

# 74CBTLVD3245

8-bit level-shifting bus switch with output enable

Rev. 4 — 22 January 2016

Product data sheet

## 1. General description

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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

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- 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:
  - ◆ 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
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74CBTLVD3245PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74CBTLVD3245BQ	-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	SOT764-1

### 4. Functional diagram

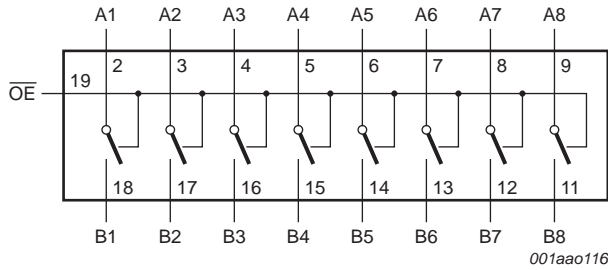


Fig 1. Logic symbol

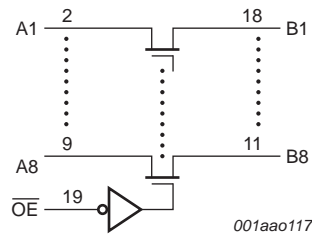
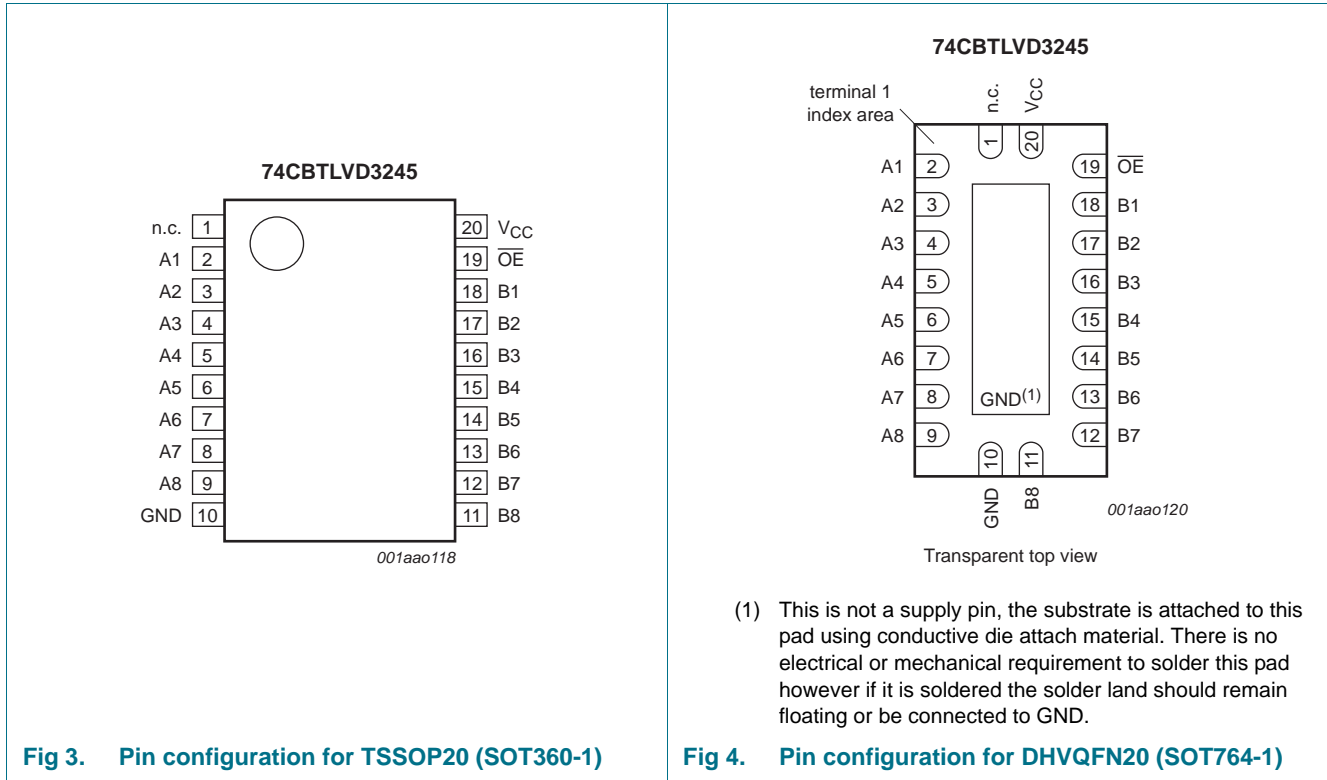


Fig 2. Logic diagram

## 5. Pinning information

### 5.1 Pinning



### 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)
OE	19	output enable input (active LOW)
VCC	20	positive supply voltage

## 6. Functional description

Table 3. Function selection<sup>[1]</sup>

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

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

## 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		-0.5	+4.6	V
$V_{SW}$	switch voltage	enable and disable mode	-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	input clamping current	$V_{IO} < -0.5$ 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	-	500	mW

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

[2] For SSOP20 and 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	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 <sup>[1]</sup>	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 3.0$ V to 3.6 V	2.0	-	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 3.0$ V to 3.6 V	-	-	0.9	-	0.9	V
$I_I$	input leakage current	pin $\overline{OE}$ ; $V_I = GND$ to $V_{CC}$ ; $V_{CC} = 3.6$ V	-	-	$\pm 1$	-	$\pm 20$	$\mu$ A
$V_{pass}$	pass voltage	$V_I = V_{CC}$ ; see <a href="#">Figure 7</a> to <a href="#">Figure 11</a>	-	-	-	-	-	V

**Table 6. Static characteristics ...continued**

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 <sup>[1]</sup>	Max	Min	Max	
I <sub>S(OFF)</sub>	OFF-state leakage current	V <sub>CC</sub> = 3.6 V; see <a href="#">Figure 5</a>	-	-	±1	-	±20	μA
I <sub>S(ON)</sub>	ON-state leakage current	V <sub>CC</sub> = 3.6 V; see <a href="#">Figure 6</a>	-	-	±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; <sup>[2]</sup> V <sub>SW</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 3.6 V	-	-	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

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 Typical pass voltage graphs

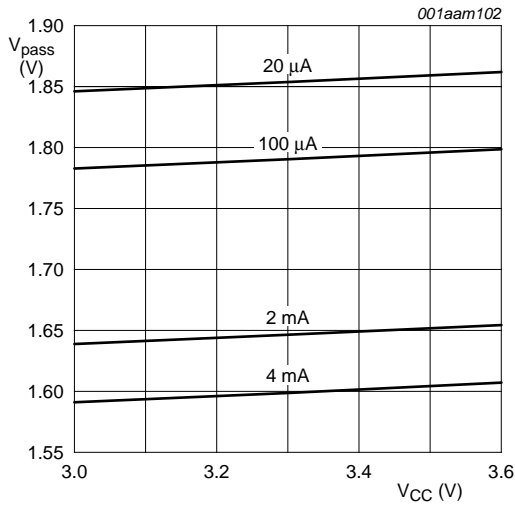


Fig 7. Pass voltage versus supply voltage;  $T_{amb} = 125\text{ °C}$  (typical)

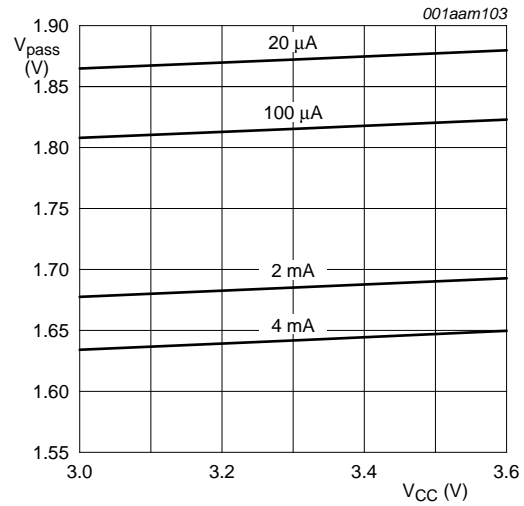


Fig 8. Pass voltage versus supply voltage;  $T_{amb} = 85\text{ °C}$  (typical)

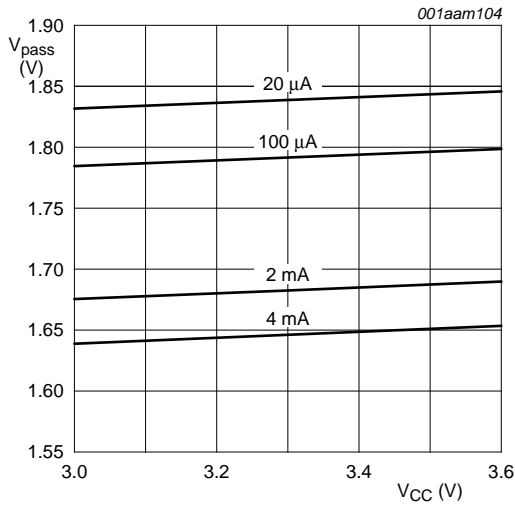


Fig 9. Pass voltage versus supply voltage;  $T_{amb} = 25\text{ °C}$  (typical)

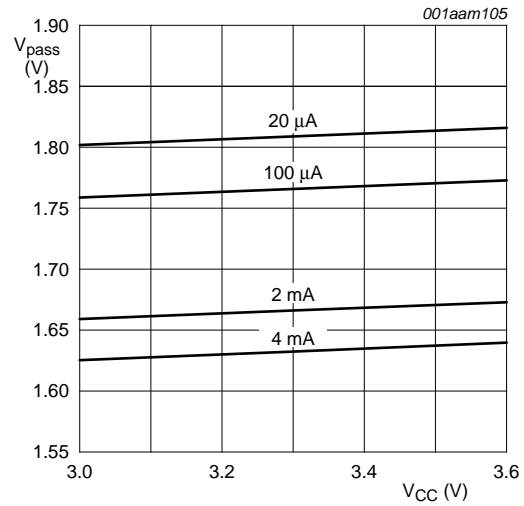


Fig 10. Pass voltage versus supply voltage;  $T_{amb} = 0\text{ °C}$  (typical)

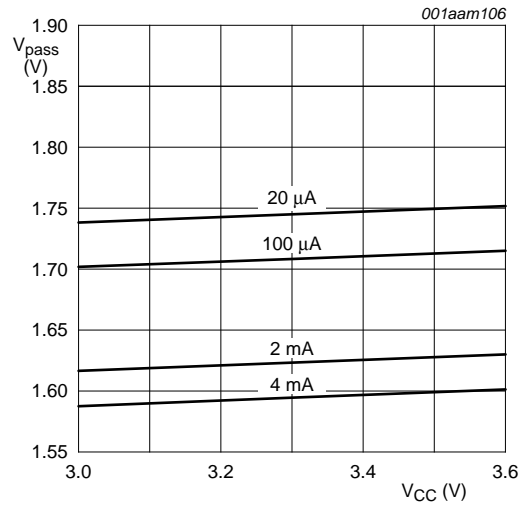


Fig 11. Pass voltage versus supply voltage;  $T_{amb} = -40\text{ °C}$  (typical)

### 9.3 ON resistance

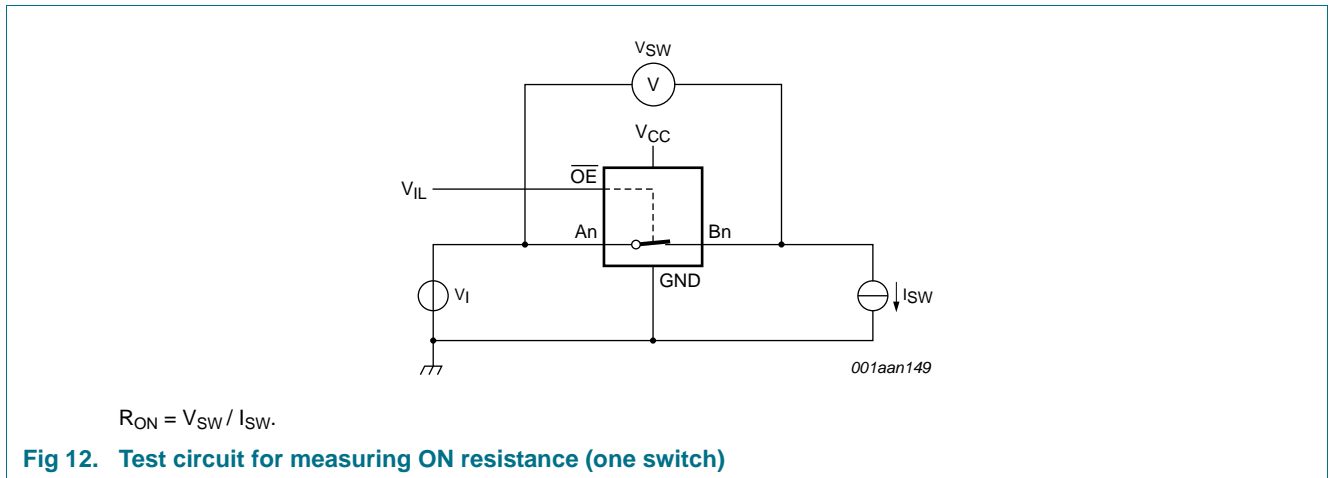
**Table 7. Resistance  $R_{ON}$**

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

Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$R_{ON}$	ON resistance	$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <sup>[2]</sup>						
		$I_{SW} = 64\text{ mA}; V_I = 0\text{ V}$	-	3.7	7.0	-	10.0	$\Omega$
		$I_{SW} = 24\text{ mA}; V_I = 0\text{ V}$	-	3.7	7.0	-	10.0	$\Omega$
		$I_{SW} = 15\text{ mA}; V_I = 1.2\text{ V}$	-	4.7	10.0	-	12.0	$\Omega$

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

### 9.4 ON resistance test circuit



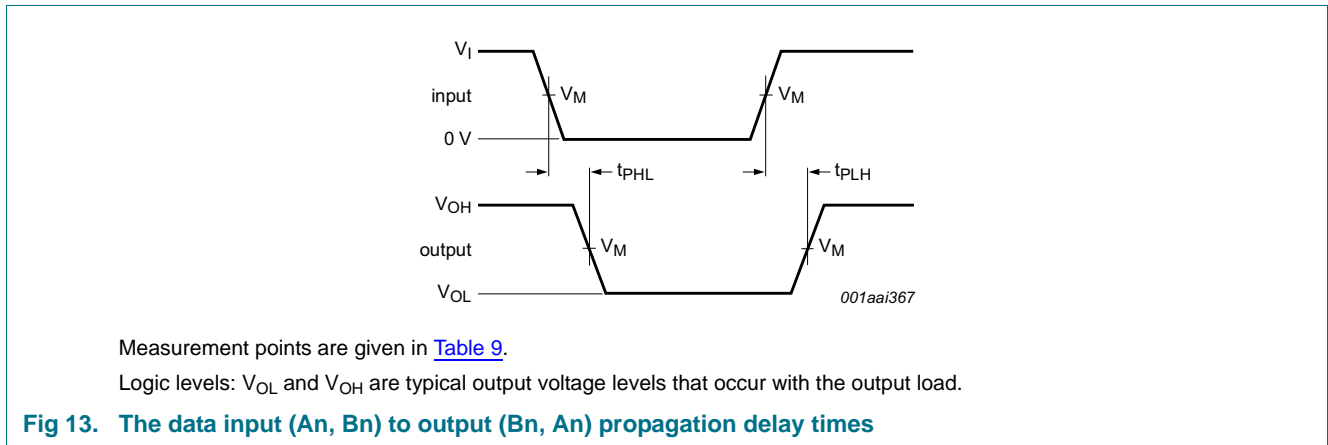
## 10. Dynamic characteristics

**Table 8. Dynamic characteristics**  
*GND = 0 V; for test circuit see Figure 15*

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

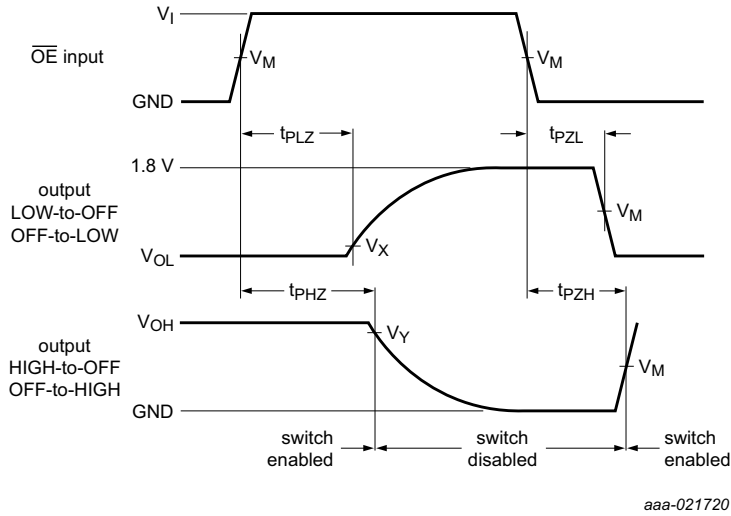
- [1] All typical values are measured at T<sub>amb</sub> = 25 °C and at nominal V<sub>CC</sub>.
- [2] The propagation delay is the calculated RC time constant of the on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).
- [3] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [4] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [5] t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.

## 11. Waveforms



**Table 9. Measurement points**

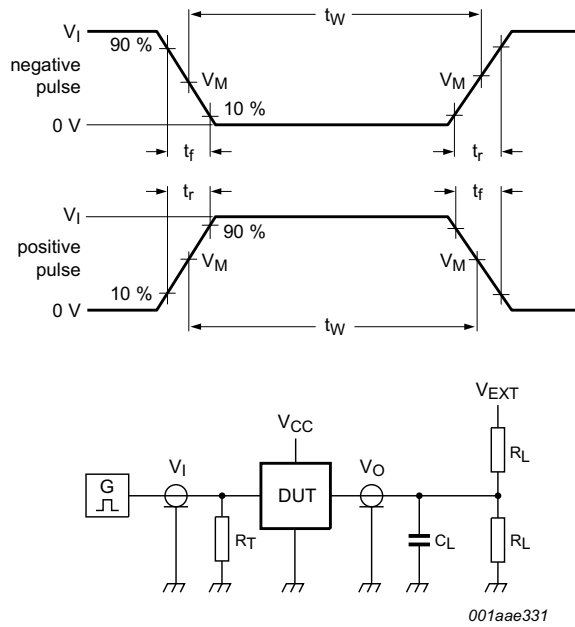
Supply voltage	Input			Output		
V <sub>CC</sub>	V <sub>M</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
3.0 V to 3.6 V	0.5V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns	0.9 V	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V



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. 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 15. 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

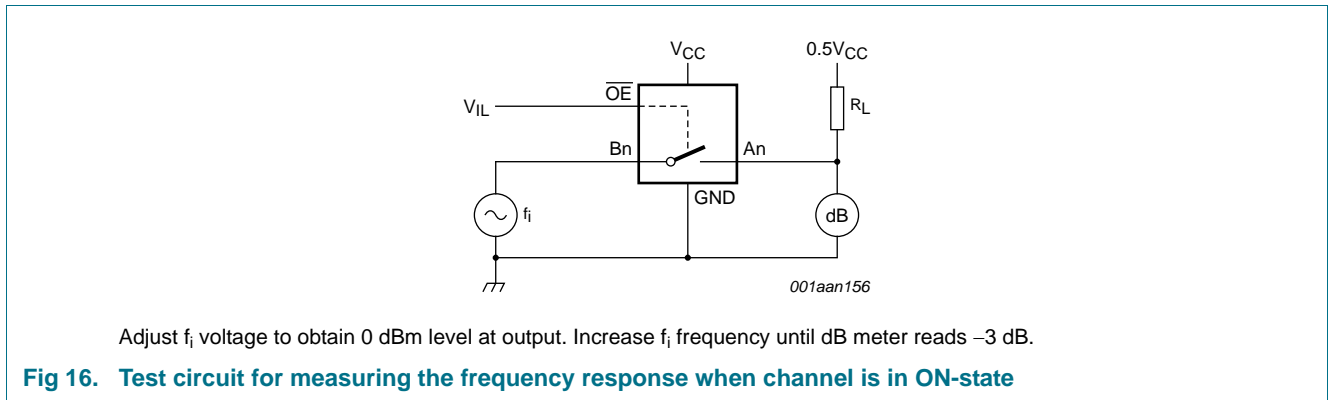
### 11.1 Additional dynamic characteristics

**Table 11. Additional dynamic characteristics**  
*GND = 0 V.*

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

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

### 11.2 Test circuit



12. Package outline

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

SOT360-1

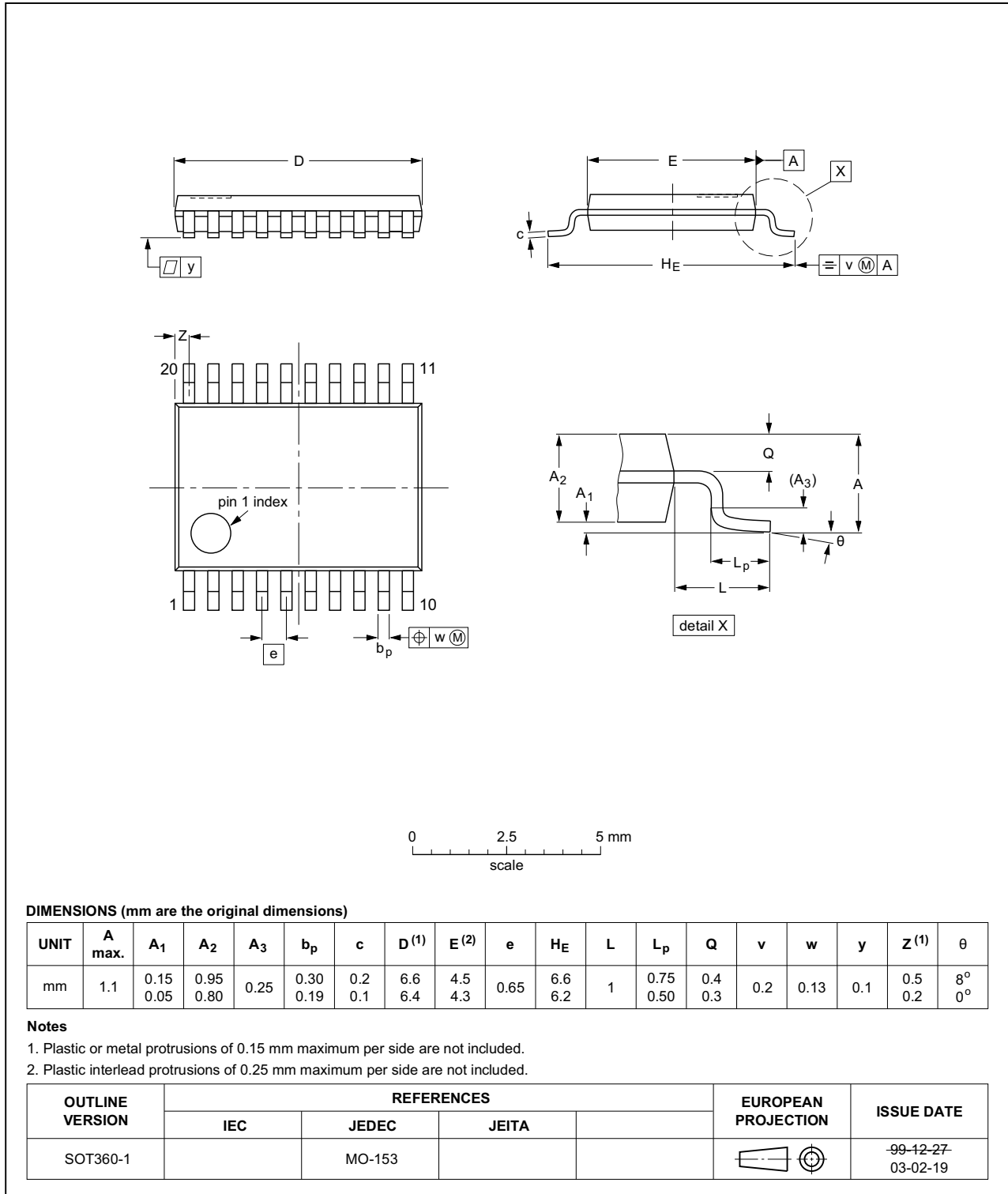


Fig 17. Package outline SOT360-1 (TSSOP20)

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

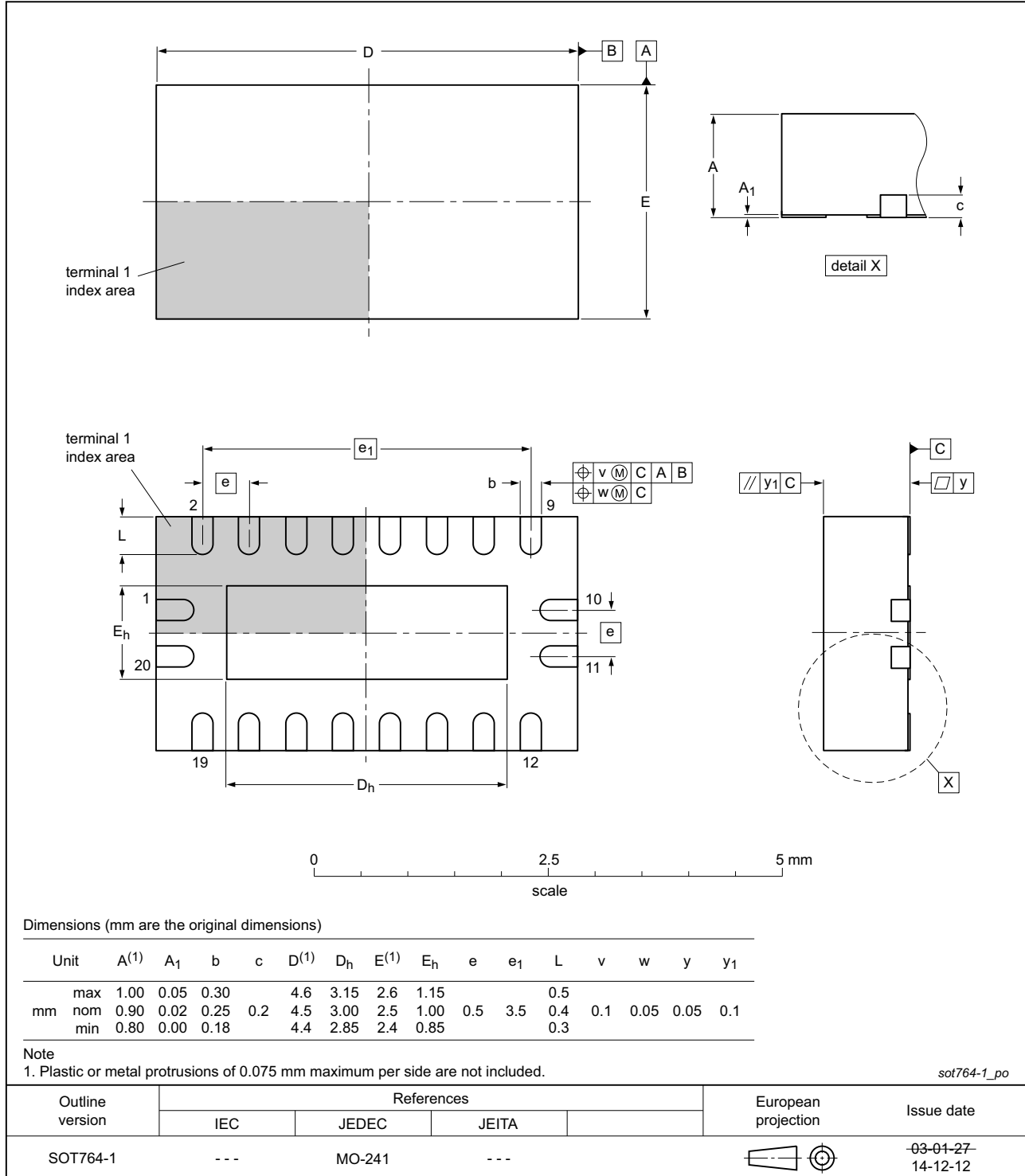


Fig 18. Package outline SOT764-1 (DHVQFN20)

## 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
MM	Machine Model

## 14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
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="#">Figure 14</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	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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