

74CBTLV3253-Q100

Dual 1-of-4 multiplexer/demultiplexer

Rev. 3 — 24 September 2020

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 ($1\overline{OE}$, $2\overline{OE}$). 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 $n\overline{OE}$ = LOW, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin $n\overline{OE}$ = 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 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 °C to +85 °C and from -40 °C to +125 °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 pF, R = 0 Ω)
- 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
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
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

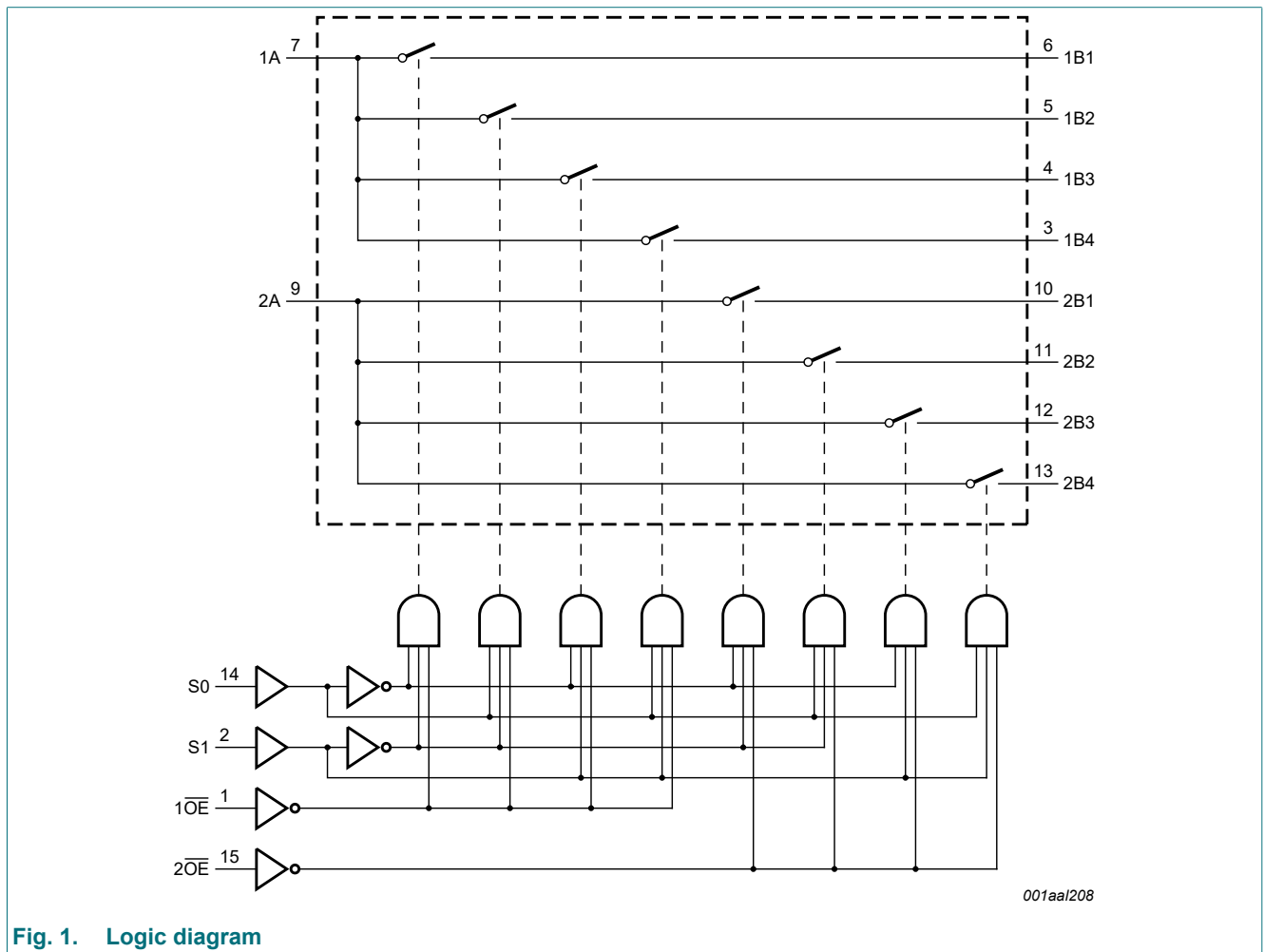
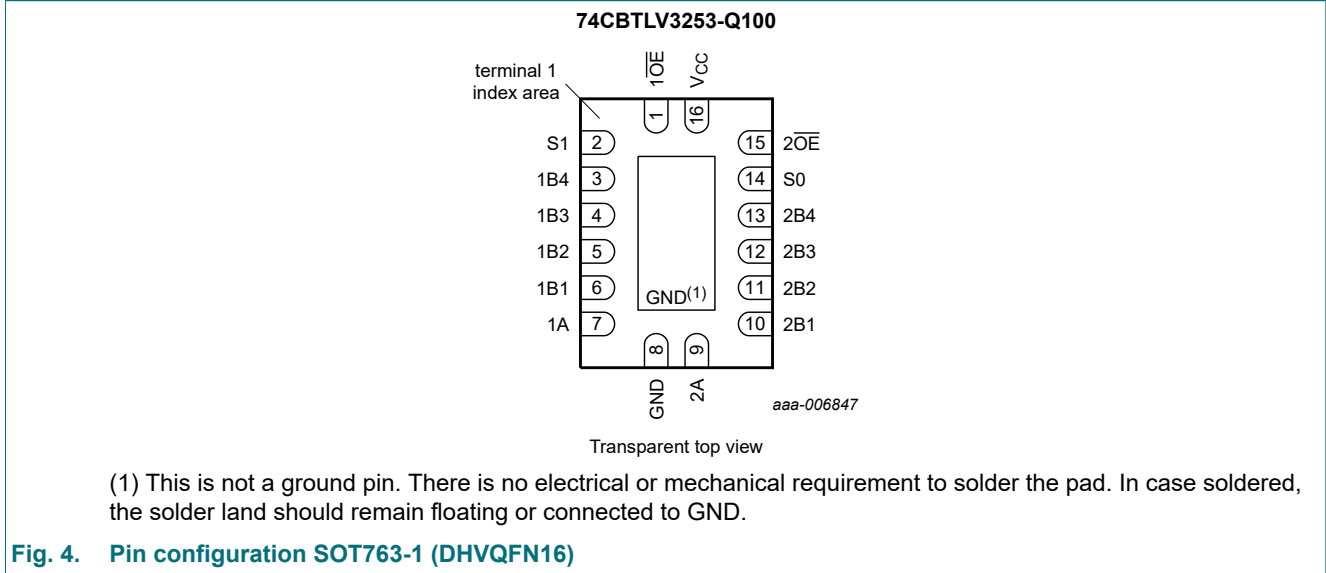
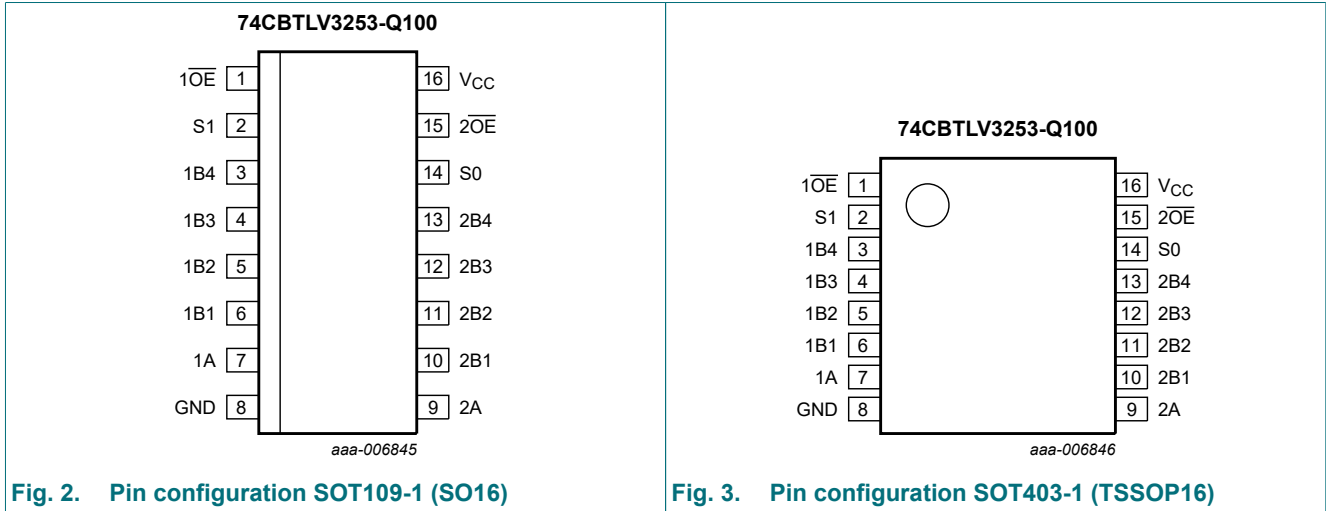


Fig. 1. Logic diagram

5. Pinning information

5.1. Pinning



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
VCC	16	supply voltage

6. Functional description

Table 3. Function table

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

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

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

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

For SOT763-1 (DHVQFN16) package: P_{tot} 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
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
$\Delta t/\Delta V$	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

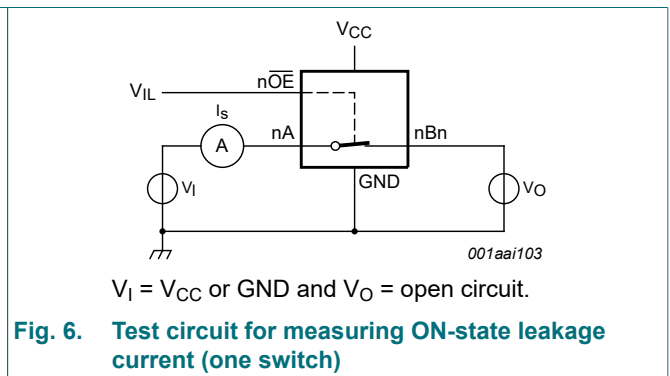
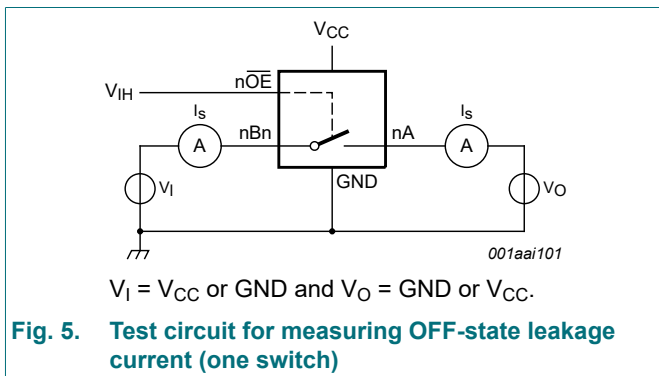
Table 6. Static characteristics

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 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 Fig. 5	-	-	±1	-	±20	μA
I _{S(ON)}	ON-state leakage current	V _{CC} = 3.6 V; see Fig. 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 n \overline{OE} ; V _I = 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
C _I	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

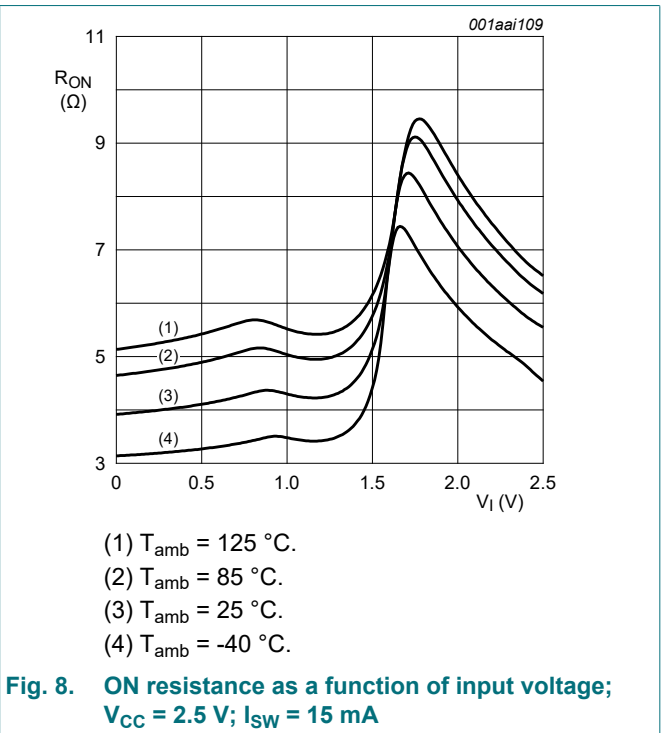
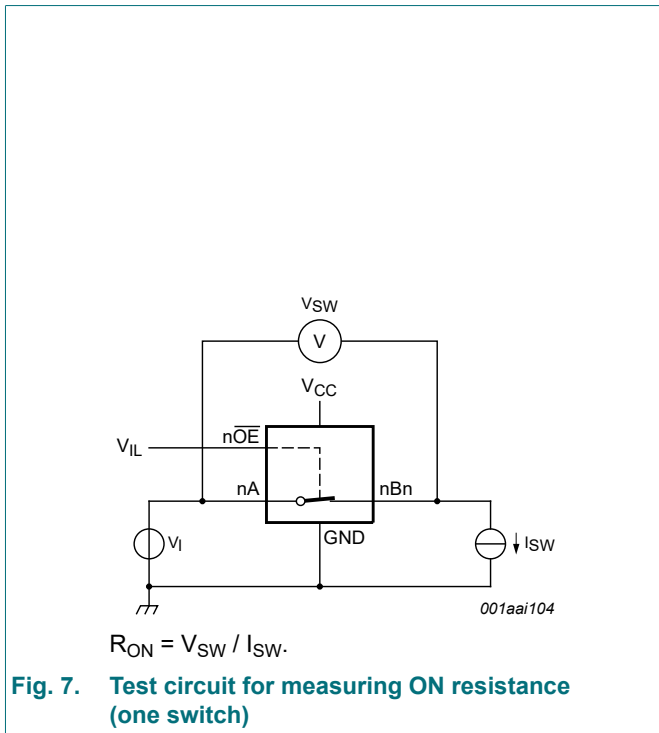
Table 7. Resistance R_{ON}

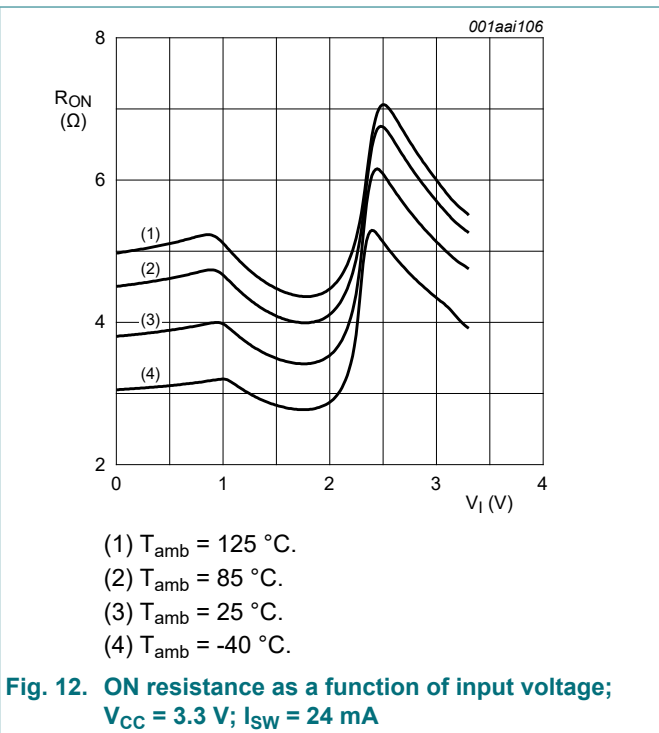
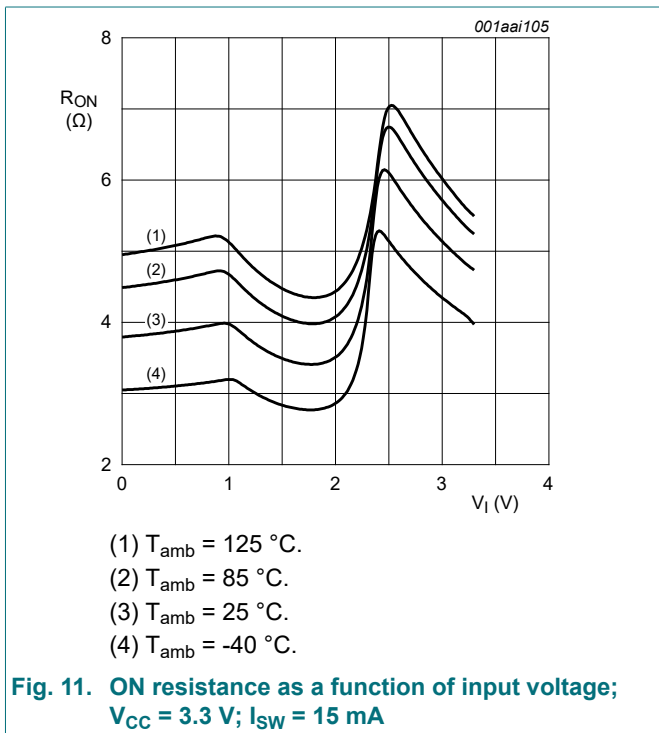
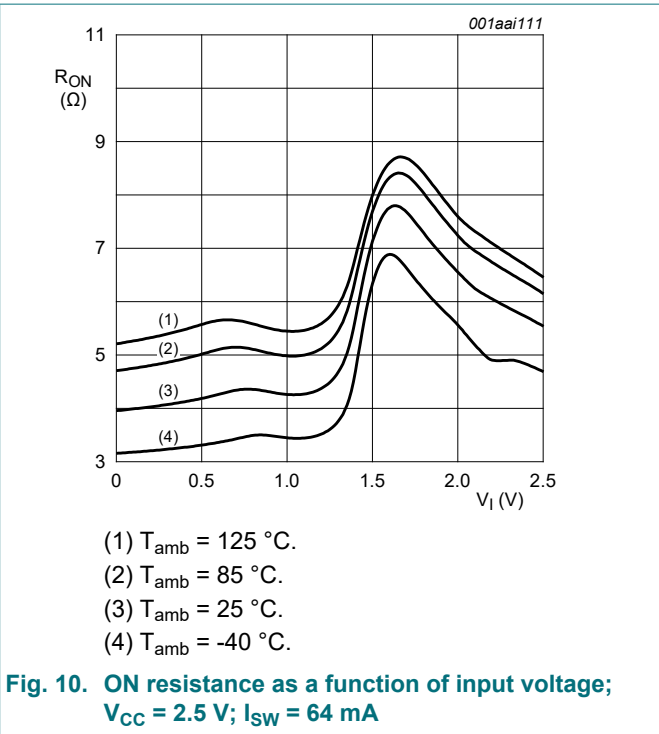
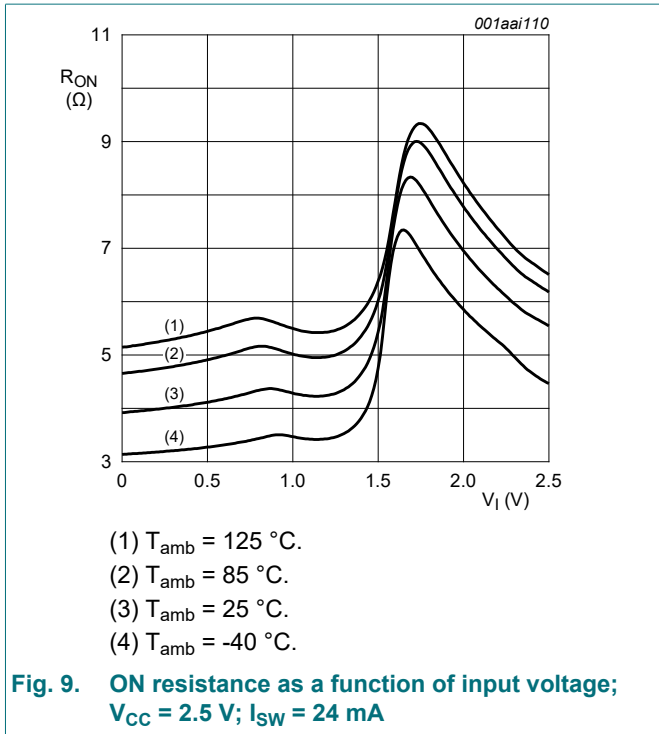
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

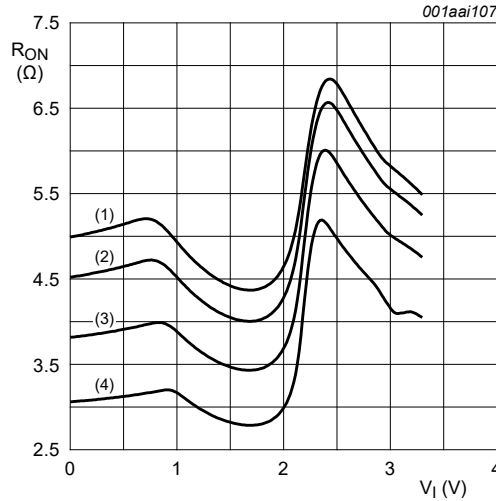
Symbol	Parameter	Conditions	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$			$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$		Unit
			Min	Typ [1]	Max	Min	Max	
R_{ON}	ON resistance	$V_{CC} = 2.3\text{ V}$ to 2.7 V ; see Fig. 8 to Fig. 10 [2]						
		$I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$	-	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 Fig. 11 to Fig. 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) $T_{amb} = 125\text{ °C}$.
- (2) $T_{amb} = 85\text{ °C}$.
- (3) $T_{amb} = 25\text{ °C}$.
- (4) $T_{amb} = -40\text{ °C}$.

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 Fig. 16

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{dis}	disable time	n $\overline{\text{OE}}$ 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 Fig. 15 [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}.
- [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}.

10.1. Waveforms

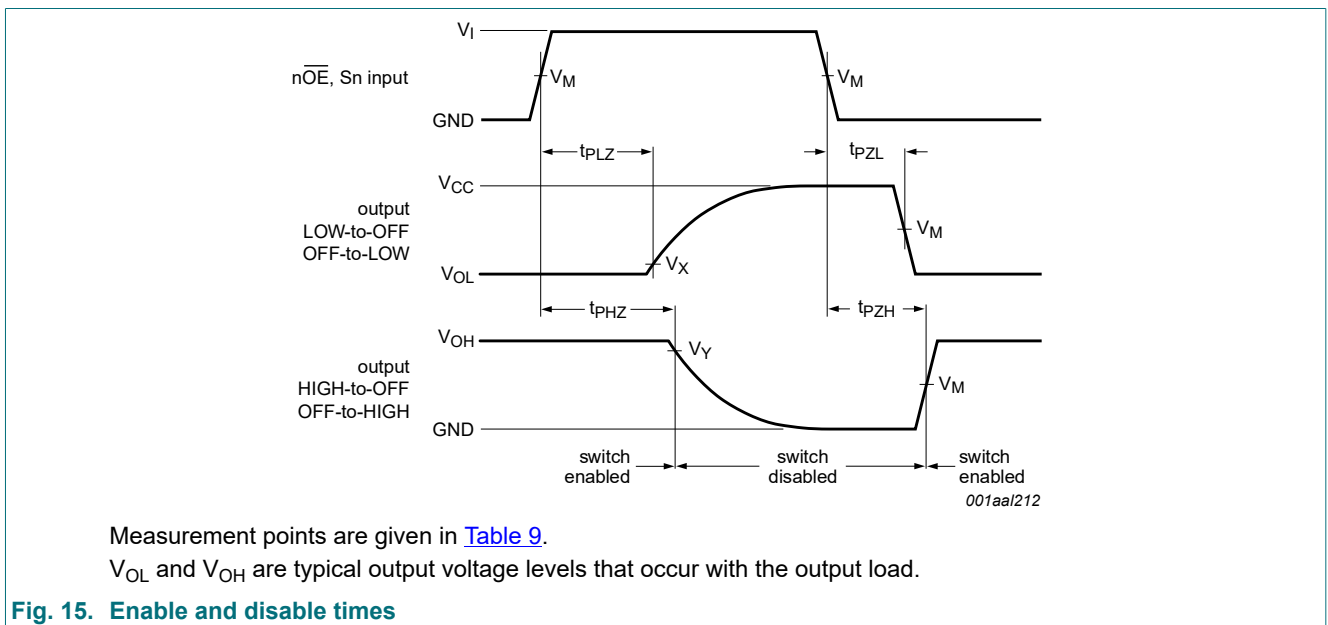
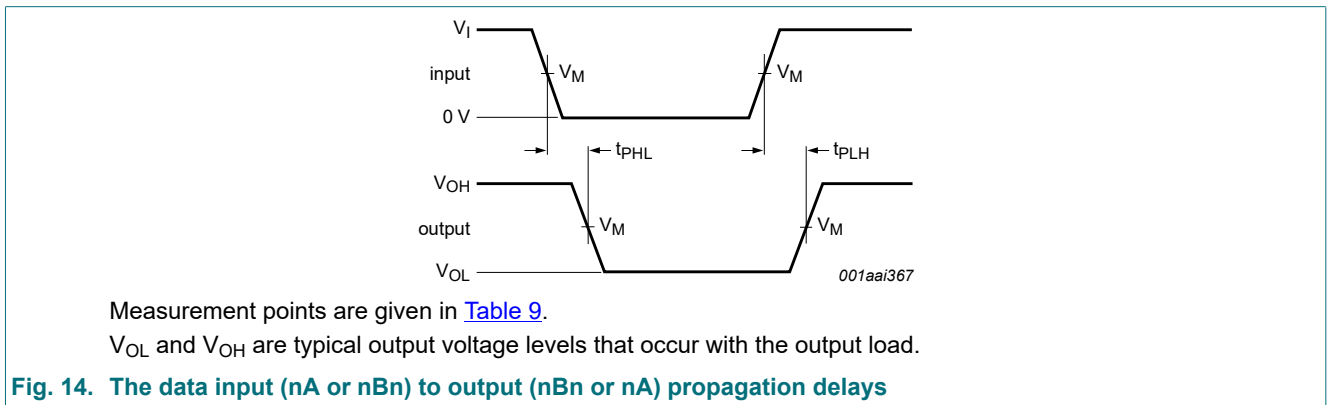
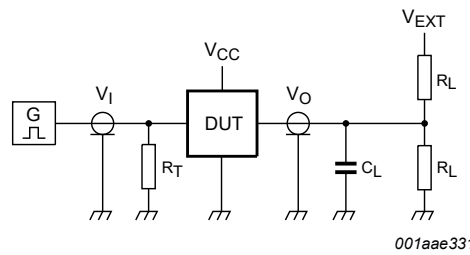
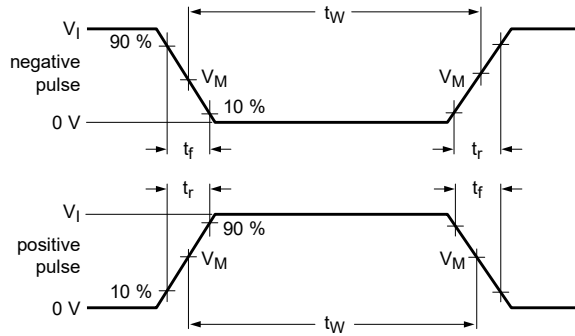


Table 9. Measurement points

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



001aae331

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. Package outline

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

SOT109-1

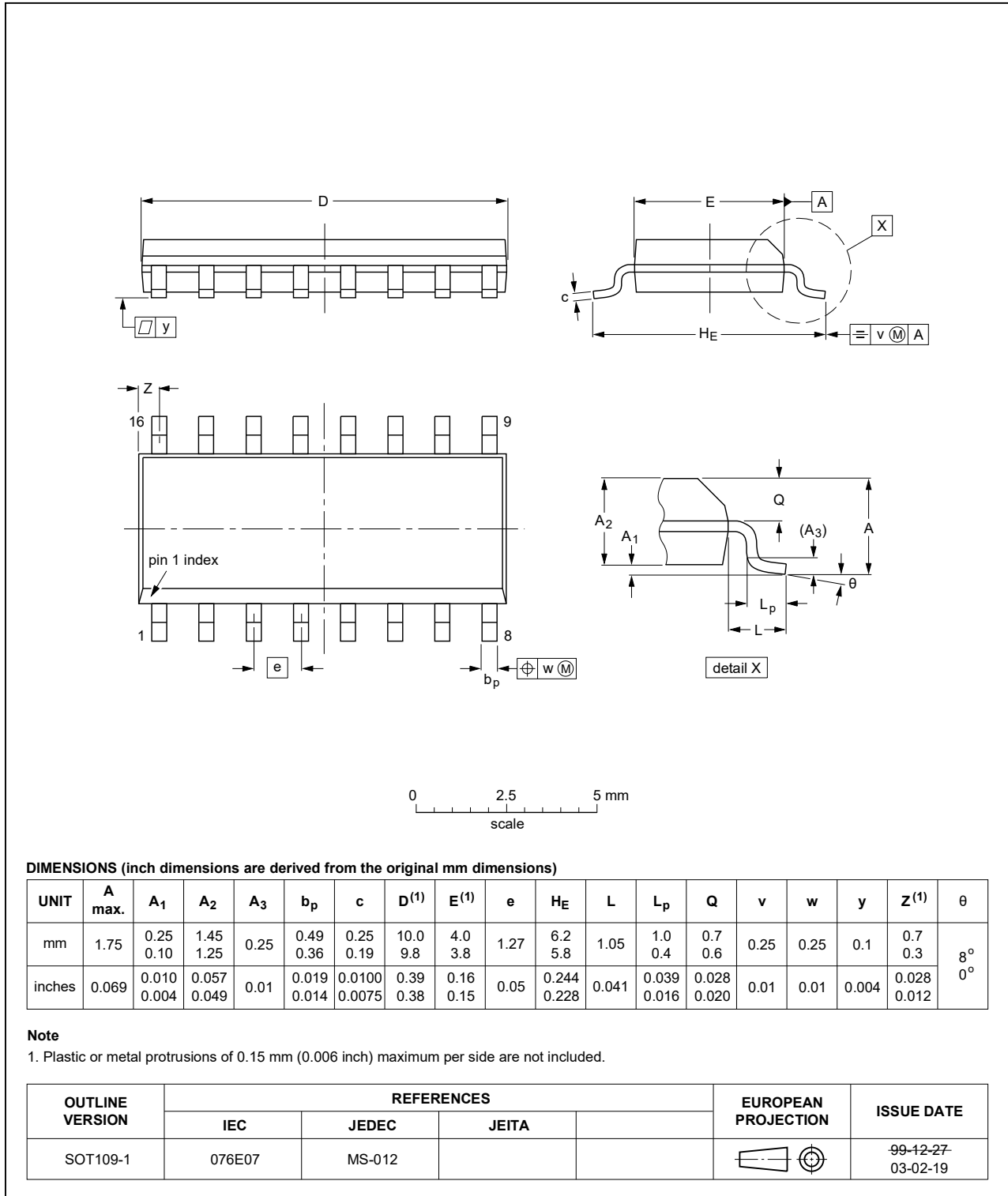


Fig. 18. Package outline SOT109-1 (SO16)

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

SOT403-1

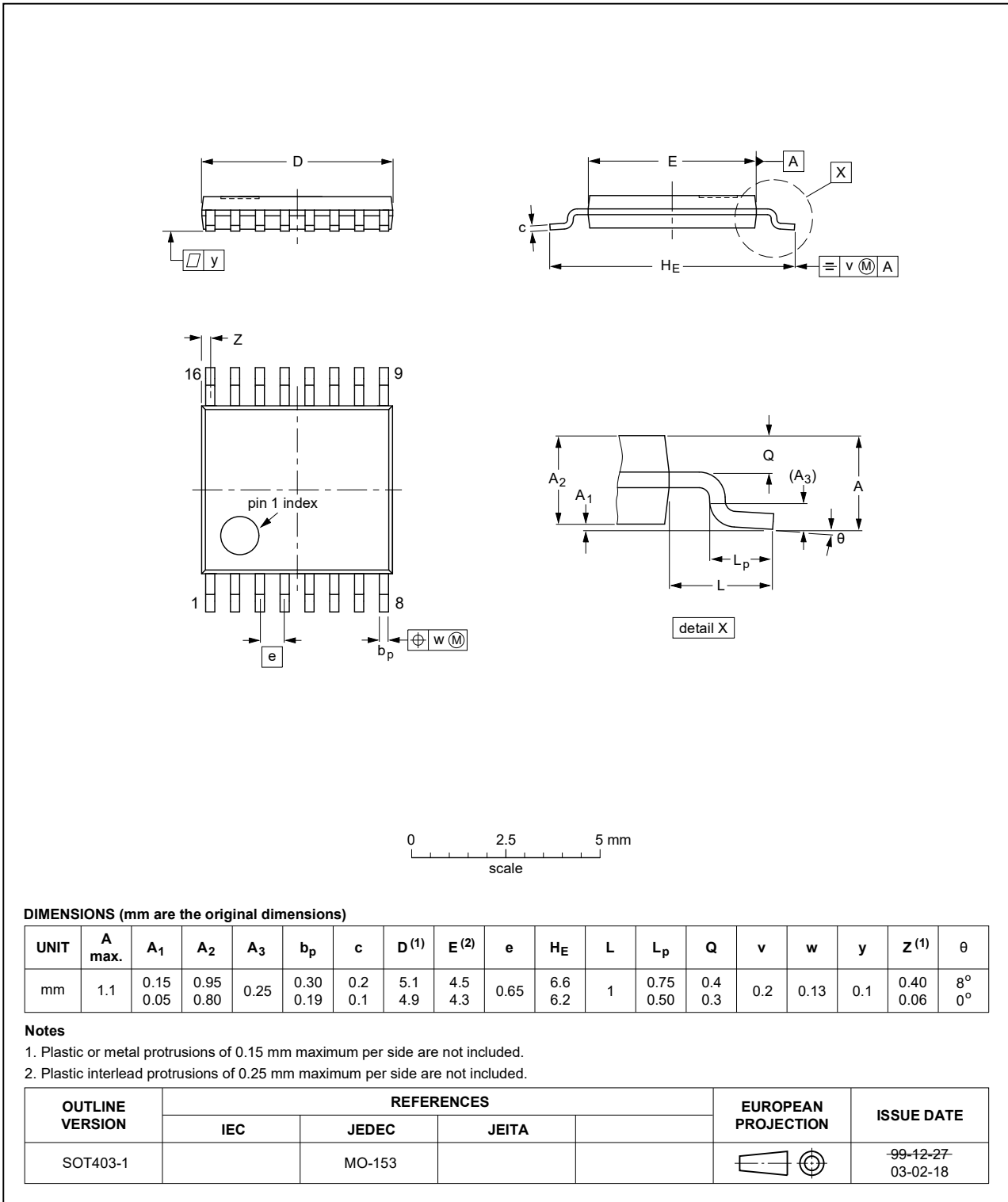


Fig. 19. Package outline SOT403-1 (TSSOP16)

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

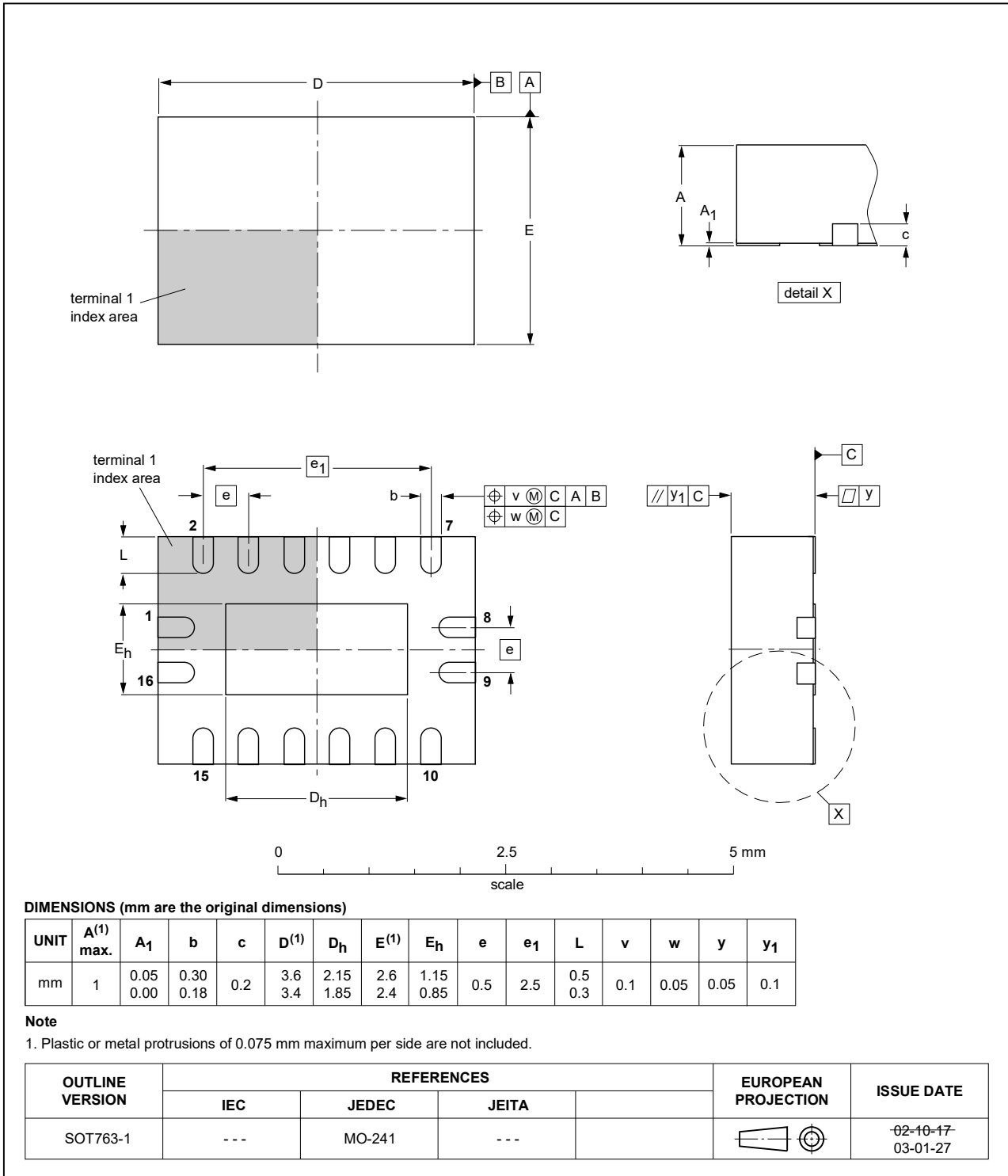


Fig. 20. Package outline SOT763-1 (DHVQFN16)

12. Abbreviations

Table 12. Abbreviations

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

13. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV3253_Q100 v.3	20200924	Product data sheet	-	74CBTLV3253_Q100 v.2
Modifications:	<ul style="list-style-type: none"> 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. Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation updated. 			
74CBTLV3253_Q100 v.2	20161110	Product data sheet	-	74CBTLV3253_Q100 v.1
Modifications:	<ul style="list-style-type: none"> Section 10.2 added. 			
74CBTLV3253_Q100 v.1	20130403	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.

- [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 <https://www.nexperia.com>.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This Nexperia product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or

equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.