

# 74CBTLVD3245

8-bit level-shifting bus switch with output enable

Rev. 7 — 24 June 2024

Product data sheet

## 1. General description

The 74CBTLVD3245 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.

## 2. Features and benefits

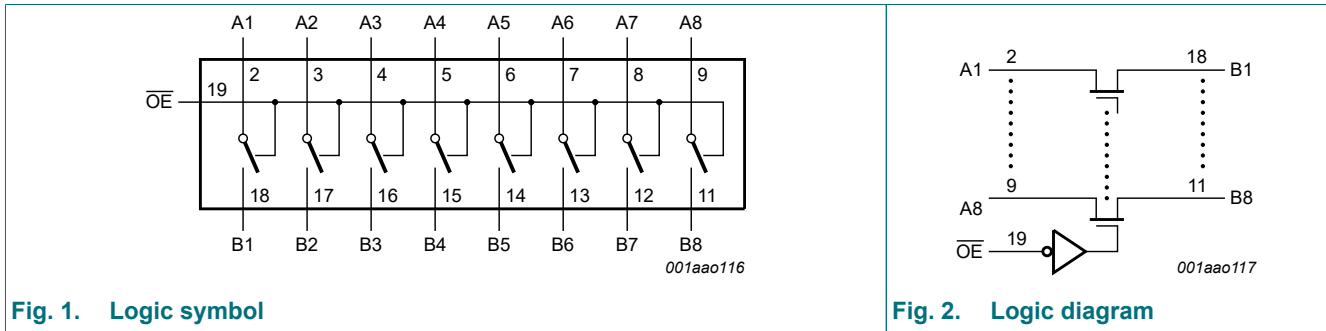
- Supply voltage range from 3.0 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-B/JESD36 (3.0 V to 3.6 V)
- 5  $\Omega$  switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance exceeds 250 mA per JESD78B Class I level A
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

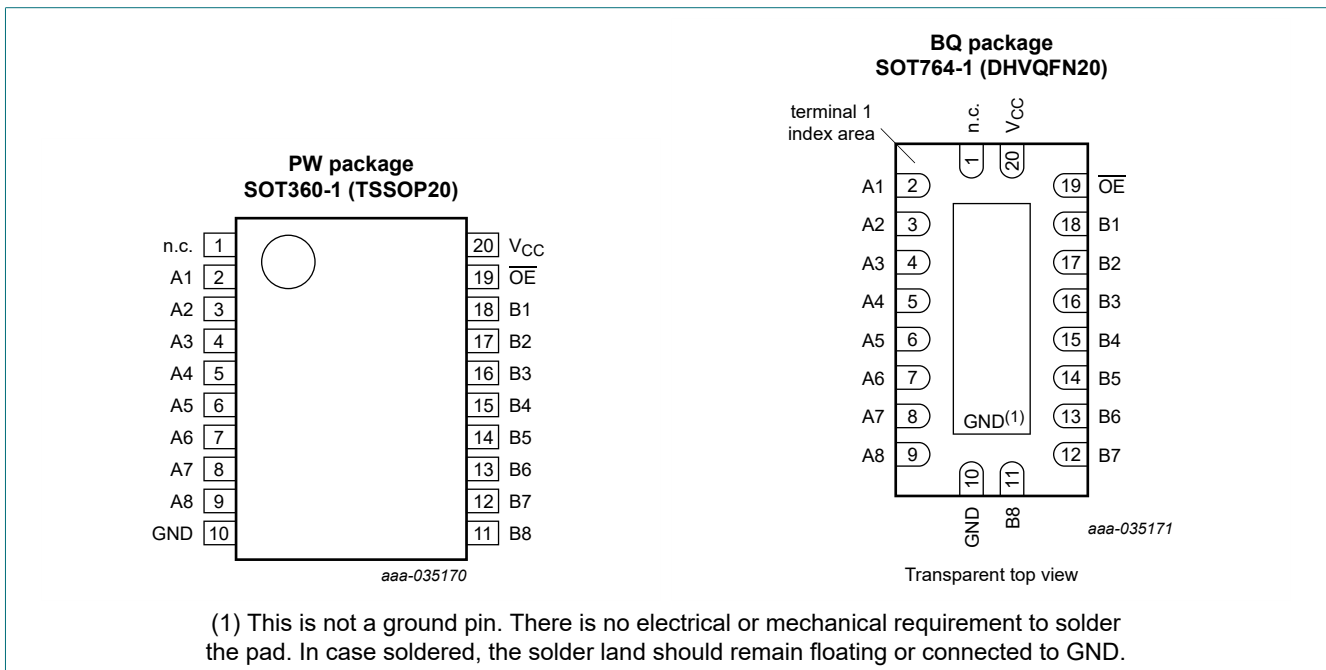
Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74CBTLVD3245PW</a>	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	<a href="#">SOT360-1</a>
<a href="#">74CBTLVD3245BQ</a>	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	<a href="#">SOT764-1</a>

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



#### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
n.c.	1	not connected
A1, A2, A3, A4, A5, A6, A7, A8	2, 3, 4, 5, 6, 7, 8, 9	data input/output (A port)
GND	10	ground (0 V)
B1, B2, B3, B4, B5, B6, B7, B8	18, 17, 16, 15, 14, 13, 12, 11	data input/output (B port)
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 SOT360-1 (TSSOP20) package:  $P_{tot}$  derates linearly with 10.0 mW/K above 100 °C.  
For SOT764-1 (DHVQFN20) package:  $P_{tot}$  derates linearly with 12.9 mW/K above 111 °C.

## 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**

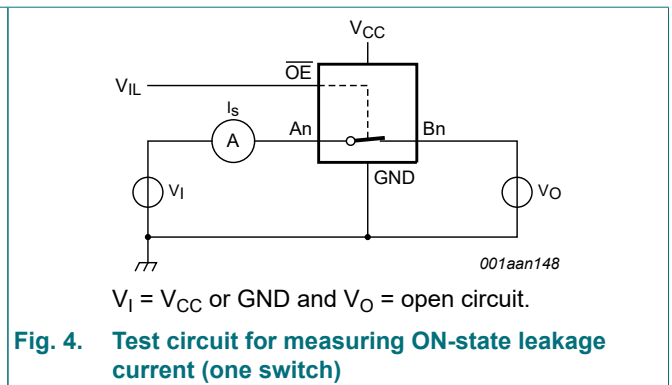
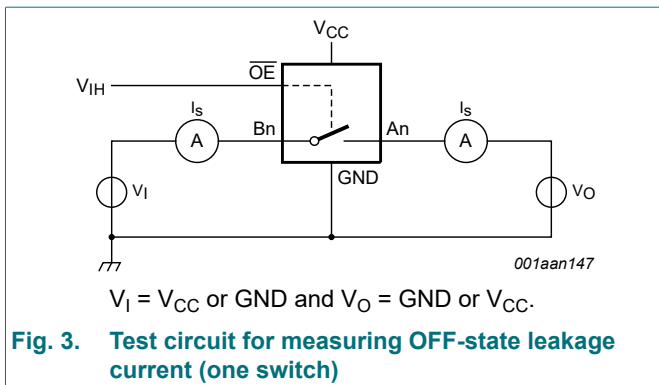
At recommended operating conditions voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	2.0	-	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.9	-	0.9	V
$I_I$	input leakage current	pin $\overline{OE}$ ; $V_I = \text{GND to }V_{CC}$ ; $V_{CC} = 3.6\text{ V}$	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$V_{pass}$	pass voltage	$V_I = V_{CC}$ ; see Fig. 5 to Fig. 9	-	-	-	-	-	V
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 3.6\text{ V}$ ; see Fig. 3	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 3.6\text{ V}$ ; see Fig. 4	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 0\text{ V to }3.6\text{ V}$ ; $V_{CC} = 0\text{ V}$	-	-	$\pm 10$	-	$\pm 50$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ ; $I_O = 0\text{ A}$ ; $V_{CC} = 3.6\text{ V}$ ; $V_{SW} = \text{GND or }V_{CC}$	-	-	20	-	50	$\mu\text{A}$
		$V_I = \text{GND}$ ; $I_O = 0\text{ A}$ ; $V_{CC} = 3.6\text{ V}$ ; $V_{SW} = \text{GND or }V_{CC}$	-	-	100	-	150	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	pin $\overline{OE}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $V_{SW} = \text{GND or }V_{CC}$ ; $V_{CC} = 3.6\text{ V}$ [2]	-	-	300	-	2000	$\mu\text{A}$
$C_I$	input capacitance	pin $\overline{OE}$ ; $V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V to }3.3\text{ V}$	-	0.9	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V to }3.3\text{ V}$	-	2.5	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = 0\text{ V to }3.3\text{ V}$	-	9.0	-	-	-	pF

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

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

### 9.1. Test circuits



9.2. Typical pass voltage graphs

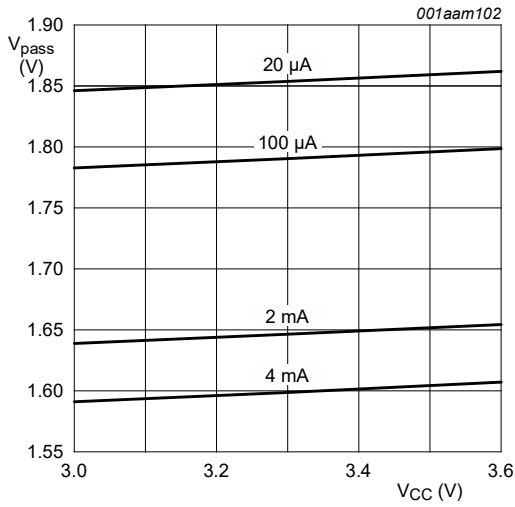


Fig. 5. Pass voltage versus supply voltage;  $T_{amb} = 125\text{ °C}$  (typical)

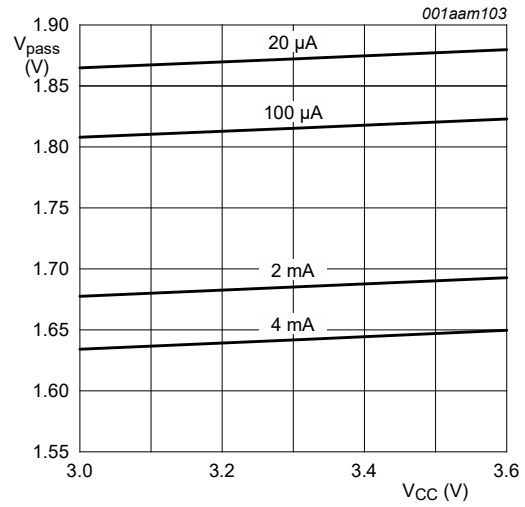


Fig. 6. Pass voltage versus supply voltage;  $T_{amb} = 85\text{ °C}$  (typical)

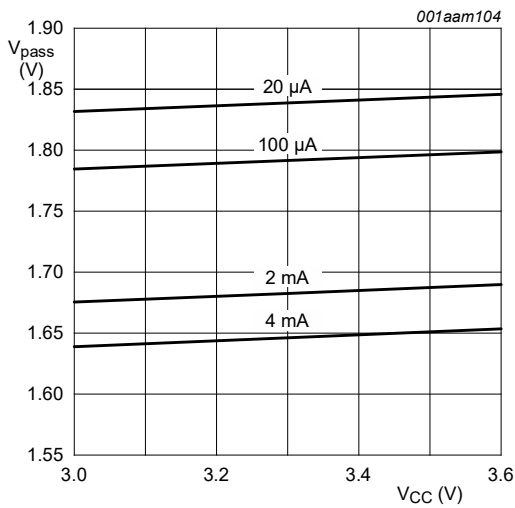


Fig. 7. Pass voltage versus supply voltage;  $T_{amb} = 25\text{ °C}$  (typical)

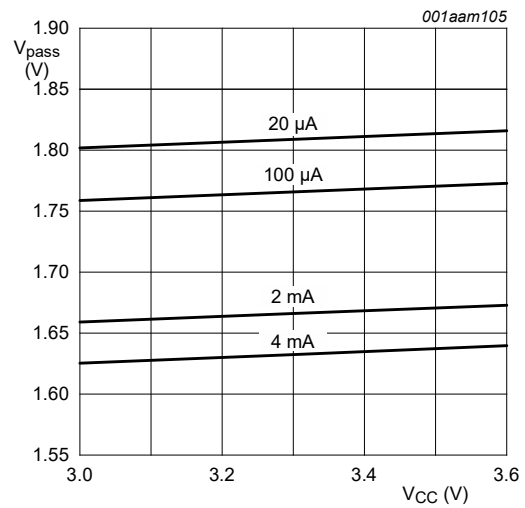


Fig. 8. Pass voltage versus supply voltage;  $T_{amb} = 0\text{ °C}$  (typical)

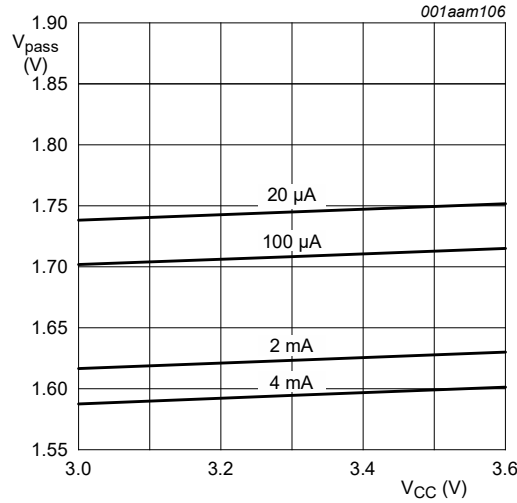


Fig. 9. Pass voltage versus supply voltage; T<sub>amb</sub> = -40 °C (typical)

### 9.3. ON resistance

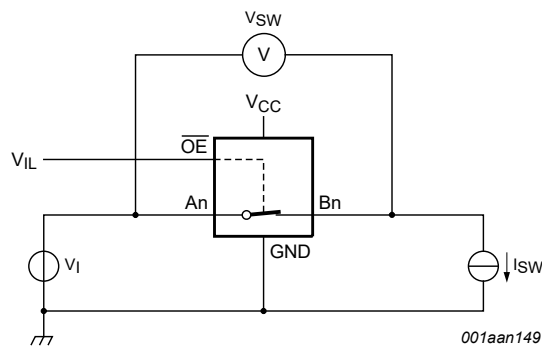
Table 7. Resistance R<sub>ON</sub>

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 10.

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. 10. Test circuit for measuring ON resistance (one switch)

## 10. Dynamic characteristics

**Table 8. Dynamic characteristics**

$GND = 0\text{ V}$ ; for test circuit see [Fig. 13](#)

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. 11</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. 12</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. 12</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

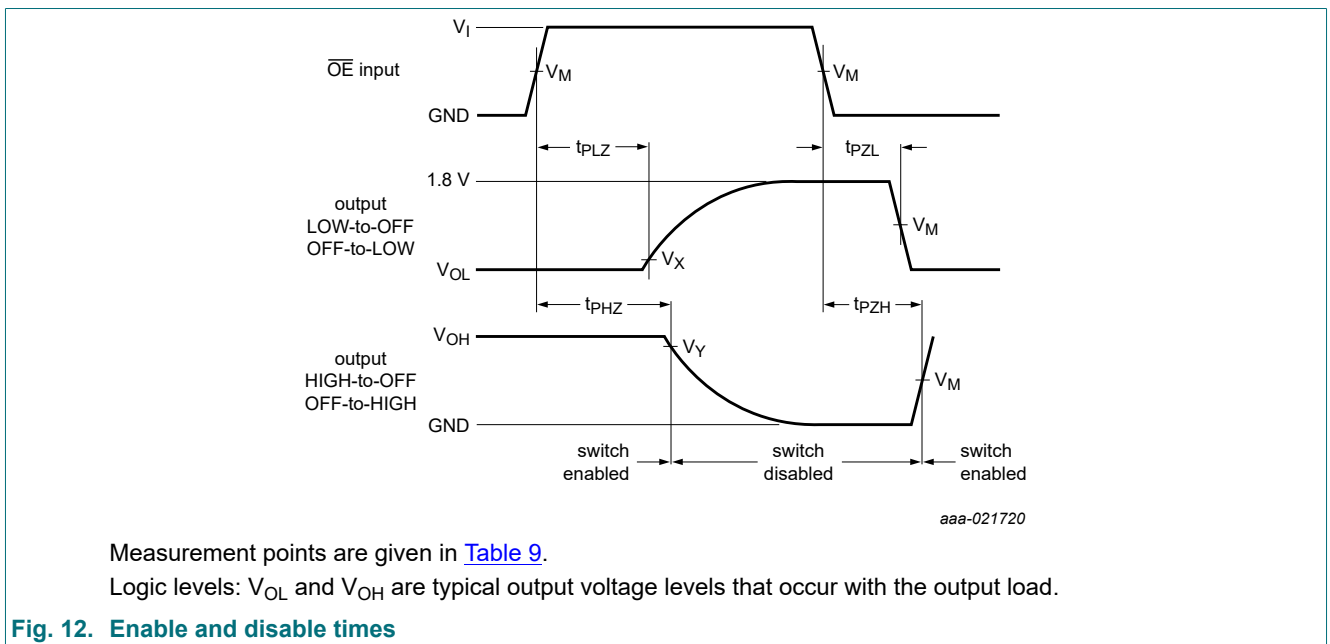
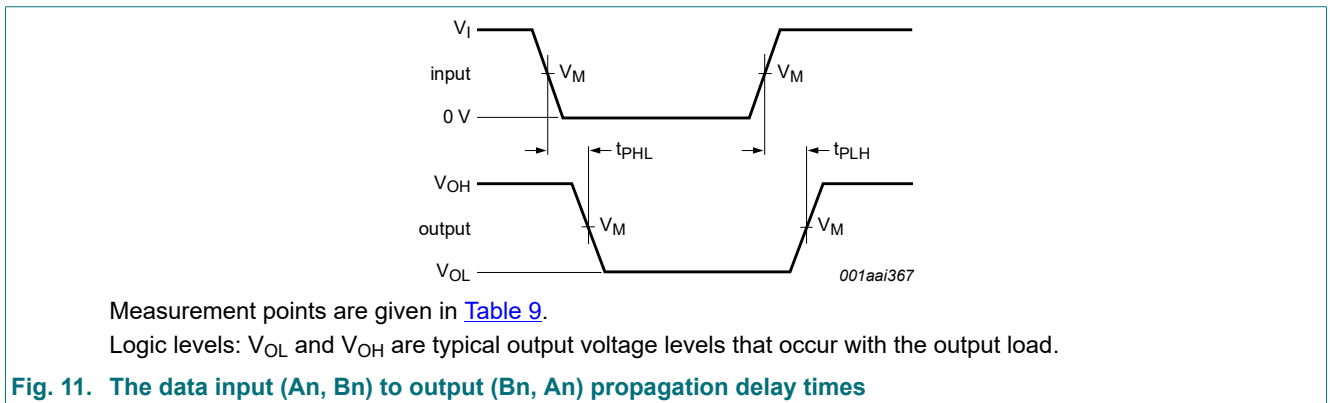
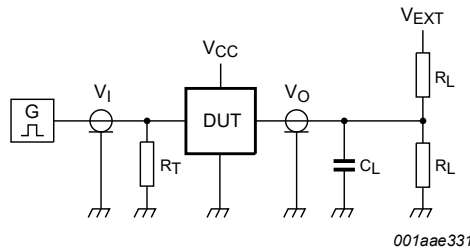
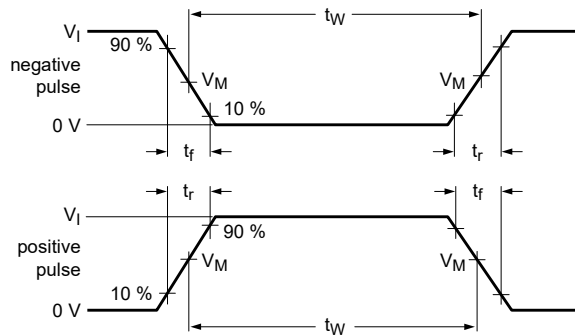


Table 9. Measurement points

Supply voltage	Input			Output		
$V_{CC}$	$V_M$	$V_I$	$t_r = t_f$	$V_M$	$V_X$	$V_Y$
3.0 V to 3.6 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns	0.9 V	$V_{OL} + 0.15$ V	$V_{OH} - 0.15$ V



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. 13. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Load		$V_{EXT}$		
$V_{CC}$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
3.0 V to 3.6 V	30 pF	1 k $\Omega$	open	GND	3.6 V



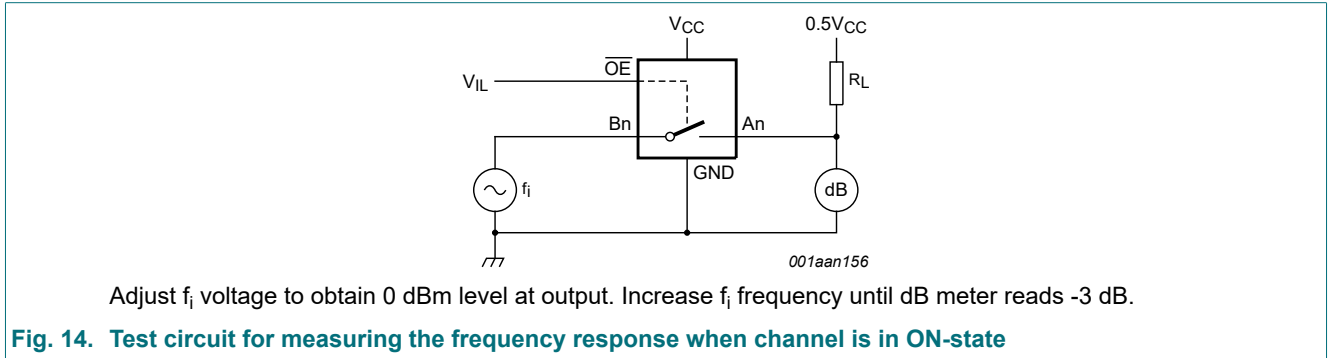
10.2. Additional dynamic characteristics

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. 14 [1]	-	575	-	MHz

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



### 11. Package outline

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

SOT360-1

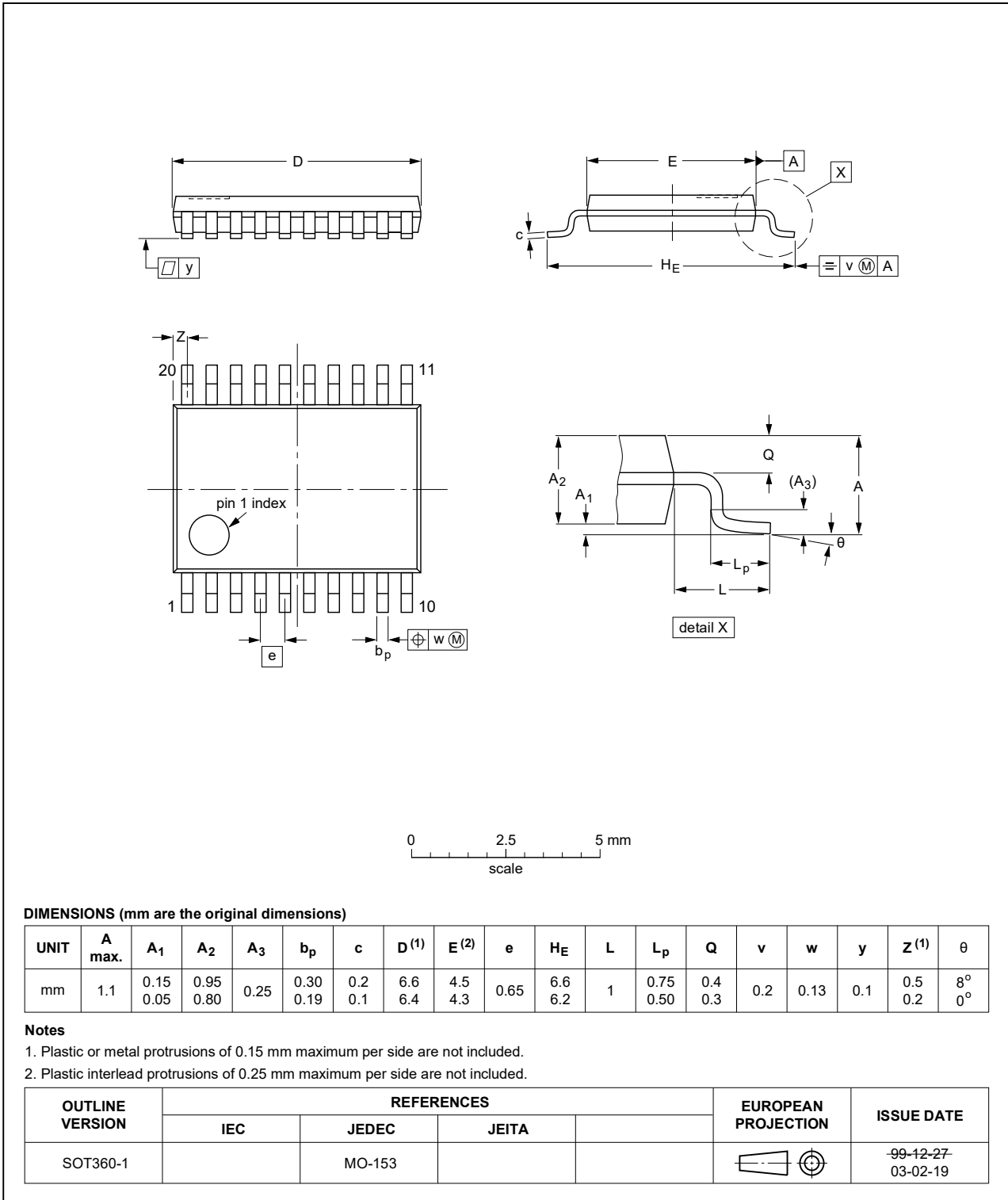


Fig. 15. Package outline SOT360-1 (TSSOP20)

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

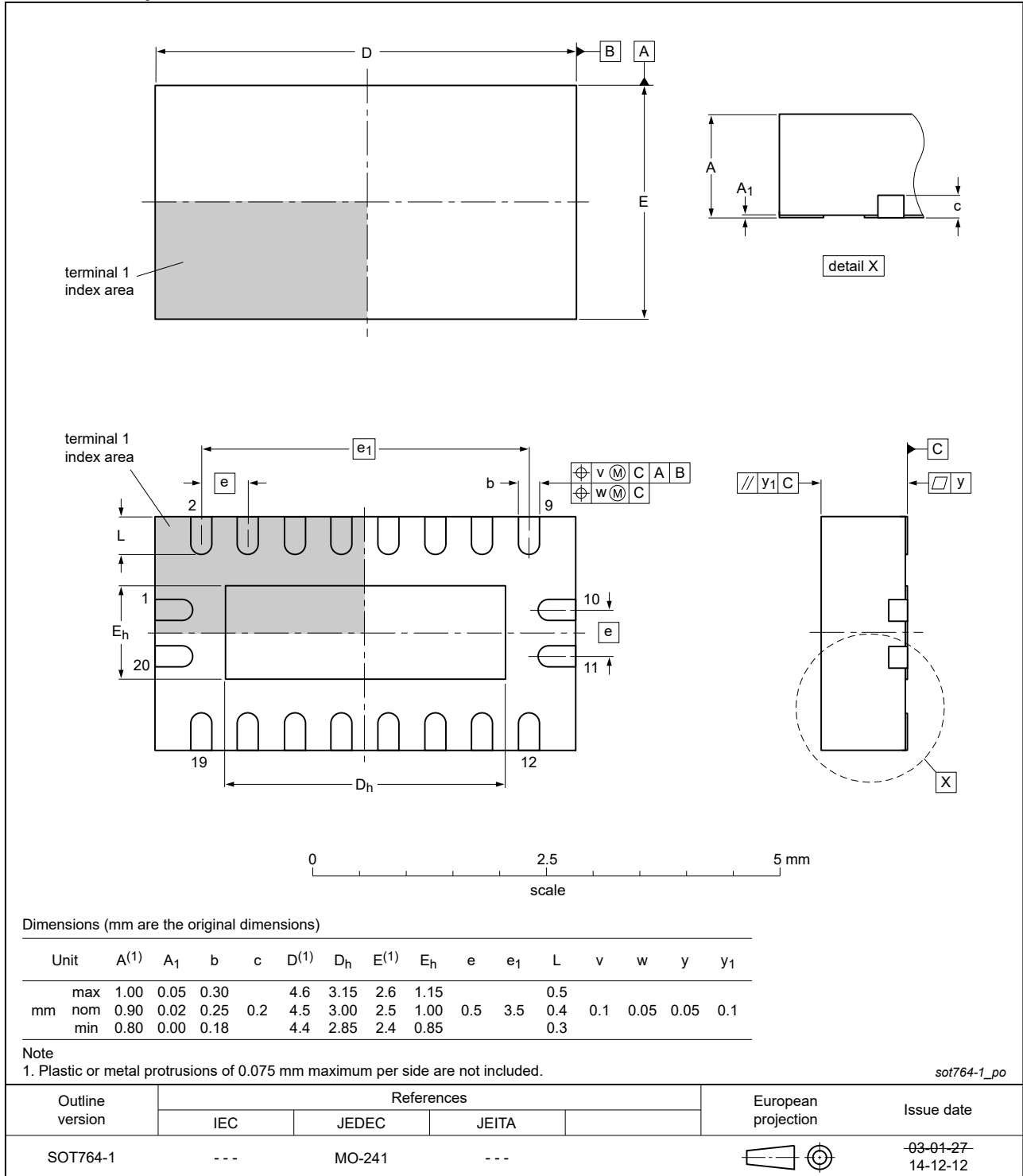


Fig. 16. Package outline SOT764-1 (DHVQFN20)

## 12. Abbreviations

Table 12. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

## 13. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLVD3245 v.7	20240624	Product data sheet	-	74CBTLVD3245 v.6
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li> </ul>			
74CBTLVD3245 v.6	20200930	Product data sheet	-	74CBTLVD3245 v.5
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74CBTLVD3245 v.5	20190416	Product data sheet	-	74CBTLVD3245 v.4
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 v.4	20160122	Product data sheet	-	74CBTLVD3245 v.3
Modifications:	<ul style="list-style-type: none"> <li>Type number 74CBTLVD3245DS removed.</li> <li><a href="#">Fig. 12</a> updated.</li> </ul>			
74CBTLVD3245 v.3	20111216	Product data sheet	-	74CBTLVD3245 v.2
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
74CBTLVD3245 v.2	20111012	Product data sheet	-	74CBTLVD3245 v.1
74CBTLVD3245 v.1	20110506	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".
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**Date of release: 24 June 2024**