

# 74LVT241

3.3 V octal buffer/line driver; 3-state

Rev. 03 — 7 May 2008

Product data sheet

## 1. General description

The 74LVT241 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

This device is an octal buffer that is ideal for driving bus lines. The device features two output enables ( $\overline{1OE}$ ,  $2OE$ ), each controlling four of the 3-state outputs.

## 2. Features

- 3-state buffers
- Octal bus interface
- Input and output interface capability to systems at 5 V supply
- TTL input and output switching levels
- Output capability: +64 mA/−32 mA
- Latch-up protection exceeds 500 mA per JESD78 class II level A
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Bus-hold data inputs eliminate the need for external pull-up resistors for unused inputs
- Live insertion/extraction permitted
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus

## 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVT241D	−40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVT241DB	−40 °C to +85 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVT241PW	−40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVT241BQ	−40 °C to +85 °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

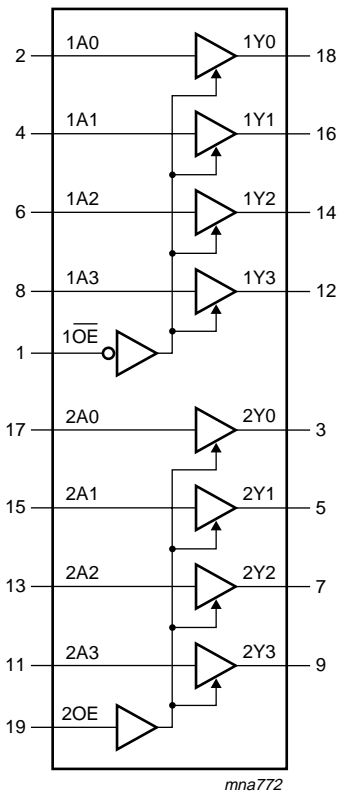


Fig 1. Logic symbol

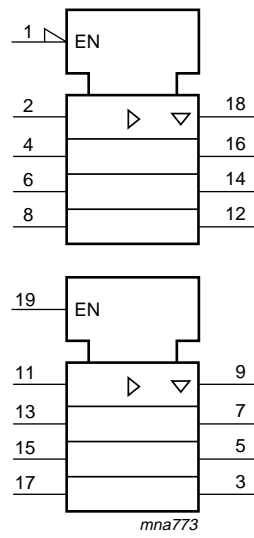
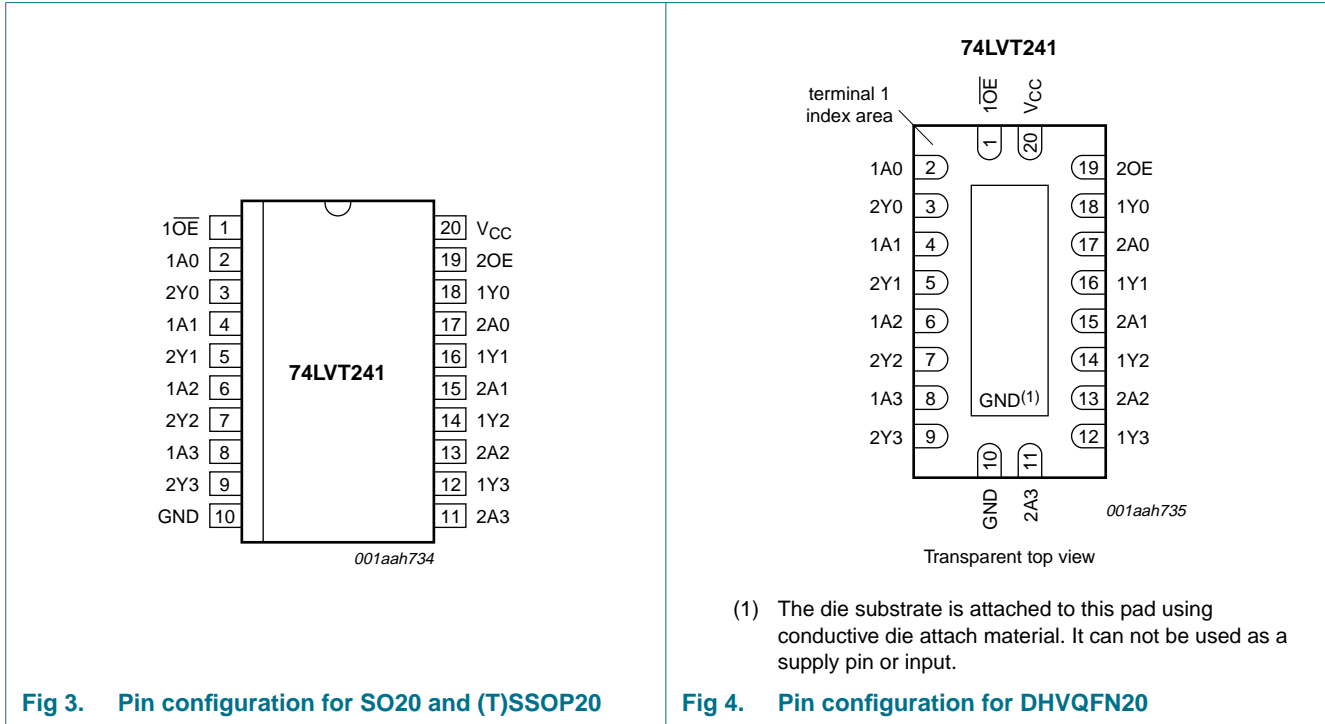


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE	1	output enable input (active LOW)
1A0 to 1A3	2, 4, 6, 8	data input
2A0 to 2A3	17, 15, 13, 11	data input
GND	10	ground (0 V)
1Y0 to 1Y3	18, 16, 14, 12	data output
2Y0 to 2Y3	3, 5, 7, 9	data output
2OE	19	output enable input (active HIGH)
VCC	20	supply voltage

## 6. Functional description

**Table 3. Function table**

Inputs				Outputs	
1OE	2OE	1An	2An	1Yn	2Yn
L	H	L	L	L	L
L	H	H	H	H	H
H	L	X	X	Z	Z

- [1] H = HIGH voltage level;
- L = LOW voltage level;
- X = Don't care;
- 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).<sup>[1]</sup>

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage		<sup>[2]</sup> -0.5	+7.0	V
V <sub>O</sub>	output voltage	output in OFF or HIGH state	<sup>[2]</sup> -0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
I <sub>O</sub>	output current	output in LOW state	-	128	mA
		output in HIGH state	-64	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>j</sub>	junction temperature		-	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	<sup>[3]</sup> -	500	mW

- [1] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- [2] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
- [3] For SO20 packages: above 70 °C derate linearly with 8 mW/K.  
For SSOP20 and TSSOP20 packages: above 60 °C derate linearly with 5.5 mW/K.  
For DHVQFN20 packages: above 60 °C derate linearly with 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		2.7	3.6	V
V <sub>I</sub>	input voltage		0	5.5	V
I <sub>OH</sub>	HIGH-level output current		-32	-	mA

**Table 5.** Recommended operating conditions ...continued

Symbol	Parameter	Conditions	Min	Max	Unit
I <sub>OL</sub>	LOW-level output current		-	32	mA
		current duty cycle ≤ 50 %; f <sub>i</sub> ≥ 1 kHz	-	64	mA
T <sub>amb</sub>	ambient temperature	in free air	-40	+85	°C
Δt/ΔV	input transition rise and fall rate	output enabled	0	10	ns/V

## 9. Static characteristics

**Table 6.** Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V); T<sub>amb</sub> = -40 °C to +85 °C.

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = -18 mA	-1.2	-0.9	-	V
V <sub>IH</sub>	HIGH-level input voltage		2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage		-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 2.7 V to 3.6 V; I <sub>OH</sub> = -100 μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub> - 0.1	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -8 mA	2.4	2.5	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -32 mA	2.0	2.2	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 100 μA		0.1	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 24 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA	-	0.25	0.4	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 32 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 64 mA	-	0.4	0.55	V
I <sub>I</sub>	input leakage current	control and data pins				
		V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	1	10	μA
		control pins				
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	0.1	±1	μA
		data pins	<a href="#">[2]</a>			
	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub>	-	0.1	1	μA	
	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V	-5	-1	-	μA	
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V	-	1	±100	μA
I <sub>BHL</sub>	bus hold LOW current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 0.8 V	75	150	-	μA
I <sub>BHH</sub>	bus hold HIGH current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 2.0 V	-	-150	-75	μA
I <sub>BHLO</sub>	bus hold LOW overdrive current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V to 3.6 V	<a href="#">[3]</a> 500	-	-	μA
I <sub>BHHO</sub>	bus hold HIGH overdrive current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V to 3.6 V	<a href="#">[3]</a> -	-	-500	μA
I <sub>LO</sub>	output leakage current	V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 3.0 V; output HIGH	-	60	125	μA
I <sub>O(pu/pd)</sub>	power-up/power-down output current	V <sub>CC</sub> ≤ 1.2 V; V <sub>O</sub> = 0.5 V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> ; 1OE, 2OE = don't care	<a href="#">[4]</a> -	±1	±100	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 3.6 V; V <sub>O</sub> = 3.0 V	-	1	5	μA
		V <sub>CC</sub> = 3.6 V; V <sub>O</sub> = 0.5 V	-5	-1	-	μA

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

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V);  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit	
$I_{CC}$	supply current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$					
		outputs HIGH	-	0.12	0.19	mA	
		outputs LOW	-	3	12	mA	
		outputs disabled	[5]	-	0.12	0.19	mA
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ ; one input = $V_{CC} - 0.6\text{ V}$ other inputs at $V_{CC}$ or GND	[6]	-	0.1	0.25	mA
$C_I$	input capacitance	$1\overline{OE}$ and $2OE$ inputs; outputs disabled; $V_I = 0\text{ V}$ or $3.0\text{ V}$	-	4	-	pF	
$C_{I/O}$	input/output capacitance	at input/output data pins, outputs disabled; $V_{I/O} = 0\text{ V}$ or $3.0\text{ V}$	-	8	-	pF	

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

[2] Unused pins at  $V_{CC}$  or GND.

[3] This is the bus hold overdrive current required to force the input to the opposite logic state.

[4] This parameter is valid for any  $V_{CC}$  between 0 V and 1.2 V with a transition time of up to 10 ms. From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  a transition time of 100 ms is permitted. This parameter is valid for  $T_{amb} = +25\text{ }^{\circ}\text{C}$  only.

[5]  $I_{CC}$  with the outputs disabled is measured with outputs pulled to  $V_{CC}$  or GND.

[6] This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#);  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$t_{PLH}$	LOW to HIGH propagation delay	1An to 1Yn, 2An to 2Yn; see <a href="#">Figure 5</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	4.0	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	2.8	3.8	ns
$t_{PHL}$	HIGH to LOW propagation delay	1An to 1Yn, 2An to 2Yn; see <a href="#">Figure 5</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	4.0	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	2.8	3.8	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$1\overline{OE}$ to 1Yn; see <a href="#">Figure 6</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	5.0	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.2	4.4	ns
		$2OE$ to 2Yn; see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	5.6	ns
	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.8	5.1	ns	

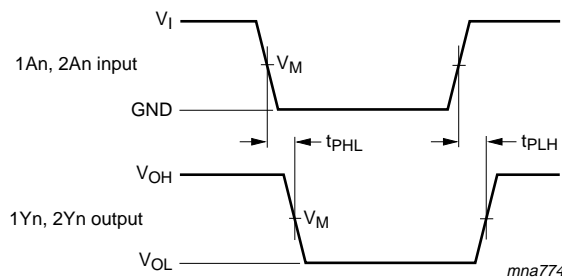
**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#);  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>PZL</sub>	OFF-state to LOW propagation delay	1 $\overline{\text{OE}}$ to 1Yn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.9	ns
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V	1.0	3.1	4.3	ns
		2OE to 2Yn; see <a href="#">Figure 7</a>				
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	1 $\overline{\text{OE}}$ to 1Yn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	5.4	ns
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V	2.0	3.6	5.2	ns
		2OE to 2Yn; see <a href="#">Figure 7</a>				
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	1 $\overline{\text{OE}}$ to 1Yn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.3	ns
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V	1.6	2.9	4.2	ns
		2OE to 2Yn; see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.3	ns
		V <sub>CC</sub> = 3.3 V $\pm$ 0.3 V	1.0	2.8	4.0	ns

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 3.3 V.

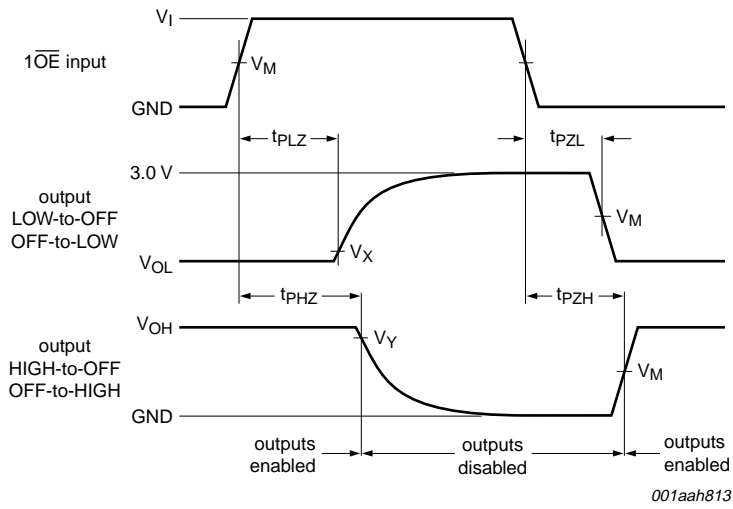
## 11. Waveforms



See [Table 8](#) for measurement points.

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

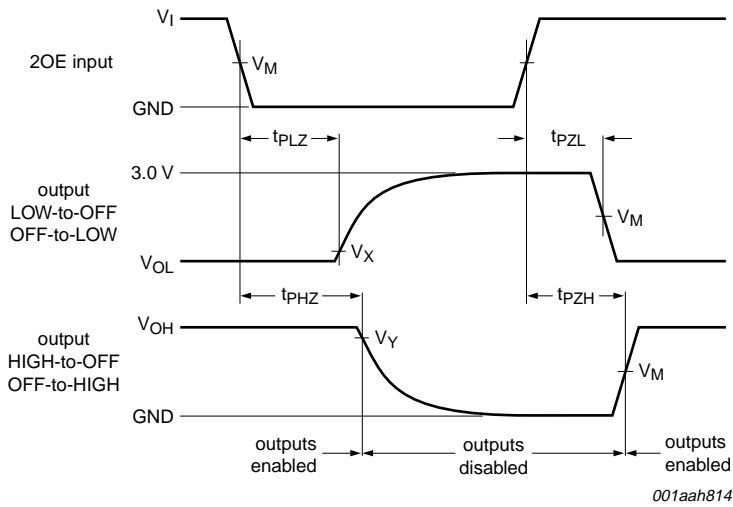
**Fig 5. Input (1An, 2An) to output (1Yn, 2Yn) propagation delays and output transition times**



See [Table 8](#) for measurement points.

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

**Fig 6. 3-state output enable and disable times**



See [Table 8](#) for measurement points.

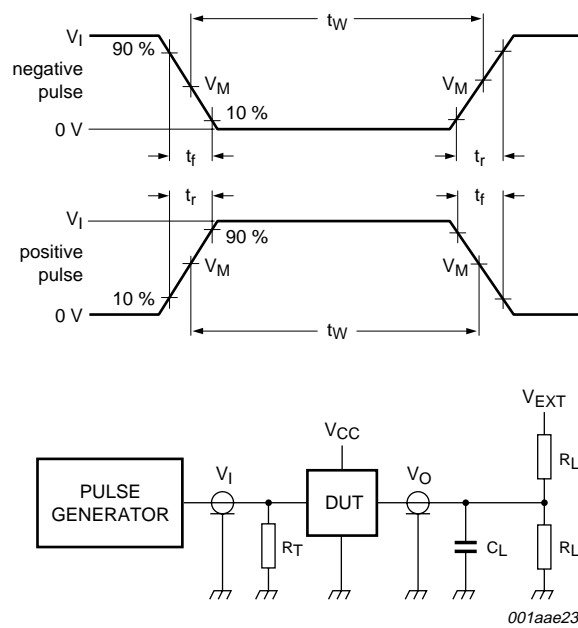
$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 7. 3-state output enable and disable times**

**Table 8. Measurement points**

$V_{CC}$	Input	Output		
	$V_M$	$V_X$	$V_Y$	$V_M$
2.7 V to 3.6 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$	1.5 V





Test data is given in [Table 9](#).

Definitions test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$V_{EXT}$  = External voltage for measuring switching times.

**Fig 8. Test circuit for switching times**

**Table 9. Test data**

Input				Load		$V_{EXT}$		
$V_I$	$f_i$	$t_W$	$t_r, t_f$	$R_L$	$C_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
2.7 V	$\leq 10$ MHz	500 ns	$\leq 2.5$ ns	500 $\Omega$	50 pF	GND	6 V	open

12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

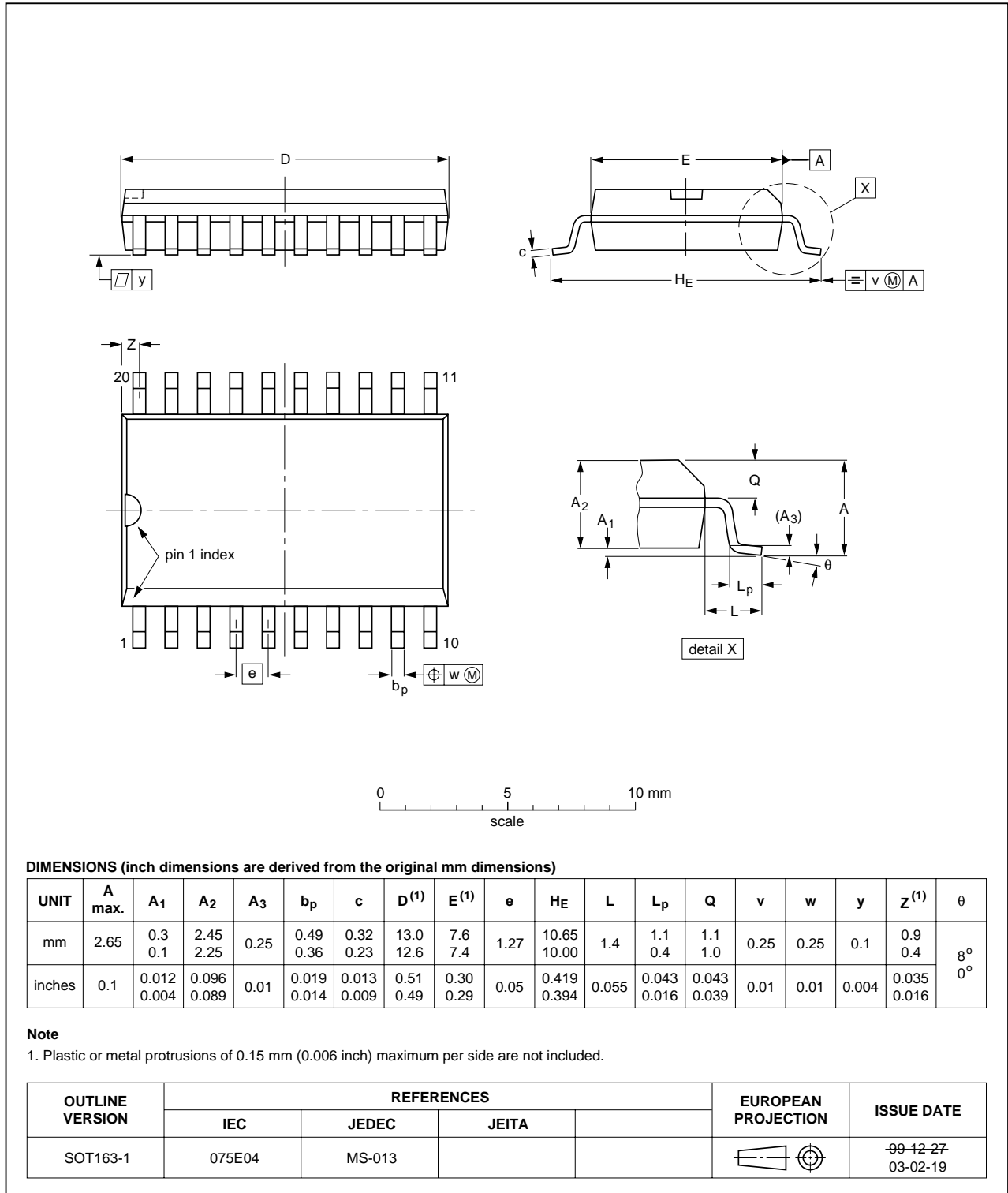


Fig 9. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

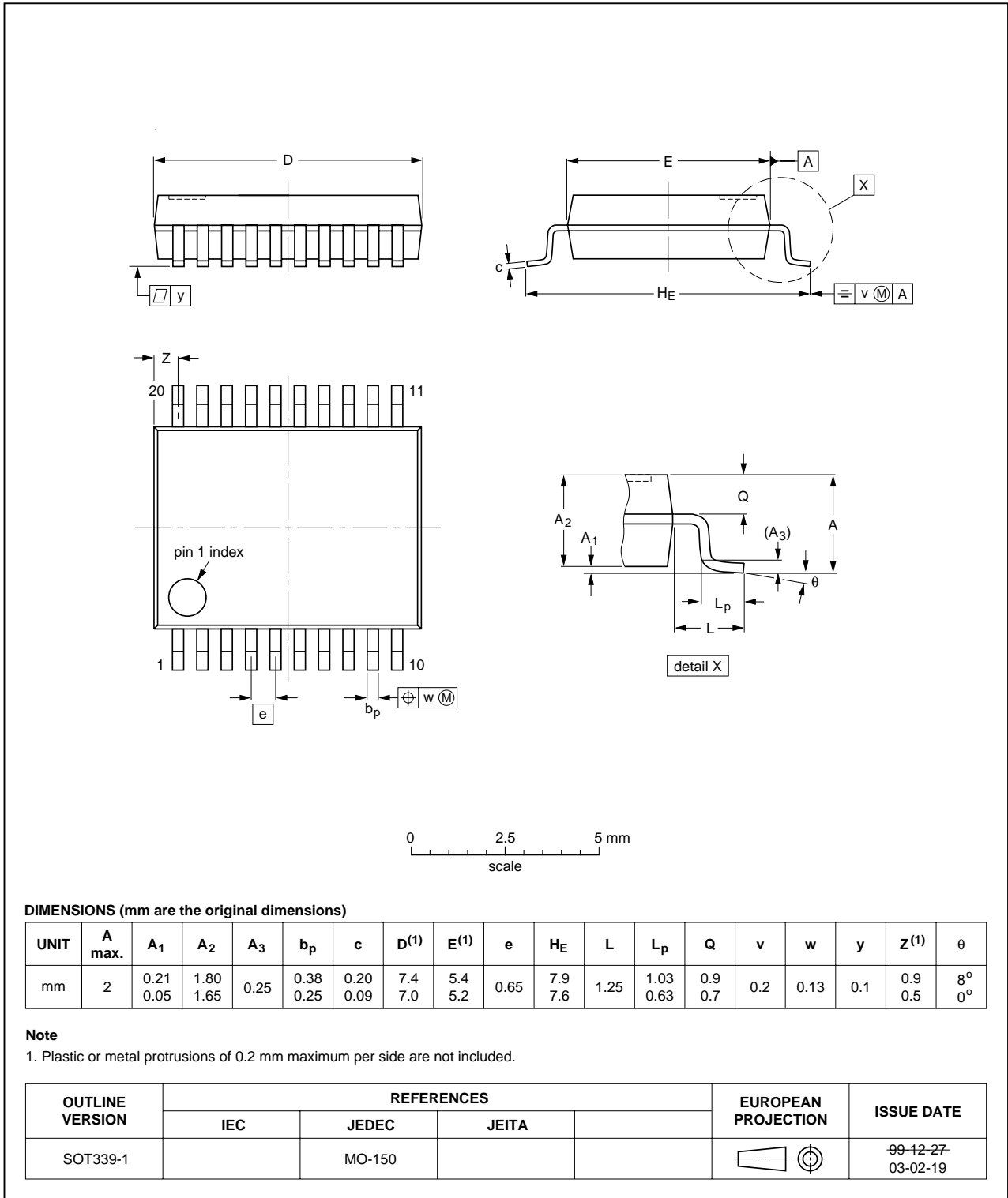


Fig 10. Package outline SOT339-1 (SSOP20)

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

SOT360-1

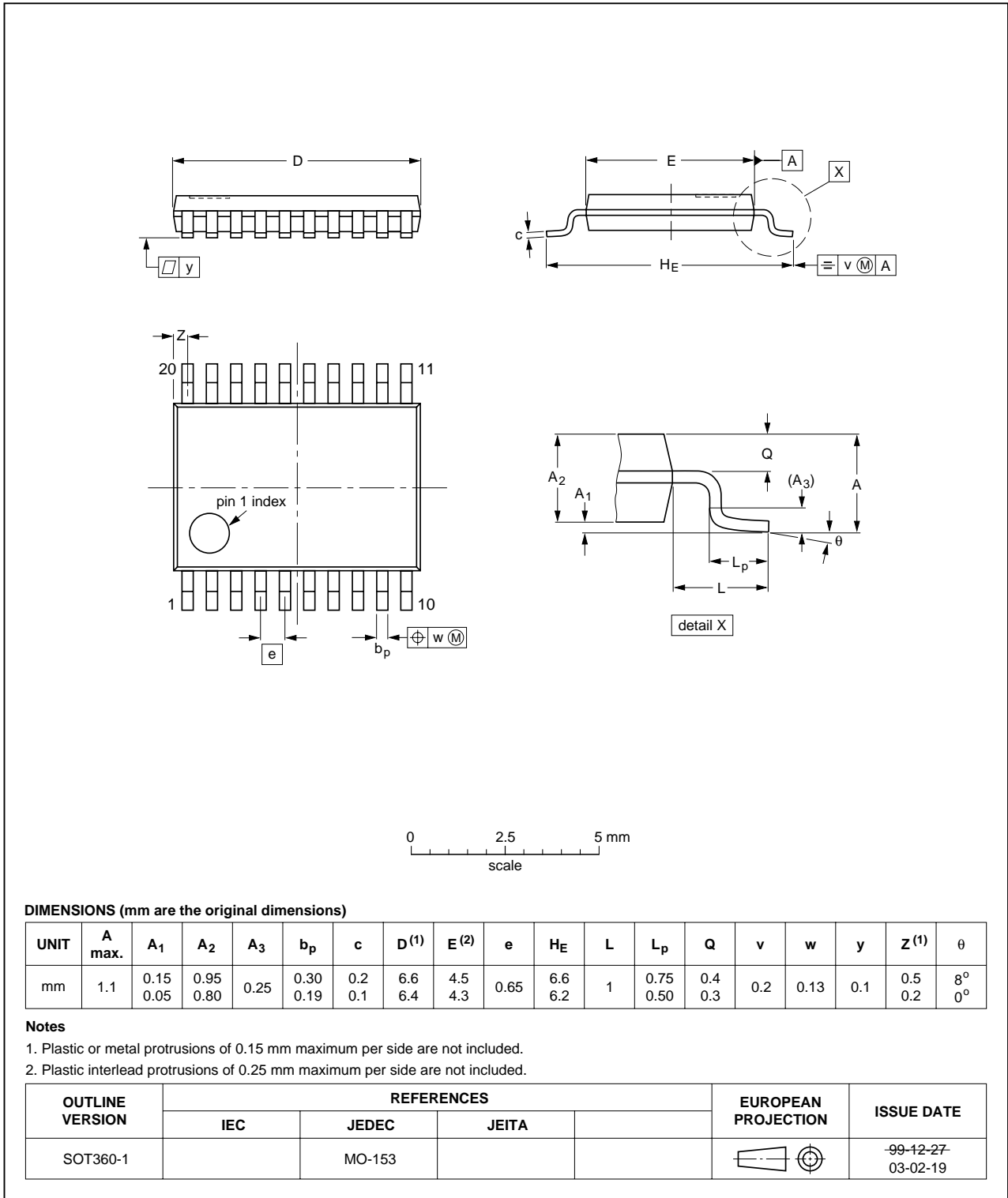


Fig 11. Package outline SOT360-1 (TSSOP20)

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

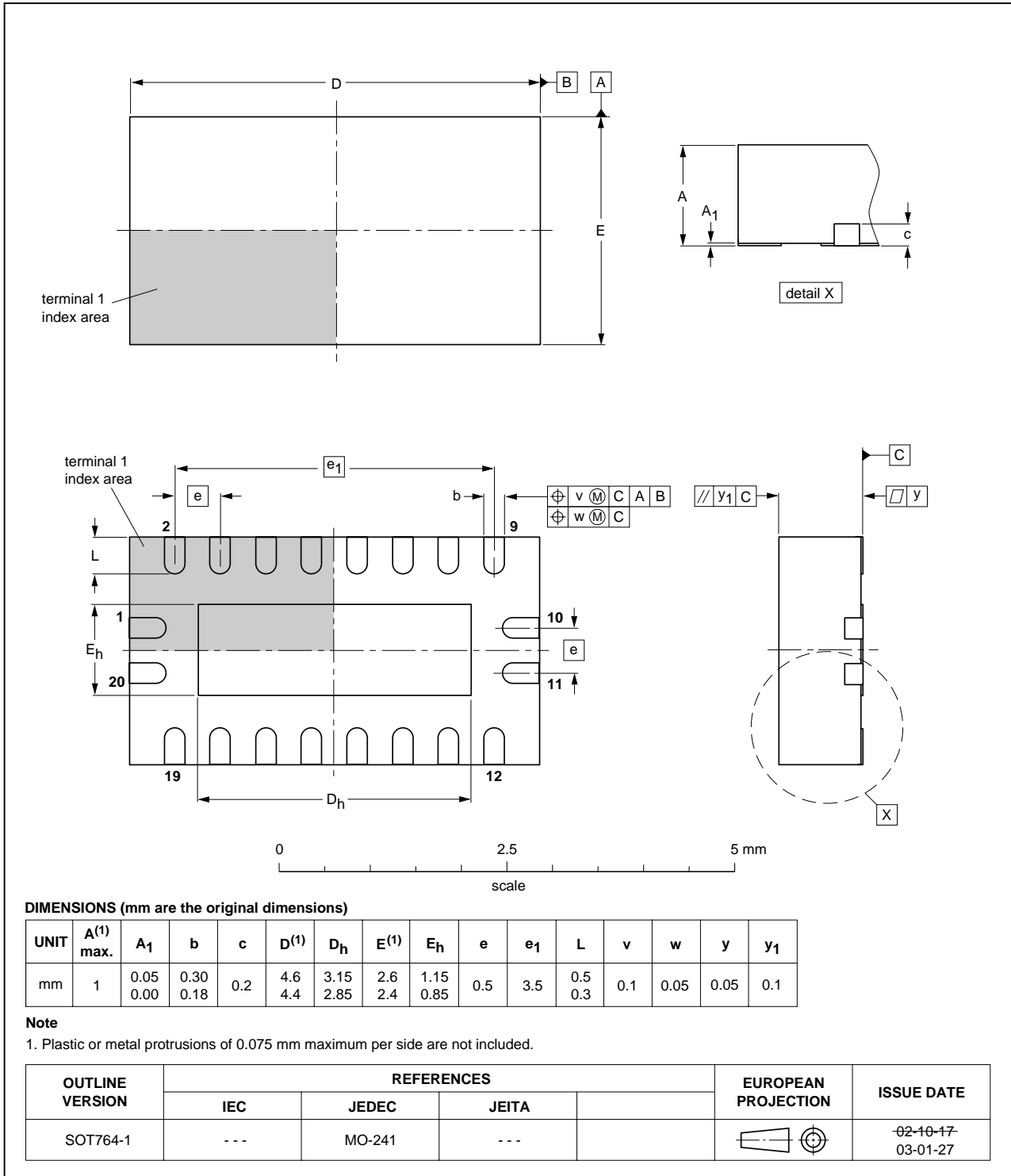


Fig 12. Package outline SOT764-1 (DHVQFN20)

## 13. Abbreviations

**Table 10. Abbreviations**

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

## 14. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT241_3	20080507	Product data sheet	ECN07_046	74LVT241_2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>DHVQFN20 package added <a href="#">Section 3 “Ordering information”</a> and <a href="#">Section 12 “Package outline”</a>.</li> </ul>			
74LVT241_2	19980219	Product specification	-	74LVT241_1
74LVT241_1	19960529	Product specification	-	-

## 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".

[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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