

# 74LVT2241

## 3.3 V octal buffer/line driver with 30 $\Omega$ series termination resistors; 3-state

Rev. 3 — 17 February 2021

Product data sheet

### 1. General description

The 74LVT2241 is an 8-bit buffer/line driver with 3-state outputs. The device can be used as two 4-bit buffers or one 8-bit buffer. The device features two output enables ( $1\overline{OE}$  and  $2OE$ ), each controlling four of the 3-state outputs. A HIGH on  $1\overline{OE}$  or a LOW on  $2OE$  causes the associated outputs to assume a high-impedance OFF-state. Bus hold data inputs eliminate the need for external pull-up resistors to define unused inputs.

### 2. Features and benefits

- Octal bus interface
- 3-state buffers
- Wide supply voltage range from 2.7 to 3.6 V
- BiCMOS high speed and output drive
- Output capability: +12 mA/–12 mA
- Direct interface with TTL levels
- Overvoltage tolerant inputs to 5.5 V
- Input and output interface capability to systems at 5 V supply
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Outputs include series resistance of 30  $\Omega$  making external termination resistors unnecessary
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 500 mA per JESD 78 Class II Level B
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVT2241D	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVT2241PW	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

### 4. Functional diagram

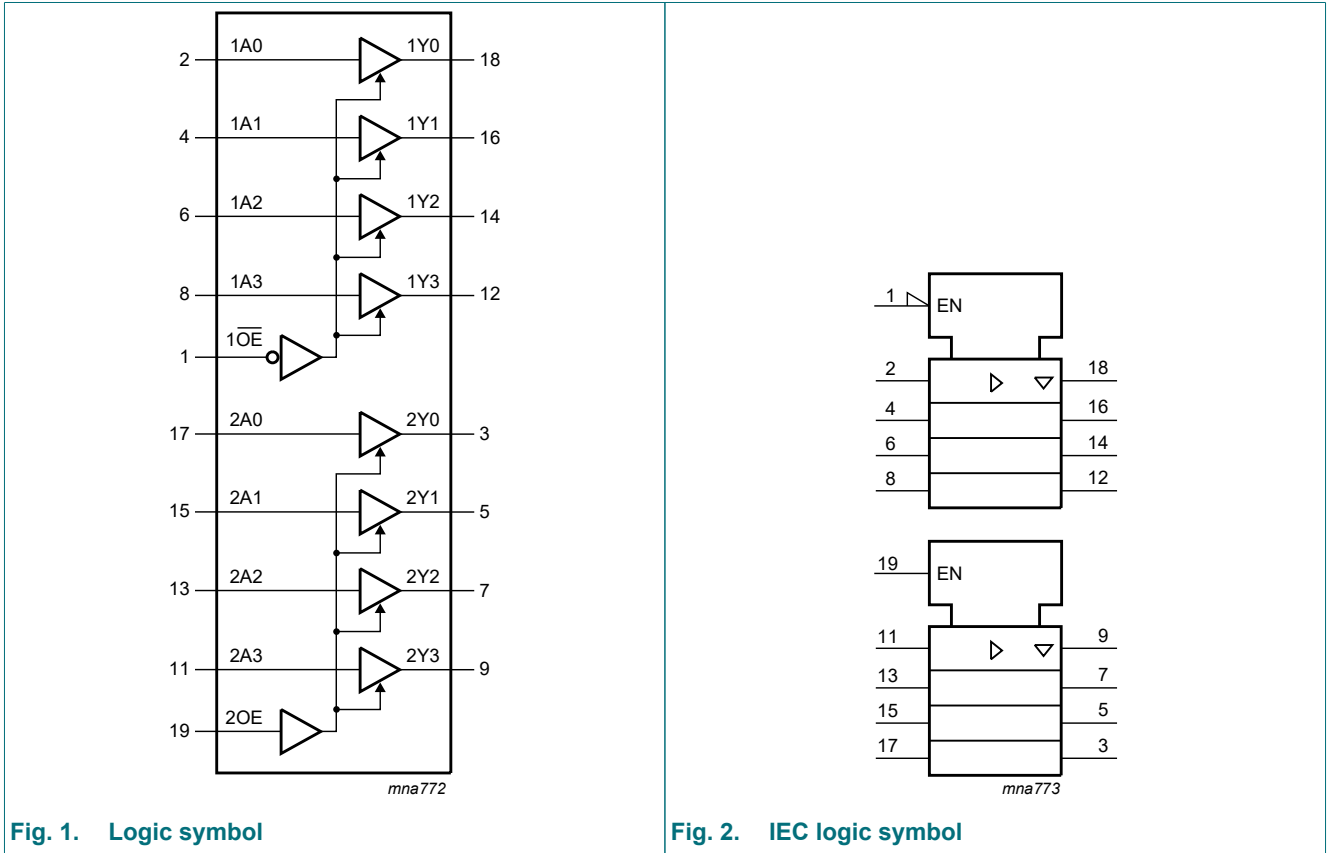


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

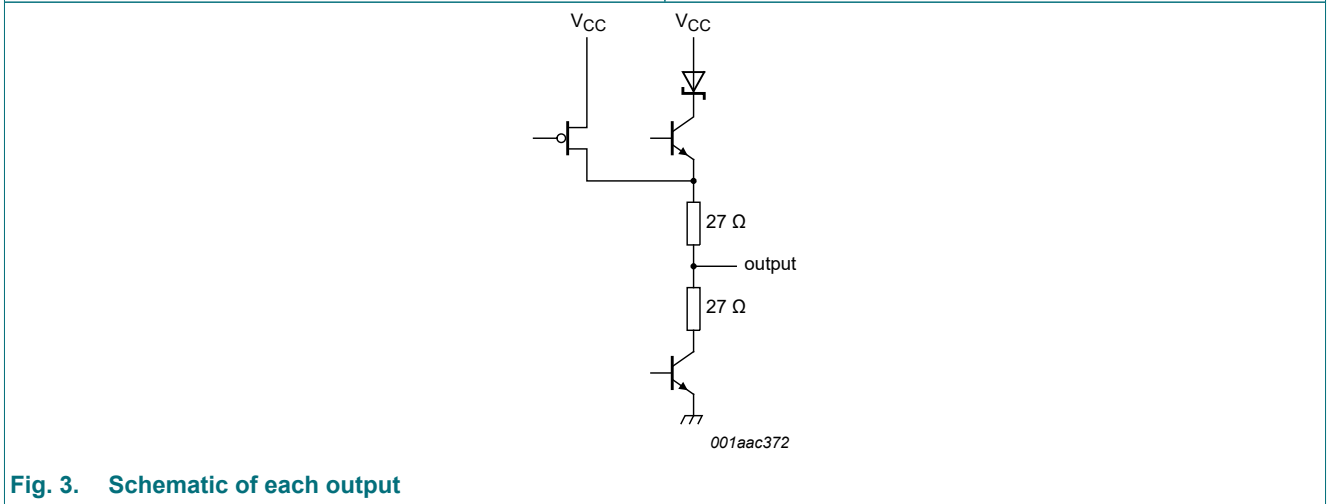


Fig. 3. Schematic of each output

## 5. Pinning information

### 5.1. Pinning

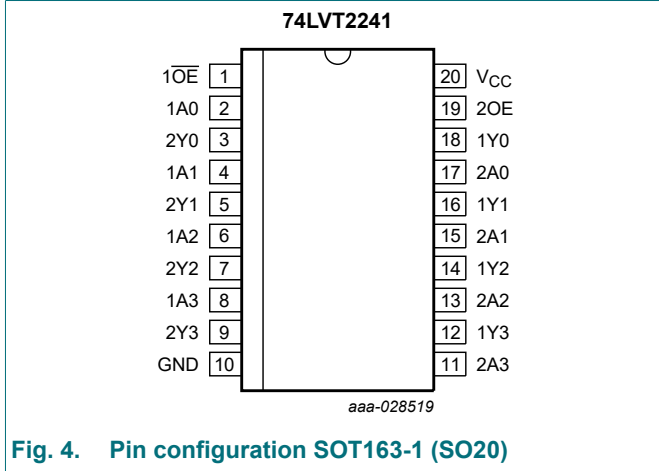


Fig. 4. Pin configuration SOT163-1 (SO20)

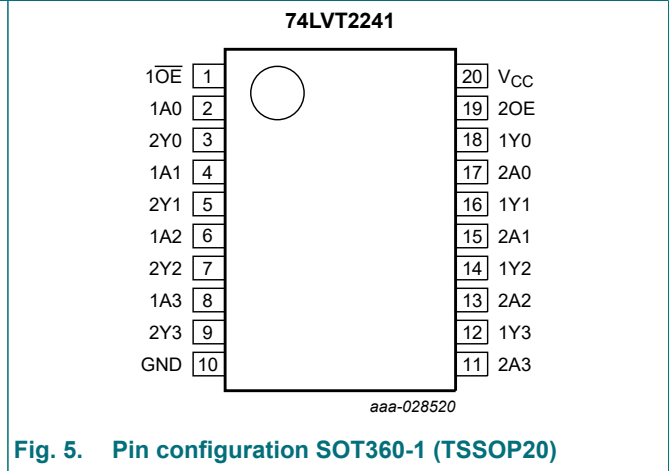


Fig. 5. Pin configuration SOT360-1 (TSSOP20)

### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE	1	output enable input (active LOW)
1A0, 1A1, 1A2, 1A3	2, 4, 6, 8	data input
2A0, 2A1, 2A2, 2A3	17, 15, 13, 11	data input
GND	10	ground (0 V)
1Y0, 1Y1, 1Y2, 1Y3	18, 16, 14, 12	data output
2Y0, 2Y1, 2Y2, 2Y3	3, 5, 7, 9	data output
2OE	19	output enable input (active HIGH)
V <sub>CC</sub>	20	supply voltage

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = Don't care; Z = High impedance "OFF" state.

Enable active LOW			Enable active HIGH		
Inputs		Outputs	Inputs		Outputs
1OE	1An	1Yn	2OE	2An	2Yn
L	L	L	H	L	L
L	H	H	H	H	H
H	X	Z	L	X	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	+7.0	V
$V_O$	output voltage	output in OFF or HIGH state	[1] -0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$I_{OK}$	output clamping current	$V_O < 0$ V	-50	-	mA
$I_O$	output current	output in LOW state	-	128	mA
		output in HIGH state	-64	-	mA
$T_{stg}$	storage temperature		-65	+150	$^{\circ}$ C
$T_j$	junction temperature		[2] -	+150	$^{\circ}$ C

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		2.7	3.6	V
$V_I$	input voltage		0	5.5	V
$I_{OH}$	HIGH-level output current		-12	-	mA
$I_{OL}$	LOW-level output current		-	12	mA
$T_{amb}$	ambient temperature	in free air	-40	+85	$^{\circ}$ C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	10	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$V_{IK}$	input clamping voltage	$V_{CC} = 2.7\text{ V}$ ; $I_{IK} = -18\text{ mA}$	-1.2	-0.9	-	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 3.0\text{ V}$ ; $I_{OH} = -12\text{ mA}$	2.0	2.2	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 3.0\text{ V}$ ; $I_{OL} = 12\text{ mA}$	-	-	0.8	V
$I_I$	input leakage current	all input pins				
		$V_{CC} = 0\text{ V}$ or $3.6\text{ V}$ ; $V_I = 5.5\text{ V}$	-	1	10	$\mu\text{A}$
		control pins				
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND	-	$\pm 0.1$	$\pm 1$	$\mu\text{A}$
		data pins [2]				
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$	-	0.1	1	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V}$	-5	-1	-	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 0\text{ V}$ to $4.5\text{ V}$	-	1	$\pm 100$	$\mu\text{A}$
$I_{BHL}$	bus hold LOW current	$V_{CC} = 3.0\text{ V}$ ; $V_I = 0.8\text{ V}$	75	150	-	$\mu\text{A}$
$I_{BHH}$	bus hold HIGH current	$V_{CC} = 3.0\text{ V}$ ; $V_I = 2.0\text{ V}$	-	-150	-75	$\mu\text{A}$
$I_{BHLO}$	bus hold LOW overdrive current	$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V}$ to $3.6\text{ V}$ [3]	500	-	-	$\mu\text{A}$
$I_{BHHO}$	bus hold HIGH overdrive current	$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V}$ to $3.6\text{ V}$ [3]	-	-	-500	$\mu\text{A}$
$I_{EX}$	external current	nYn output in HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}$ ; $V_{CC} = 3.0\text{ V}$	-	60	125	$\mu\text{A}$
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq 1.2\text{ V}$ ; $V_O = 0.5\text{ V}$ to $V_{CC}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; 1 $\overline{\text{OE}}$ , 2 $\text{OE}$ = don't care [4]	-	$\pm 1$	$\pm 100$	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	$V_{CC} = 3.6\text{ V}$ ; $V_O = 3.0\text{ V}$	-	1	5	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ ; $V_O = 0.5\text{ V}$	-5	-1	-	$\mu\text{A}$
$I_{CC}$	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	$V_I = 0\text{ V}$ or $3.0\text{ V}$	-	4	-	pF
$C_O$	output capacitance	outputs disabled; $V_O = 0\text{ V}$ 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  $V_{CC} - 0.6\text{ V}$ .

## 10. Dynamic characteristics

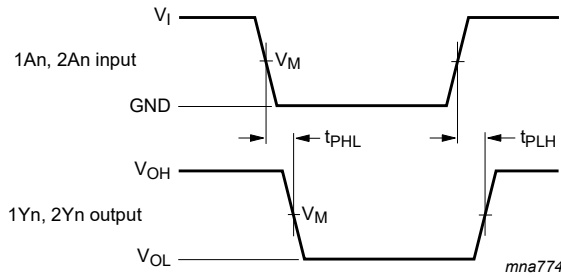
**Table 7. Dynamic characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 9.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$t_{PLH}$	LOW to HIGH propagation delay	1An to 1Yn, 2An to 2Yn; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	5.0	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.0	4.2	ns
$t_{PHL}$	HIGH to LOW propagation delay	1An to 1Yn, 2An to 2Yn; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	4.7	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.3	4.3	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	1 $\overline{OE}$ to 1Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	8.5	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	4.4	6.2	ns
		2OE to 2Yn; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	-	-	7.9	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	4.4	6.2	ns
$t_{PZL}$	OFF-state to LOW propagation delay	1 $\overline{OE}$ to 1Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	6.8	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	4.3	5.9	ns
		2OE to 2Yn; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	-	-	6.2	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	4.1	5.5	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	1 $\overline{OE}$ to 1Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.2	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.4	5.0	ns
		2OE to 2Yn; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	-	-	6.4	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.9	5.7	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	1 $\overline{OE}$ to 1Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	4.5	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.6	3.2	4.5	ns
		2OE to 2Yn; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	-	-	5.8	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.8	5.1	ns

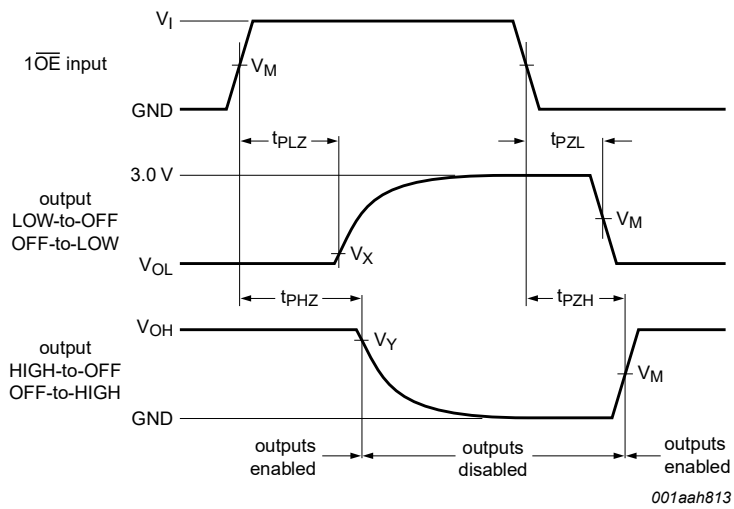
[1] Typical values are measured at  $T_{amb} = 25\text{ }^\circ\text{C}$  and  $V_{CC} = 3.3\text{ V}$ .

10.1. Waveforms and test circuit



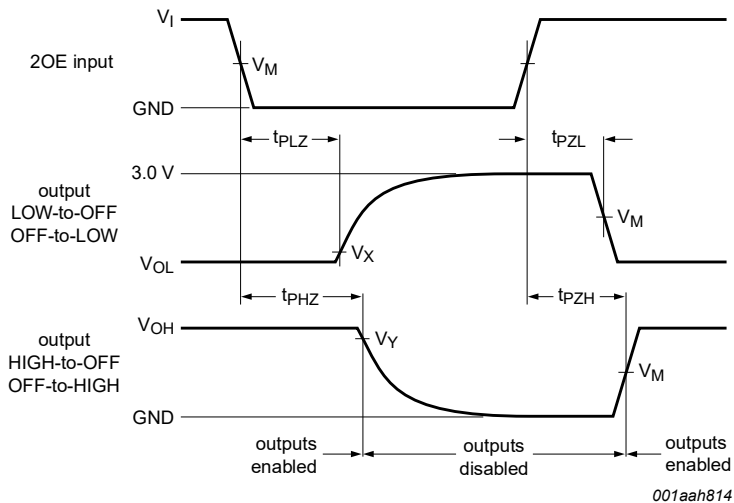
See [Table 8](#) for measurement points.  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 6. Input (1An, 2An) to output (1Yn, 2Yn) propagation delays



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 (1Yn) enable and disable times



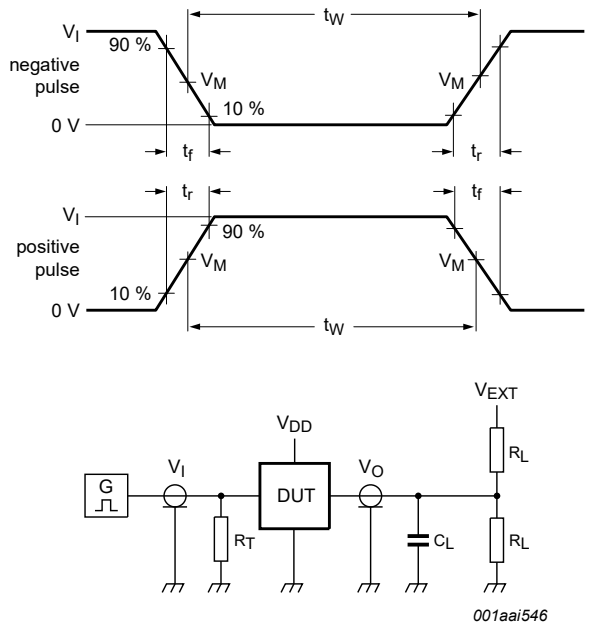
See [Table 8](#) for measurement points.  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 8. 3-state output (2Yn) enable and disable times

3.3 V octal buffer/line driver with 30 Ω series termination resistors; 3-state

Table 8. Measurement points

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



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. 9. Test circuit for measuring 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 Ω	50 pF	GND	6 V	open



### 11. Package outline

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

SOT163-1

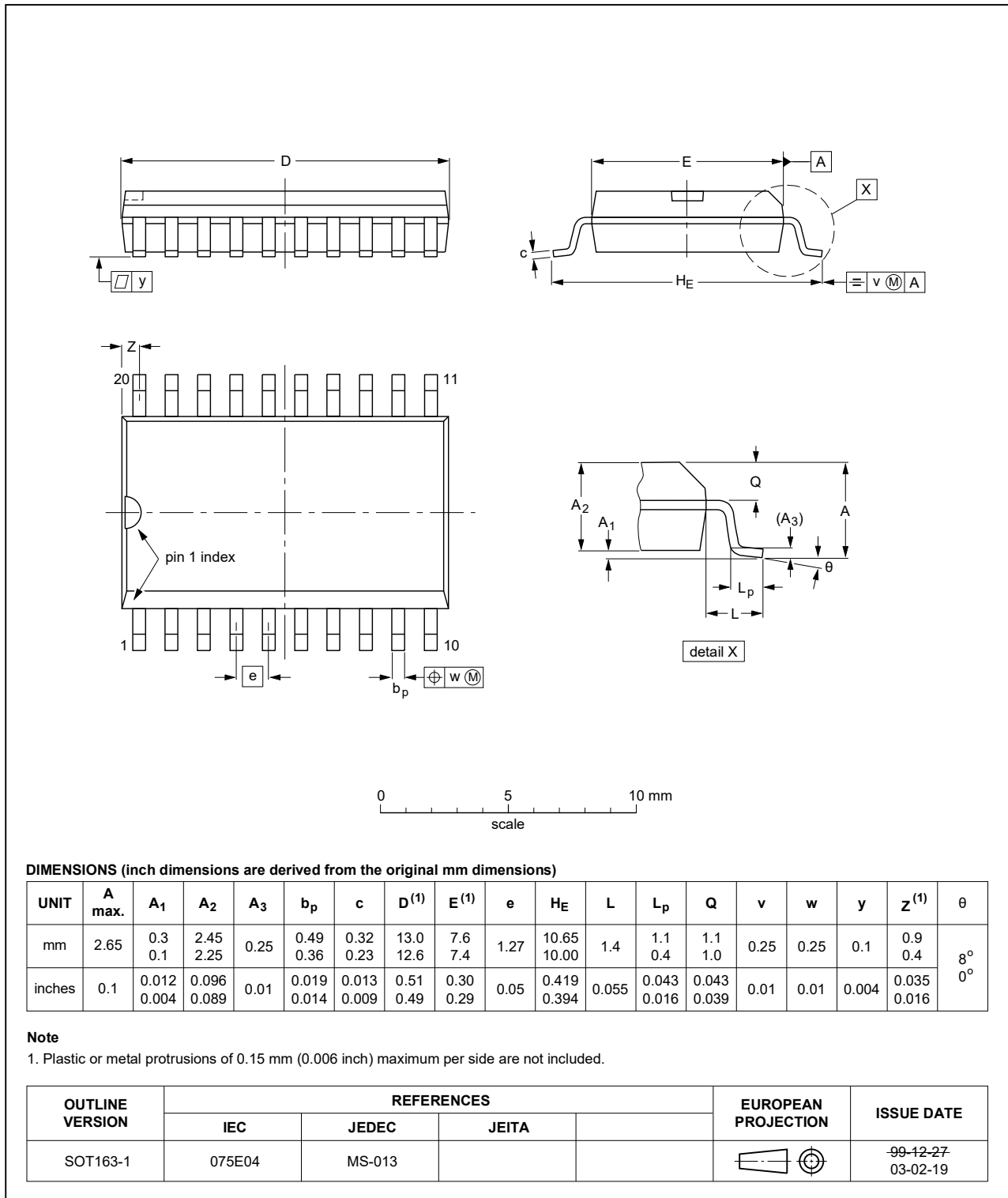


Fig. 10. Package outline SOT163-1 (SO20)

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

SOT360-1



Fig. 11. Package outline SOT360-1 (TSSOP20)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT2241 v.3	20210217	Product data sheet	-	74LVT2241 v.2
Modifications:	<ul style="list-style-type: none"> <li>Type number 74LVT2241DB (SOT339-1 / SSOP20) removed.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> </ul>			
74LVT2241 v.2	20180503	Product data sheet	-	74LVT2241 v.1
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>			
74LVT2241 v.1	19960529	Product specification	-	-

## 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.
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Date of release: 17 February 2021