

# 74CBTLVD3245-Q100

8-bit level-shifting bus switch with output enable

Rev. 3 — 16 April 2019

Product data sheet

## 1. General description

The 74CBTLVD3245-Q100 is an 8-pole, single-throw bus switch. The device features a single output enable input ( $\overline{OE}$ ) that controls eight switch channels. The switches are disabled when  $\overline{OE}$  is HIGH. Schmitt trigger action at control inputs makes the circuit tolerant of slower input rise and fall times. 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

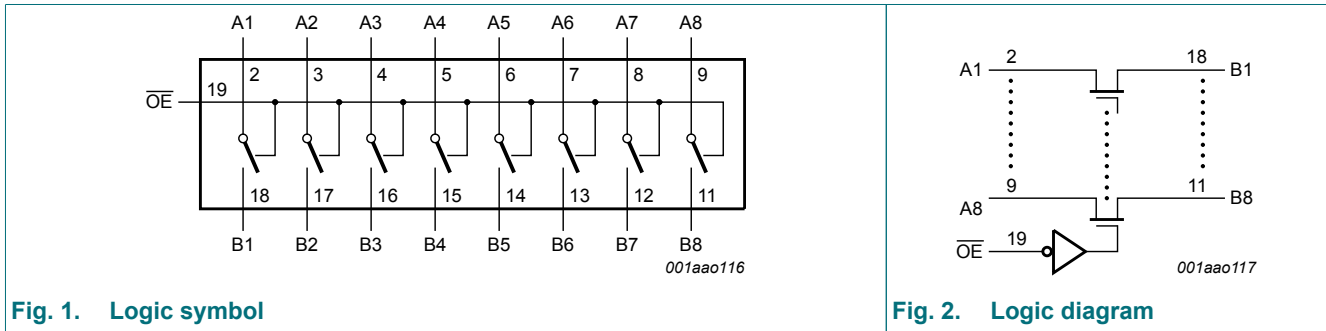
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Supply voltage range from 3.0 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-B/JESD36 (3.0 V to 3.6 V)
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - CDM AEC-Q100-011 revision B exceeds 1000 V
- $5\ \Omega$  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

## 3. Ordering information

Table 1. Ordering information

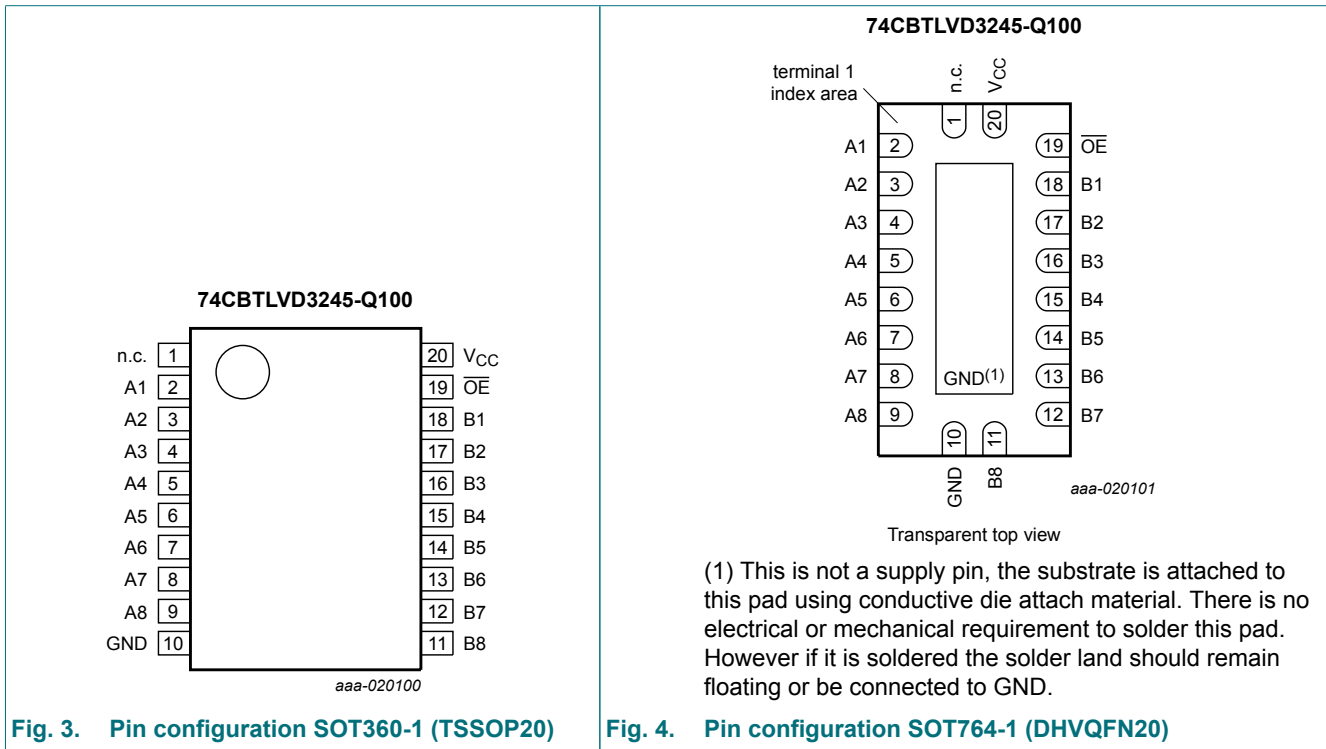
Type number	Package			
	Temperature range	Name	Description	Version
74CBTLVD3245PW-Q100	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74CBTLVD3245BQ-Q100	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	DHVQFN20	plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body $2.5 \times 4.5 \times 0.85$ mm	SOT764-1

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



(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
n.c.	1	not connected
A1 to A8	2, 3, 4, 5, 6, 7, 8, 9	data input/output (A port)
GND	10	ground (0 V)
B1 to B8	18, 17, 16, 15, 14, 13, 12, 11	data input/output (B port)
$\overline{OE}$	19	output enable input (active LOW)
V <sub>CC</sub>	20	positive supply voltage

## 6. Functional description

**Table 3. Function selection**

*H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.*

Input	Input/output
OE	An, Bn
L	An = Bn
H	Z

## 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	[1]	-0.5	+4.6	V
$V_{SW}$	switch voltage	enable and disable mode [1]	-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	input clamping current	$V_{I/O} < -0.5$ V	-50	-	mA
$I_{SK}$	switch clamping current	$V_I < -0.5$ V	-50	-	mA
$I_{SW}$	switch current	$V_{SW} = 0$ V to $V_{CC}$	-	$\pm 128$	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 [2]	-	500	mW

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

[2] For TSSOP20 packages: above 60 °C the value of  $P_{tot}$  derates linearly at 5.5 mW/K.  
For DHVQFN20 packages: above 60 °C the value of  $P_{tot}$  derates linearly at 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		3.0	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	$V_{CC} = 3.0$ V to 3.6 V [1]	0	200	ns/V

[1] Applies to control signal levels.

## 9. Static characteristics

**Table 6. Static characteristics**

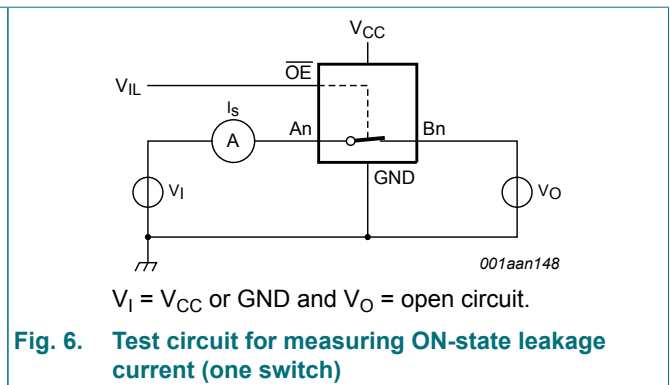
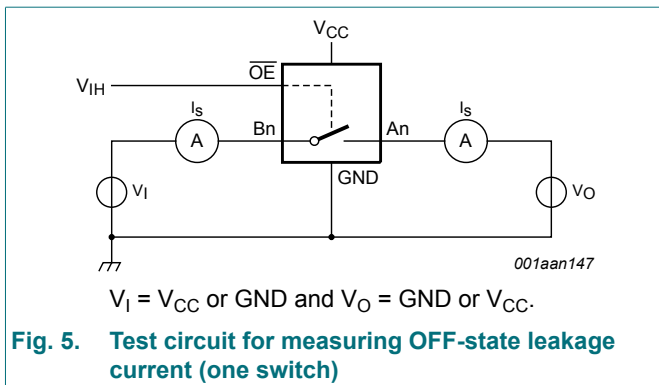
At recommended operating conditions voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	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> = 3.0 V to 3.6 V	-	-	0.9	-	0.9	V
I <sub>I</sub>	input leakage current	pin $\overline{OE}$ ; V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.6 V	-	-	±1	-	±20	µA
V <sub>pass</sub>	pass voltage	V <sub>I</sub> = V <sub>CC</sub> ; see Fig. 7 to Fig. 11	-	-	-	-	-	V
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> = V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.6 V; V <sub>SW</sub> = GND or V <sub>CC</sub>	-	-	20	-	50	µA
		V <sub>I</sub> = GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.6 V; V <sub>SW</sub> = GND or V <sub>CC</sub>	-	-	100	-	150	µA
ΔI <sub>CC</sub>	additional supply current	pin $\overline{OE}$ ; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>SW</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 3.6 V [2]	-	-	300	-	2000	µA
C <sub>I</sub>	input capacitance	pin $\overline{OE}$ ; 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	-	2.5	-	-	-	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	-	9.0	-	-	-	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



9.2. Typical pass voltage graphs

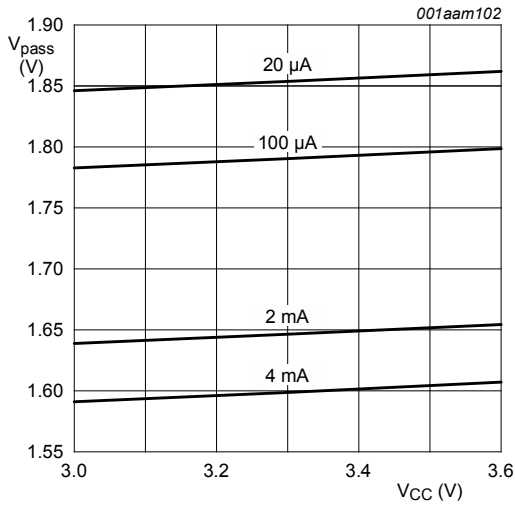


Fig. 7. Pass voltage versus supply voltage;  $T_{amb} = 125\text{ °C}$  (typical)

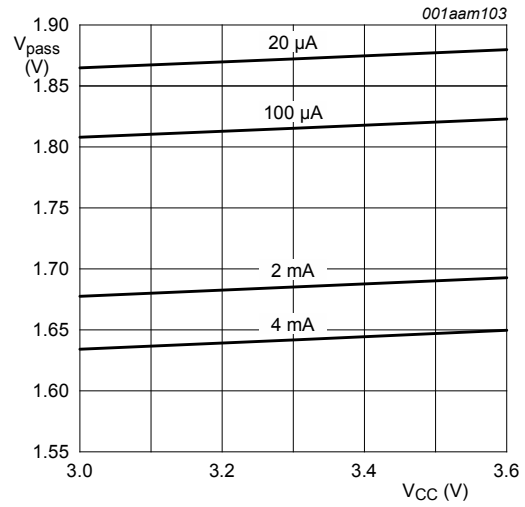


Fig. 8. Pass voltage versus supply voltage;  $T_{amb} = 85\text{ °C}$  (typical)

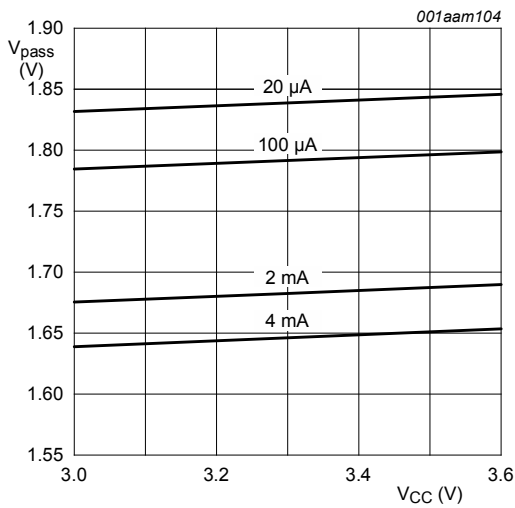


Fig. 9. Pass voltage versus supply voltage;  $T_{amb} = 25\text{ °C}$  (typical)

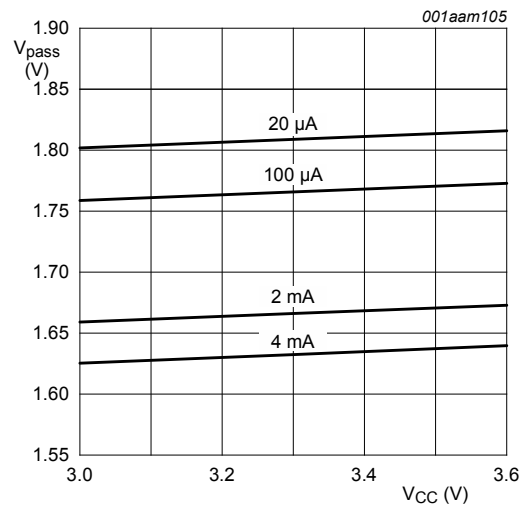


Fig. 10. Pass voltage versus supply voltage;  $T_{amb} = 0\text{ °C}$  (typical)

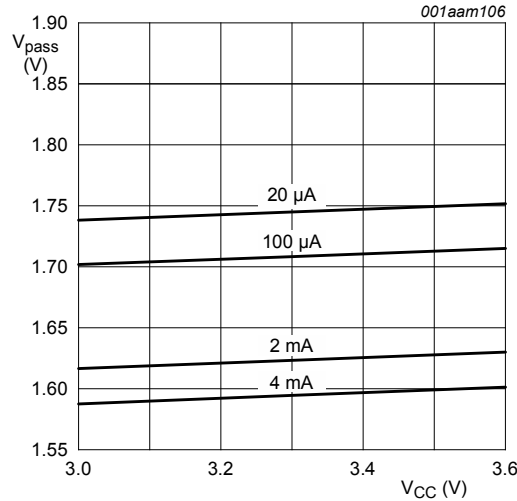


Fig. 11. Pass voltage versus supply voltage; T<sub>amb</sub> = -40 °C (typical)

### 9.3. ON resistance

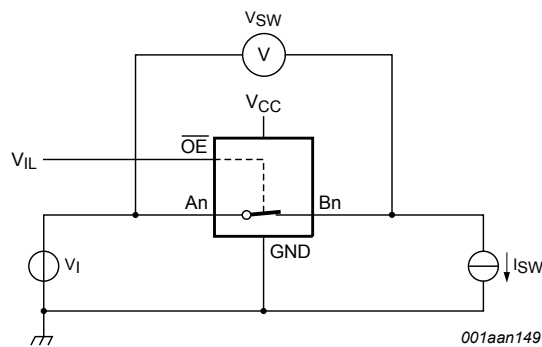
Table 7. Resistance R<sub>ON</sub>

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
R <sub>ON</sub>	ON resistance	V <sub>CC</sub> = 3.0 V to 3.6 V [2]						
		I <sub>SW</sub> = 64 mA; V <sub>I</sub> = 0 V	-	3.7	7.0	-	10.0	Ω
		I <sub>SW</sub> = 24 mA; V <sub>I</sub> = 0 V	-	3.7	7.0	-	10.0	Ω
		I <sub>SW</sub> = 15 mA; V <sub>I</sub> = 1.2 V	-	4.7	10.0	-	12.0	Ω

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

[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.



$$R_{ON} = V_{SW} / I_{SW}$$

Fig. 12. Test circuit for measuring ON resistance (one switch)

## 10. Dynamic characteristics

**Table 8. Dynamic characteristics**

$GND = 0\text{ V}$ ; for test circuit see [Fig. 15](#)

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit	
			Min	Typ [1]	Max	Min	Max		
$t_{pd}$	propagation delay	An to Bn or Bn to An; $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ; see <a href="#">Fig. 13</a>	[2][3]	-	-	0.11	-	0.22	ns
$t_{en}$	enable time	$\overline{OE}$ to An or Bn; $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ; see <a href="#">Fig. 14</a>	[4]	1.5	2.9	5.0	1.5	6.0	ns
$t_{dis}$	disable time	$\overline{OE}$ to An or Bn; $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ; see <a href="#">Fig. 14</a>	[5]	0.8	3.4	7.0	0.8	8.0	ns

- [1] All typical values are measured at  $T_{amb} = 25\text{ °C}$  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  $t_{PLZ}$ .

### 10.1. Waveforms and test circuit

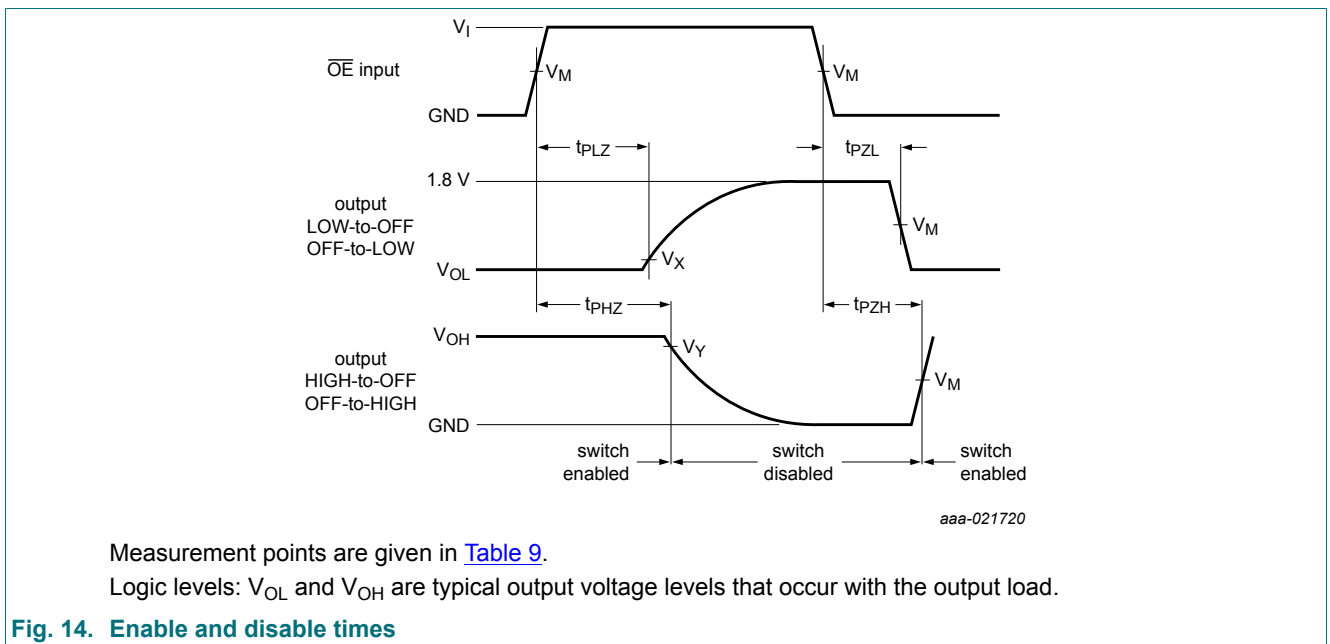
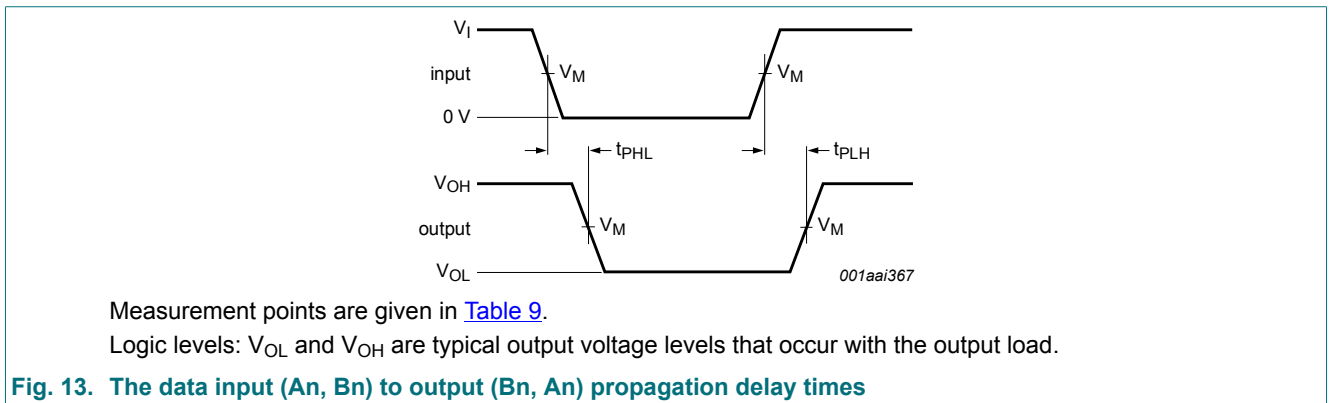
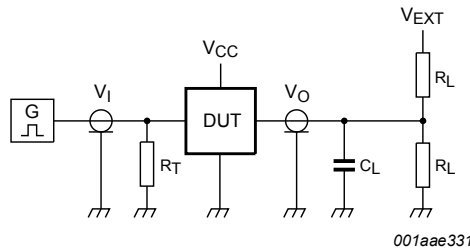
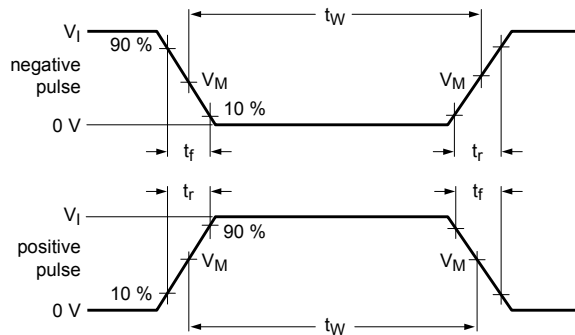


Table 9. Measurement points

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>
3.0 V to 3.6 V	0.5V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns	0.9 V	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V



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. 15. 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>
3.0 V to 3.6 V	30 pF	1 kΩ	open	GND	3.6 V



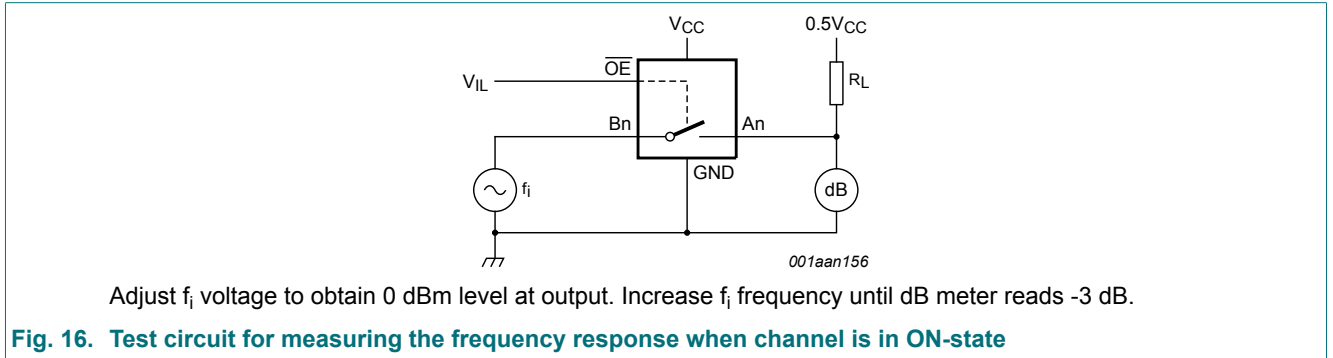
10.2. Additional dynamic characteristics

Table 11. Additional dynamic characteristics

GND = 0 V.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			Unit
			Min	Typ	Max	
f <sub>i(-3dB)</sub>	-3 dB frequency response	V <sub>CC</sub> = 3.3 V; R <sub>L</sub> = 50 Ω; see Fig. 16 [1]	-	575	-	MHz

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



### 11. Package outline

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

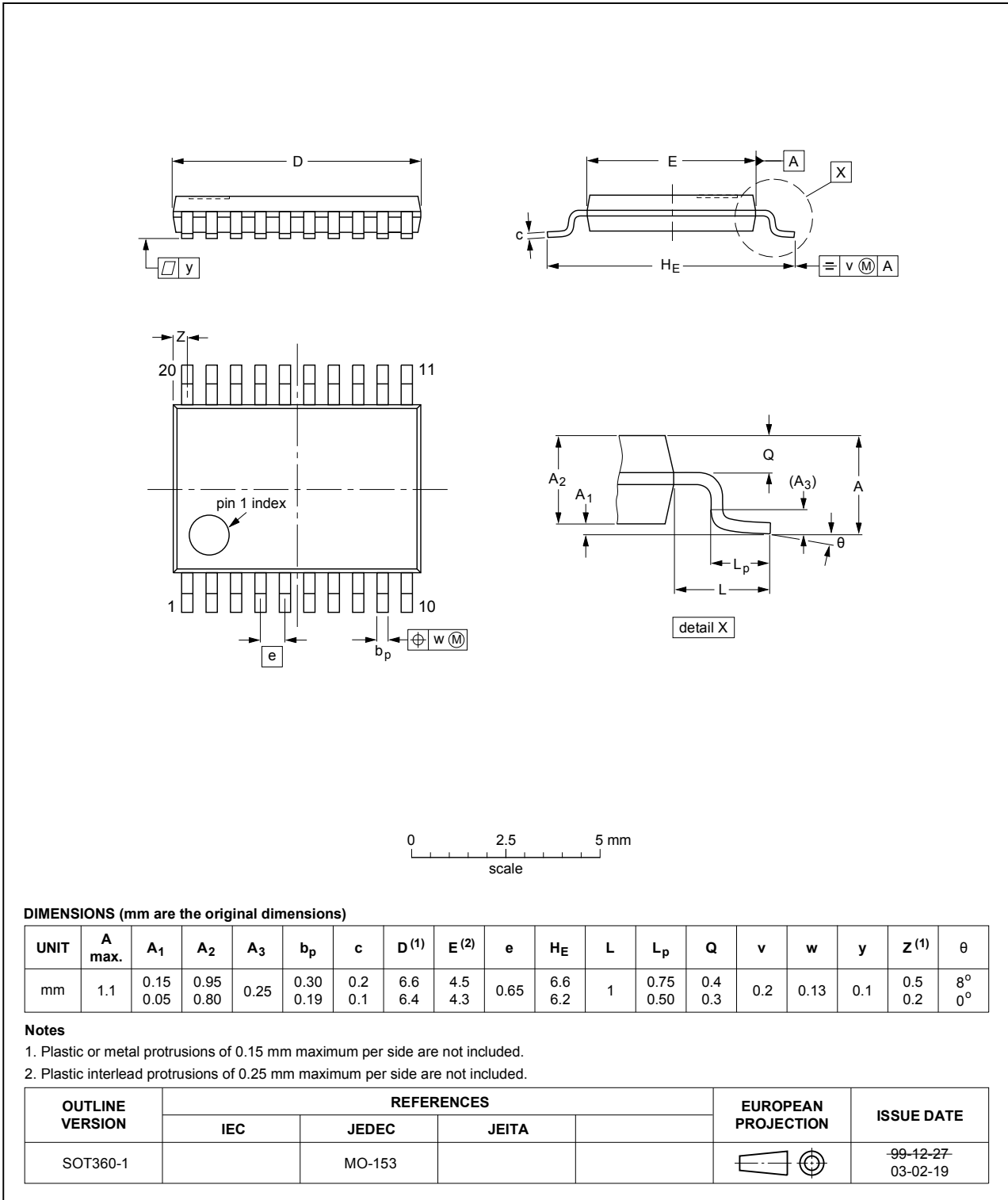


Fig. 17. Package outline SOT360-1 (TSSOP20)

**DHVQFN20:** plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;  
 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1

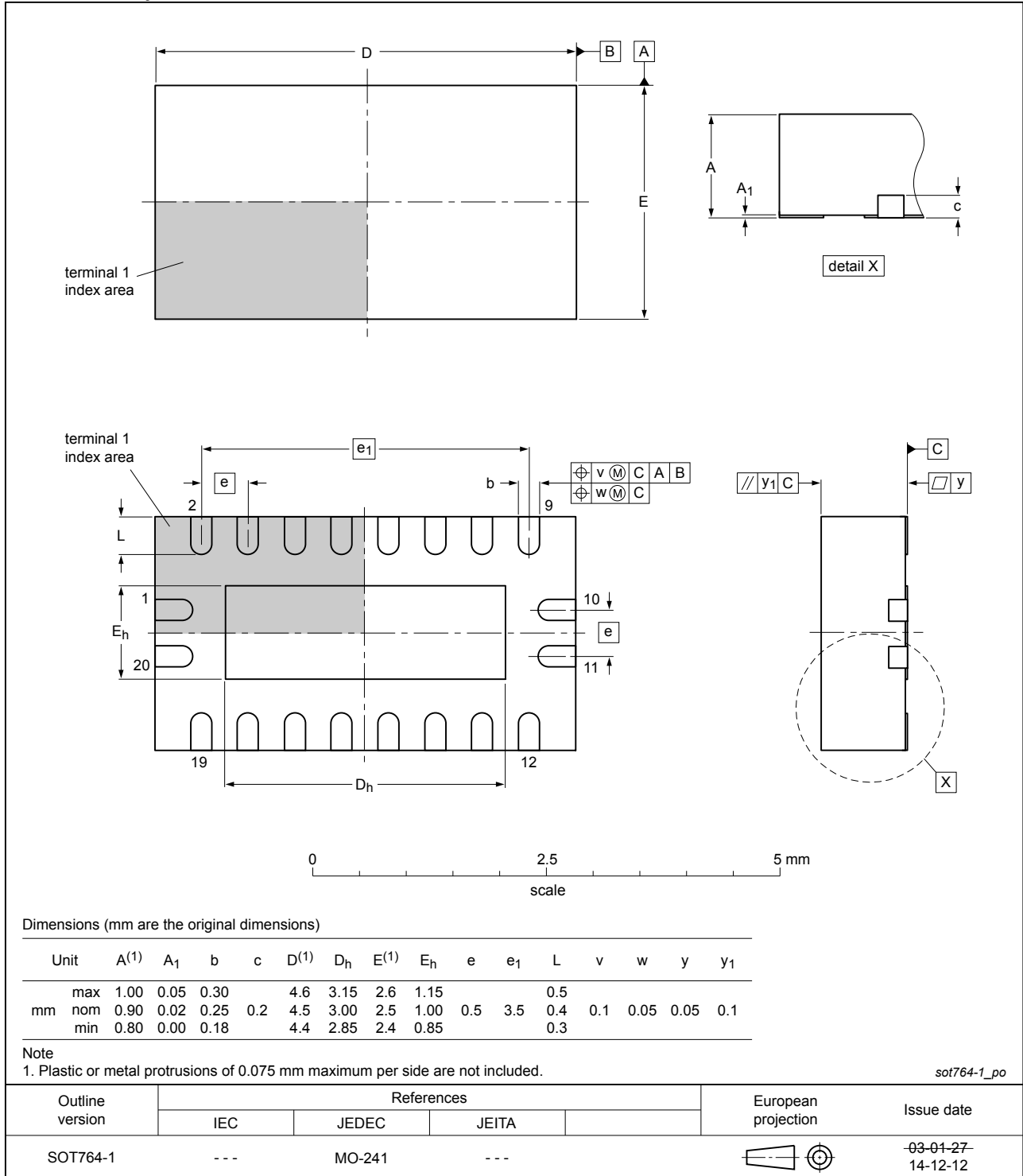


Fig. 18. Package outline SOT764-1 (DHVQFN20)

## 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
MIL	Military

## 13. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLVD3245_Q100 v.3	20190416	Product data sheet	-	74CBTLVD3245_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> </ul>			
74CBTLVD3245_Q100 v.2	20160122	Product data sheet	-	74CBTLVD3245_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Fig. 14</a> updated.</li> </ul>			
74CBTLVD3245_Q100 v.1	20151016	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.
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