Dual 1-of-4 multiplexer/demultiplexer Rev. 6 — 24 September 2020

1. General description

The 74CBTLV3253 provides a dual 1-of-4 high-speed multiplexer/demultiplexer with two common select inputs (S0, S1) and two output enable inputs ($\overline{10E}$, $2\overline{0E}$). 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 $\overline{n0E}$ = LOW, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin $\overline{n0E}$ = HIGH, all switches are in the high-impedance OFF-state, independent of pins S0 and S1.

To ensure the high-impedance OFF-state during power-up or power-down, $n\overline{OE}$ 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

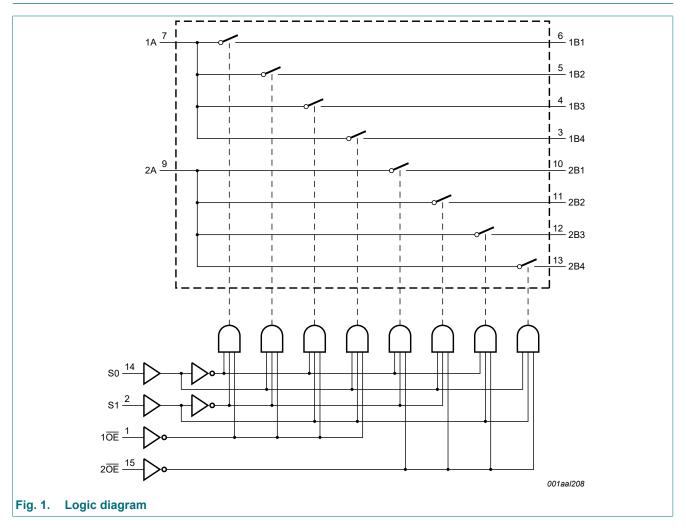
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3. Ordering information

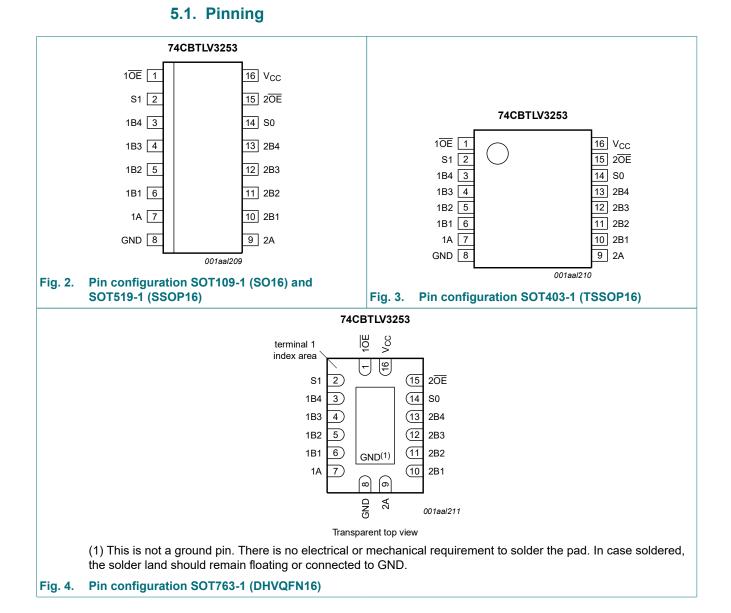
Type number	Package								
	Temperature range	Name	Description	Version					
74CBTLV3253D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1					
74CBTLV3253DS	-40 °C to +85 °C	SSOP16 [1]	plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 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



5. Pinning information



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1 0E , 2 0E	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 _{CC}	16	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

Inputs		Function switch		
1 0E	2 0E	S1	S0	
Х	Н	Х	Х	disconnect 2A and 2Bn
Н	Х	Х	Х	disconnect 1A and 1Bn
L	L	L	L	1A to 1B1 and 2A to 2B1
L	L	L	Н	1A to 1B2 and 2A to 2B2
L	L	Н	L	1A to 1B3 and 2A to 2B3
L	L	Н	Н	1A to 1B4 and 2A to 2B4

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	+4.6	V
VI	input voltage	control inputs	[1]	-0.5	+4.6	V
V _{SW}	switch voltage	enable and disable mode	[2]	-0.5	V _{CC} + 0.5	V
I _{IK}	input clamping current	V _I < -0.5 V		-50	-	mA
I _{SK}	switch clamping current	V _I < -0.5 V		-50	-	mA
I _{SW}	switch current	$V_{SW} = 0 V$ to V_{CC}		-	±128	mA
I _{CC}	supply current			-	+100	mA
I _{GND}	ground current			-100	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	T_{amb} = -40 °C to +125 °C	[3]	-	500	mW

[1] The minimum input voltage 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 SOT109-1 (SO16) package: P_{tot} derates linearly with 12.4 mW/K above 110 °C.

For SOT519-1 (SSOP16) packages: P_{tot} derates linearly with 8.5 mW/K above 91 °C.

For SOT403-1 (TSSOP16) package: Ptot derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package: Ptot derates linearly with 11.2 mW/K above 106 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions Symbol Parameter Conditions Min Max Unit V_{CC} supply voltage 2.3 3.6 V VI input voltage 0 3.6 v 0 V_{CC} V V_{SW} switch voltage enable and disable mode T_{amb} -40 +125 °C ambient temperature Δt/ΔV input transition rise and fall rate V_{CC} = 2.3 V to 3.6 V 0 200 [1] ns/V

[1] Applies to control signal levels.

9. Static characteristics

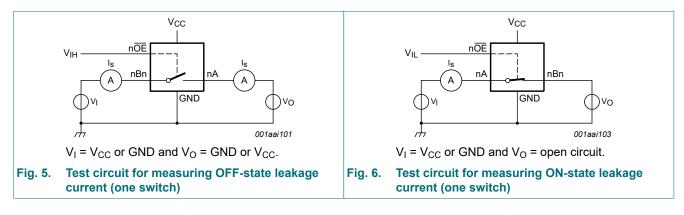
Table 6. Static characteristics

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

Symbol	Parameter	Conditions	T _{amb} =	= -40 °C to	+85 °C		= -40 °C 25 °C	Unit
			Min	Тур [1]	Мах	Min	Max	1
V _{IH}	HIGH-level input	V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
	voltage	V _{CC} = 3.0 V to 3.6 V	2.0	-	-	2.0	-	V
V _{IL}	LOW-level input	V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
	voltage	V _{CC} = 3.0 V to 3.6 V	-	-	0.9	-	0.9	V
lı	input leakage current	pin n \overline{OE} ; V _I = GND to V _{CC} ; V _{CC} = 3.6 V	-	-	±1	-	±20	μA
I _{S(OFF)}	OFF-state leakage current	V _{CC} = 3.6 V; see <u>Fig. 5</u>	-	-	±1	-	±20	μA
I _{S(ON)}	ON-state leakage current	V _{CC} = 3.6 V; see <u>Fig. 6</u>	-	-	±1	-	±20	μA
I _{OFF}	power-off leakage current	V_{I} or V_{O} = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±10	-	±50	μA
I _{CC}	supply current	V_I = GND or V_{CC} ; I_O = 0 A; V_{SW} = GND or V_{CC} ; V_{CC} = 3.6 V	-	-	10	-	50	μA
ΔI _{CC}	additional supply current	pin $n\overline{OE}$; V ₁ = V _{CC} - 0.6 V; V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V; One input at 3 V, other inputs at V _{CC} or GND.	-	-	300	-	2000	μA
CI	input capacitance	pin n \overline{OE} ; V _{CC} = 3.3 V; V _I = 0 V to 3.3 V	-	0.9	-	-	-	pF
C _{S(OFF)}	OFF-state capacitance	V_{CC} = 3.3 V; V _I = 0 V to 3.3 V	-	5.2	-	-	-	pF
C _{S(ON)}	ON-state capacitance	V_{CC} = 3.3 V; V _I = 0 V to 3.3 V	-	20.0	-	-	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

9.1. Test circuits



9.2. ON resistance

Table 7. Resistance R_{ON}

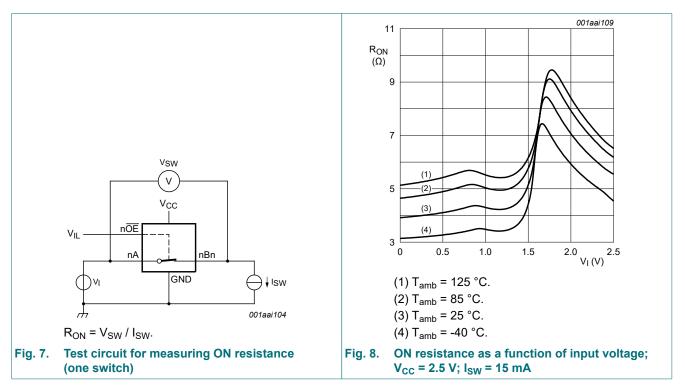
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	neter Conditions		-40 °C to	+85 °C	T _{amb} = -40 °	C to +125 °C	Unit
			Min	Typ [1]	Max	Min	Мах	
R _{ON}	ON resistance	V _{CC} = 2.3 V to 2.7 V; [2] see <u>Fig. 8</u> to <u>Fig. 10</u>						
		I _{SW} = 64 mA; V _I = 0 V	-	4.2	8.0	-	15.0	Ω
		I _{SW} = 24 mA; V _I = 0 V	-	4.2	8.0	-	15.0	Ω
		I _{SW} = 15 mA; V _I = 1.7 V	-	8.4	40.0	-	60.0	Ω
		V _{CC} = 3.0 V to 3.6 V; see <u>Fig. 11</u> to <u>Fig. 13</u>						
		I _{SW} = 64 mA; V _I = 0 V	-	4.0	7.0	-	11.0	Ω
		I _{SW} = 24 mA; V _I = 0 V	-	4.0	7.0	-	11.0	Ω
		I _{SW} = 15 mA; V _I = 2.4 V	-	6.2	15.0	-	25.5	Ω

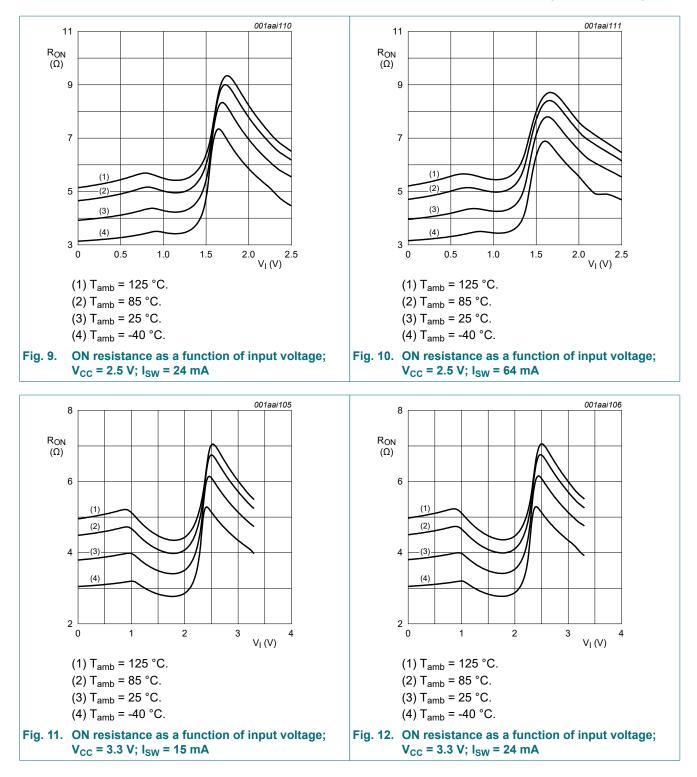
[1] Typical values are measured at T_{amb} = 25 °C and nominal V_{CC}.

[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.

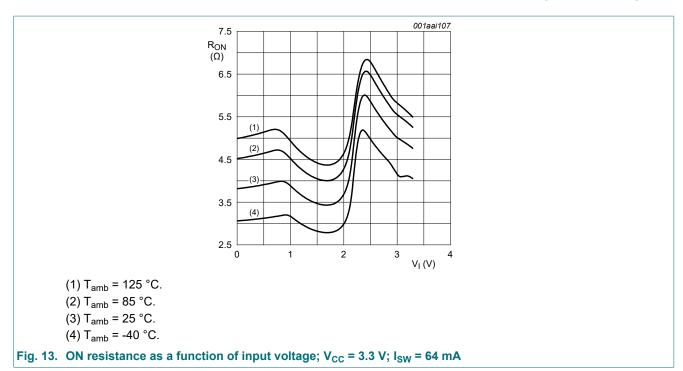
9.3. ON resistance test circuit and graphs



Dual 1-of-4 multiplexer/demultiplexer



Dual 1-of-4 multiplexer/demultiplexer



10. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V; for test circuit see Fig. 16

Symbol	Parameter	Conditions	T _{amb} =	-40 °C to	+85 °C		-40 °C 25 °C	ns
			Min	Тур [1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nBn or nBn to nA; see Fig. 14 [2] [3]						
		V _{CC} = 2.3 V to 2.7 V	-	-	0.15	-	0.25	ns
		V _{CC} = 3.0 V to 3.6 V	-	-	0.15	-	0.25	ns
	Sn to nA; see <u>Fig. 14</u> [3]							
		V _{CC} = 2.3 V to 2.7 V	1.0	2.2	6.8	1.0	7.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.0	5.5	1.0	6.1	ns
t _{en}	enable time	nOE to nA or nBn; see Fig. 15 [4]						
		V _{CC} = 2.3 V to 2.7 V	1.0	2.1	5.0	1.0	5.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	1.9	4.8	1.0	5.3	ns
		Sn to nBn; see <u>Fig. 15</u> [4]						
		V _{CC} = 2.3 V to 2.7 V	1.0	2.1	4.3	1.0	4.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	1.9	4.0	1.0	4.4	ns

Dual 1-of-4 multiplexer/demultiplexer

Symbol	Parameter	Conditions		T _{amb} = -40 °C to +85 °C		T _{amb} = to +1	Unit		
				Min	Typ [1]	Max	Min	Max	7
t _{dis}	disable time	nOE to nA or nBn; see Fig. 15	[5]						
		V _{CC} = 2.3 V to 2.7 V		1.0	2.6	5.5	1.0	6.1	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	3.2	5.4	1.0	5.9	ns
		Sn to nBn; see <u>Fig. 15</u>	[5]						
		V _{CC} = 2.3 V to 2.7 V		0.8	2.0	4.8	0.8	5.3	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	2.0	4.5	1.0	5.0	ns

[1]

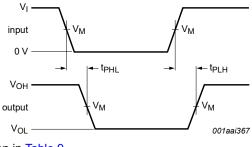
All typical values are measured at T_{amb} = 25 °C and at nominal V_{CC} . The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the load capacitance, [2] when driven by an ideal voltage source (zero output impedance).

 t_{pd} is the same as t_{PLH} and t_{PHL} . [3]

[4] t_{en} is the same as t_{PZH} and t_{PZL} .

 t_{dis} is the same as t_{PHZ} and t_{PLZ} . [5]

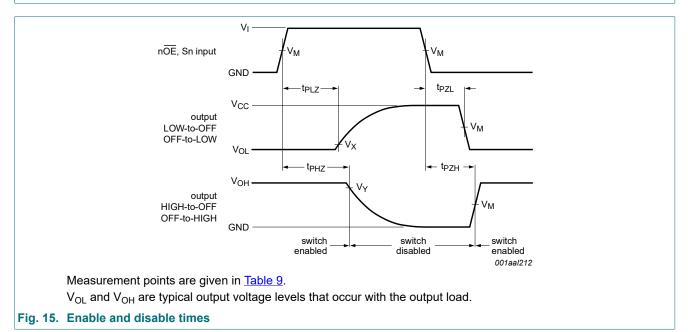
10.1. Waveforms



Measurement points are given in Table 9.

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

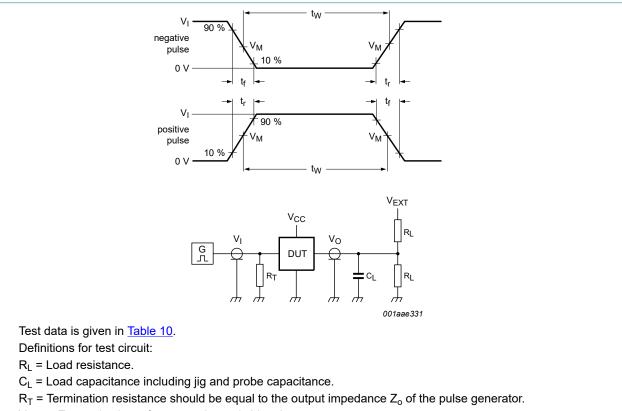
Fig. 14. The data input (nA or nBn) to output (nBn or nA) propagation delays



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Table 9. Measurement points								
Supply voltage	Input	Input						
V _{cc}	V _M	VI	t _r = t _f	V _M	V _X	V _Y		
2.3 V to 2.7 V	0.5V _{CC}	V _{CC}	≤ 2.0 ns	0.5V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V		
3.0 V to 3.6 V	0.5V _{CC}	V _{CC}	≤ 2.0 ns	0.5V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V		





 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}	CL	RL	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}	
2.3 V to 2.7 V	30 pF	500 Ω	open	GND	2V _{CC}	
3.0 V to 3.6 V	50 pF	500 Ω	open	GND	2V _{CC}	

10.2. Additional dynamic characteristics

Table 11. Additional dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); $V_I = GND$ or V_{CC} (unless otherwise specified); $t_r = t_f \le 2.5$ ns.

Symbol	Parameter	Conditions	٦	۲ _{amb} = 25 °C	;	Unit
			Min	Тур	Мах	
f _(-3dB)	-3 dB frequency response	V_{CC} = 3.3 V; R _L = 50 Ω ; see <u>Fig. 17</u> [1]	-	302	-	MHz

[1] f_i is biased at 0.5V_{CC}.

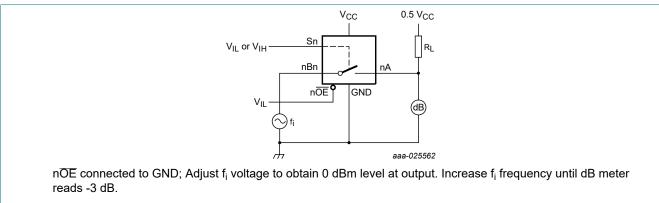


Fig. 17. Test circuit for measuring the frequency response when channel is in ON-state

74CBTLV3253

11. Package outline

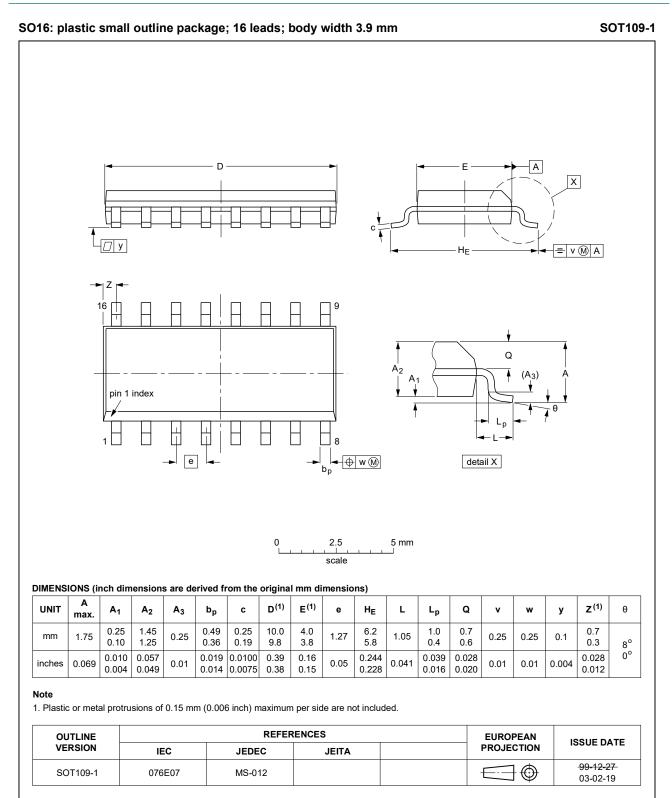


Fig. 18. Package outline SOT109-1 (SO16)

74CBTLV3253

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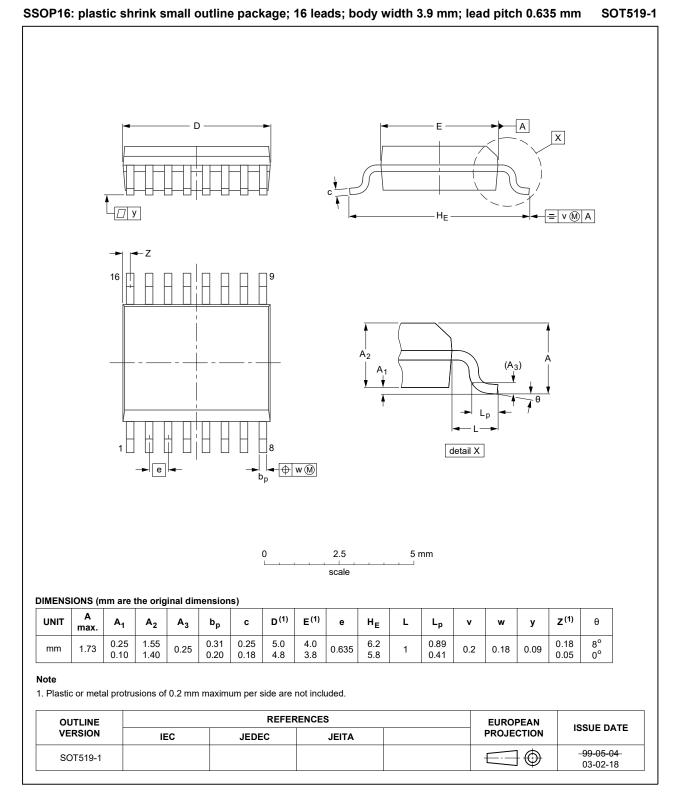


Fig. 19. Package outline SOT519-1 (SSOP16)

⁷⁴CBTLV3253

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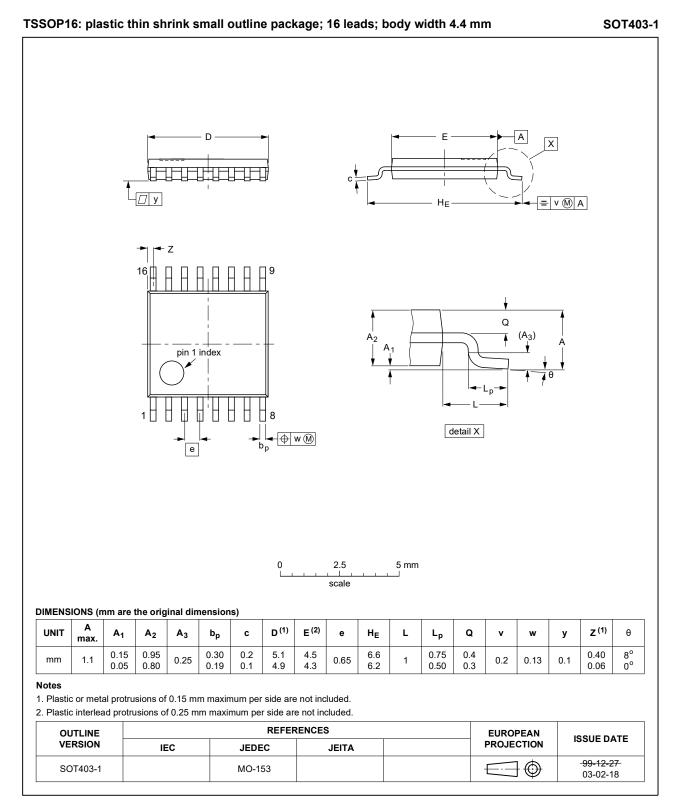


Fig. 20. Package outline SOT403-1 (TSSOP16)

⁷⁴CBTLV3253

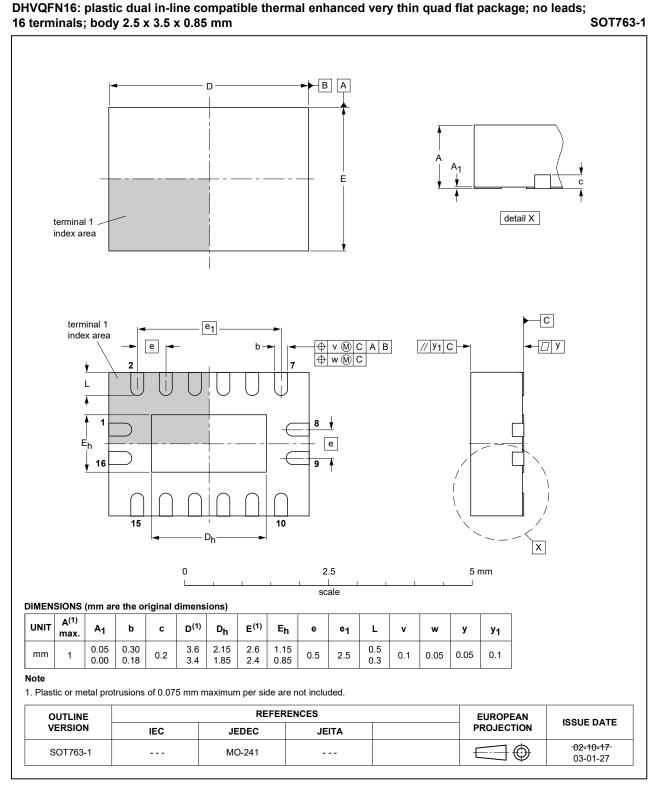


Fig. 21. Package outline SOT763-1 (DHVQFN16)

⁷⁴CBTLV3253

12. Abbreviations

Table 12. 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				

13. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74CBTLV3253 v.6	20200924	Product data sheet	-	74CBTLV3253 v.5	
Modifications:	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. <u>Table 4</u>: Derating values for P_{tot} total power dissipation updated. 				
74CBTLV3253 v.5	20161111	Product data sheet	-	74CBTLV3253 v.4	
Modifications:	• <u>Section 10.2</u> added.				
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	-	-	

14. Legal information

Data sheet status

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

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

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