

# 74LV241

Octal buffer/line driver; 3-state

Rev. 03 — 10 October 2005

Product data sheet

## 1. General description

The 74LV241 is a low-voltage, Si-gate CMOS device and is pin and function compatible with 74HC241 and 74HCT241.

The 74LV241 is an octal non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs (pins  $\overline{1OE}$  and 2OE).

## 2. Features

- Optimized for low-voltage applications from 1.0 V to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Typical  $V_{OLP}$  (output ground bounce) < 0.8 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot) > 2 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-C exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V

## 3. Quick reference data

**Table 1: Quick reference data**

$GND = 0$  V;  $T_{amb} = 25$  °C;  $t_r = t_f \leq 2.5$  ns.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHL}$ , $t_{PLH}$	propagation delay 1An to 1Yn, 2An to 2Yn	$C_L = 15$ pF; $V_{CC} = 3.3$ V	-	8.0	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_{PD}$	power dissipation capacitance	$V_{CC} = 3.3$ V; $V_I = GND$ to $V_{CC}$	[1]	-	30	pF

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

**PHILIPS**

### 4. Ordering information

Table 2: Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LV241N	-40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74LV241D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LV241DB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LV241PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

### 5. Functional diagram

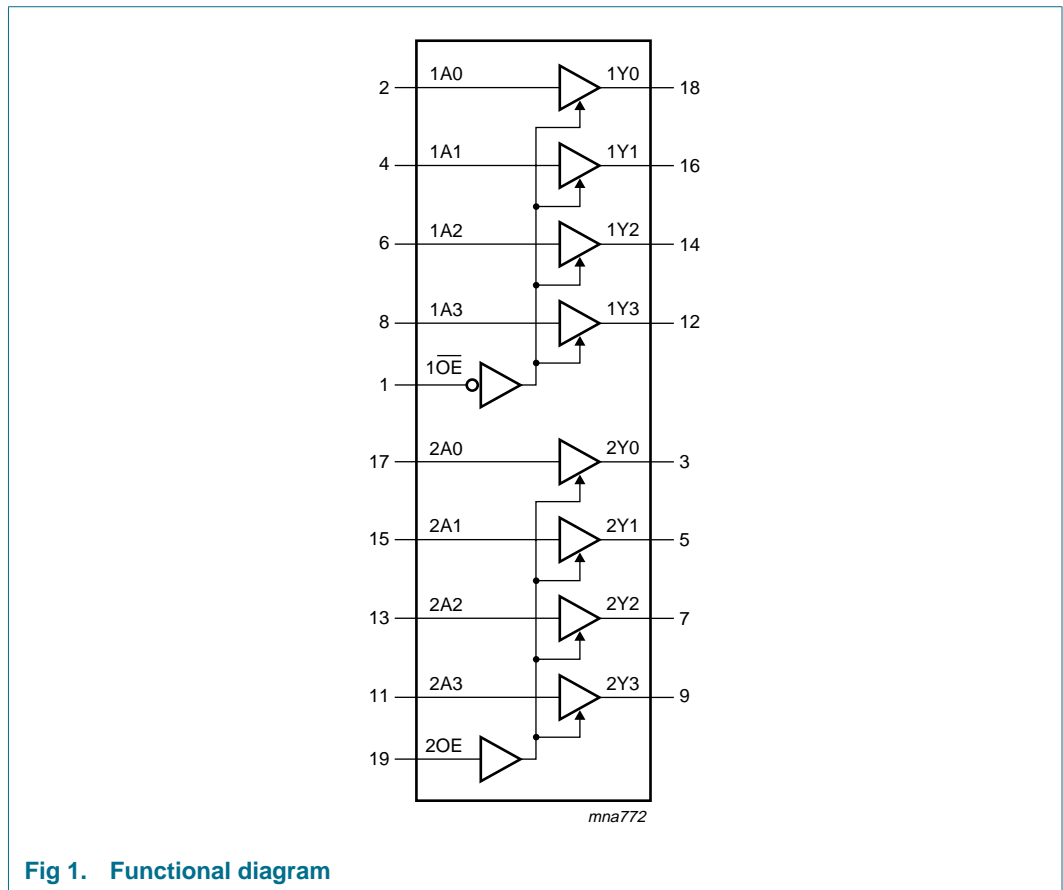


Fig 1. Functional diagram

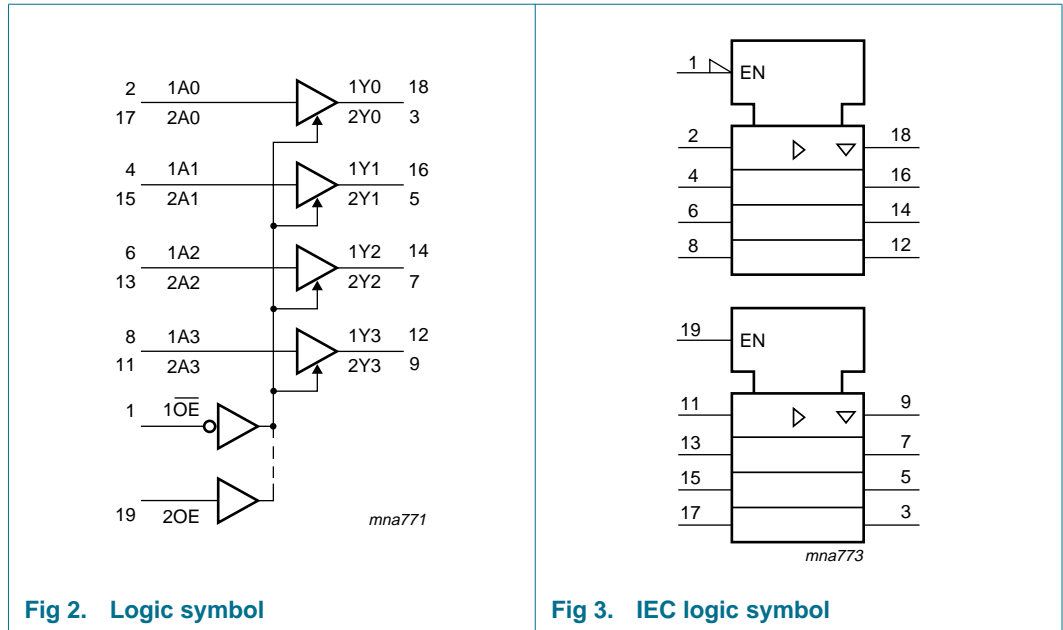


Fig 2. Logic symbol

Fig 3. IEC logic symbol

## 6. Pinning information

### 6.1 Pinning

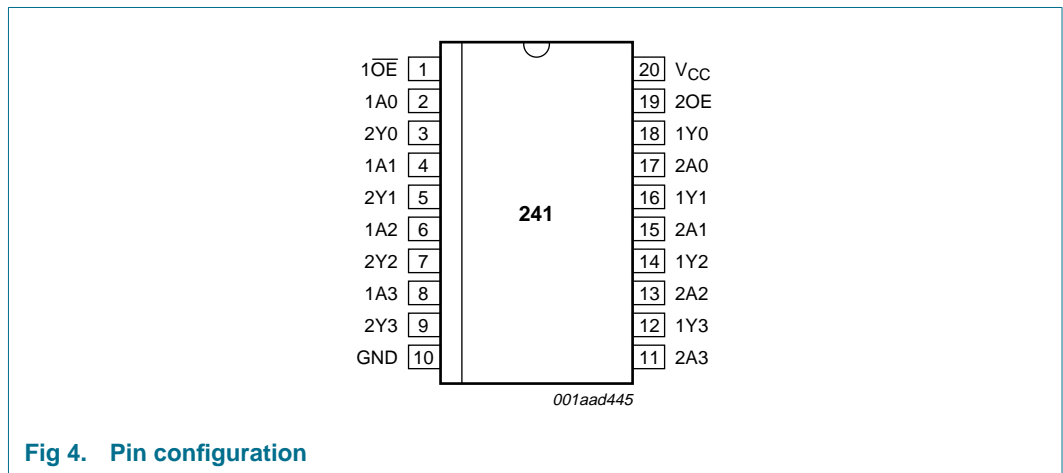


Fig 4. Pin configuration

### 6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
$1\overline{OE}$	1	1 output enable input (active LOW)
1A0	2	1 data input 0
2Y0	3	2 bus output 0
1A1	4	1 data input 1
2Y1	5	2 bus output 1

Table 3: Pin description ...continued

Symbol	Pin	Description
1A2	6	1 data input 2
2Y2	7	2 bus output 2
1A3	8	1 data input 3
2Y3	9	2 bus output 3
GND	10	ground (0 V)
2A3	11	2 data input 3
1Y3	12	1 bus output 3
2A2	13	2 data input 2
1Y2	14	1 bus output 2
2A1	15	2 data input 1
1Y1	16	1 bus output 1
2A0	17	2 data input 0
1Y0	18	1 bus output 0
2OE	19	2 output enable input (active HIGH)
V <sub>CC</sub>	20	supply voltage

## 7. Functional description

### 7.1 Function table

Table 4: Function table [1]

Input		Output	Input		Output
1OE	1An	1Yn	2OE	2An	2Yn
L	L	L	H	L	L
L	H	H	H	H	H
H	X	Z	L	X	Z

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 X = don't care;  
 Z = high-impedance OFF-state.

## 8. Limiting values

Table 5: 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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±50	mA
I <sub>O</sub>	output current	V <sub>O</sub> = 0.5 V to V <sub>CC</sub> + 0.5 V	-	±35	mA

**Table 5: Limiting values ...continued**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{CC}$	supply current		-	$\pm 70$	mA
$I_{GND}$	ground current		-	$\pm 70$	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C to }+125\text{ °C}$ [1]			
	DIL20 package		-	750	mW
	SO20 package		-	500	mW
	(T)SSOP20 package		-	400	mW

[1] For DIL20 packages: above 70 °C the value of  $P_{tot}$  derates linearly with 12 mW/K.

For SO20 packages: above 70 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

For (T)SSOP20 packages: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		[1] 1.0	3.3	3.6	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature	in free air	-40	-	+125	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 1.0\text{ V to }2.0\text{ V}$	-	-	500	ns/V
		$V_{CC} = 2.0\text{ V to }2.7\text{ V}$	-	-	200	ns/V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	100	ns/V

[1] The 74LV241 is guaranteed to function down to 1.0 V (input levels GND or  $V_{CC}$ ); static characteristics are guaranteed from  $V_{CC} = 1.2\text{ V to }V_{CC} = 3.6\text{ V}$ .

## 10. Static characteristics

**Table 7: Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math> [1]</b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.2\text{ V}$	0.9	-	-	V
		$V_{CC} = 2.0\text{ V}$	1.4	-	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.2\text{ V}$	-	-	0.3	V
		$V_{CC} = 2.0\text{ V}$	-	-	0.6	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	V

**Table 7: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 μA	-	1.2	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 μA	1.8	2.0	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 μA	2.5	2.7	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 μA	2.8	3.0	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -8 mA	2.40	2.82	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = 100 μA	-	0	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = 100 μA	-	0	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = 100 μA	-	0	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 100 μA	-	0	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 8 mA	-	0.20	0.40	V
I <sub>LI</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	1.0	μA
I <sub>OZ</sub>	3-state output OFF-state current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	5	μA
I <sub>CC</sub>	quiescent supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	20	μA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V	-	-	500	μA
C <sub>i</sub>	input capacitance		-	3.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	0.9	-	-	V
		V <sub>CC</sub> = 2.0 V	1.4	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.3	V
		V <sub>CC</sub> = 2.0 V	-	-	0.6	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = -100 μA	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = -100 μA	1.8	-	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = -100 μA	2.5	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -100 μA	2.8	-	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -8 mA	2.20	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		V <sub>CC</sub> = 1.2 V; I <sub>O</sub> = 100 μA	-	-	-	V
		V <sub>CC</sub> = 2.0 V; I <sub>O</sub> = 100 μA	-	-	0.2	V
		V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = 100 μA	-	-	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 100 μA	-	-	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 8 mA	-	-	0.50	V
I <sub>LI</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	-	1.0	μA

**Table 7: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{OZ}$	3-state output OFF-state current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND	-	-	10	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$	-	-	160	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current per input pin	$V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$	-	-	850	$\mu\text{A}$

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

## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**Voltages are referenced to GND (ground = 0 V);  $C_L = 50\text{ pF}$ ; unless otherwise stated; for test circuit see [Figure 8](#)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+85\text{ }^\circ\text{C}</math> [1]</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay 1An to 1Yn, 2An to 2Yn	see <a href="#">Figure 5</a>				
		$V_{CC} = 1.2\text{ V}$	-	45	-	ns
		$V_{CC} = 2.0\text{ V}$	-	15	31	ns
		$V_{CC} = 2.7\text{ V}$	-	11	23	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	[2] -	9	18	ns
		$V_{CC} = 3.3\text{ V}$ ; $C_L = 15\text{ pF}$	-	8	-	ns
$t_{PZH}$ , $t_{PZL}$	3-state output enable time 1OE to 1Yn, 2OE to 2Yn	see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>				
		$V_{CC} = 1.2\text{ V}$	-	55	-	ns
		$V_{CC} = 2.0\text{ V}$	-	19	36	ns
		$V_{CC} = 2.7\text{ V}$	-	14	26	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	[2] -	10	21	ns
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time 1OE to 1Yn, 2OE to 2Yn	see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>				
		$V_{CC} = 1.2\text{ V}$	-	60	-	ns
		$V_{CC} = 2.0\text{ V}$	-	22	39	ns
		$V_{CC} = 2.7\text{ V}$	-	17	29	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	[2] -	13	24	ns
$C_{PD}$	power dissipation capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = \text{GND}$ to $V_{CC}$	[3] -	30	-	pF
<b><math>T_{amb} = -40\text{ }^\circ\text{C}</math> to <math>+125\text{ }^\circ\text{C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay 1An to 1Yn, 2An to 2Yn	see <a href="#">Figure 5</a>				
		$V_{CC} = 1.2\text{ V}$	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	-	36	ns
		$V_{CC} = 2.7\text{ V}$	-	-	26	ns
		$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$	-	-	21	ns

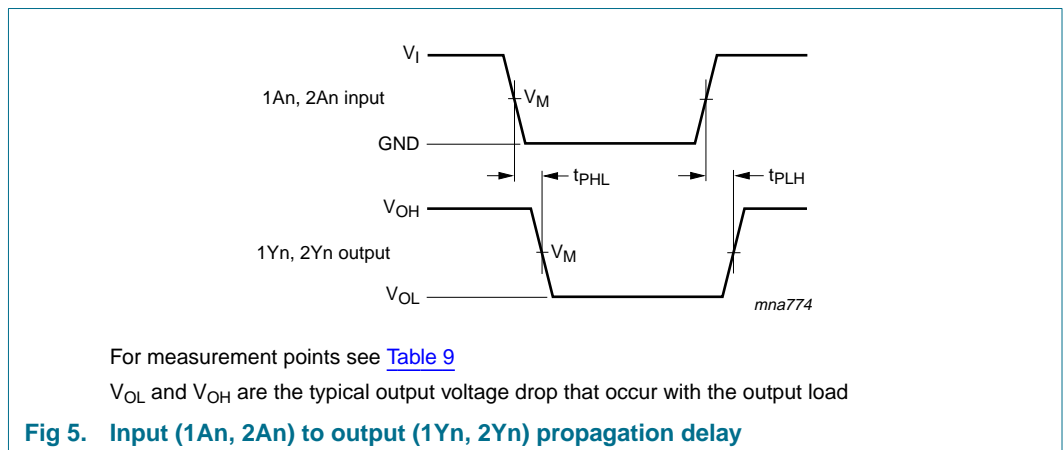
**Table 8: Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V);  $C_L = 50$  pF; unless otherwise stated; for test circuit see [Figure 8](#)

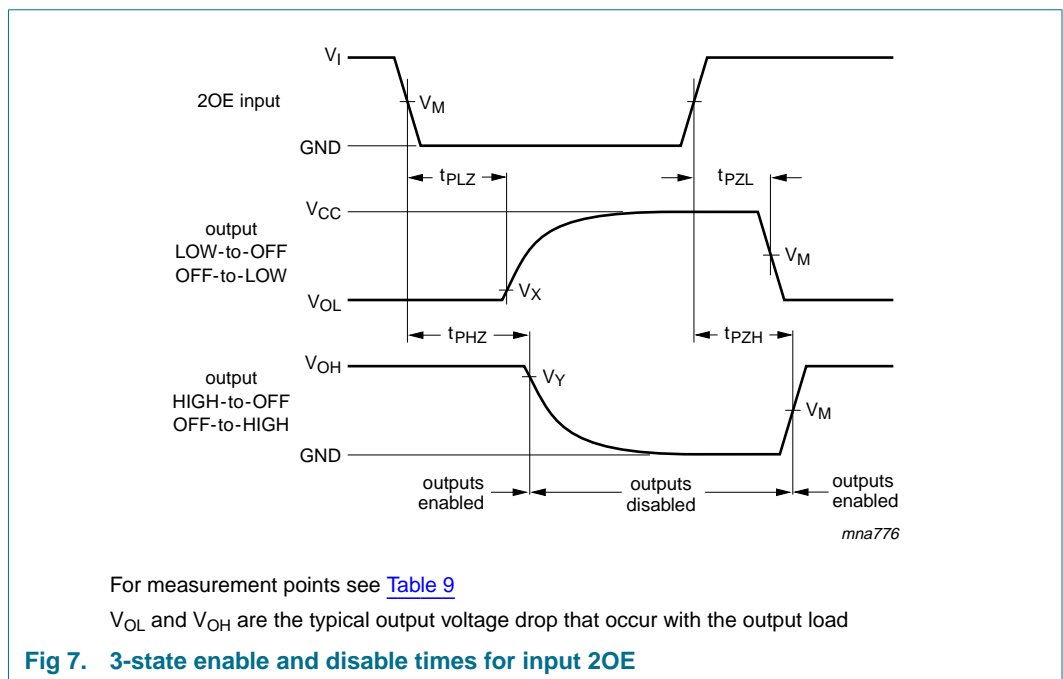
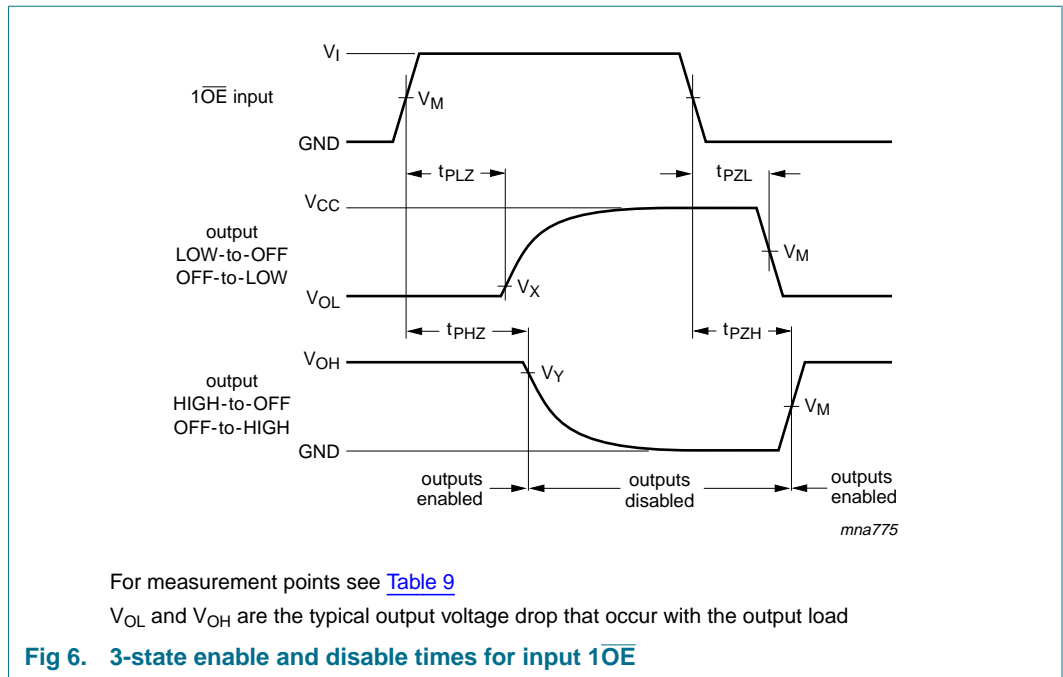
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PZH}, t_{PZL}$	3-state output enable time 1OE to 1Yn, 2OE to 2Yn	see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>				
		$V_{CC} = 1.2$ V	-	-	-	ns
		$V_{CC} = 2.0$ V	-	-	44	ns
		$V_{CC} = 2.7$ V	-	-	33	ns
		$V_{CC} = 3.0$ V to 3.6 V	-	-	26	ns
$t_{PHZ}, t_{PLZ}$	3-state output disable time 1OE to 1Yn, 2OE to 2Yn	see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>				
		$V_{CC} = 1.2$ V	-	-	-	ns
		$V_{CC} = 2.0$ V	-	-	48	ns
		$V_{CC} = 2.7$ V	-	-	36	ns
		$V_{CC} = 3.0$ V to 3.6 V	-	-	29	ns

- [1] All typical values are measured at  $T_{amb} = 25$  °C
- [2] These typical values are measured at  $V_{CC} = 3.3$  V
- [3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  
 $f_o$  = output frequency in MHz;  
 $C_L$  = output load capacitance in pF;  
 $V_{CC}$  = supply voltage in V;  
 $N$  = number of inputs switching;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## 12. Waveforms

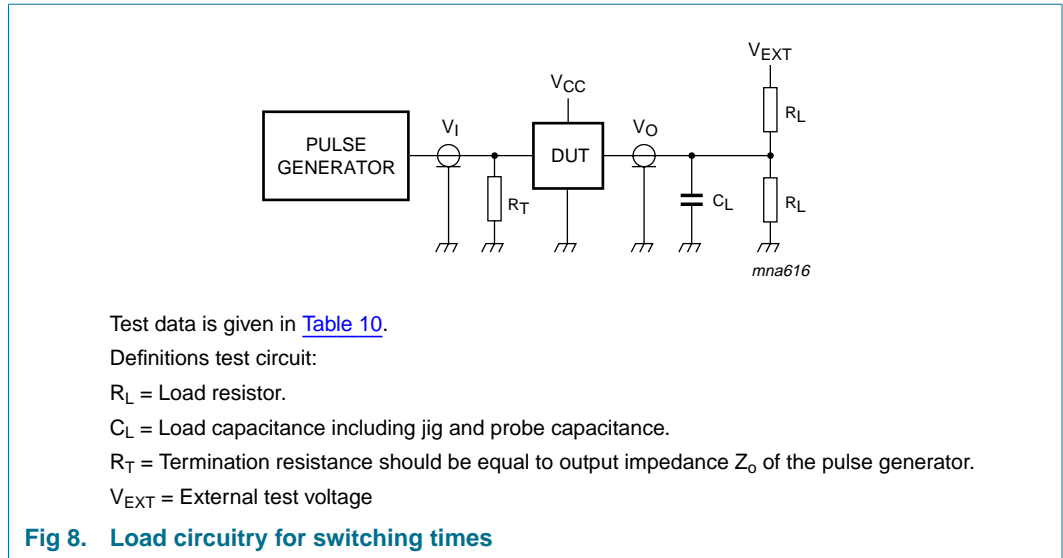






**Table 9: Measurement points**

Supply voltage	Input	Output		
$V_{CC}$	$V_M$	$V_X$	$V_Y$	$V_M$
$< 2.7\text{ V}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 \times V_{CC}$	$V_{OH} - 0.1 \times V_{CC}$	$0.5 \times V_{CC}$
$\geq 2.7\text{ V}$	1.5 V	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$	1.5 V



**Fig 8. Load circuitry for switching times**

**Table 10: Test data**

Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
< 2.7 V	$V_{CC}$	$\leq 2.5$ ns	50 pF	1 k $\Omega$	open	GND	$2 \times V_{CC}$
$\geq 2.7$ V	2.7 V	$\leq 2.5$ ns	50 pF	1 k $\Omega$	open	GND	$2 \times V_{CC}$

13. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1

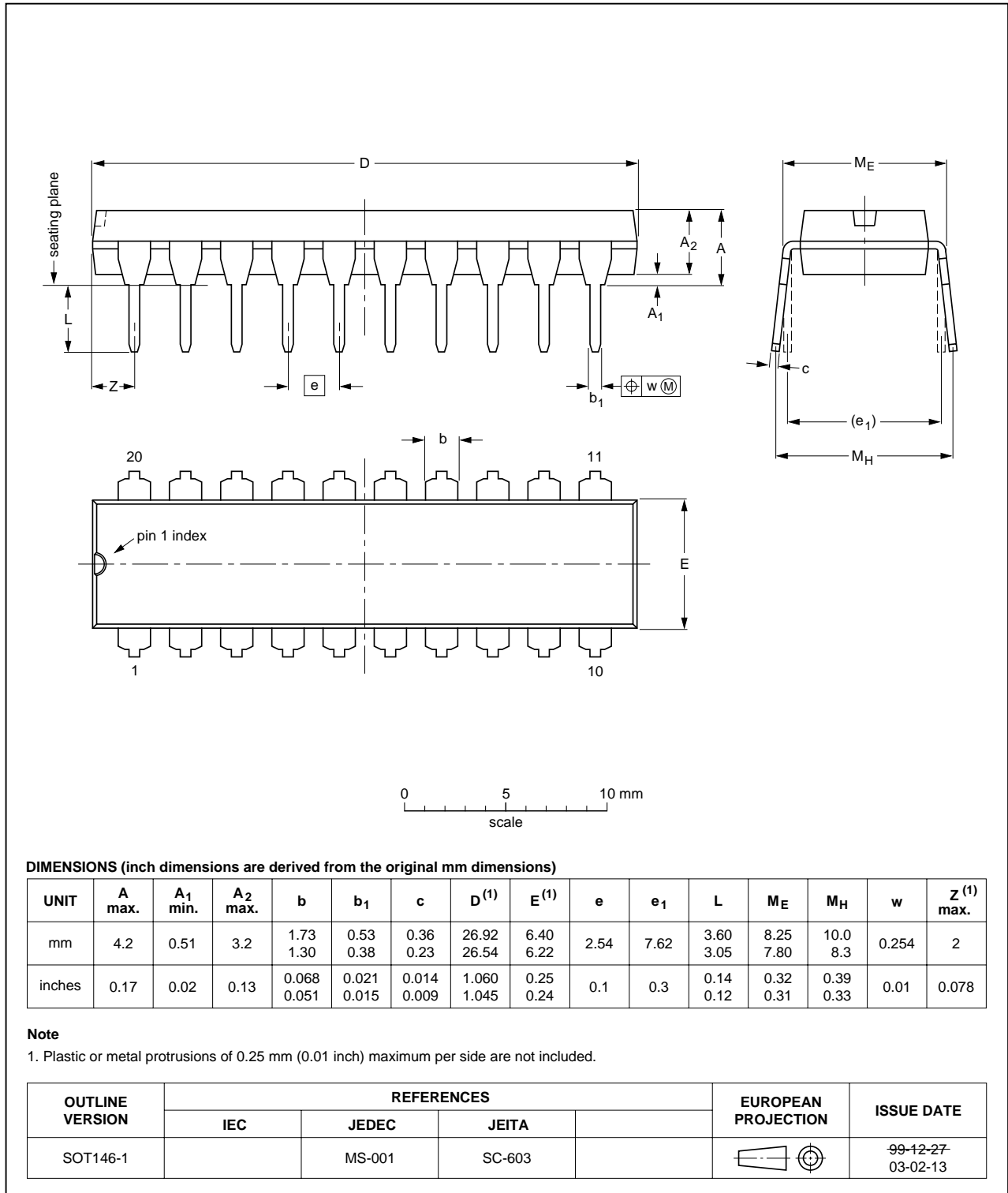


Fig 9. Package outline SOT146-1 (DIP20)

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

SOT163-1

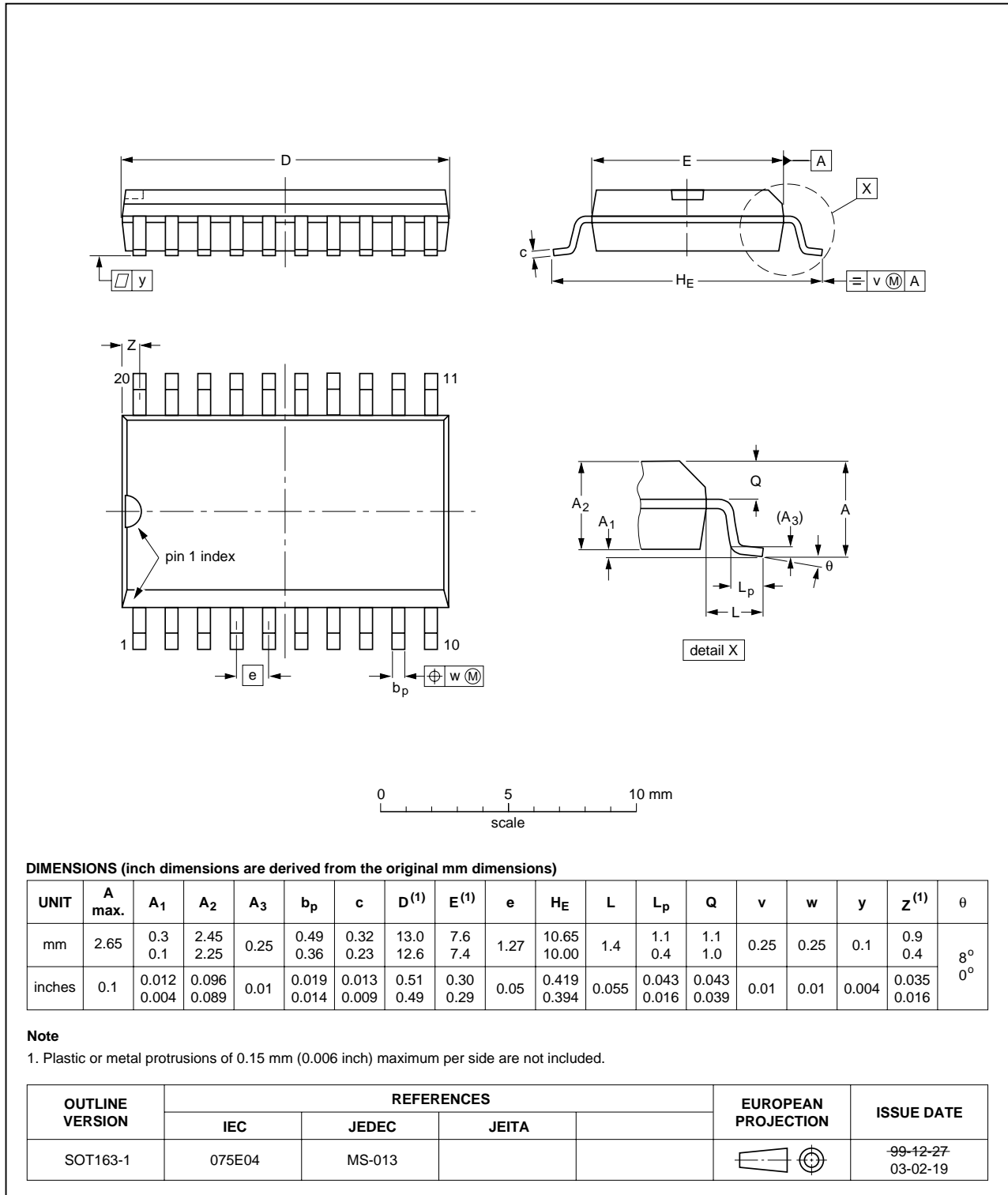


Fig 10. Package outline SOT163-1 (SO20)

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

SOT339-1



Fig 11. Package outline SOT339-1 (SSOP20)

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

SOT360-1

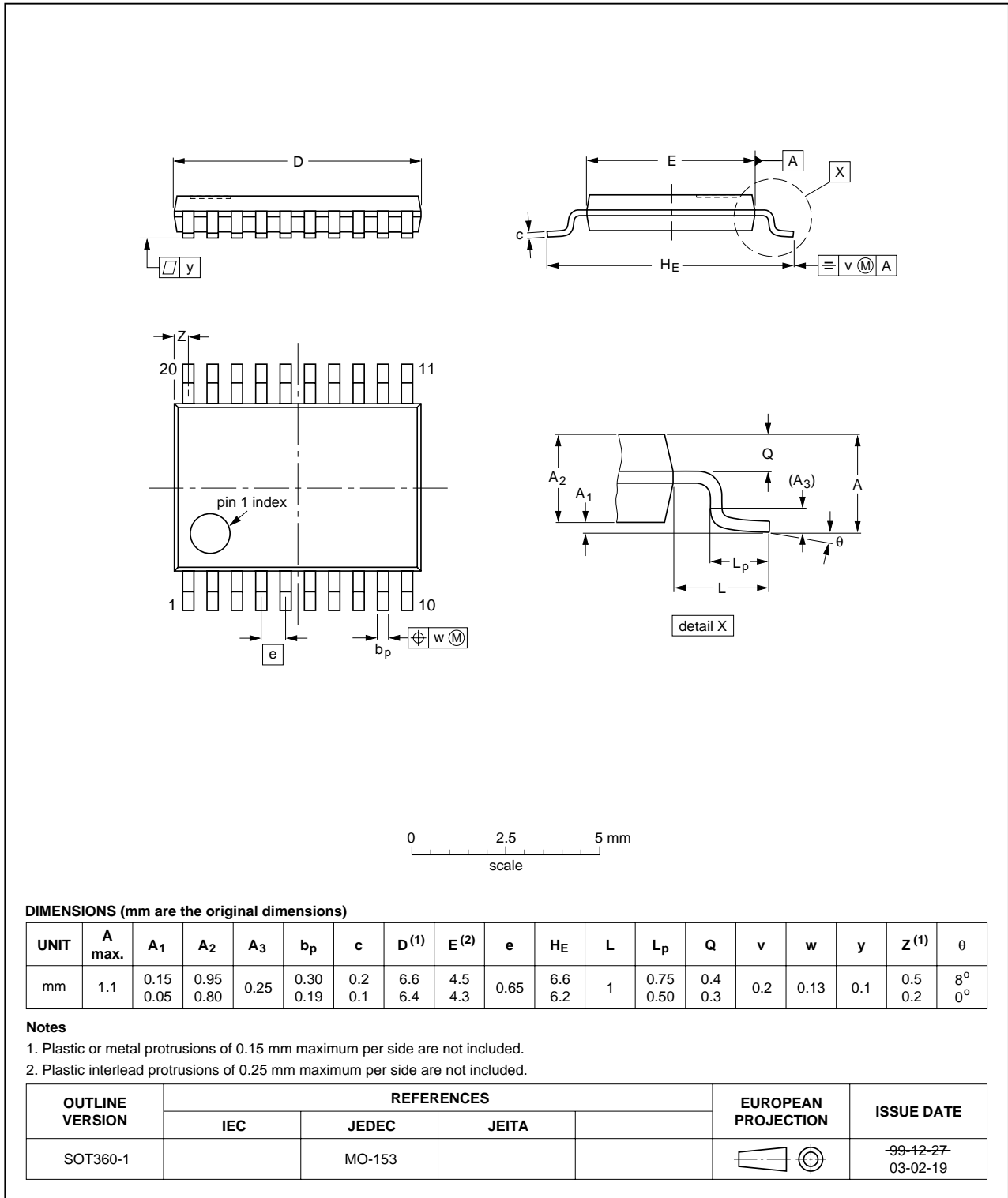


Fig 12. Package outline SOT360-1 (TSSOP20)

## 14. Revision history

Table 11: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74LV241_3	20051010	Product data sheet	-	-	74LV241_2
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li><li><a href="#">Section 7.1 "Function table"</a>: Corrected 1Yn values</li></ul>				
74LV241_2	19980520	Product specification	-	9397 750 04436	74LV241_1
74LV241_1	19970219	Product specification	-	-	-

## 15. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2] [3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 16. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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## 19. Contact information

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