

# 74CBTLV3253

Dual 1-of-4 multiplexer/demultiplexer

Rev. 4 — 15 December 2011

Product data sheet

## 1. General description

The 74CBTLV3253 provides a dual 1-of-4 high-speed multiplexer/demultiplexer with two common select inputs ( $S_0$ ,  $S_1$ ) and two output enable inputs ( $\overline{1OE}$ ,  $\overline{2OE}$ ). 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 pin  $nOE = LOW$ , one of the four switches is selected (low-impedance ON-state) with pins  $S_0$  and  $S_1$ . When pin  $nOE = HIGH$ , all switches are in the high-impedance OFF-state, independent of pins  $S_0$  and  $S_1$ .

To ensure the high-impedance OFF-state during power-up or power-down,  $nOE$  should be tied to the  $V_{CC}$  through a pull-up resistor. The minimum value of the resistor is determined by the current-sinking capability of the driver.

Schmitt trigger action at control input makes the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range from 2.3 V to 3.6 V.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

## 2. Features and benefits

- Supply voltage range from 2.3 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM AEC-Q100-011 revision B exceeds 1000 V
- 5 Ω switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance exceeds 250 mA per JESD78B Class I level A
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C



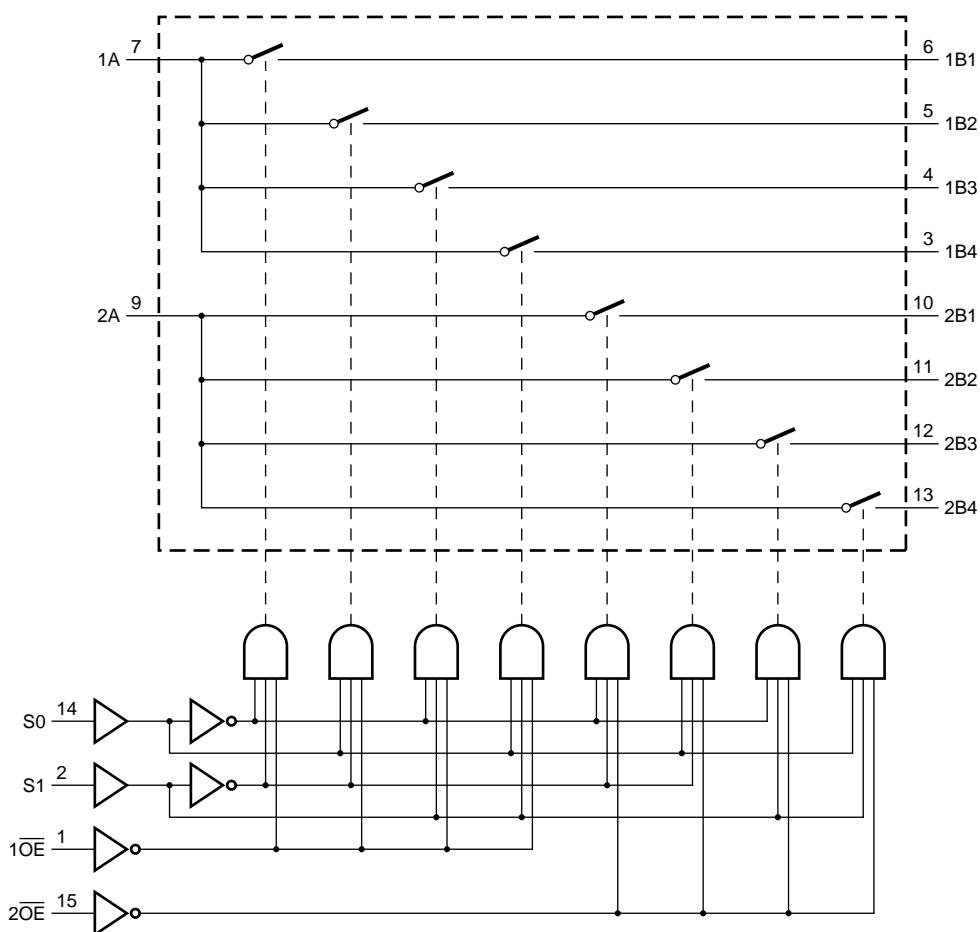
### 3. Ordering information

**Table 1. Ordering information**

Type number	Package				Version
	Temperature range	Name	Description		
74CBTLV3253D	−40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm		SOT109-1
74CBTLV3253DS	−40 °C to +85 °C	SSOP16 <sup>[1]</sup>	plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm		SOT519-1
74CBTLV3253PW	−40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm		SOT403-1
74CBTLV3253BQ	−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

[1] Also known as QSOP16.

### 4. Functional diagram

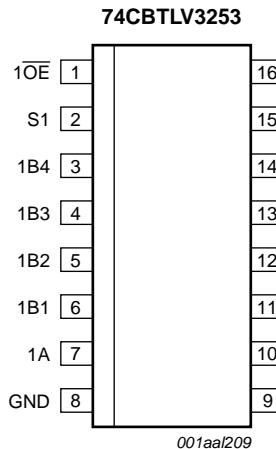


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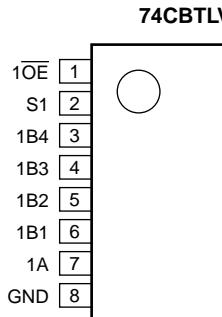
**Fig 1. Logic diagram**

## 5. Pinning information

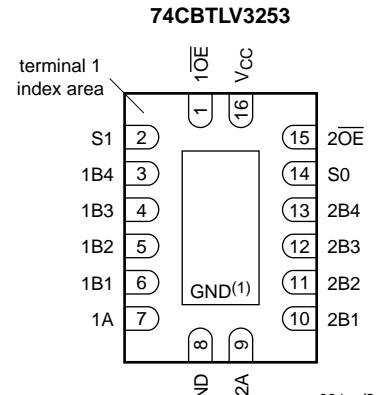
### 5.1 Pinning



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



**Fig 3.** Pin configuration SOT403-1 (TSSOP16)



**Fig 4.** Pin configuration SOT763-1 (DHVQFN16)

- (1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

### 5.2 Pin description

**Table 2.** Pin description

Symbol	Pin	Description
1OE, 2OE	1, 15	output enable input (active LOW)
S0, S1	14, 2	select input
1B1 to 1B4	6, 5, 4, 3	B input/output
2B1 to 2B4	10, 11, 12, 13	B input/output
GND	8	ground (0 V)
1A, 2A	7, 9	A input/output
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

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

Inputs				Function switch
<b>1OE</b>	<b>2OE</b>	<b>S1</b>	<b>S0</b>	
X	H	X	X	disconnect 2A and 2Bn
H	X	X	X	disconnect 1A and 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.

## 7. Limiting values

**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage	control inputs	<sup>[1]</sup> -0.5	+4.6	V
V <sub>SW</sub>	switch voltage	enable and disable mode	<sup>[2]</sup> -0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SK</sub>	switch clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SW</sub>	switch current	V <sub>SW</sub> = 0 V to V <sub>CC</sub>	-	±128	mA
I <sub>CC</sub>	supply current		-	+100	mA
I <sub>GND</sub>	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	<sup>[3]</sup> -	500	mW

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

[2] The switch voltage ratings may be exceeded if switch clamping current ratings are observed

[3] For SSOP16 and TSSOP16 packages: P<sub>tot</sub> derates linearly with 5.5 mW/K above 60 °C.

For DHVQFN16 packages: P<sub>tot</sub> derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		2.3	3.6	V
V <sub>I</sub>	input voltage		0	3.6	V
V <sub>SW</sub>	switch voltage	enable and disable mode	0	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.3 V to 3.6 V	<sup>[1]</sup> 0	200	ns/V

[1] Applies to control signal levels.

## 9. Static characteristics

**Table 6. Static characteristics**

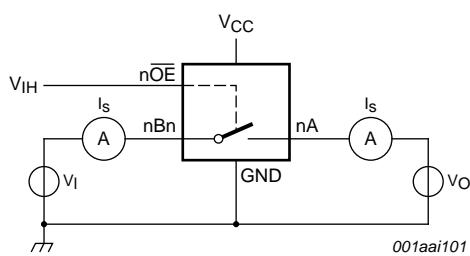
At recommended operating conditions voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	$T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$			$T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$			Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max		
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	1.7	-	-	1.7	-	-	V
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	2.0	-	-	2.0	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	-	-	0.7	-	0.7	-	V
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	-	-	0.9	-	0.9	-	V
$I_I$	input leakage current	pin $n\overline{OE}$ ; $V_I = \text{GND}$ to $V_{CC}$ ; $V_{CC} = 3.6\text{ V}$	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$	
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 3.6\text{ V}$ ; see <a href="#">Figure 5</a>	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$	
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 3.6\text{ V}$ ; see <a href="#">Figure 6</a>	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$	
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 0\text{ V}$ to $3.6\text{ V}$ ; $V_{CC} = 0\text{ V}$	-	-	$\pm 10$	-	$\pm 50$	$\mu\text{A}$	
$I_{CC}$	supply current	$V_I = \text{GND}$ or $V_{CC}$ ; $I_O = 0\text{ A}$ ; $V_{SW} = \text{GND}$ or $V_{CC}$ ; $V_{CC} = 3.6\text{ V}$	-	-	10	-	50	$\mu\text{A}$	
$\Delta I_{CC}$	additional supply current	pin $n\overline{OE}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $V_{SW} = \text{GND}$ or $V_{CC}$ ; $V_{CC} = 3.6\text{ V}$	[2]	-	-	300	-	2000	$\mu\text{A}$
$C_I$	input capacitance	pin $n\overline{OE}$ ; $V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V}$ to $3.3\text{ V}$	-	0.9	-	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V}$ to $3.3\text{ V}$	-	5.2	-	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V}$ to $3.3\text{ V}$	-	20.0	-	-	-	-	pF

[1] All typical values are measured at  $T_{amb} = 25^{\circ}\text{C}$ .

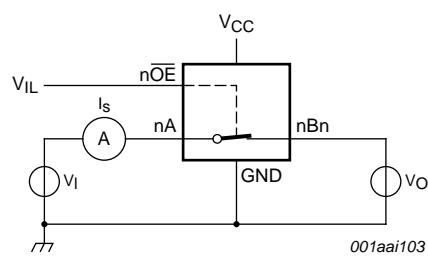
[2] One input at 3 V, other inputs at  $V_{CC}$  or GND.

### 9.1 Test circuits



$V_I = V_{CC}$  or GND and  $V_O = \text{GND}$  or  $V_{CC}$ .

**Fig 5. Test circuit for measuring OFF-state leakage current (one switch)**



$V_I = V_{CC}$  or GND and  $V_O = \text{open circuit}$ .

**Fig 6. Test circuit for measuring ON-state leakage current (one switch)**

## 9.2 ON resistance

**Table 7. Resistance  $R_{ON}$**

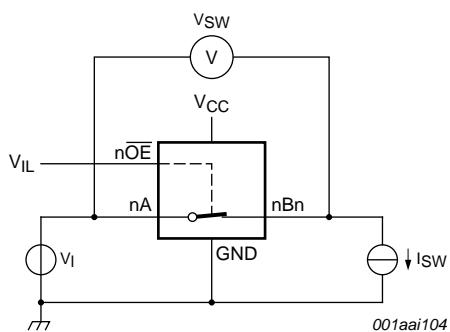
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	$T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$			$T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$			Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max		
$R_{ON}$	ON resistance	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$ ; <a href="#">[2]</a>	-	4.2	8.0	-	15.0	$\Omega$	
			-	4.2	8.0	-	15.0	$\Omega$	
			-	8.4	40.0	-	60.0	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ ; <a href="#">see Figure 11 to Figure 13</a>	-	6.2	15.0	-	25.5	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	
			-	4.0	7.0	-	11.0	$\Omega$	

[1] Typical values are measured at  $T_{amb} = 25^{\circ}\text{C}$  and nominal  $V_{CC}$ .

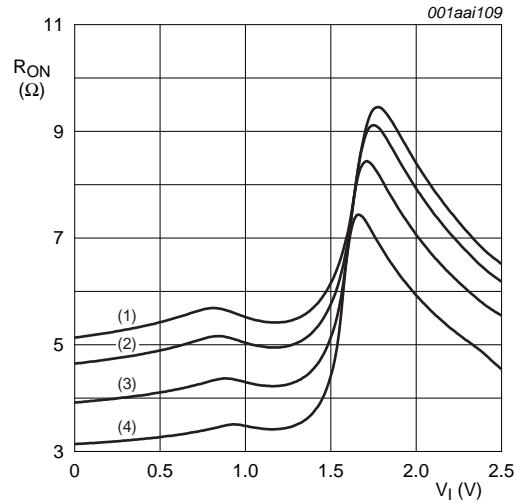
[2] Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

## 9.3 ON resistance test circuit and graphs



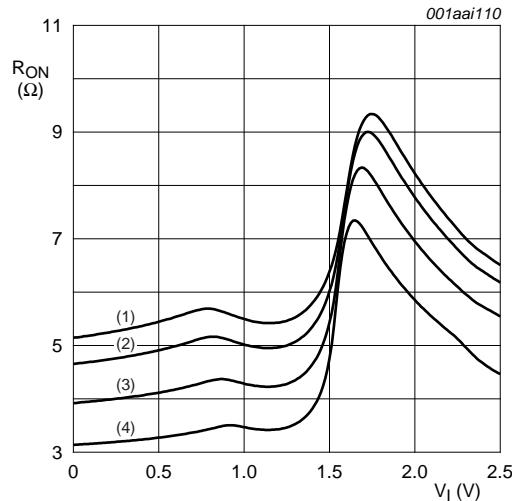
$$R_{ON} = V_{sw} / I_{sw}.$$

**Fig 7. Test circuit for measuring ON resistance (one switch)**

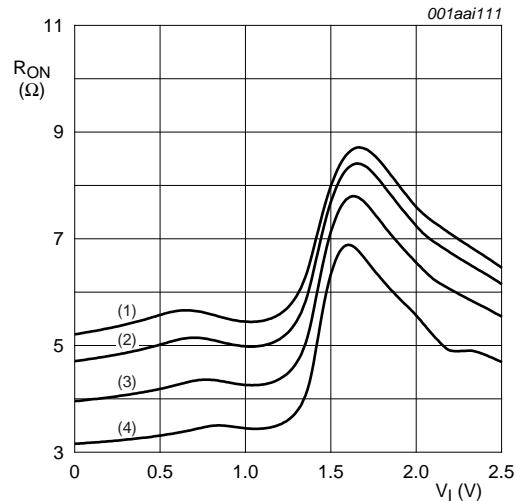


- (1)  $T_{amb} = 125^{\circ}\text{C}$ .
- (2)  $T_{amb} = 85^{\circ}\text{C}$ .
- (3)  $T_{amb} = 25^{\circ}\text{C}$ .
- (4)  $T_{amb} = -40^{\circ}\text{C}$ .

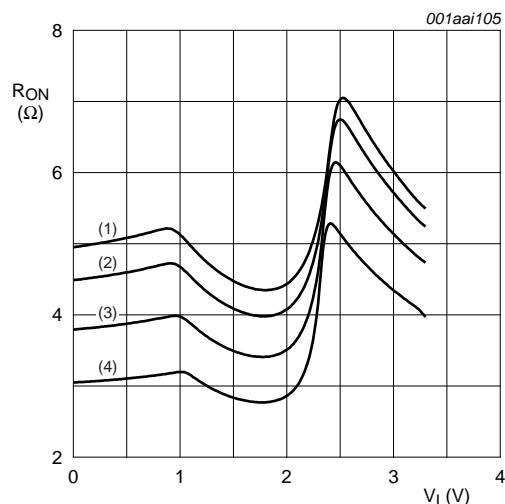
**Fig 8. ON resistance as a function of input voltage;  $V_{CC} = 2.5\text{ V}$ ;  $I_{sw} = 15\text{ mA}$**



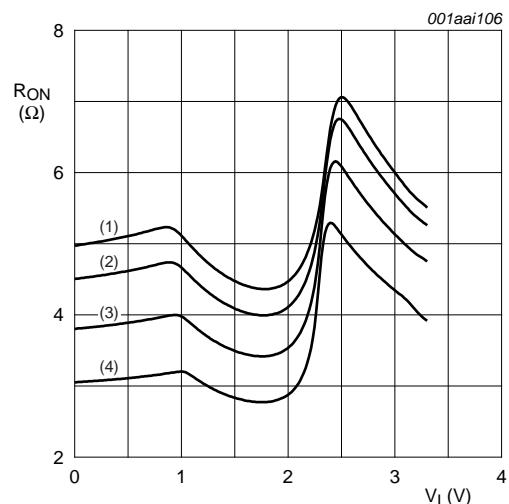
**Fig 9.** ON resistance as a function of input voltage;  
 $V_{CC} = 2.5\text{ V}$ ;  $I_{SW} = 24\text{ mA}$



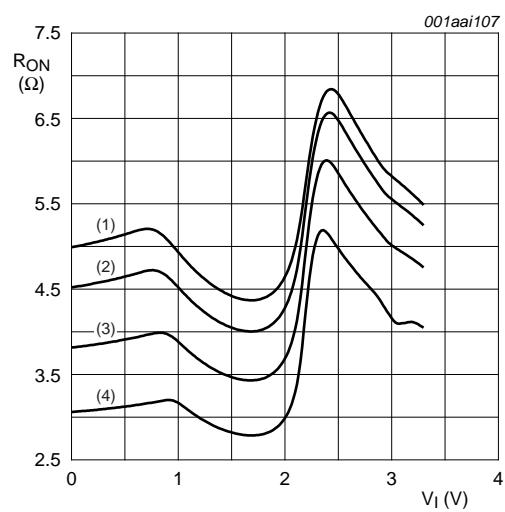
**Fig 10.** ON resistance as a function of input voltage;  
 $V_{CC} = 2.5\text{ V}$ ;  $I_{SW} = 64\text{ mA}$



**Fig 11.** ON resistance as a function of input voltage;  
 $V_{CC} = 3.3\text{ V}$ ;  $I_{SW} = 15\text{ mA}$



**Fig 12.** ON resistance as a function of input voltage;  
 $V_{CC} = 3.3\text{ V}$ ;  $I_{SW} = 24\text{ mA}$



- (1)  $T_{amb} = 125 \text{ } ^\circ\text{C.}$
- (2)  $T_{amb} = 85 \text{ } ^\circ\text{C.}$
- (3)  $T_{amb} = 25 \text{ } ^\circ\text{C.}$
- (4)  $T_{amb} = -40 \text{ } ^\circ\text{C.}$

**Fig 13. ON resistance as a function of input voltage;  $V_{CC} = 3.3 \text{ V}$ ;  $I_{SW} = 64 \text{ mA}$**

## 10. Dynamic characteristics

**Table 8. Dynamic characteristics***GND = 0 V; for test circuit see [Figure 16](#)*

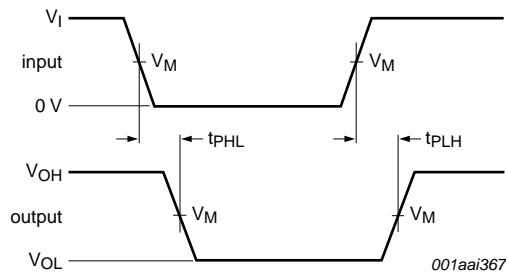
Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max		
t <sub>pd</sub>	propagation delay	nA to nBn or nBn to nA; <a href="#">[2][3]</a> see <a href="#">Figure 14</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.15	-	0.25	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.15	-	0.25	ns
		Sn to nA; see <a href="#">Figure 14</a> <a href="#">[3]</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.2	6.8	1.0	7.5	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.0	5.5	1.0	6.1	ns
		nOE to nA or nBn; <a href="#">[4]</a> see <a href="#">Figure 15</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.1	5.0	1.0	5.5	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	1.9	4.8	1.0	5.3	ns
t <sub>en</sub>	enable time	Sn to nBn; see <a href="#">Figure 15</a> <a href="#">[4]</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.1	4.3	1.0	4.7	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	1.9	4.0	1.0	4.4	ns
		nOE to nA or nBn; <a href="#">[5]</a> see <a href="#">Figure 15</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.6	5.5	1.0	6.1	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.2	5.4	1.0	5.9	ns
		Sn to nBn; see <a href="#">Figure 15</a> <a href="#">[5]</a>	V <sub>CC</sub> = 2.3 V to 2.7 V	0.8	2.0	4.8	0.8	5.3	ns
			V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.0	4.5	1.0	5.0	ns
t <sub>dis</sub>	disable time								

[1] All typical values are measured at T<sub>amb</sub> = 25 °C and at nominal V<sub>CC</sub>.

[2] The propagation delay is the calculated RC time constant of the on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).

[3] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.[4] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.[5] t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.

## 11. Waveforms



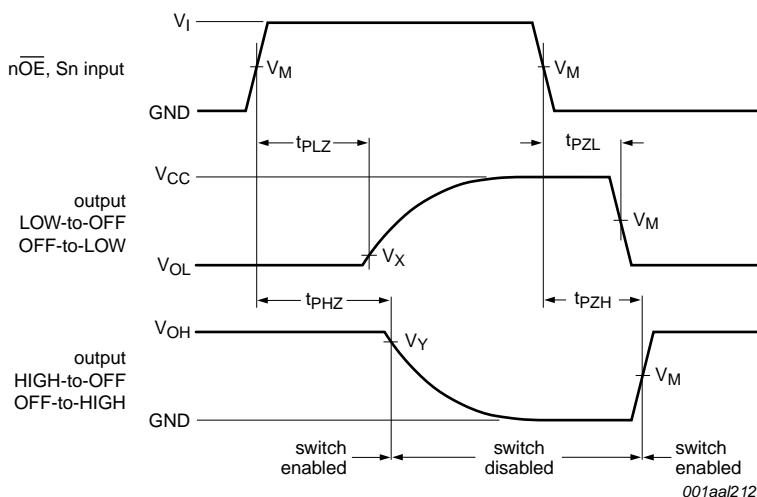
Measurement points are given in [Table 9](#).

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

**Fig 14. The data input (nA or nBn) to output (nBn or nA) propagation delays**

**Table 9. Measurement points**

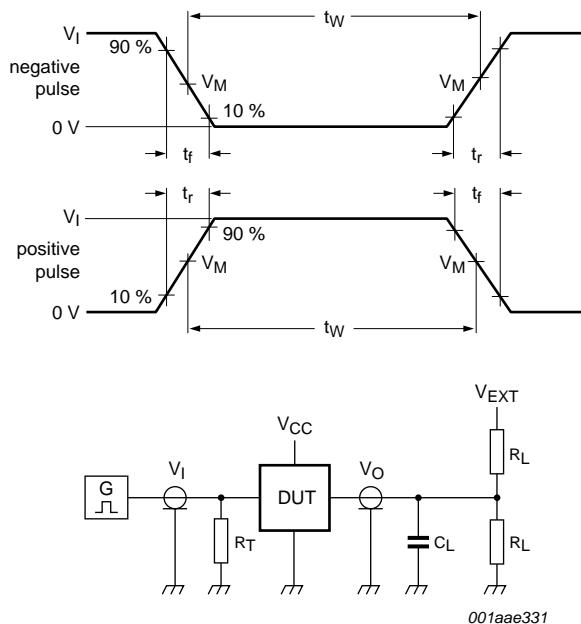
Supply voltage	Input	Output				
$V_{CC}$	$V_M$	$V_I$	$t_r = t_f$	$V_M$	$V_X$	$V_Y$
2.3 V to 2.7 V	0.5 $V_{CC}$	$V_{CC}$	$\leq 2.0\text{ ns}$	0.5 $V_{CC}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$
3.0 V to 3.6 V	0.5 $V_{CC}$	$V_{CC}$	$\leq 2.0\text{ ns}$	0.5 $V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$



Measurement points are given in [Table 9](#).

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

**Fig 15. Enable and disable times**



Test data is given in [Table 10](#).

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.

**Fig 16. Test circuit for measuring switching times**

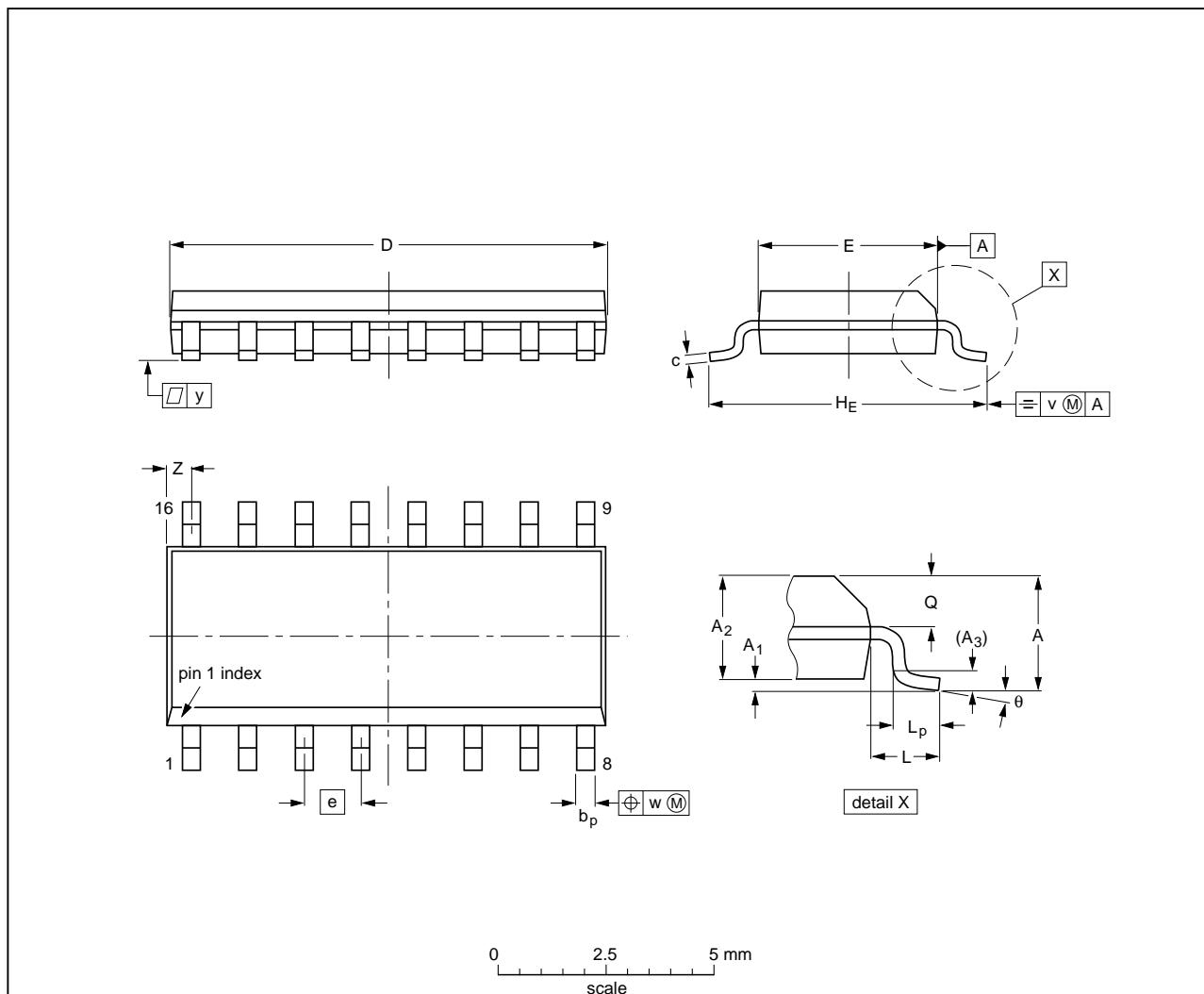
**Table 10. Test data**

Supply voltage	Load		$V_{EXT}$		
$V_{CC}$	$C_L$	$R_L$		$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$
2.3 V to 2.7 V	30 pF	500 $\Omega$	open	GND	$2V_{CC}$
3.0 V to 3.6 V	50 pF	500 $\Omega$	open	GND	$2V_{CC}$

## 12. 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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.75 0.10	0.25 0.125	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069 0.004	0.010 0.049	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

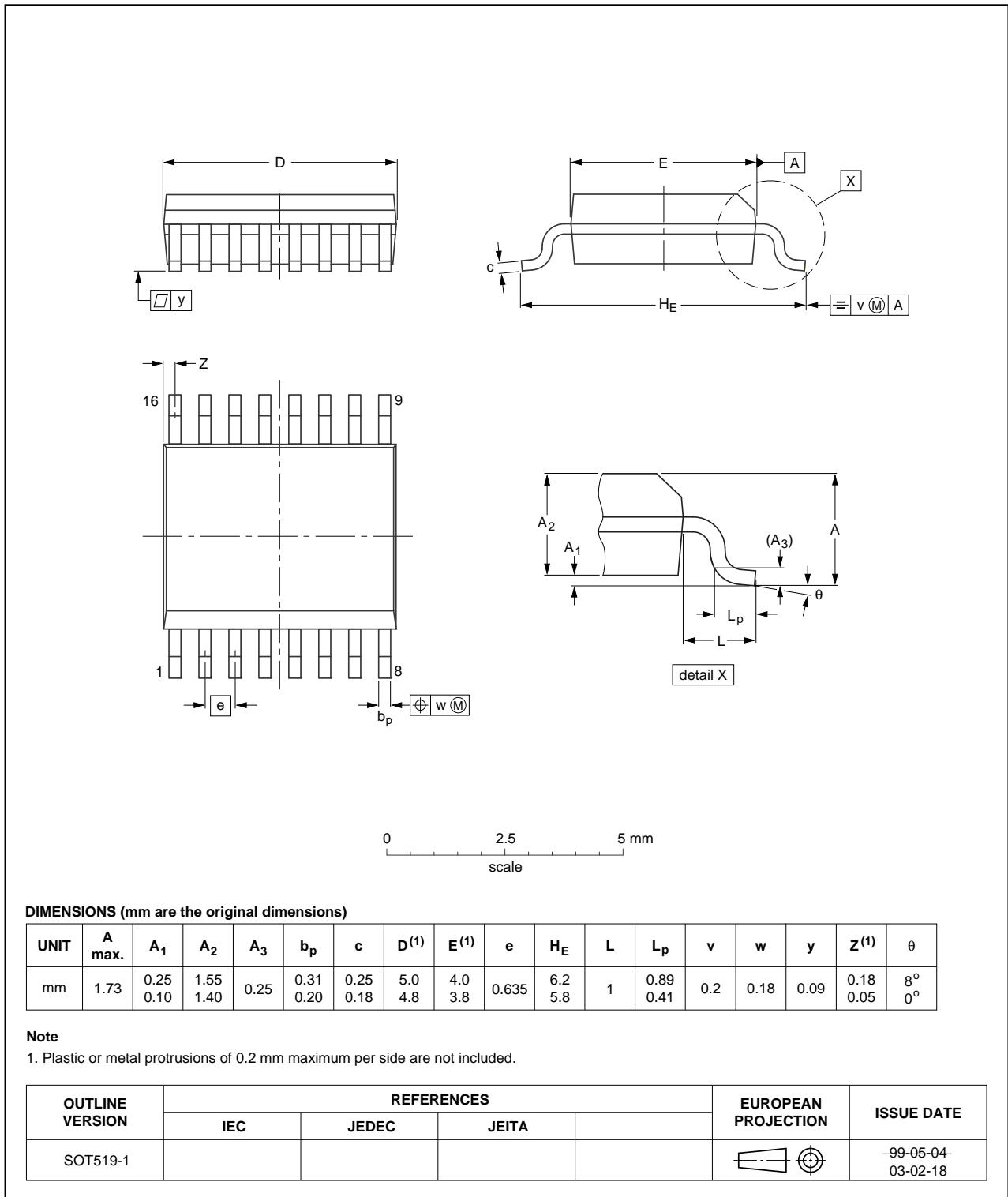
**Note**

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 03-02-19

Fig 17. Package outline SOT109-1 (SO16)

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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sup>(1)</sup>	θ
mm	1.73	0.25 0.10	1.55 1.40	0.25	0.31 0.20	0.25 0.18	5.0 4.8	4.0 3.8	0.635	6.2 5.8	1	0.89 0.41	0.2	0.18	0.09	0.18 0.05	8° 0°

**Note**

- 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						-99-05-04-03-02-18

**Fig 18. Package outline SOT519-1 (SSOP16)**

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

SOT403-1

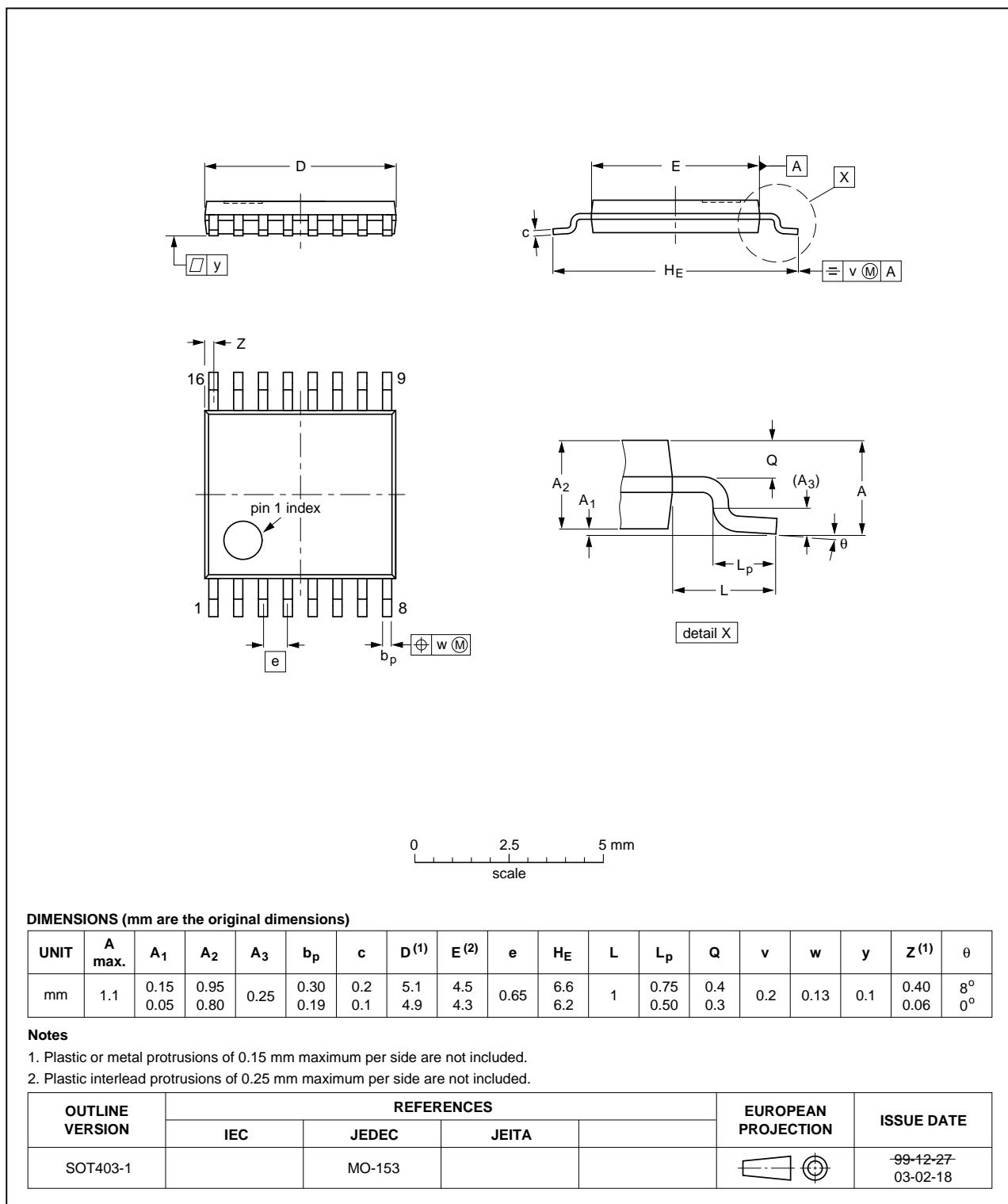


Fig 19. Package outline SOT403-1 (TSSOP16)

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

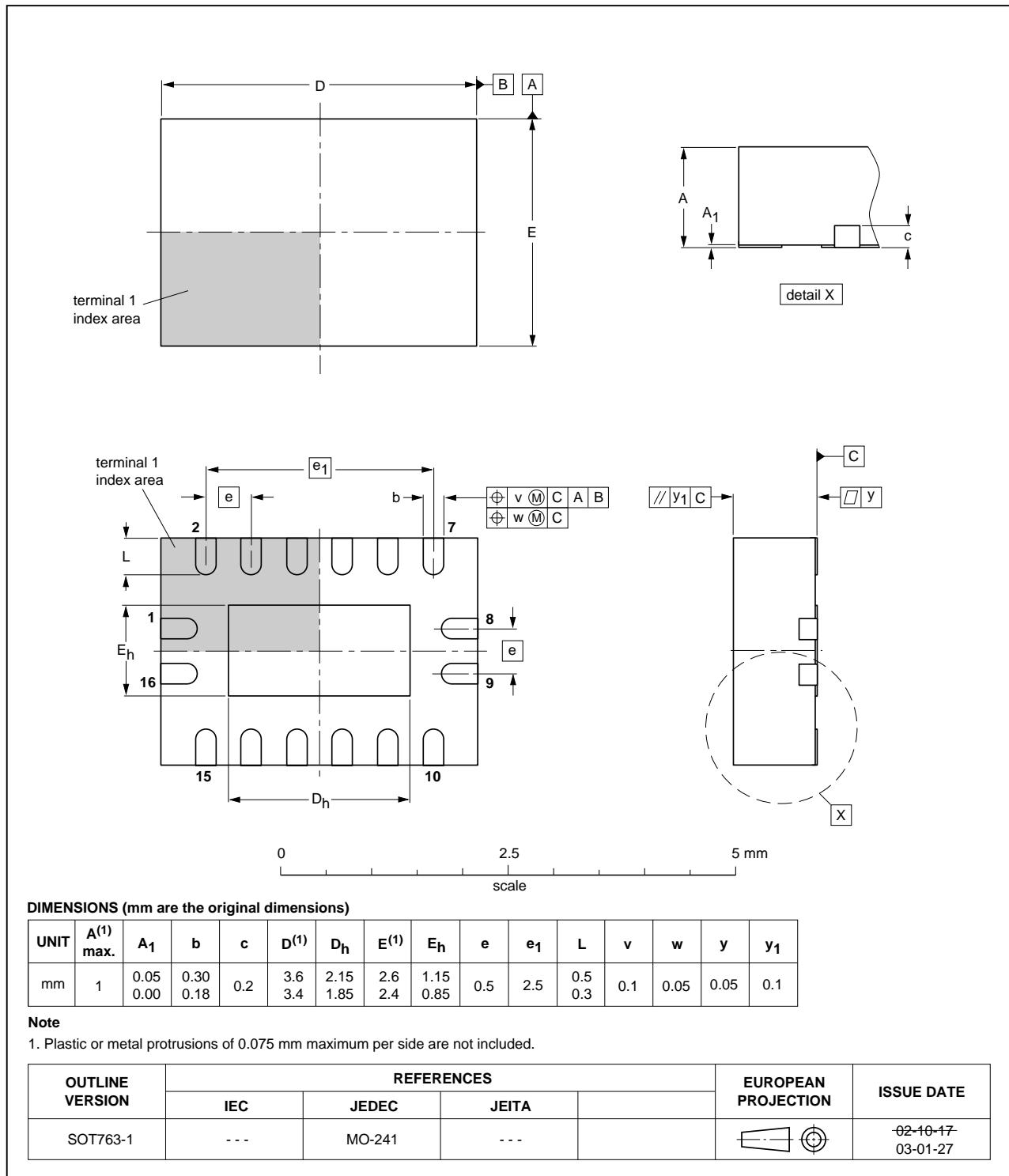


Fig 20. Package outline SOT763-1 (DHVQFN16)

## 13. Abbreviations

**Table 11. 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

## 14. Revision history

**Table 12. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV3253 v.4	20111215	Product data sheet	-	74CBTLV3253 v.3
Modifications:	• Legal pages updated.			
74CBTLV3253 v.3	20110107	Product data sheet	-	74CBTLV3253 v.2
74CBTLV3253 v.2	20101125	Product data sheet	-	74CBTLV3253 v.1
74CBTLV3253 v.1	20100108	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

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

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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

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