500 | mW |

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
[2] For SO16 package: $P_{tot}$ derates linearly with 8 mW/K above 70 °C.
[3] For SSOP16 and TSSOP16 package: $P_{tot}$ derates linearly with 5.5 mW/K above 70 °C.

# 8 Recommended operating conditions

**Table 5. Operating conditions**

*All unused control inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation.*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 4.5 | 5.5 | V |
| $V_{IH}$ | HIGH-level input voltage | | 2.0 | - | V |
| $V_{IL}$ | LOW-level input voltage | | - | 0.8 | V |
| $T_{amb}$ | ambient temperature | operating in free-air | -40 | +85 | °C |


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# 9 Static characteristics

**Table 6. Static characteristics**

*At recommended operating conditions. Voltages are referenced to GND (ground = 0 V). $T_{amb}$ = -40 °C to +85 °C.*

| Symbol | Parameter | Conditions | Min | Typ [1] | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IK}$ | input clamping voltage | $V_{CC}$ = 4.5 V; $I_I$ = -18 mA | - | - | -1.2 | V |
| $V_{pass}$ | pass voltage | $V_I$ = $V_{CC}$ = 5.0 V; $I_O$ = -100 µA | 3.6 | 3.9 | 4.2 | V |
| $I_I$ | input leakage current | $V_{CC}$ = 5.5 V; $V_I$ = GND or 5.5 V | - | - | ±1 | µA |
| $I_{CC}$ | supply current | $V_{CC}$ = 5.5 V; $I_O$ = 0 mA;$V_I$ = $V_{CC}$ or GND | - | - | 3 | µA |
| $\Delta I_{CC}$ | additional supply current | per input; $V_{CC}$ = 5.5 V; one input at 3.4 V, other inputs at $V_{CC}$ or GND [2] | - | - | 2.5 | mA |
| $C_I$ | input capacitance | control pins; $V_I$ = 3 V or 0 V | - | 4.5 | - | pF |
| $C_{io(off)}$ | off-state input/output capacitance | A port; $V_O$ = 3 V or 0 V; n$\overline{OE}$ = $V_{CC}$ | - | 11.4 | - | pF |
| | | B port; $V_O$ = 3 V or 0 V; n$\overline{OE}$ = $V_{CC}$ | - | 3.8 | - | pF |
| $C_{io(on)}$ | on-state input/output capacitance | A port and B port | - | 18.6 | - | pF |
| $R_{ON}$ | ON resistance | $V_{CC}$ = 4.5 V [3] | | | | |
| | | $V_I$ = 0 V; $I_I$ = 64 mA | - | 5 | 7 | Ω |
| | | $V_I$ = 0 V; $I_I$ = 30 mA | - | 5 | 7 | Ω |
| | | $V_I$ = 2.4 V; $I_I$ = -15 mA | - | 10 | 15 | Ω |

[1] All typical values are measured at $V_{CC}$ = 5 V; $T_{amb}$ = 25 °C.
[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than $V_{CC}$ or GND.
[3] Measured by the voltage drop between the A and the B terminals at the indicated current through the switch. The lowest voltage of the two (A or B) terminals determines the ON resistance.

# 10 Dynamic characteristics

**Table 7. Dynamic characteristics**

*$T_{amb}$ = -40 °C to +85 °C; $V_{CC}$ = 4.5 V to 5.5 V; for test circuit, see Figure 6.*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $t_{pd}$ | propagation delay | Sn to nA; see Figure 4 [1] [2] | 1.2 | 6.2 | ns |
| | | nA to nBn or nBn to nA; see Figure 4 [1] [2] | - | 0.25 | ns |
| $t_{en}$ | enable time | Sn to nBn; see Figure 5 [3] | 1.3 | 6.3 | ns |
| | | n$\overline{OE}$ to nA or nBn; see Figure 5 [3] | 1.4 | 6.4 | ns |
| $t_{dis}$ | disable time | Sn to nBn; see Figure 5 [4] | 1.1 | 7.2 | ns |
| | | n$\overline{OE}$ to nA or nBn; see Figure 5 [4] | 1.0 | 7 | ns |

[1] This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON resistance of the switch and a load capacitance, when driven by an ideal voltage source (zero output impedance).
[2] $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$.
[3] $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.
[4] $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.


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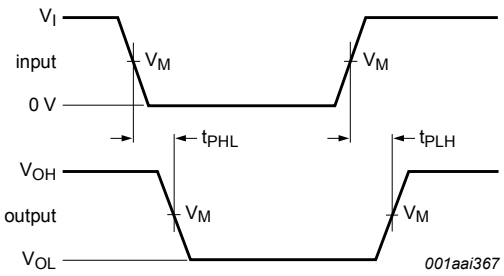
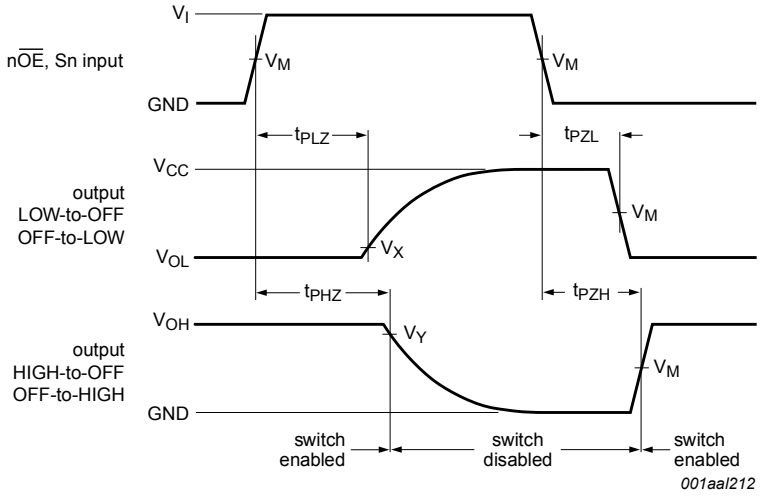
## 10.1 Waveforms and test circuit




Measurement points are given in Table 8.

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

**Figure 4. The input (nA; nBn) to output (nBn; nA) or input (Sn) to output (nA) propagation delay times**




Measurement points are given in Table 8.

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

**Figure 5. Enable and disable times**

**Table 8. Measurement points**

| Supply voltage | Input | | Output | | |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $V_M$ | $V_M$ | $V_X$ | $V_Y$ |
| 4.5 V to 5.5 V | GND to 3.0 V | 1.5 V | 1.5 V | $V_{OL}$ + 0.3 V | $V_{OH}$ - 0.3 V |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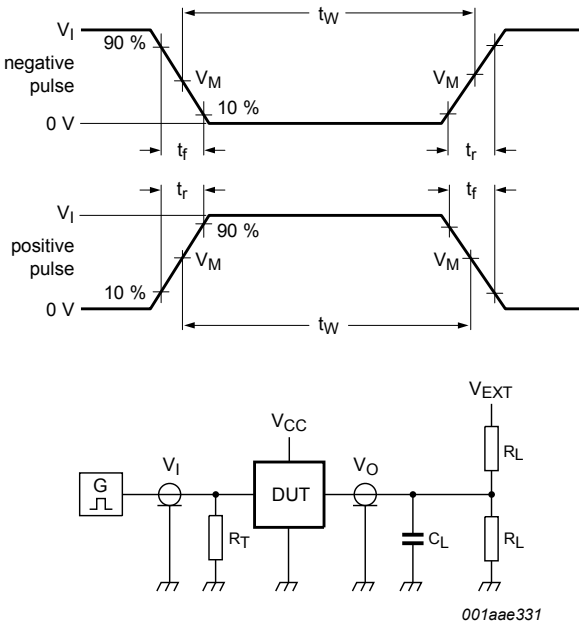


Test data is given in Table 9.

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 the output impedance $Z_o$ of the pulse generator.

$V_{EXT}$ = External voltage for measuring switching times.

**Figure 6. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage | Input | | Load | | $V_{EXT}$ | | |
|---|---|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ | $t_{PLZ}$, $t_{PZL}$ | $t_{PHZ}$, $t_{PZH}$ |
| 4.5 V to 5.5 V | GND to 3.0 V | ≤ 2.5 ns | 50 pF | 500 Ω | open | 7.0 V | open |


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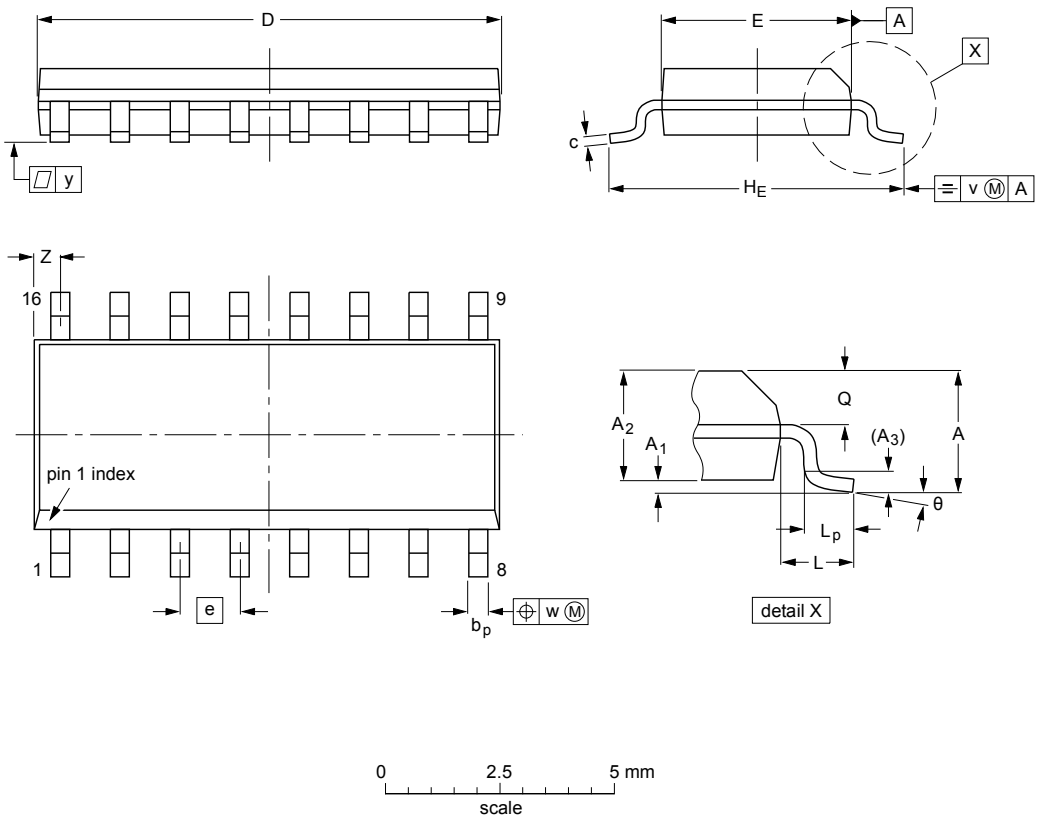
# 11 Package outline

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 10.0<br>9.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | 8°<br>0° |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT109-1 | 076E07 | MS-012 | | | | ~~99-12-27~~<br>03-02-19 |

**Figure 7. Package outline SOT109-1 (SO16)**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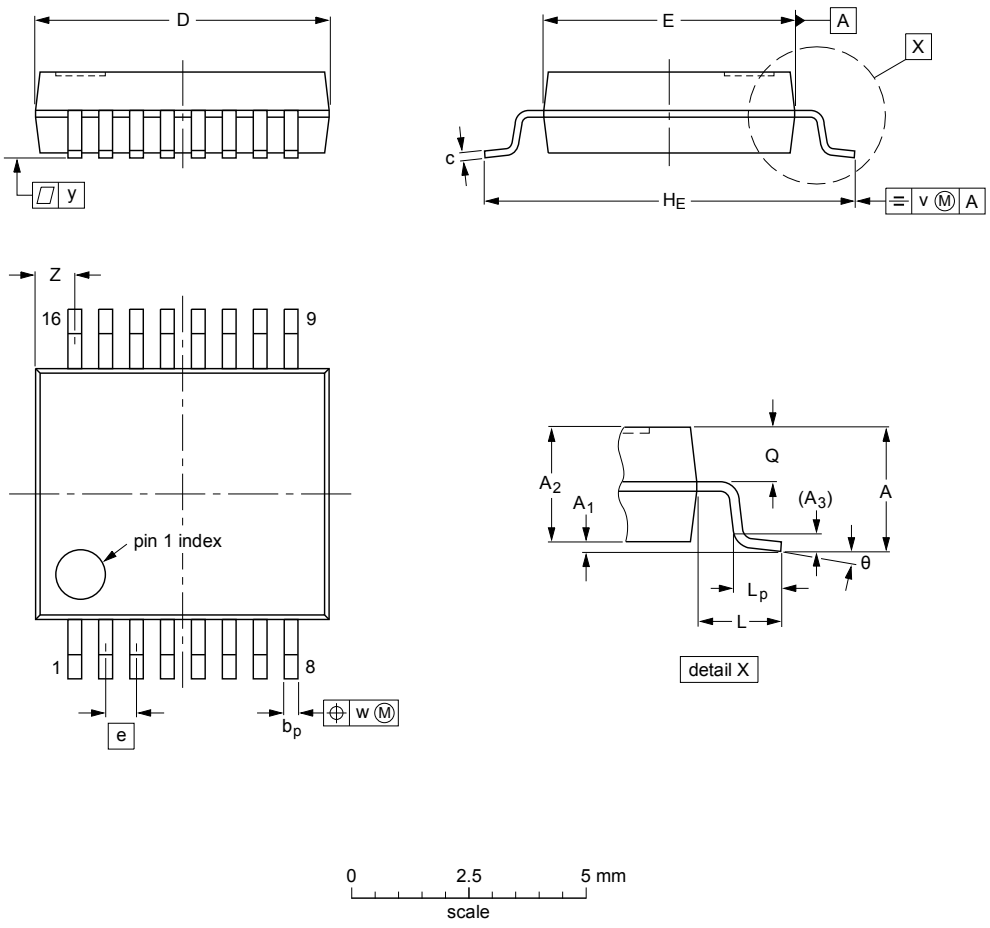
**SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm** **SOT338-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 6.4<br>6.0 | 5.4<br>5.2 | 0.65 | 7.9<br>7.6 | 1.25 | 1.03<br>0.63 | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.00<br>0.55 | $8^o$<br>$0^o$ |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT338-1 | | MO-150 | | | | ~~99-12-27~~<br>03-02-19 |

**Figure 8. Package outline SOT338-1 (SSOP16)**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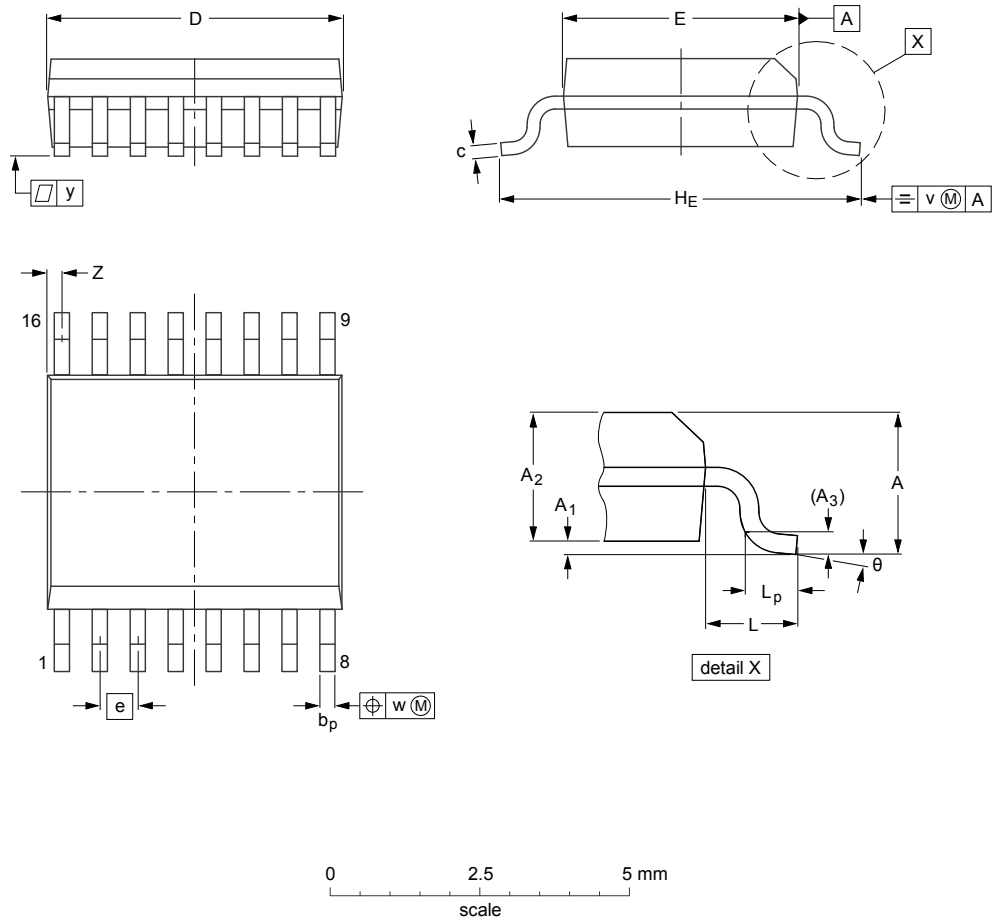
**SSOP16: plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm** **SOT519-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.73 | 0.25<br>0.10 | 1.55<br>1.40 | 0.25 | 0.31<br>0.20 | 0.25<br>0.18 | 5.0<br>4.8 | 4.0<br>3.8 | 0.635 | 6.2<br>5.8 | 1 | 0.89<br>0.41 | 0.2 | 0.18 | 0.09 | 0.18<br>0.05 | 8°<br>0° |

**Note**

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT519-1 | | | | | | ~~99-05-04~~<br>03-02-18 |

**Figure 9. Package outline SOT519-1 (SSOP16)**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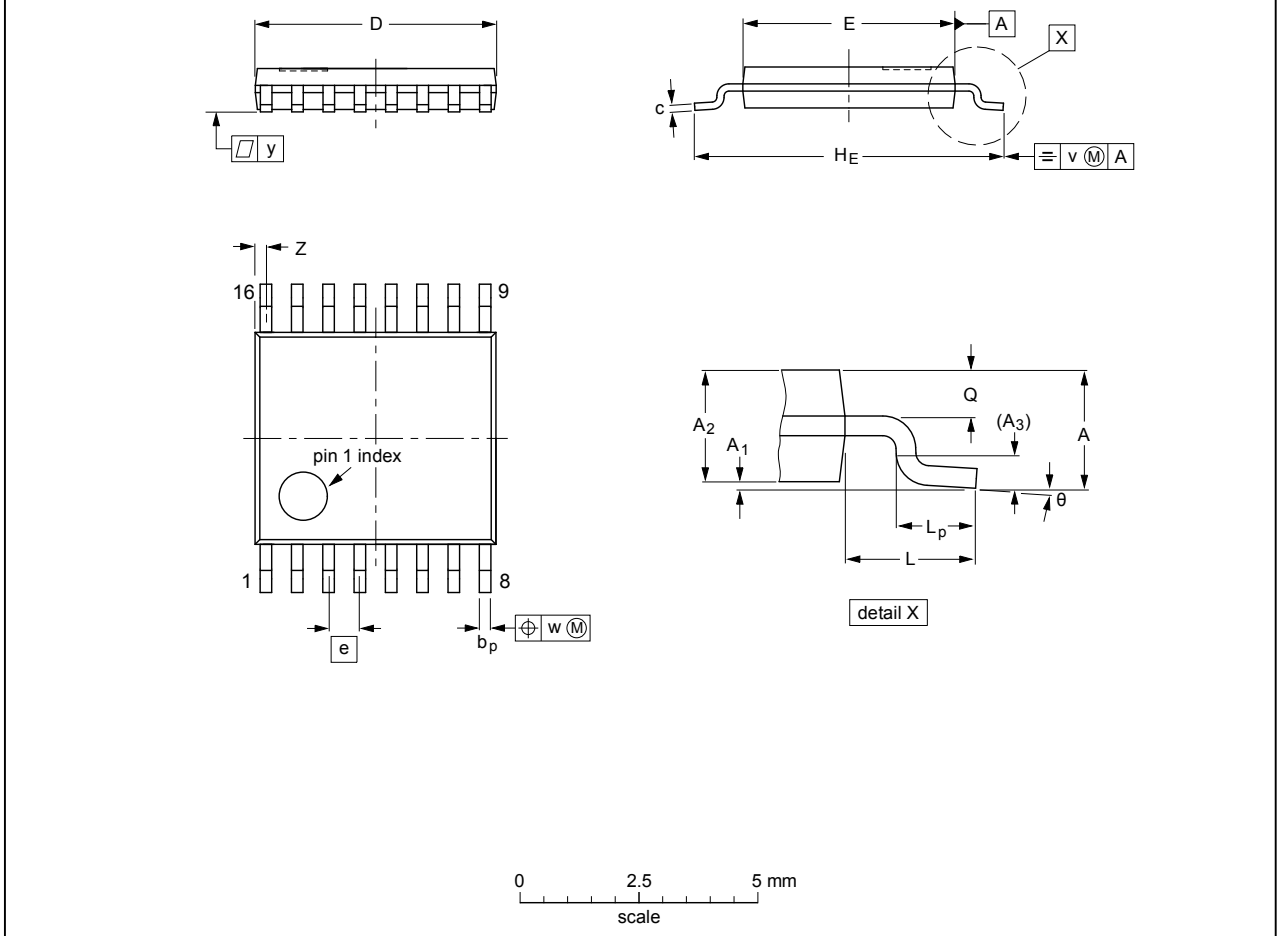
**TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm** **SOT403-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 5.1<br>4.9 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.40<br>0.06 | $8^o$<br>$0^o$ |

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT403-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-18 |

**Figure 10. Package outline SOT403-1 (TSSOP16)**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## 12 Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CDM | Charged Device Model |
| 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 |
|---|---|---|---|---|
| CBT3253A v.5 | 20170509 | Product data sheet | - | CBT3253A v.4 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| CBT3253A v.4 | 20141031 | Product data sheet | - | CBT3253A v.3 |
| Modifications: | • Section 1: text changed to align with the function of the device.<br>• Figure 1: schematic changed..<br>• Section 6: switch description changed to align with the function of the device.<br>• Table 7: typo corrected, the conditions for enable and disable times are swapped. | | | |
| CBT3253A v.3 | 20130924 | Product data sheet | - | CBT3253A v.2 |
| Modifications: | Section 9 values for pass voltage modified. | | | |
| CBT3253A v.2 | 20070208 | Product data sheet | - | CBT3253A v.1 |
| CBT3253A v.1 | 20051024 | Product data sheet | - | - |


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# 14 Legal information

## 14.1 Data sheet status

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

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[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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