

# 74CBTLV3257-Q100

Quad 1-of-2 multiplexer/demultiplexer

Rev. 3 — 9 April 2019

Product data sheet

## 1. General description

The 74CBTLV3257-Q100 provides a quad 1-of-2 high-speed multiplexer/demultiplexer with common select (S) and output enable ( $\overline{OE}$ ) inputs. 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  $\overline{OE}$  = LOW, one of the two switches is selected (low-impedance ON-state) with pin S. When pin  $\overline{OE}$  = HIGH, all switches are in the high-impedance OFF-state, independent of pin S. To ensure the high-impedance OFF-state during power-up or power-down,  $\overline{OE}$  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  $\Omega$ )
- 5  $\Omega$  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			Version
	Temperature range	Name	Description	
74CBTLV3257D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74CBTLV3257PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74CBTLV3257BQ-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 x 3.5 x 0.85 mm	SOT763-1

### 4. Functional diagram

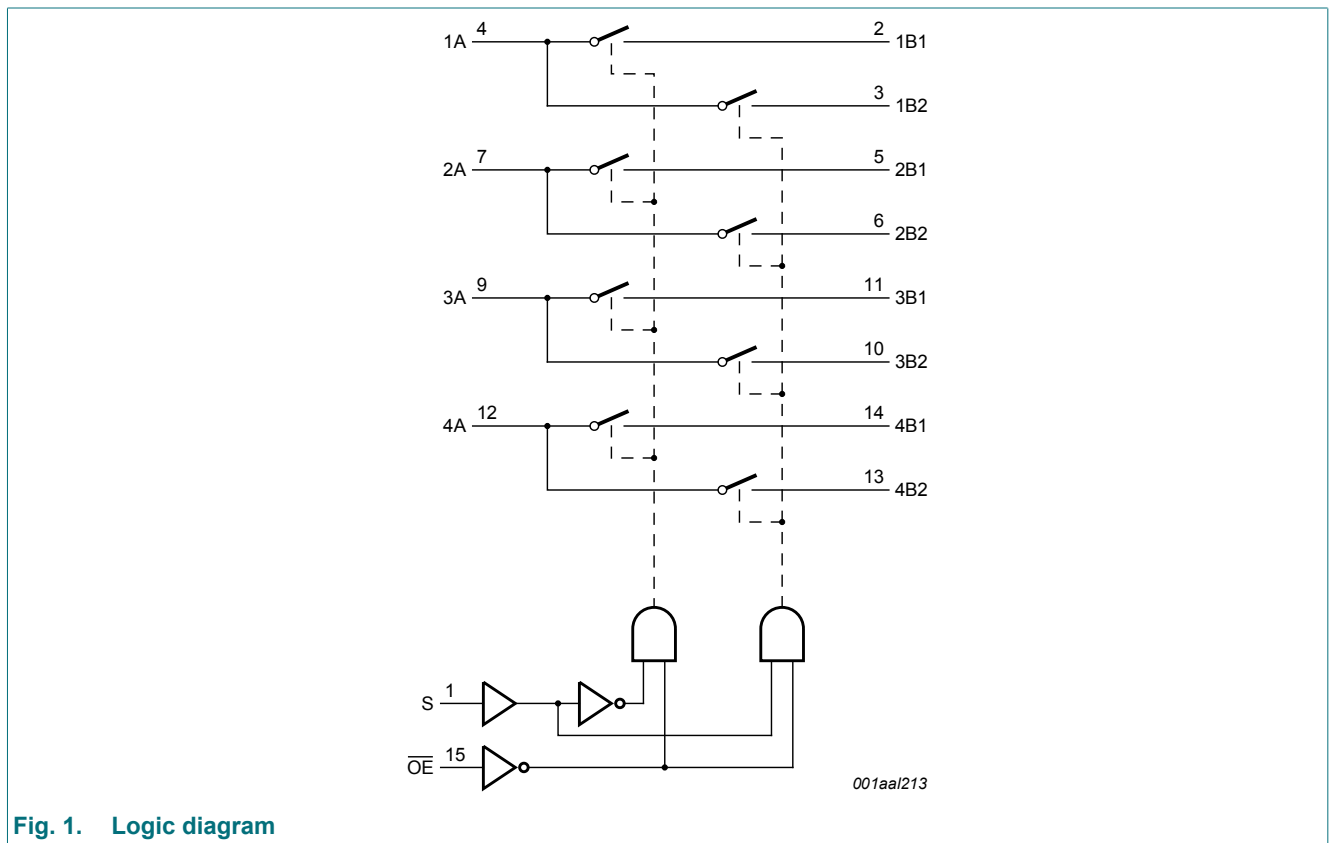


Fig. 1. Logic diagram

## 5. Pinning information

### 5.1. Pinning

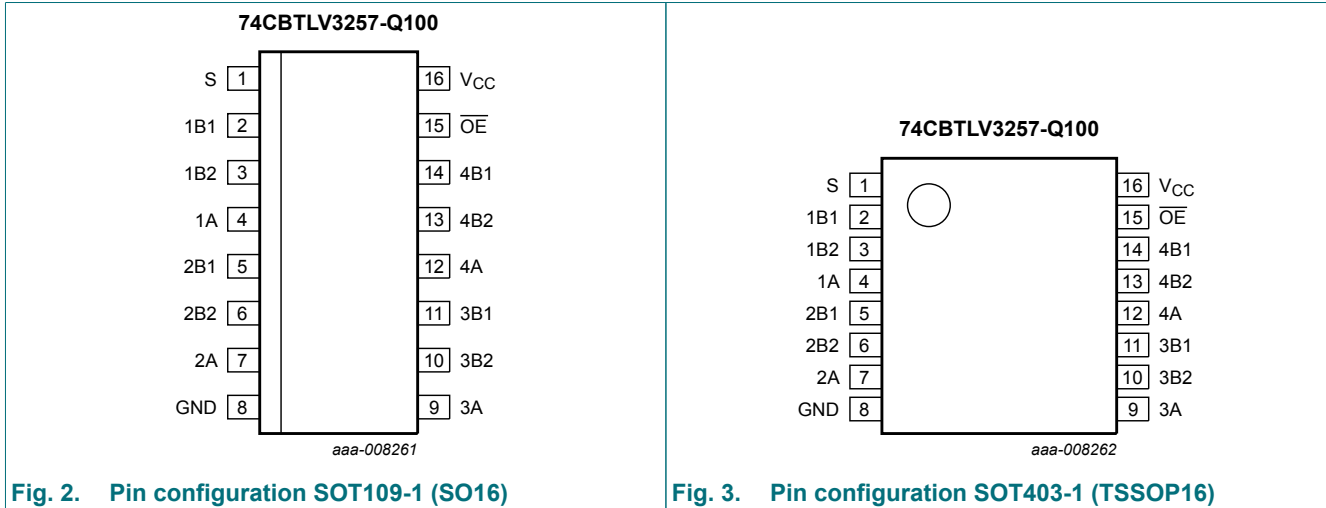


Fig. 2. Pin configuration SOT109-1 (SO16)

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

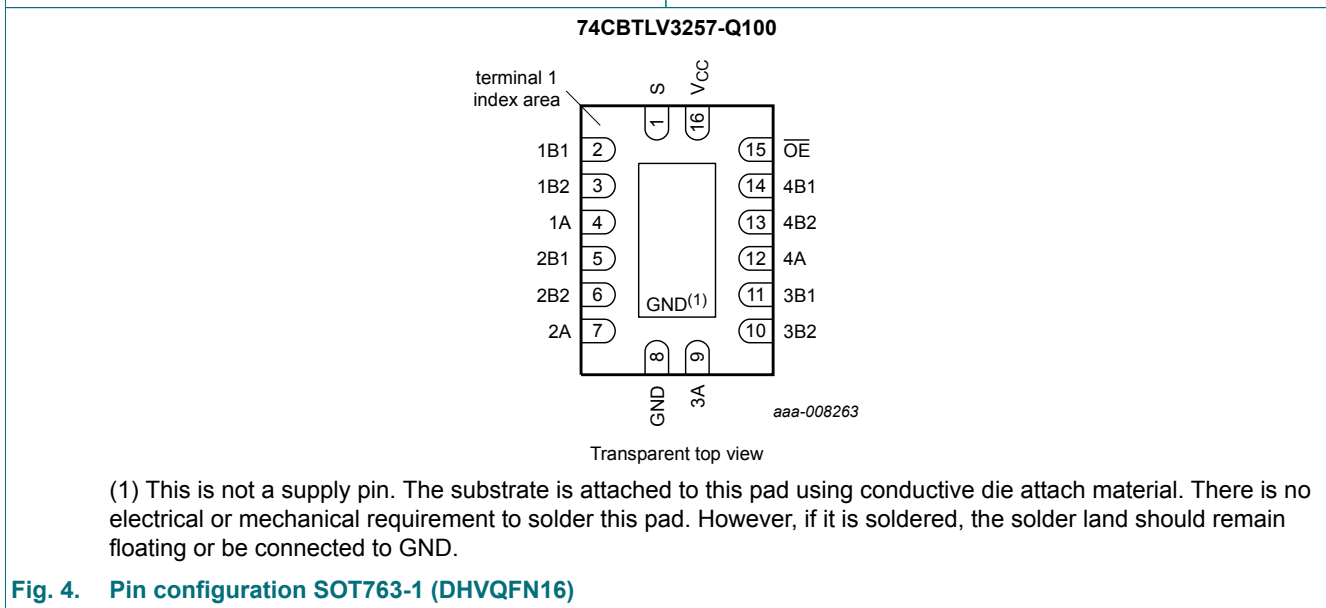


Fig. 4. Pin configuration SOT763-1 (DHVQFN16)

### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
S	1	select input
1B1 to 4B1	2, 5, 11, 14	B1 input/output
1B2 to 4B2	3, 6, 10, 13	B2 input/output
1A to 4A	4, 7, 9, 12	A input/output
GND	8	ground (0 V)
OE	15	output enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

**Table 3. Function table**

H = HIGH voltage level; L = LOW voltage level; X = don't care

Inputs		Function switch
OE	S	
L	L	nA = nB1
L	H	nA = nB2
H	X	disconnect nA and nBn

## 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 [1]	-0.5	+4.6	V
V <sub>SW</sub>	switch voltage	enable and disable mode [2]	-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 [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<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 [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 <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	-	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.9	-	0.9	V
I <sub>I</sub>	input leakage current	pin $\overline{\text{OE}}$ , S; V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	-	±1	-	±20	µA
I <sub>S(OFF)</sub>	OFF-state leakage current	V <sub>CC</sub> = 3.6 V; see Fig. 5	-	-	±1	-	±20	µA
I <sub>S(ON)</sub>	ON-state leakage current	V <sub>CC</sub> = 3.6 V; see Fig. 6	-	-	±1	-	±20	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V	-	-	±10	-	±50	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>SW</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 3.6 V; I <sub>O</sub> = 0 A	-	-	10	-	50	µA
ΔI <sub>CC</sub>	additional supply current	pin $\overline{\text{OE}}$ , S; V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>SW</sub> = GND or V <sub>CC</sub>	[2]	-	300	-	2000	µA
C <sub>I</sub>	input capacitance	pin $\overline{\text{OE}}$ , S; V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = 0 V to 3.3 V	-	0.9	-	-	-	pF
C <sub>S(OFF)</sub>	OFF-state capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = 0 V to 3.3 V	-	5.2	-	-	-	pF
C <sub>S(ON)</sub>	ON-state capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = 0 V to 3.3 V	-	14.3	-	-	-	pF

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

[2] One input at 3 V, other inputs at V<sub>CC</sub> or GND.

### 9.1. Test circuits

V<sub>I</sub> = V<sub>CC</sub> or GND and V<sub>O</sub> = GND or V<sub>CC</sub>.

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

V<sub>I</sub> = V<sub>CC</sub> or GND and V<sub>O</sub> = open circuit.

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

### 9.2. ON resistance

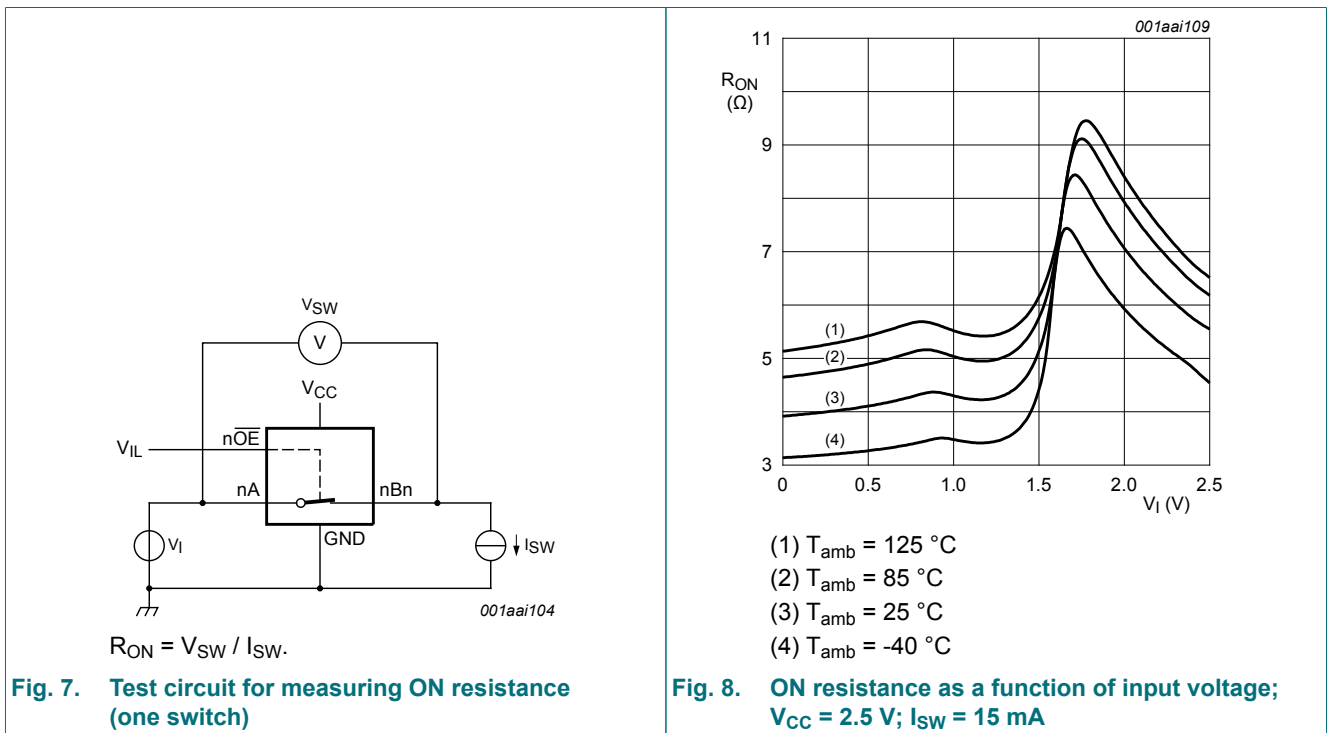
**Table 7. Resistance  $R_{ON}$**

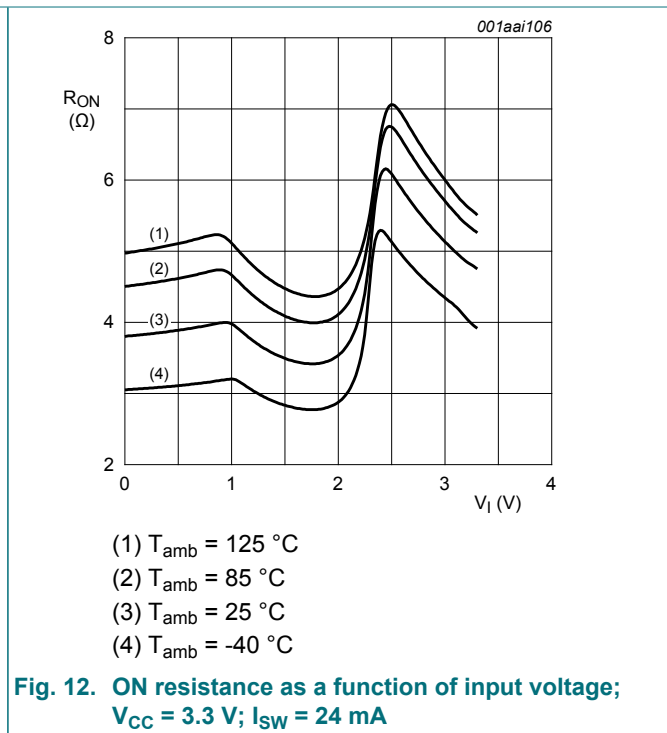
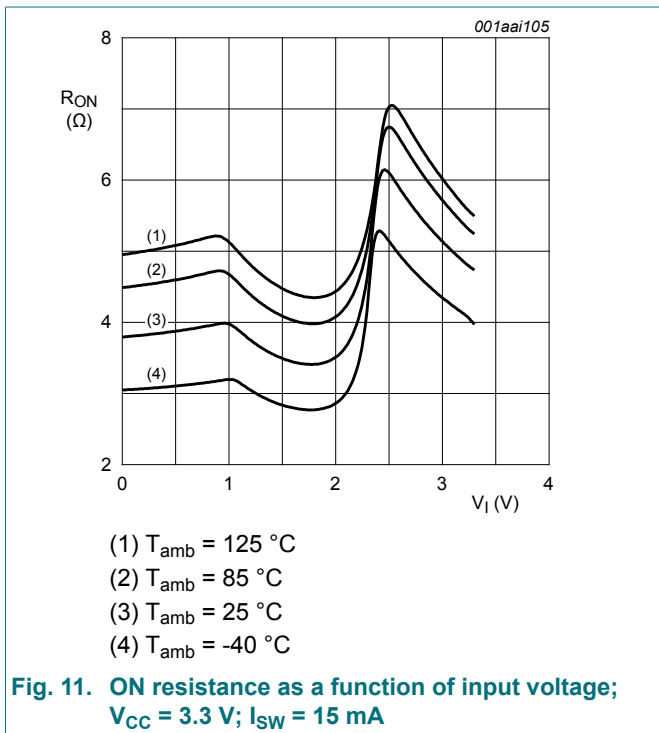
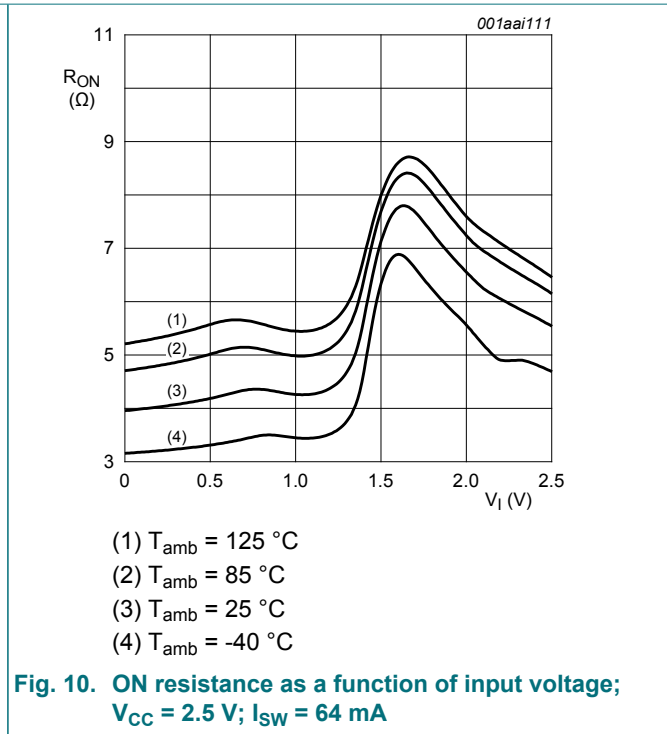
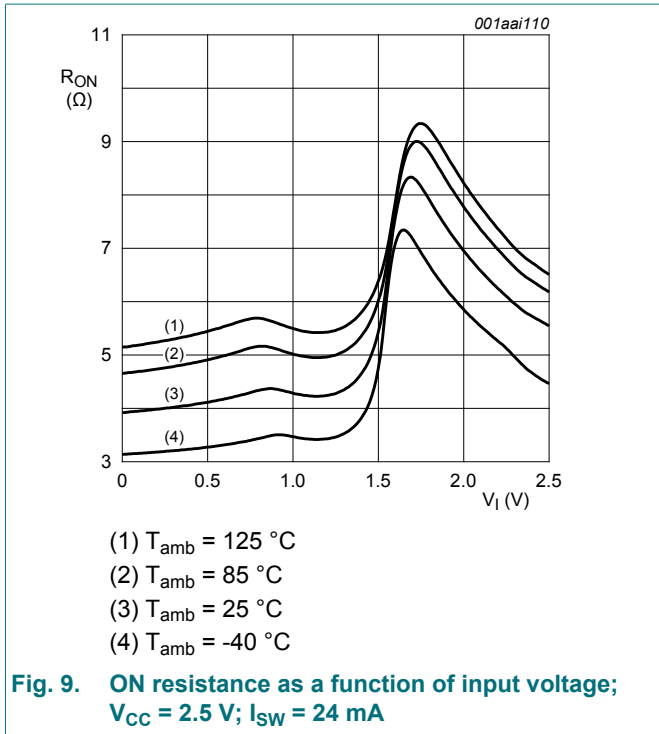
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

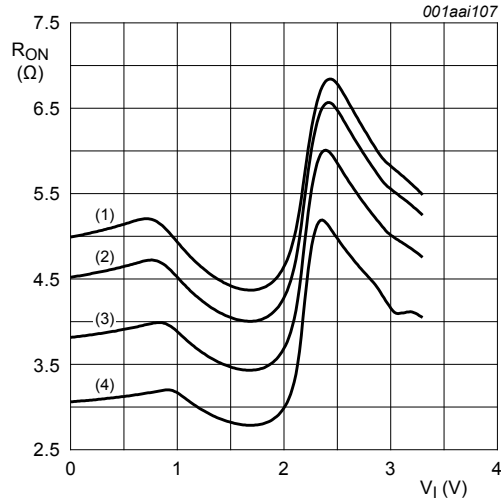
Symbol	Parameter	Conditions	$T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$			$T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$		Unit	
			Min	Typ[1]	Max	Min	Max		
$R_{ON}$	ON resistance	$V_{CC} = 2.3\text{ V to }2.7\text{ V};$ see Fig. 8 to Fig. 10	[2]						
			$I_{SW} = 64\text{ mA}; V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	$\Omega$
			$I_{SW} = 24\text{ mA}; V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	$\Omega$
		$I_{SW} = 15\text{ mA}; V_I = 1.7\text{ V}$	-	8.4	40.0	-	60.0	$\Omega$	
		$V_{CC} = 3.0\text{ V to }3.6\text{ V};$ see Fig. 11 to Fig. 13	$I_{SW} = 64\text{ mA}; V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	$\Omega$
			$I_{SW} = 24\text{ mA}; V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	$\Omega$
			$I_{SW} = 15\text{ mA}; V_I = 2.4\text{ V}$	-	6.2	15.0	-	25.5	$\Omega$

- [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

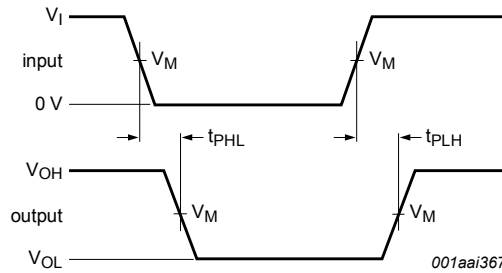
Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ[1]	Max	Min	Max	
$t_{pd}$	propagation delay	nA to nBn or nBn to nA; see Fig. 14 [2] [3]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.15	-	0.25	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.15	-	0.25	ns
		S to nA; see Fig. 14 [3]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.8	6.1	1.0	6.7	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	5.3	1.0	5.8	ns
$t_{en}$	enable time	$\overline{OE}$ to nA or nBn; see Fig. 15 [4]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.2	5.6	1.0	6.2	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	2.0	5.0	1.0	5.5	ns
		S to nBn; see Fig. 15 [4]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.5	6.1	1.0	6.7	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.0	5.3	1.0	5.8	ns



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	
			$t_{dis}$	disable time	$\overline{OE}$ to nA or nBn; see Fig. 15 [5]			
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.6	5.5	1.0	6.1	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.1	5.5	1.0	6.1	ns
		S to nBn; see Fig. 15 [5]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.6	4.8	1.0	5.3	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	4.5	1.0	5.0	ns

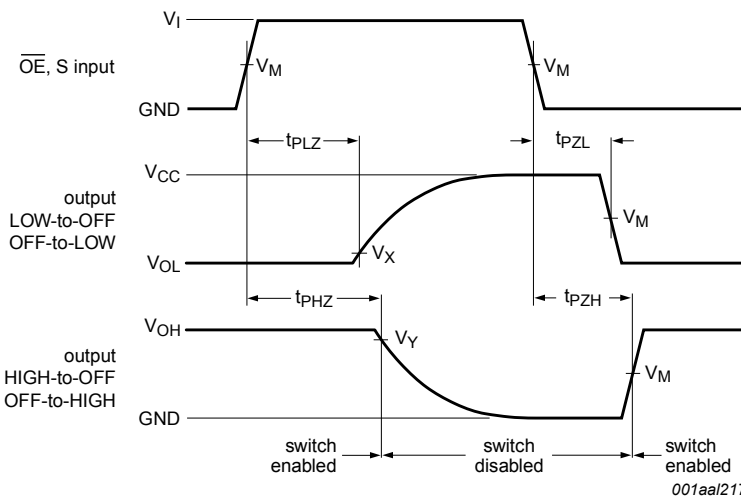
- [1] All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$  and at nominal  $V_{CC}$ .
- [2] The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).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

### 10.1. Waveforms and test circuit



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

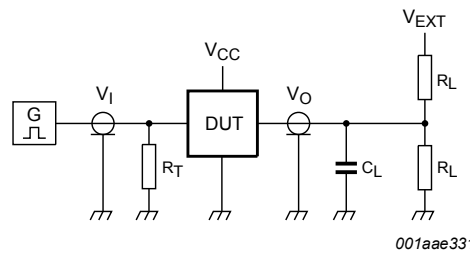
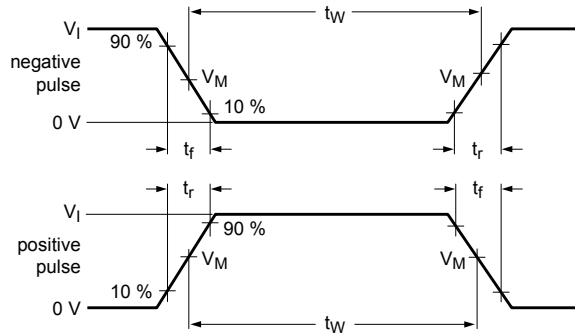


Measurement points are given in Table 9.  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 15. Enable and disable times

Table 9. Measurement points

Supply voltage	Input			Output		
V <sub>CC</sub>	V <sub>M</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
2.3 V to 2.7 V	0.5V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V
3.0 V to 3.6 V	0.5V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V



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

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to the output impedance Z<sub>O</sub> of the pulse generator.

V<sub>EXT</sub> = External voltage for measuring switching times.

Fig. 16. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Load		V <sub>EXT</sub>		
V <sub>CC</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZH</sub> , t <sub>PHZ</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub>
2.3 V to 2.7 V	30 pF	500 Ω	open	GND	2V <sub>CC</sub>
3.0 V to 3.6 V	50 pF	500 Ω	open	GND	2V <sub>CC</sub>

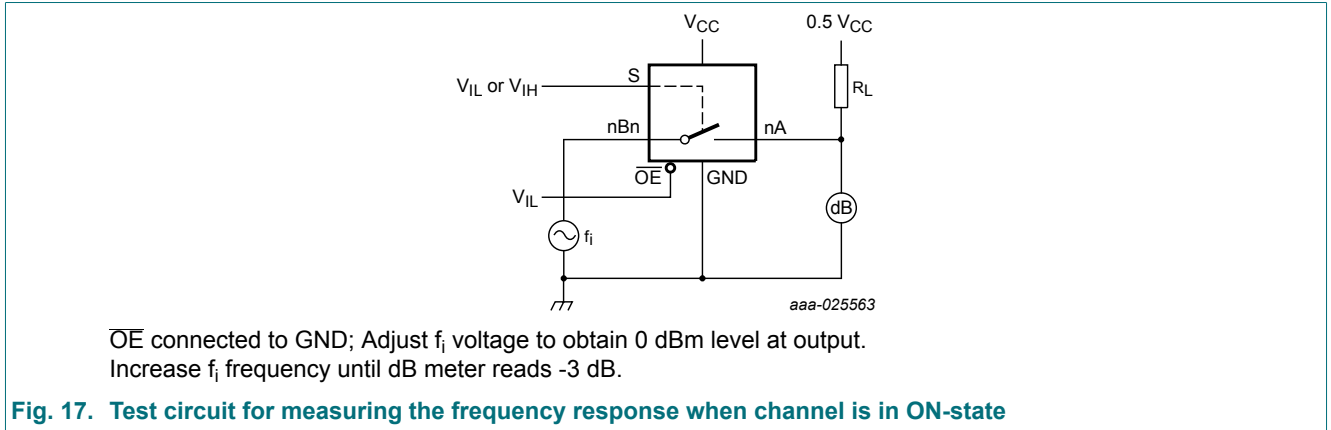
10.2. Additional dynamic characteristics

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);  $t_r = t_f \leq 2.5$  ns.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			Unit
			Min	Typ	Max	
f <sub>(-3dB)</sub>	-3 dB frequency response	V <sub>CC</sub> = 3.3 V; R <sub>L</sub> = 50 Ω; see Fig. 17 [1]	-	398	-	MHz

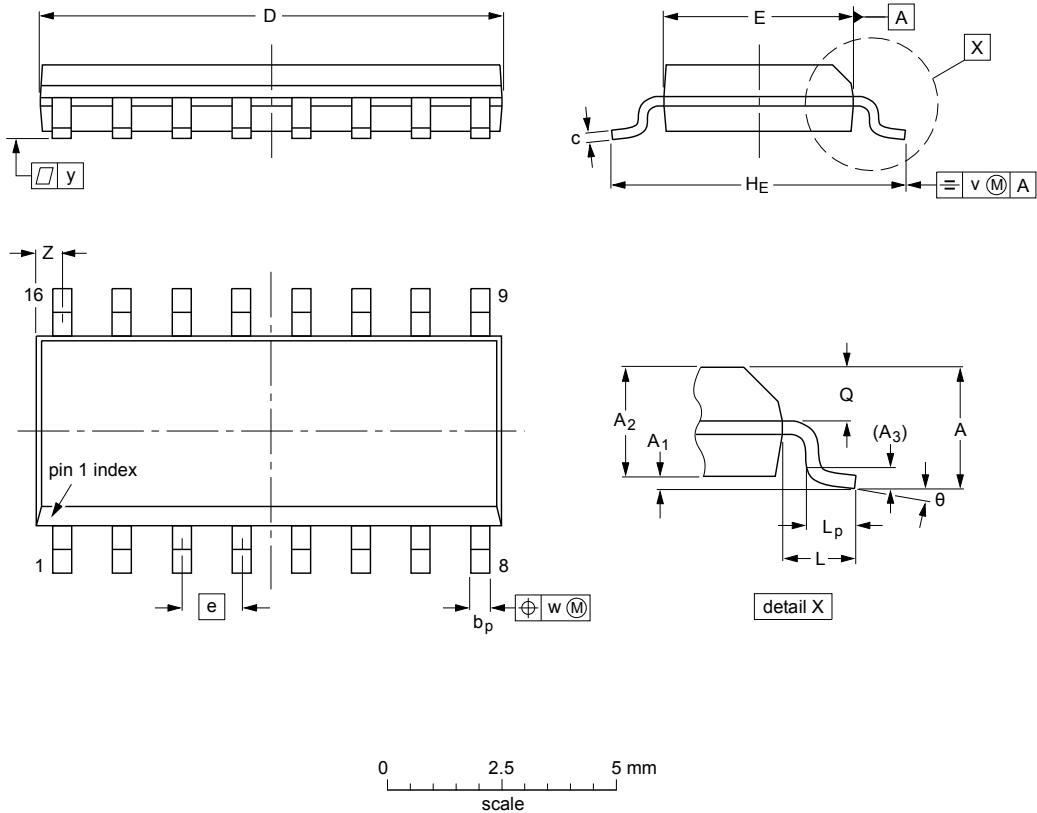
[1] f<sub>i</sub> is biased at 0.5V<sub>CC</sub>.



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 <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	0.25 0.10	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	0.010 0.004	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

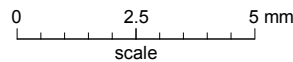
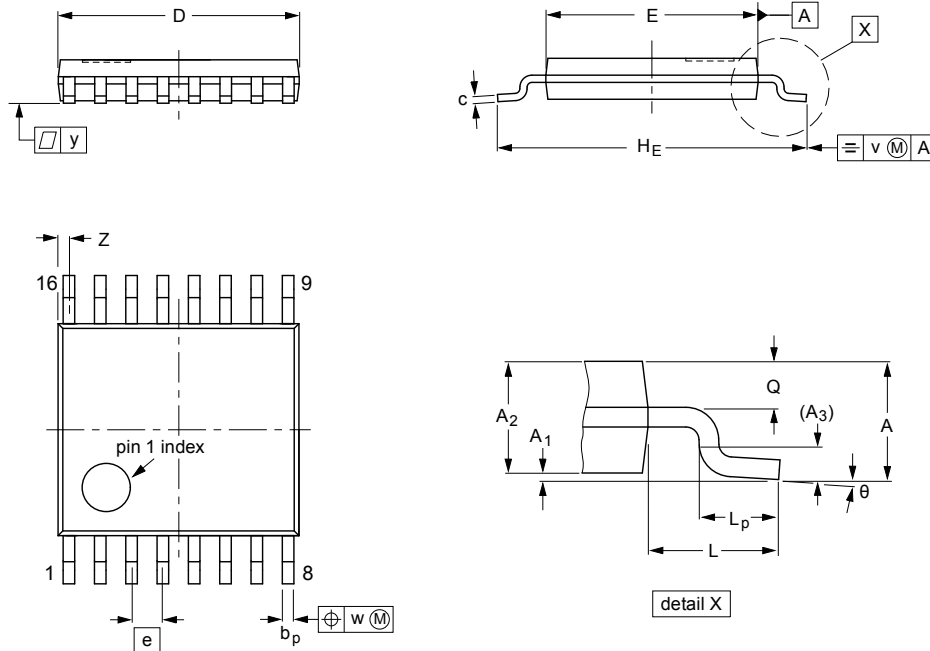
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

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

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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

**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 03-02-18

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

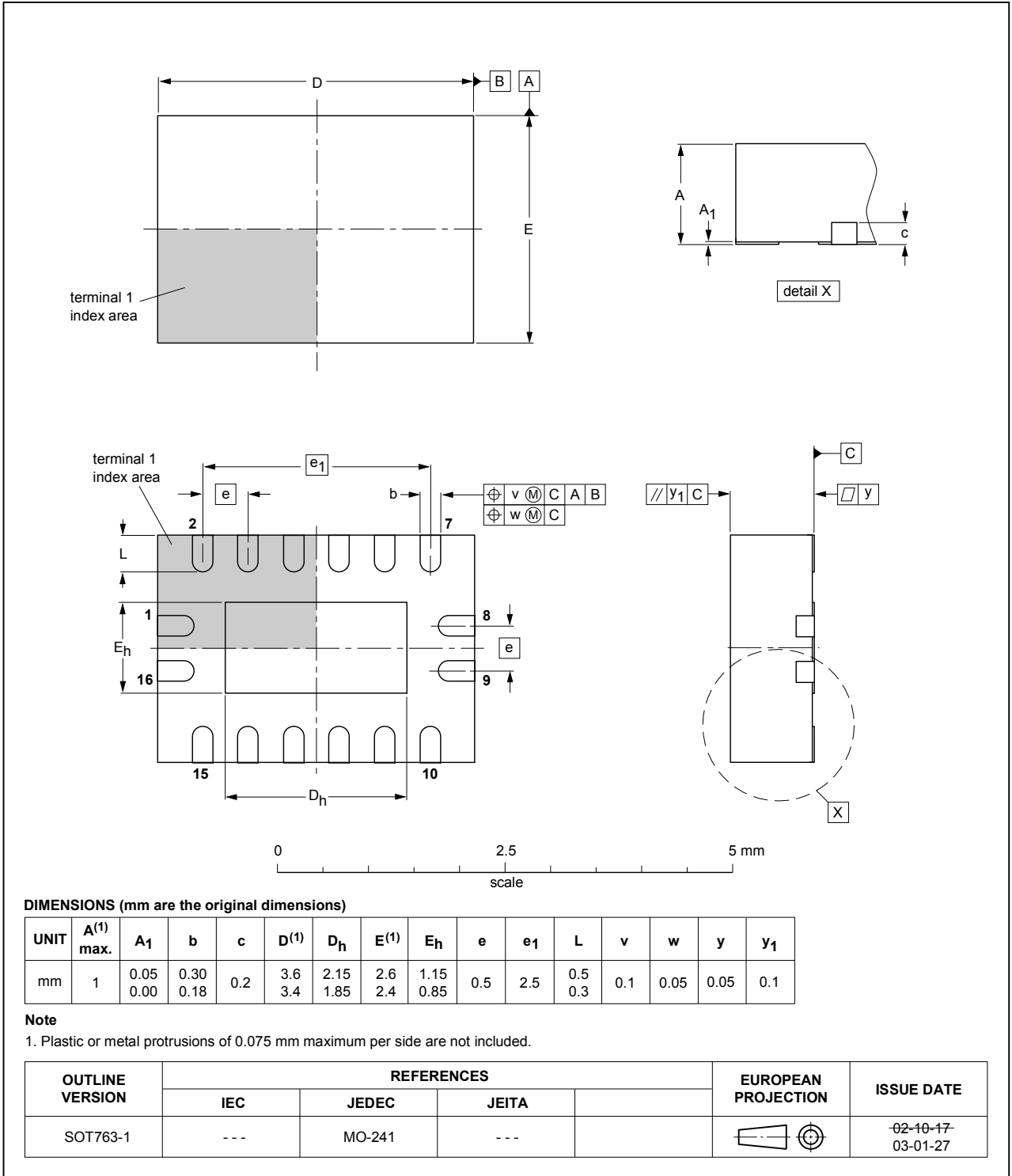


Fig. 20. Package outline SOT763-1 (DHVQFN16)

## 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
74CBTLV3257_Q100 v.3	20190409	Product data sheet	-	74CBTLV3257_Q100 v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number 74CBTLV3257DS-Q100 (SSOP16/SOT519-1) removed.</li> </ul>			
74CBTLV3257_Q100 v.2	20161110	Product data sheet	-	74CBTLV3257_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Section 10.2</a> added.</li> </ul>			
74CBTLV3257_Q100 v.1	20130704	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>.

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## Contents

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<b>1. General description</b> .....	<b>1</b>
<b>2. Features and benefits</b> .....	<b>1</b>
<b>3. Ordering information</b> .....	<b>2</b>
<b>4. Functional diagram</b> .....	<b>2</b>
<b>5. Pinning information</b> .....	<b>3</b>
5.1. Pinning.....	3
5.2. Pin description.....	3
<b>6. Functional description</b> .....	<b>4</b>
<b>7. Limiting values</b> .....	<b>4</b>
<b>8. Recommended operating conditions</b> .....	<b>4</b>
<b>9. Static characteristics</b> .....	<b>5</b>
9.1. Test circuits.....	5
9.2. ON resistance.....	6
9.3. ON resistance test circuit and graphs.....	6
<b>10. Dynamic characteristics</b> .....	<b>8</b>
10.1. Waveforms and test circuit.....	9
10.2. Additional dynamic characteristics.....	11
<b>11. Package outline</b> .....	<b>12</b>
<b>12. Abbreviations</b> .....	<b>15</b>
<b>13. Revision history</b> .....	<b>15</b>
<b>14. Legal information</b> .....	<b>16</b>

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