

74CBTLV3245

8-bit bus switch with output enable

Rev. 1 — 30 December 2010

Product data sheet

1. General description

The 74CBTLV3245 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 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:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM AEC-Q100-011 revision B exceeds 1000 V
- 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
- 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	
74CBTLV3245DS	−40 °C to +125 °C	SSOP20 ^[1]	plastic shrink small outline package; 20 leads; body width 3.9 mm; lead pitch 0.635 mm	SOT724-1
74CBTLV3245PW	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74CBTLV3245BQ	−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

[1] Also known as QSOP20 package

4. Functional diagram

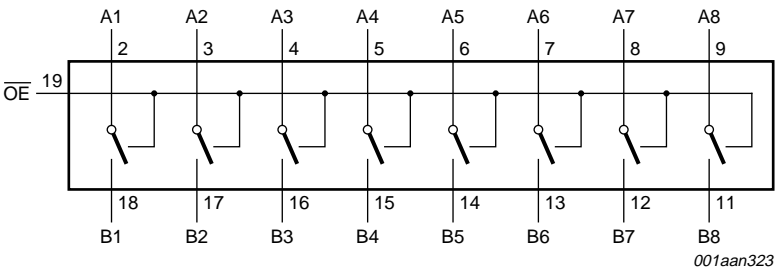


Fig 1. Logic symbol

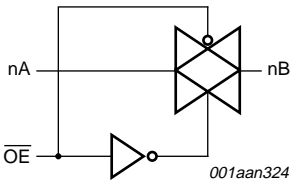


Fig 2. Logic diagram (one switch)

5. Pinning information

5.1 Pinning

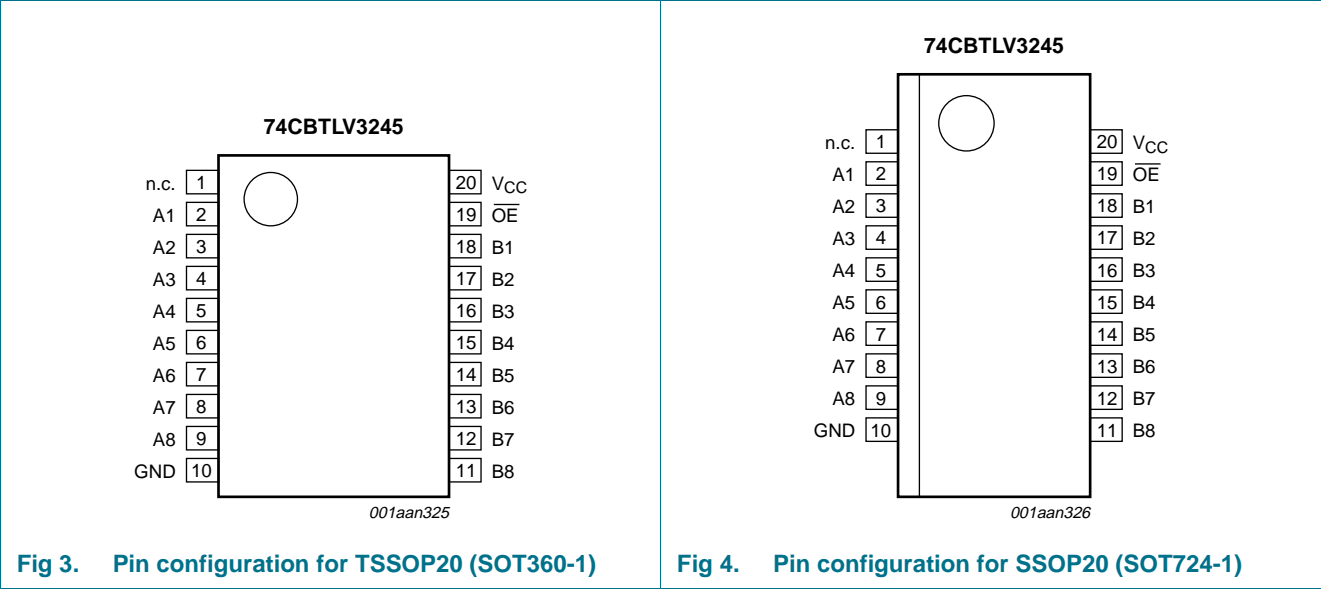


Fig 3. Pin configuration for TSSOP20 (SOT360-1)

Fig 4. Pin configuration for SSOP20 (SOT724-1)

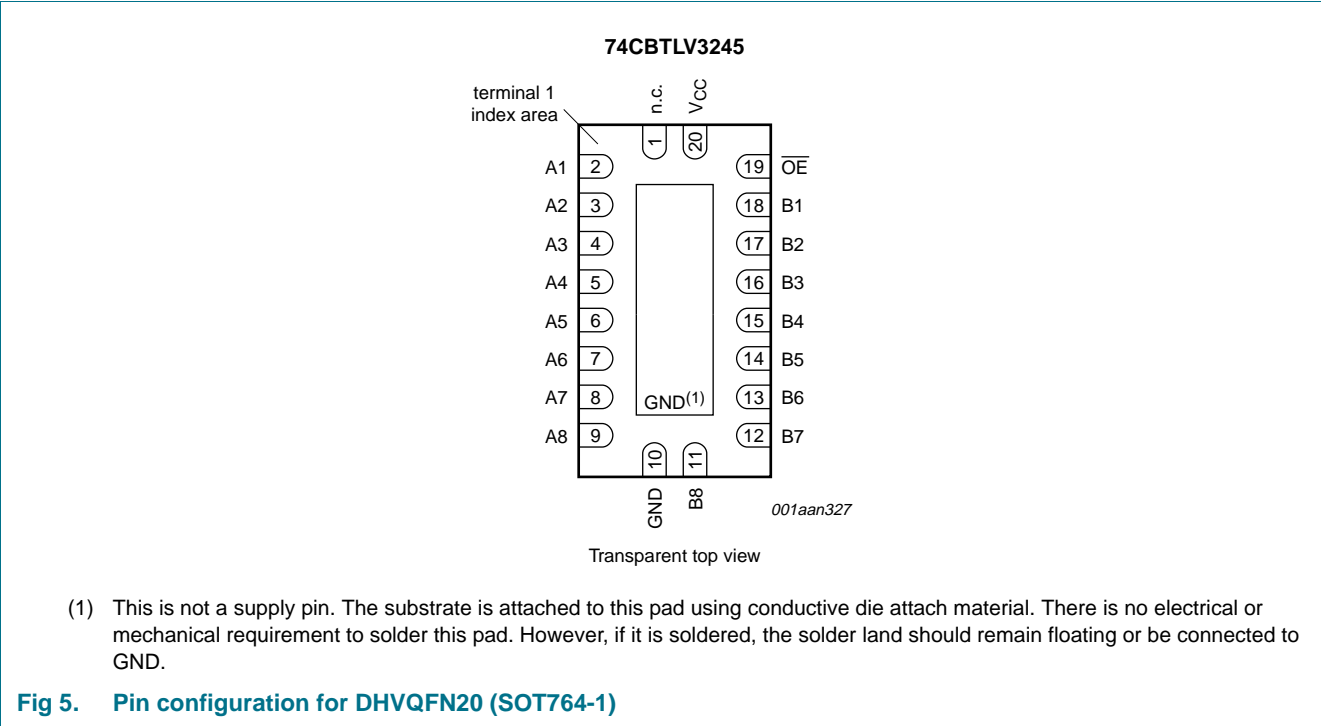


Fig 5. Pin configuration for DHVQFN20 (SOT764-1)

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
nc	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)
$\overline{\text{OE}}$	19	output enable input (active LOW)
V_{CC}	20	positive supply voltage

6. Functional description

Table 3. Function selection^[1]

Input	Input/output
$\overline{\text{OE}}$	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		^[1] -0.5	+4.6	V
V_{SW}	switch voltage	enable and disable mode	^[1] -0.5	$V_{\text{CC}} + 0.5$	V
I_{IK}	input clamping current	$V_{\text{I}} < -0.5 \text{ V}$	-50	-	mA
I_{SK}	switch clamping current	$V_{\text{I}} < -0.5 \text{ V}$	-50	-	mA
I_{SW}	switch current	$V_{\text{SW}} = 0 \text{ V to } V_{\text{CC}}$	-	± 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	$T_{\text{amb}} = -40 \text{ °C to } +125 \text{ °C}$	^[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 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		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	$V_{CC} = 2.3\text{ V to }3.6\text{ V}$	[1] -	200	ns/V

[1] Applies to control signal levels.

9. Static characteristics

Table 6. Static characteristics

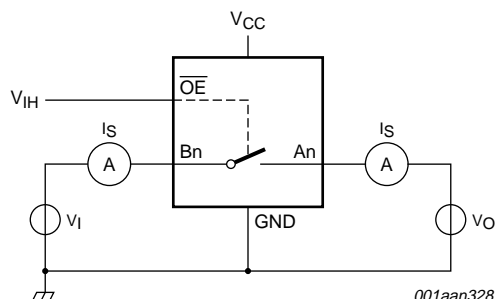
At recommended operating conditions voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	-	-	1.7	-	V
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	2.0	-	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.7	-	0.7	V
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.9	-	0.9	V
I_I	input leakage current	pin \overline{OE} ; $V_I = \text{GND to }V_{CC}$; $V_{CC} = 3.6\text{ V}$	-	-	± 1	-	± 20	μA
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 3.6\text{ V}$; see Figure 6	-	-	± 1	-	± 20	μA
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 3.6\text{ V}$; see Figure 7	-	-	± 1	-	± 20	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 0\text{ V to }3.6\text{ V}$; $V_{CC} = 0\text{ V}$	-	-	± 10	-	± 50	μA
I_{CC}	supply current	$V_I = \text{GND or }V_{CC}$; $I_O = 0\text{ A}$; $V_{SW} = \text{GND or }V_{CC}$; $V_{CC} = 3.6\text{ V}$	-	-	10	-	50	μA
ΔI_{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	μA
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	$V_{CC} = 3.3\text{ V}$; $V_I = 0\text{ V to }3.3\text{ V}$	-	5.2	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance	$V_{CC} = 3.3\text{ V}$; $V_I = 0\text{ V to }3.3\text{ V}$	-	14.3	-	-	-	pF

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

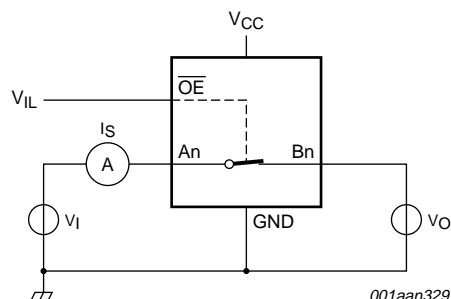
[2] One input at 3 V, other inputs at V_{CC} or GND.

9.1 Test circuits



$V_I = V_{CC}$ or GND and $V_O = \text{GND}$ or V_{CC} .

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



$V_I = V_{CC}$ or GND and $V_O = \text{open circuit}$.

Fig 7. 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 [Figure 8](#).

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 Figure 9 to Figure 11 ^[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	-	60.0	Ω
		$V_{CC} = 3.0\text{ V}$ to 3.6 V ; see Figure 12 to Figure 14						
		$I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$	-	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	-	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

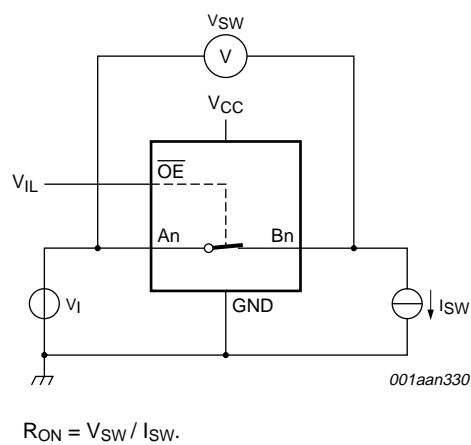
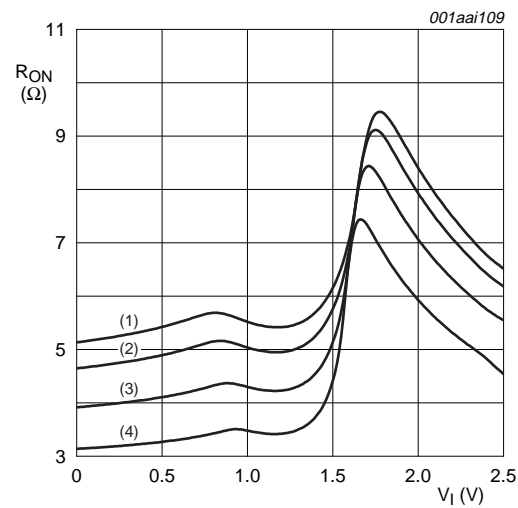
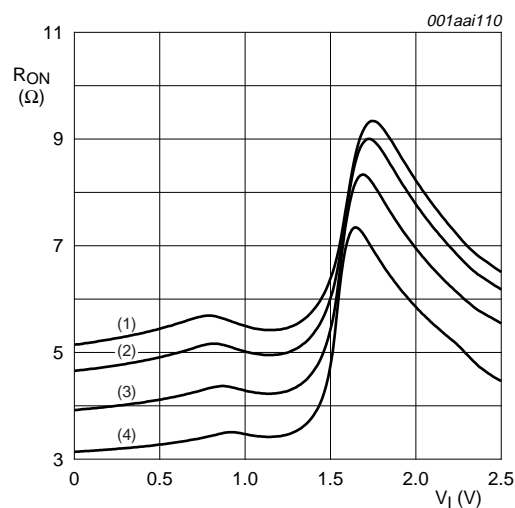


Fig 8. Test circuit for measuring ON resistance (one switch)



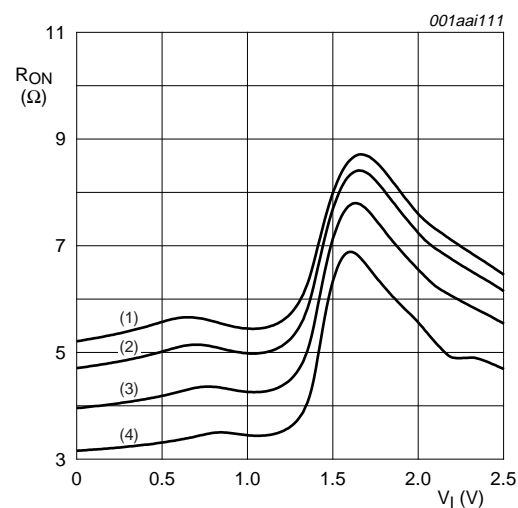
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$.
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$.
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$.
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$.

Fig 9. ON resistance as a function of input voltage; $V_{CC} = 2.5\text{ V}$; $I_{SW} = 15\text{ mA}$



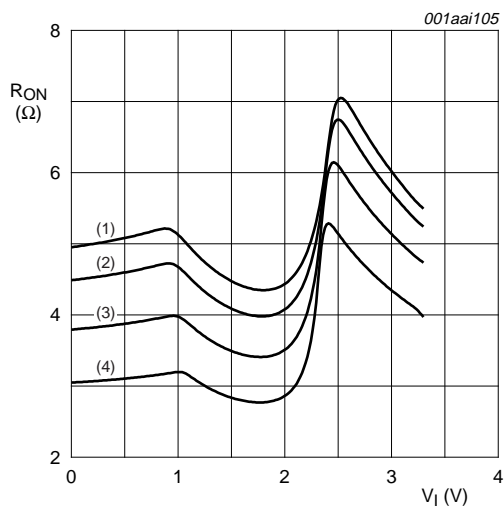
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$.
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$.
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$.
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$.

Fig 10. ON resistance as a function of input voltage; $V_{CC} = 2.5\text{ V}$; $I_{SW} = 24\text{ mA}$



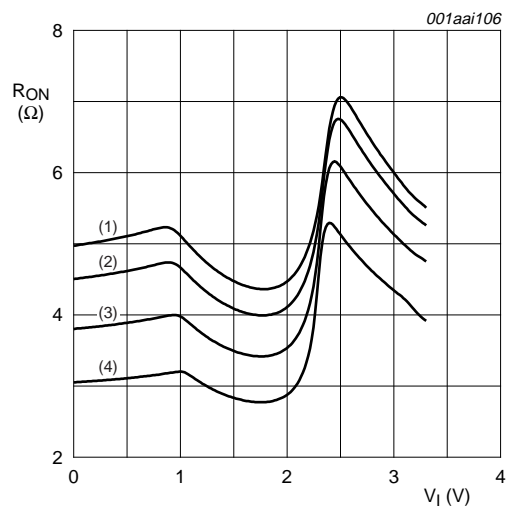
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$.
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$.
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$.
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$.

Fig 11. ON resistance as a function of input voltage; $V_{CC} = 2.5\text{ V}$; $I_{SW} = 64\text{ mA}$



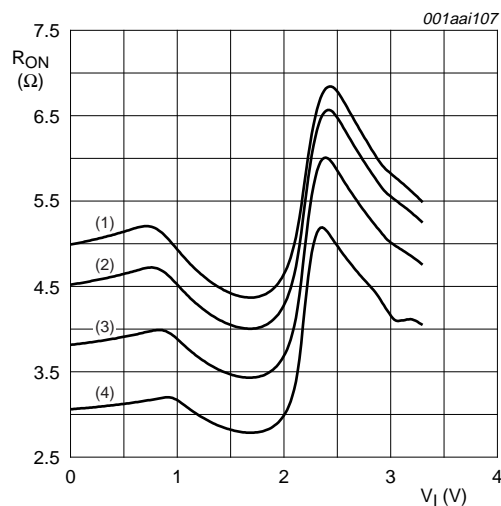
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 12. ON resistance as a function of input voltage;
 $V_{CC} = 3.3\text{ V}; I_{SW} = 15\text{ mA}$



- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 13. ON resistance as a function of input voltage;
 $V_{CC} = 3.3\text{ V}; I_{SW} = 24\text{ mA}$



- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 14. 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 [Figure 17](#)

Symbol	Parameter	Conditions	$T_{\text{amb}} = -40\text{ °C to }+85\text{ °C}$			$T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	An to Bn or Bn to An; see Figure 15 ^{[2][3]}						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.13	-	0.20	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.20	-	0.31	ns
t_{en}	enable time	$\overline{\text{OE}}$ to An or Bn; see Figure 16 ^[4]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.4	5.5	1.0	8.0	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.0	4.9	1.0	7.0	ns
t_{dis}	disable time	$\overline{\text{OE}}$ to An or Bn; see Figure 16 ^[5]						
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.0	5.5	1.0	8.0	ns
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.4	5.8	1.0	8.5	ns

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

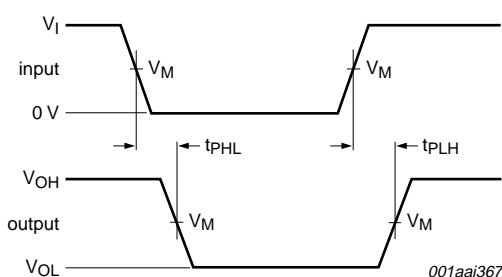
[2] The propagation delay is the calculated RC time constant of the on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).

[3] t_{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} .

11. Waveforms



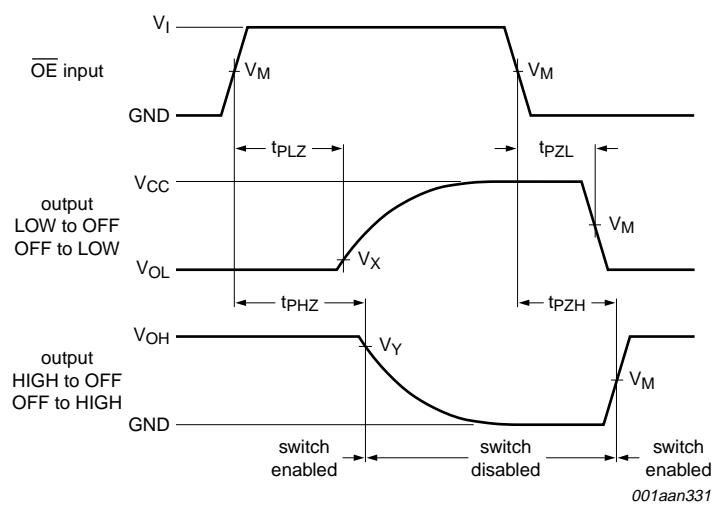
Measurement points are given in [Table 9](#).

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 15. The data input (An, Bn) to output (Bn, An) propagation delay times

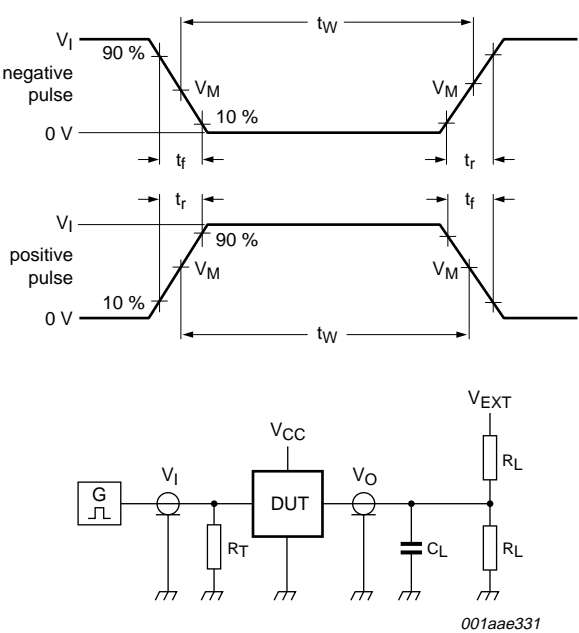
Table 9. Measurement points

Supply voltage	Input			Output		
V_{CC}	V_{M}	V_{I}	$t_{\text{r}} = t_{\text{f}}$	V_{M}	V_{X}	V_{Y}
2.3 V to 2.7 V	$0.5V_{\text{CC}}$	V_{CC}	$\leq 2.0\text{ ns}$	$0.5V_{\text{CC}}$	$V_{\text{OL}} + 0.15\text{ V}$	$V_{\text{OH}} - 0.15\text{ V}$
3.0 V to 3.6 V	$0.5V_{\text{CC}}$	V_{CC}	$\leq 2.0\text{ ns}$	$0.5V_{\text{CC}}$	$V_{\text{OL}} + 0.3\text{ V}$	$V_{\text{OH}} - 0.3\text{ V}$



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 16. 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 17. 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	$2V_{CC}$

12. Package outline

SSOP20: plastic shrink small outline package; 20 leads; body width 3.9 mm; lead pitch 0.635 mm SOT724-1

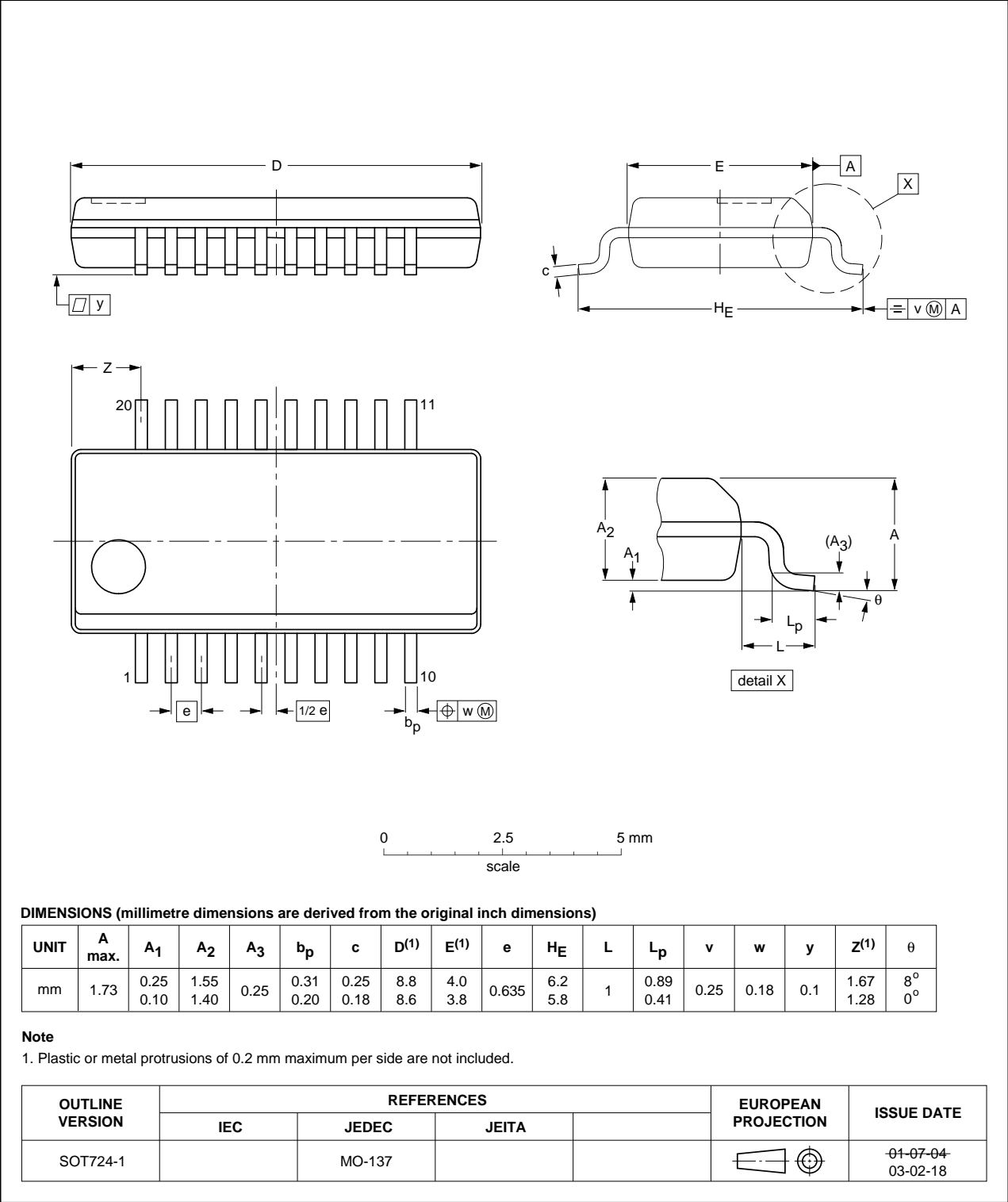


Fig 18. Package outline SOT724-1 (SSOP20)

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

SOT360-1

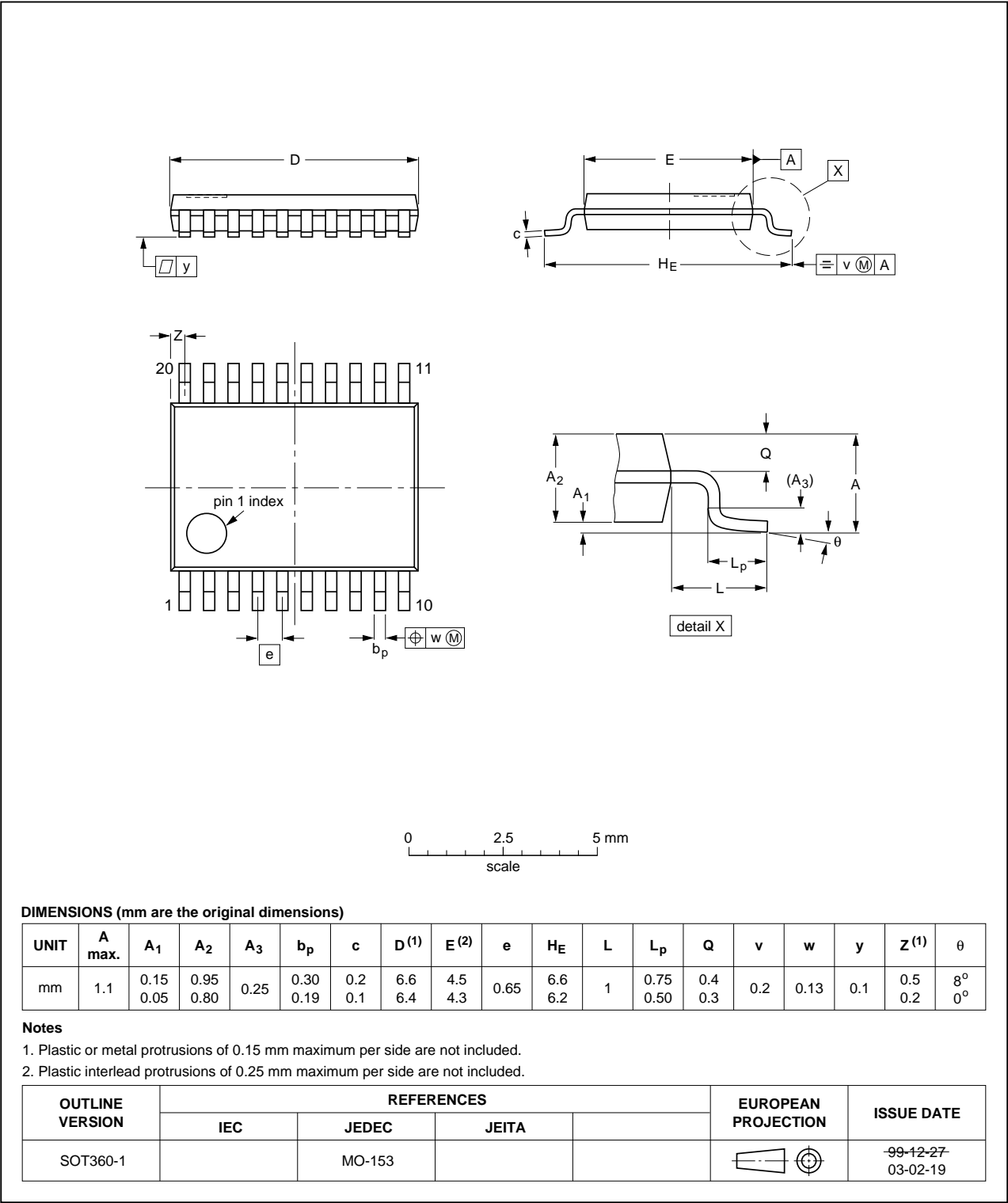


Fig 19. Package outline SOT360-1 (TSSOP20)

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

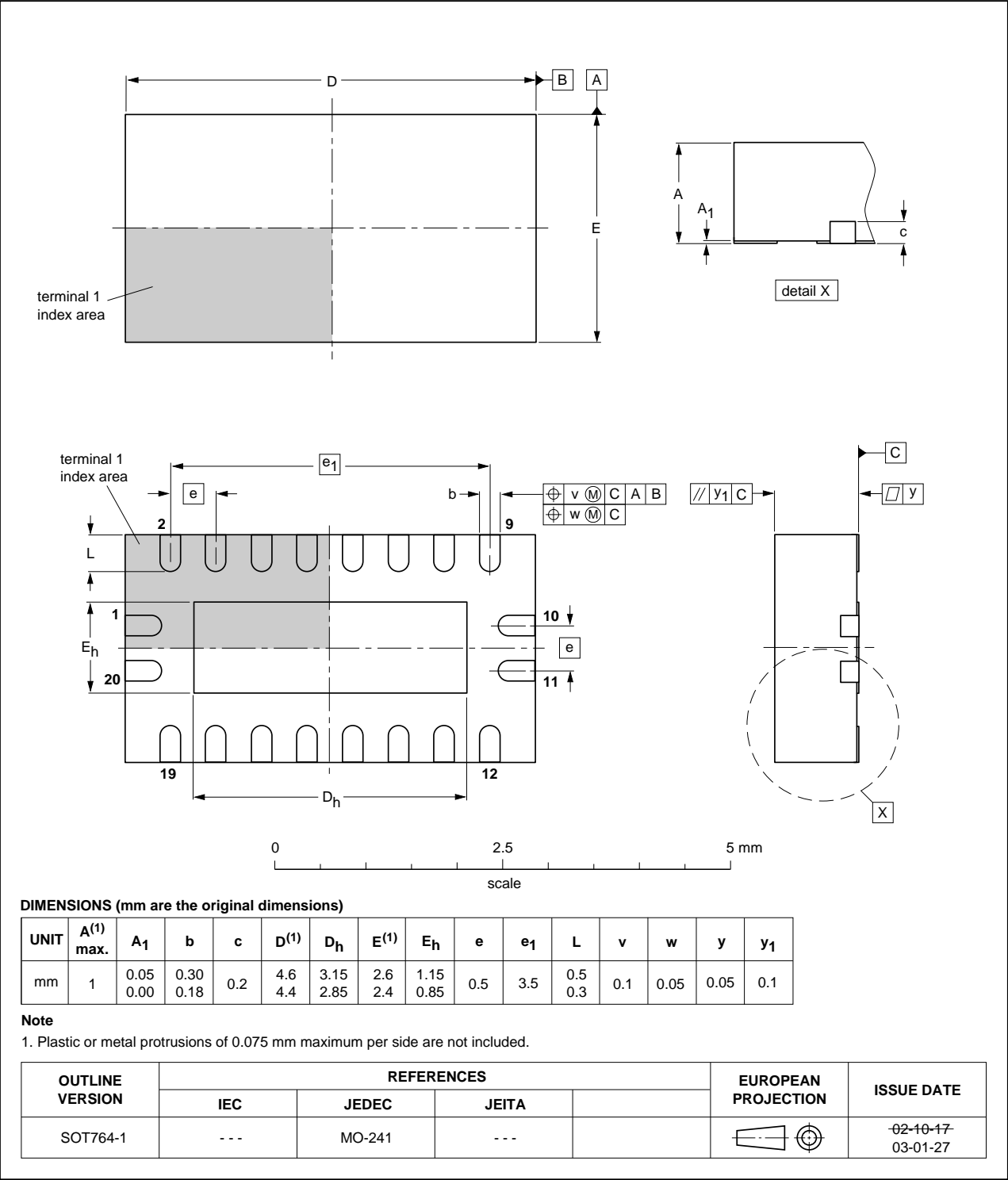


Fig 20. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 11. 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 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV3245 v.1	20101230	Product data sheet	-	-

15. Legal information

15.1 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 URL <http://www.nxp.com>.

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Date of release: 30 December 2010

Document identifier: 74CBTLV3245