

74CBTLV3253-Q100

Dual 1-of-4 multiplexer/demultiplexer

Rev. 2 — 10 November 2016

Product data sheet

1. General description

The 74CBTLV3253-Q100 provides a dual 1-of-4 high-speed multiplexer/demultiplexer with two common select inputs (S0, S1) 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 $\overline{nOE}$ = LOW, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin $\overline{nOE}$ = 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, $\overline{nOE}$ should be tied to the V_{CC} through a pull-up resistor. The current-sinking capability of the driver determines the minimum value of the resistor.

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.

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 $+125\text{ }^{\circ}\text{C}$
- 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:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)
- $5\text{ }\Omega$ 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

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74CBTLV3253D-Q100	−40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74CBTLV3253PW-Q100	−40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74CBTLV3253BQ-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. Functional diagram

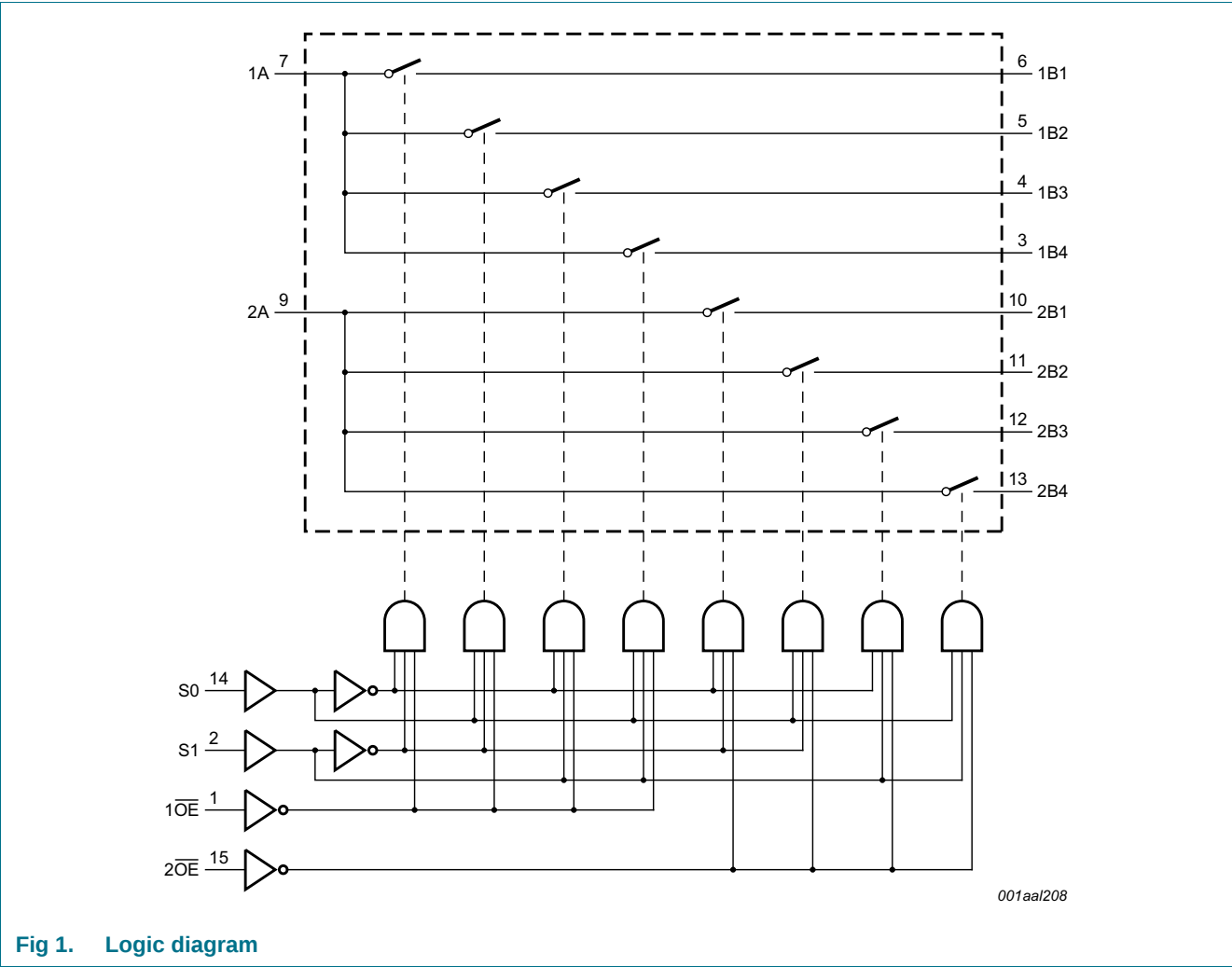


Fig 1. Logic diagram

5. Pinning information

5.1 Pinning

Fig 2. Pin configuration SOT109-1 (SO16)

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 _{CC}	16	supply voltage

6. Functional description

Table 3. Function table^[1]

Inputs				Function switch
1OE	2OE	S1	S0	
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 _{CC}	supply voltage		−0.5	+4.6	V
V _I	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 TSSOP16 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN16 packages: P_{tot} 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 _{CC}	supply voltage		2.3	3.6	V
V _I	input voltage		0	3.6	V
V _{SW}	switch voltage	enable and disable mode	0	V _{CC}	V
T _{amb}	ambient temperature		−40	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.3 V to 3.6 V ^[1]	0	200	ns/V

[1] Applies to control signal levels.

9. Static characteristics

Table 6. Static characteristics

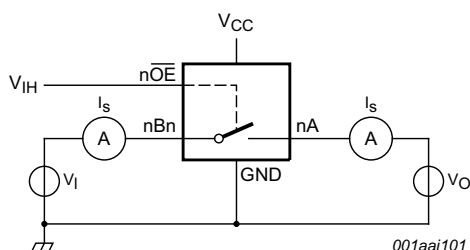
At recommended operating conditions voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	T _{amb} = –40 °C to +85 °C			T _{amb} = –40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 3.0 V to 3.6 V	2.0	-	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 3.0 V to 3.6 V	-	-	0.9	-	0.9	V
I _I	input leakage current	pin nOE; 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 Figure 5	-	-	±1	-	±20	µA
I _{S(ON)}	ON-state leakage current	V _{CC} = 3.6 V; see Figure 6	-	-	±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 nOE; V _I = V _{CC} – 0.6 V; V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V ^[2]	-	-	300	-	2000	µA
C _I	input capacitance	pin nOE; 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.

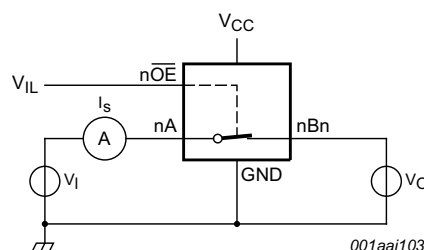
[2] One input at 3 V, other inputs at V_{CC} or GND.

9.1 Test circuits



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

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

9.2 ON resistance

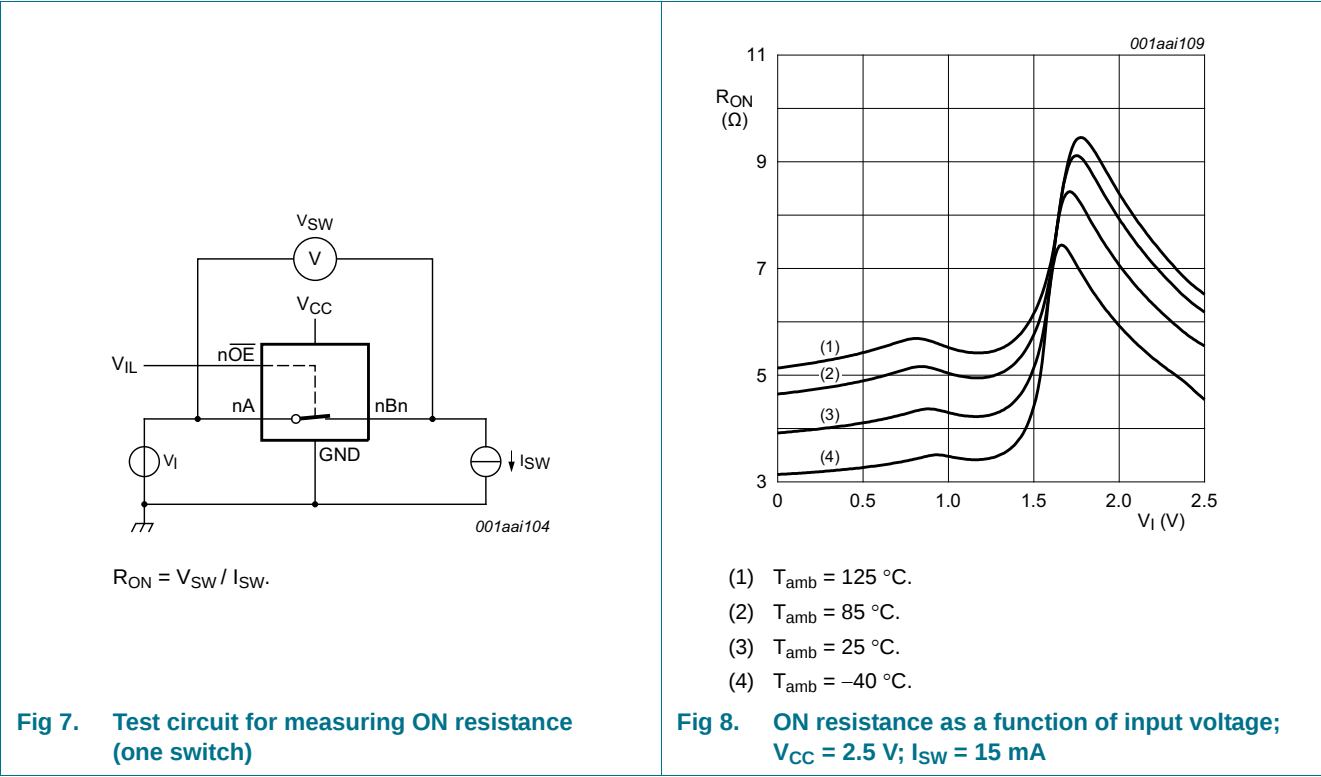
Table 7. Resistance R_{ON}

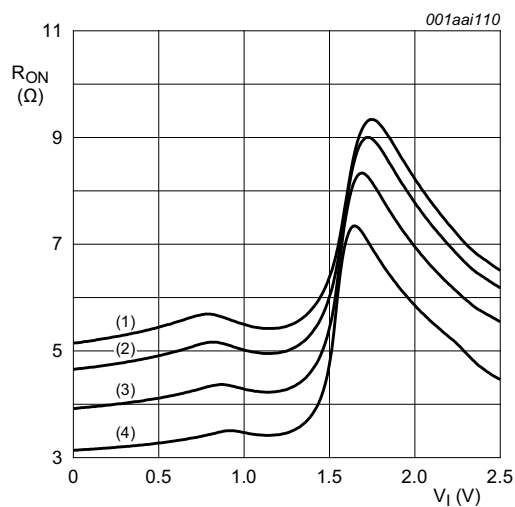
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

Symbol	Parameter	Conditions	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$			$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		Unit
			Min	Typ ^[1]	Max	Min	Max	
R_{ON}	ON resistance	$V_{CC} = 2.3\text{ V}$ to 2.7 V ; see Figure 8 to Figure 10						
		$I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	Ω
		$I_{SW} = 24\text{ mA}$; $V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	Ω
		$I_{SW} = 15\text{ mA}$; $V_I = 1.7\text{ V}$	-	8.4	40.0	-	60.0	Ω
		$V_{CC} = 3.0\text{ V}$ to 3.6 V ; see Figure 11 to Figure 13						
		$I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	Ω
		$I_{SW} = 24\text{ mA}$; $V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	Ω
		$I_{SW} = 15\text{ mA}$; $V_I = 2.4\text{ V}$	-	6.2	15.0	-	25.5	Ω

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

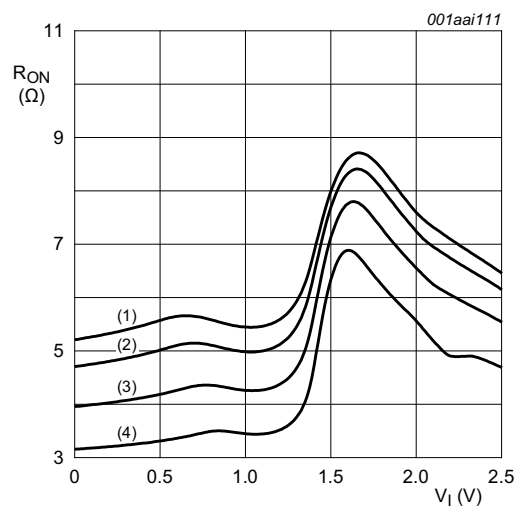
9.3 ON resistance test circuit and graphs





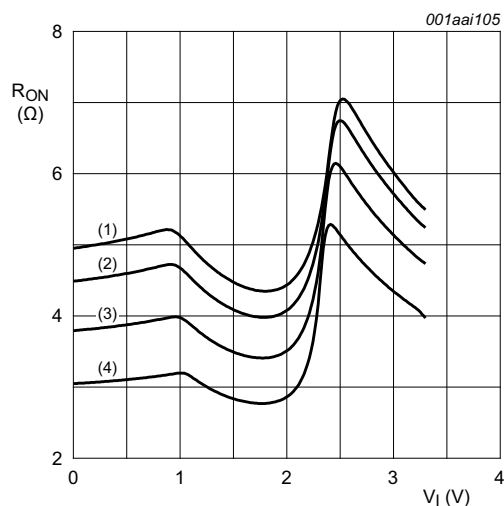
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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



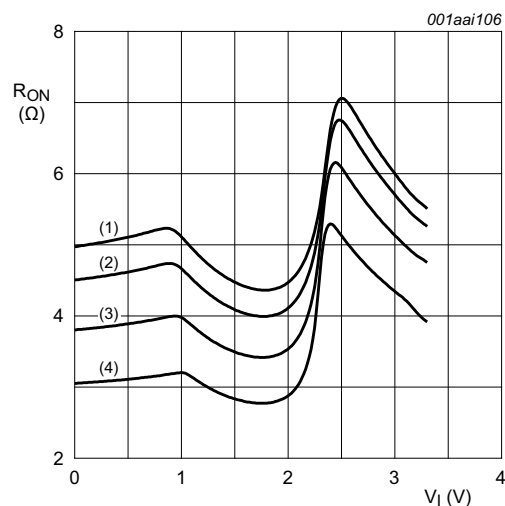
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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



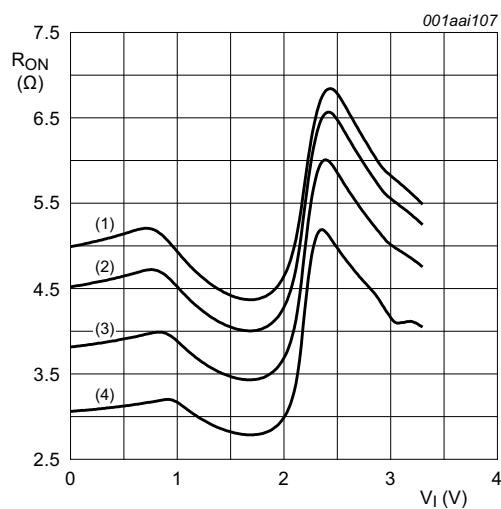
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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



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



- (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 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

$GND = 0\text{ V}$; for test circuit see [Figure 16](#)

Symbol	Parameter	Conditions	$T_{\text{amb}} = -40\text{ °C to }+85\text{ °C}$			$T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	nA to nBn or nBn to nA; see Figure 14 ^{[2][3]}						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.15	-	0.25	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.15	-	0.25	ns
		Sn to nA; see Figure 14 ^[3]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.2	6.8	1.0	7.5	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	2.0	5.5	1.0	6.1	ns
t_{en}	enable time	$\overline{\text{nOE}}$ to nA or nBn; see Figure 15 ^[4]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.1	5.0	1.0	5.5	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	1.9	4.8	1.0	5.3	ns
		Sn to nBn; see Figure 15 ^[4]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.1	4.3	1.0	4.7	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	1.9	4.0	1.0	4.4	ns
t_{dis}	disable time	$\overline{\text{nOE}}$ to nA or nBn; see Figure 15 ^[5]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.6	5.5	1.0	6.1	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	5.4	1.0	5.9	ns
		Sn to nBn; see Figure 15 ^[5]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	0.8	2.0	4.8	0.8	5.3	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	2.0	4.5	1.0	5.0	ns

[1] All typical values are measured at $T_{\text{amb}} = 25\text{ °C}$ and at nominal V_{CC} .

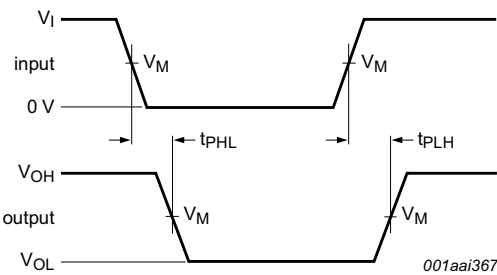
[2] The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).

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

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

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

11. Waveforms

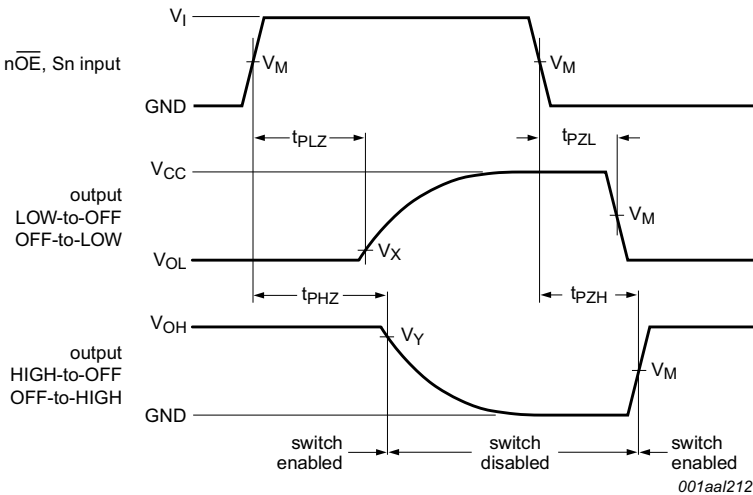


Measurement points are given in [Table 9](#).
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

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

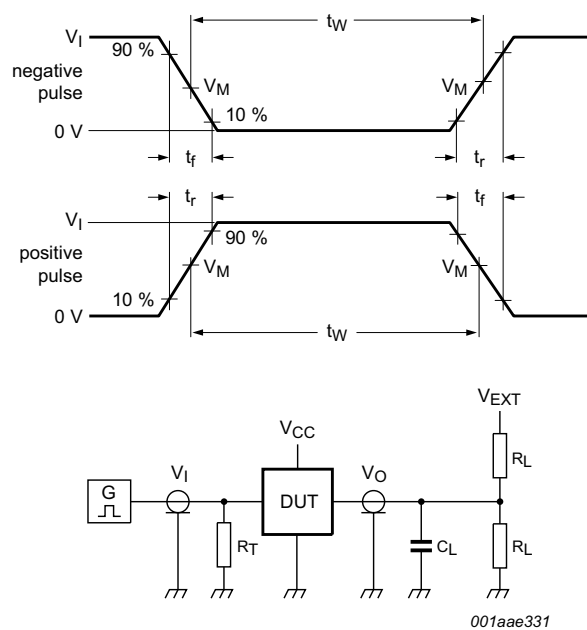
Table 9. Measurement points

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	$0.5V_{CC}$	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



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}	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	$2V_{CC}$

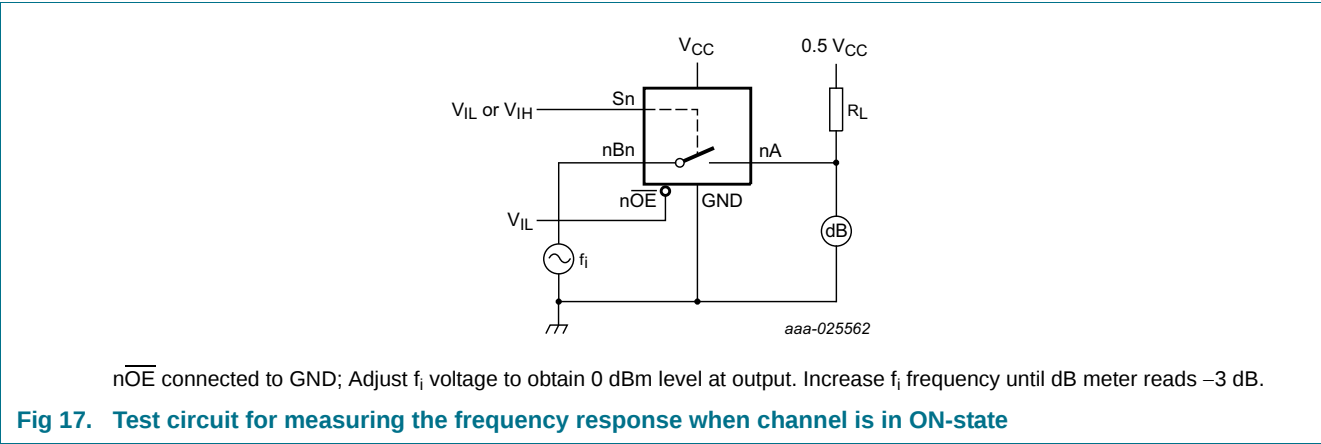
11.1 Additional dynamic characteristics

Table 11. Additional dynamic characteristics
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); $V_I = \text{GND}$ or V_{CC} (unless otherwise specified); $t_r = t_f \leq 2.5 \text{ ns}$.

Symbol	Parameter	Conditions	T _{amb} = 25 °C			Unit
			Min	Typ	Max	
f _(-3dB)	-3 dB frequency response	V _{CC} = 3.3 V; R _L = 50 Ω; see Figure 17 [1]	-	302	-	MHz

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

11.2 Test circuits



12. Package outline

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

SOT109-1

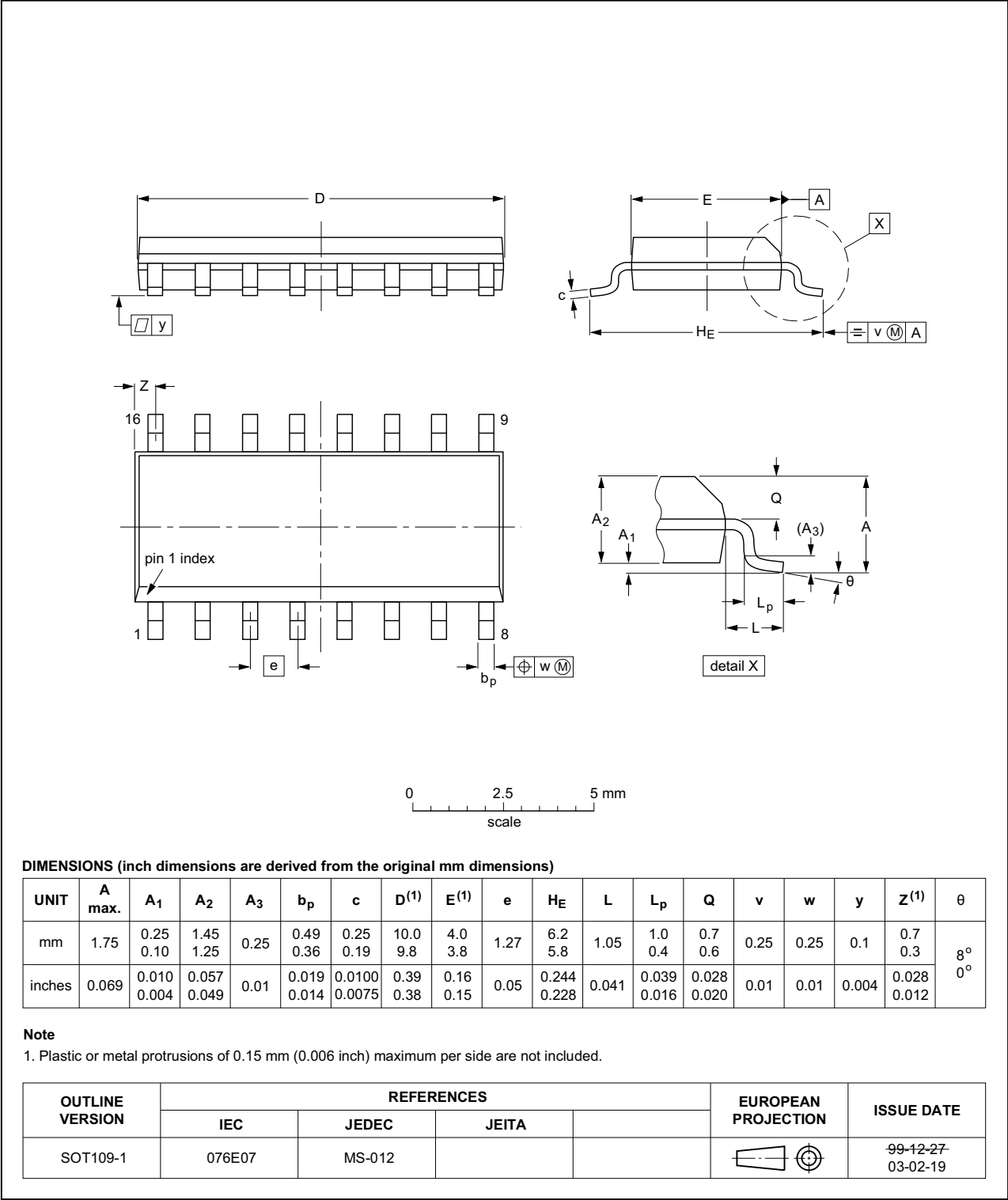


Fig 18. Package outline SOT109-1 (SO16)

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

SOT403-1

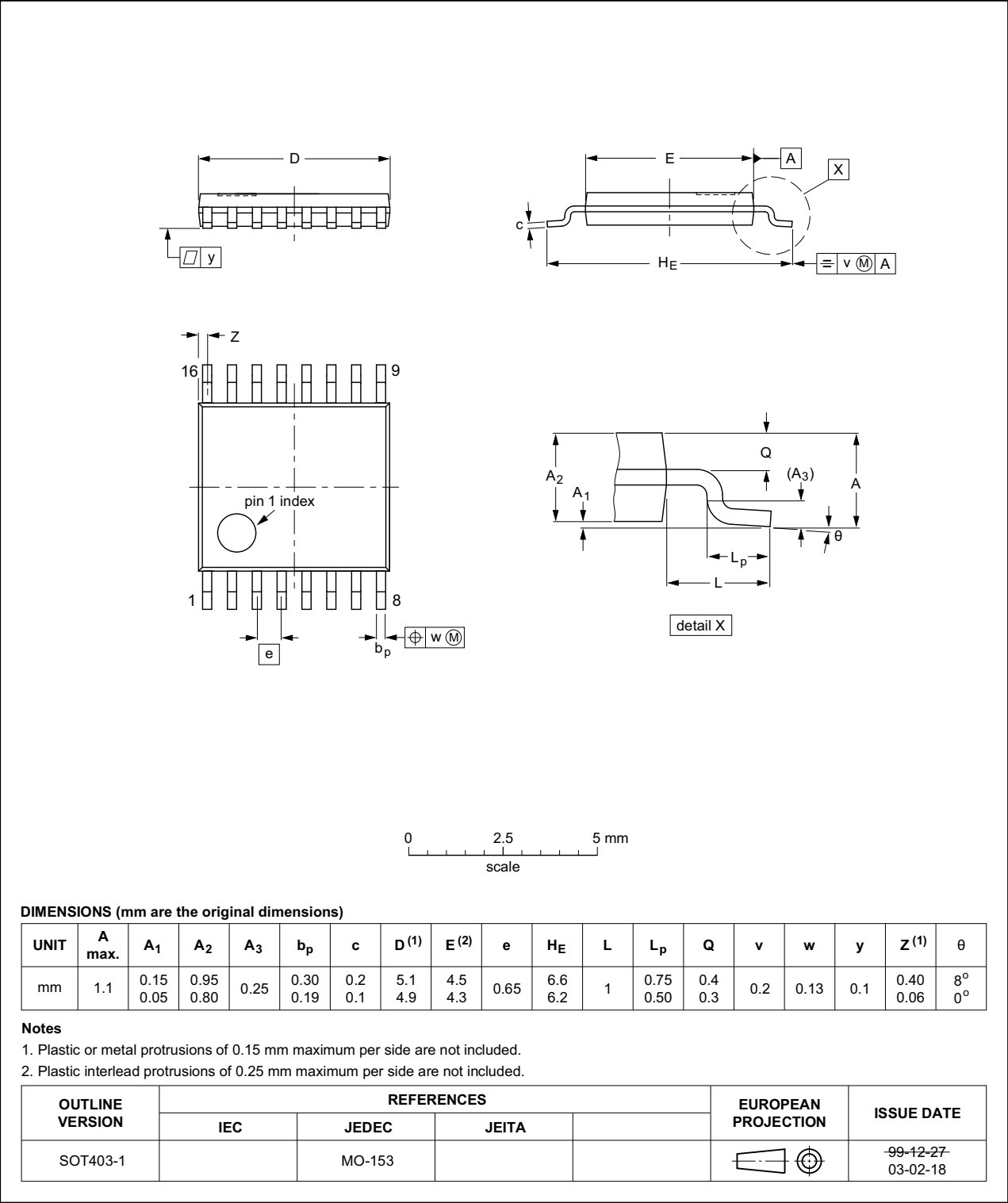


Fig 19. Package outline SOT403-1 (TSSOP16)

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

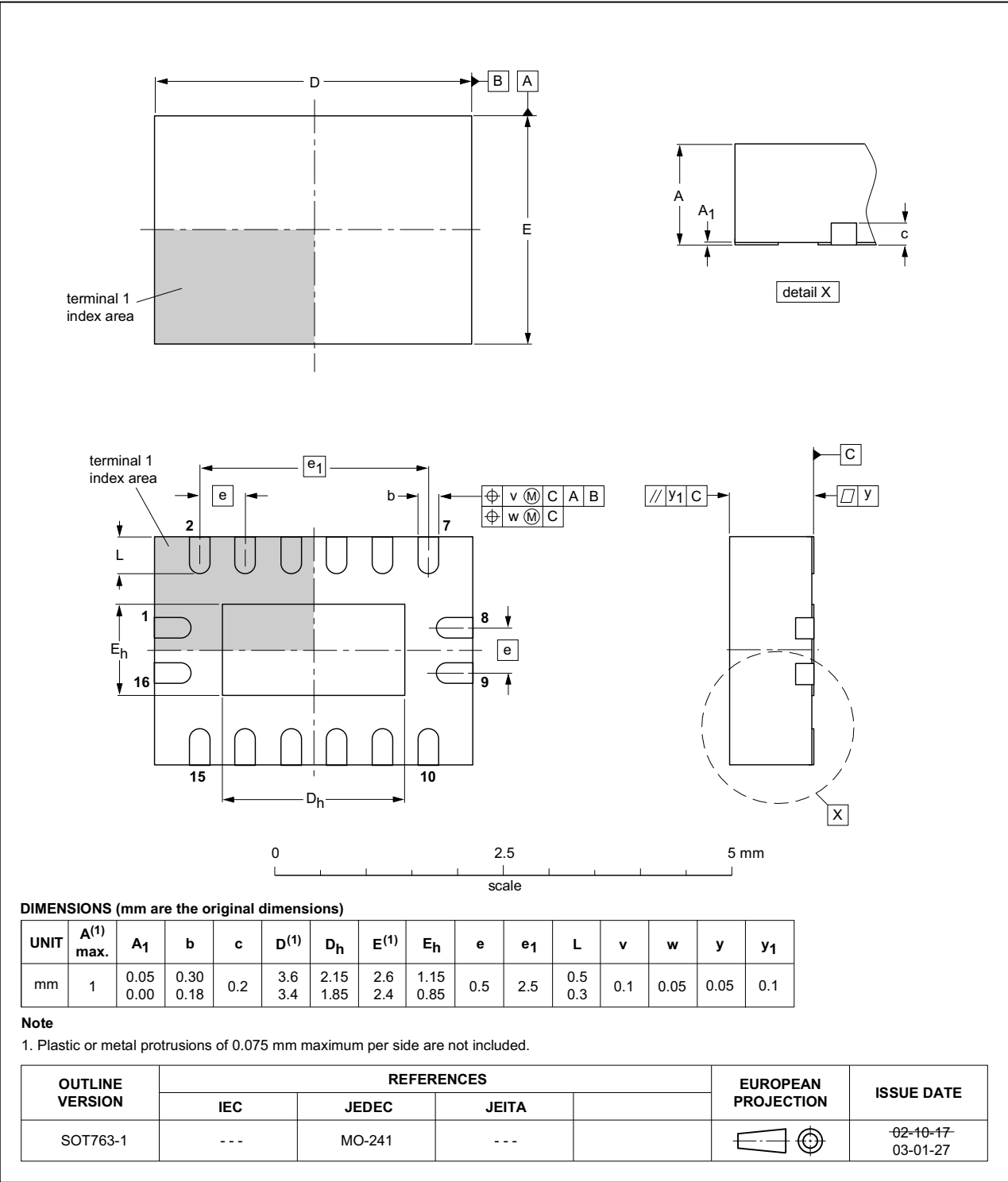


Fig 20. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 12. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV3253_Q100 v.2	20161110	Product data sheet	-	74CBTLV3253_Q100 v.1
Modifications:	• Section 11.1 and Section 11.2 added.			
74CBTLV3253_Q100 v.1	20130403	Product data sheet	-	-

15. Legal information

15.1 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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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331