

# 74LVT241

## 3.3 V octal buffer/line driver; 3-state

Rev. 4 — 27 March 2019

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 ( $1\overline{OE}$ ,  $2\overline{OE}$ ), 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			
	Temperature range	Name	Description	Version
74LVT241D	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
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 x 4.5 x 0.85 mm	SOT764-1

### 4. Functional diagram

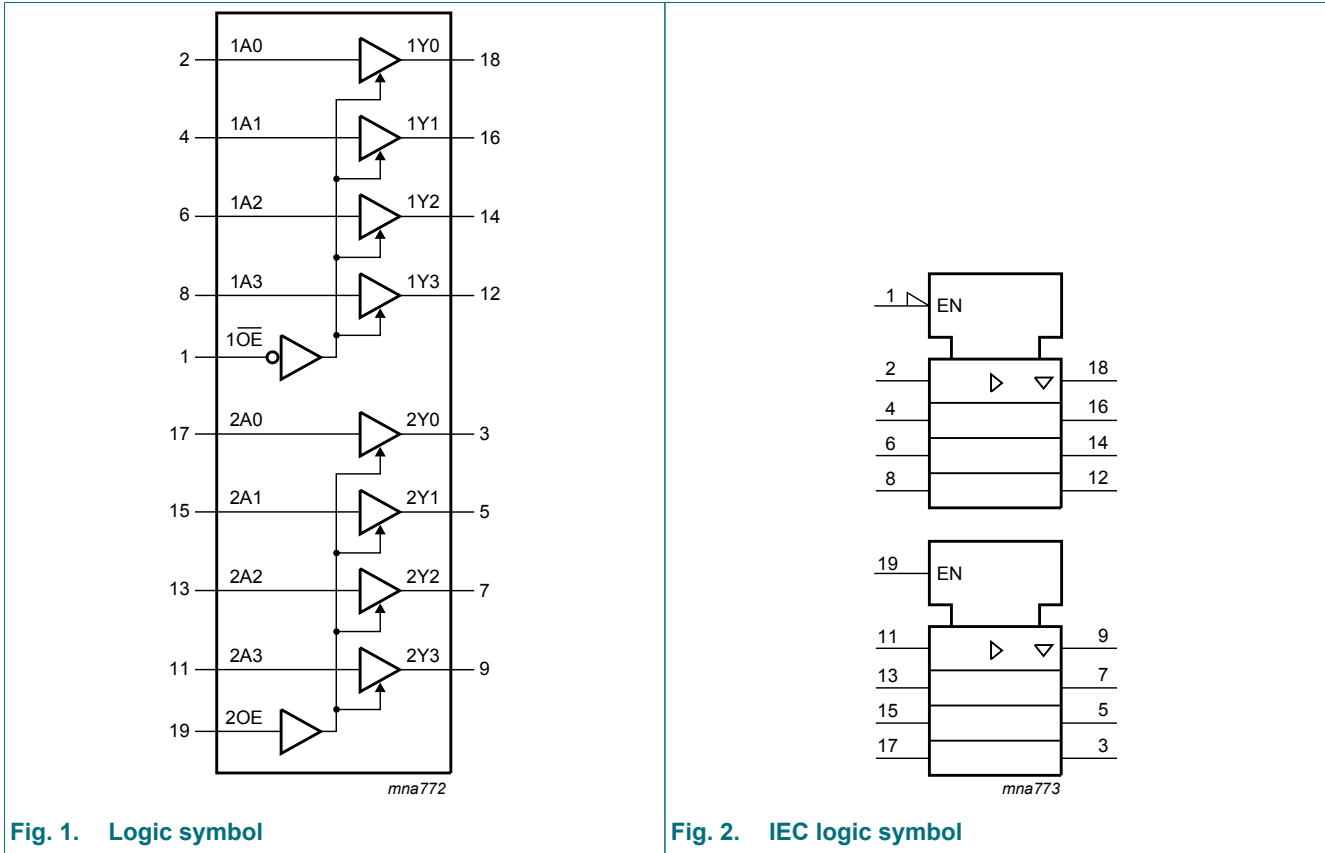
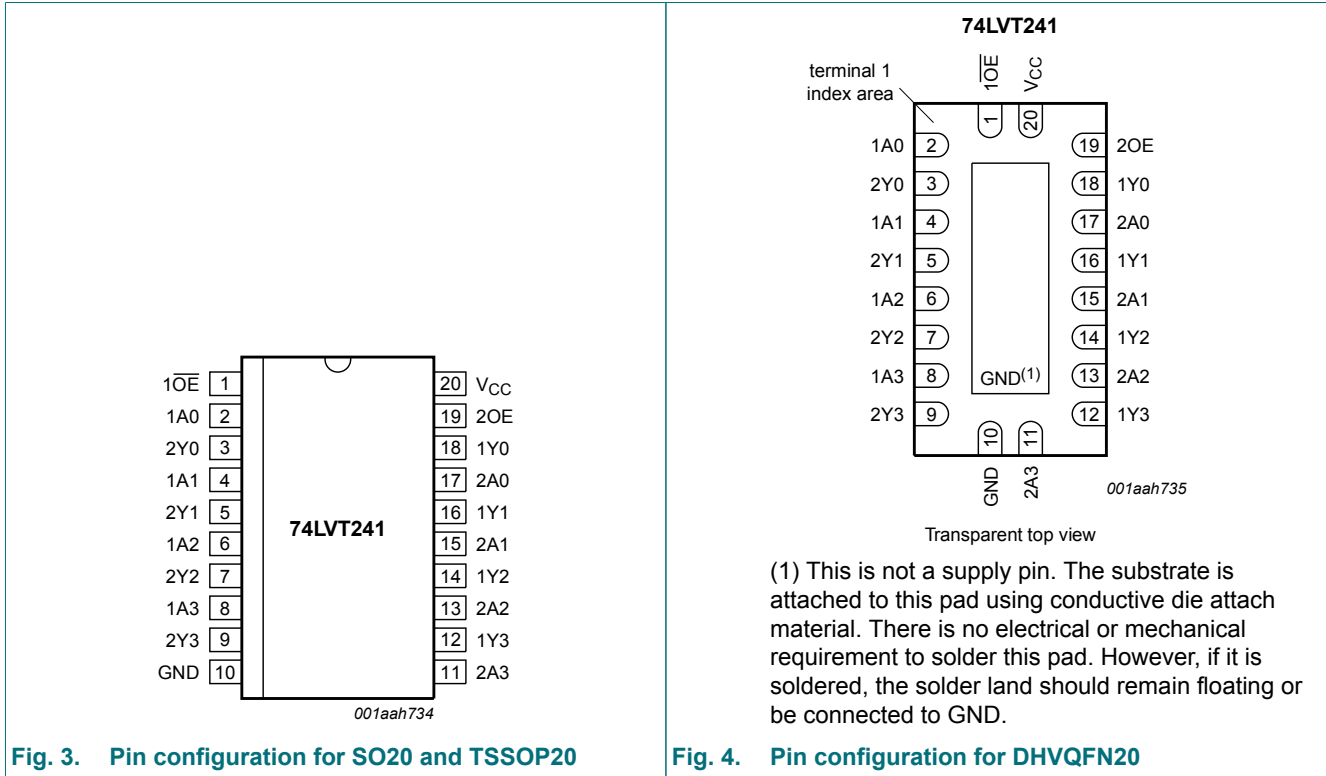


Fig. 1. Logic symbol

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)
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.

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

## 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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage		[1] -0.5	+7.0	V
V <sub>O</sub>	output voltage	output in OFF or HIGH state	[1] -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		[2] -	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	[3] -	500	mW

- [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. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- [3] For SO20 package: above 70 °C derate linearly with 8 mW/K.  
 For TSSOP20 package: above 60 °C derate linearly with 5.5 mW/K.  
 For DHVQFN20 package: 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
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);  $T_{amb} = -40\text{ °C to }+85\text{ °C}$ .

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	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$ ; $I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC} - 0.1$	-	V
		$V_{CC} = 2.7\text{ V}$ ; $I_{OH} = -8\text{ mA}$	2.4	2.5	-	V
		$V_{CC} = 3.0\text{ V}$ ; $I_{OH} = -32\text{ mA}$	2.0	2.2	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 2.7\text{ V}$ ; $I_{OL} = 100\text{ }\mu\text{A}$		0.1	0.2	V
		$V_{CC} = 2.7\text{ V}$ ; $I_{OL} = 24\text{ mA}$	-	0.3	0.5	V
		$V_{CC} = 3.0\text{ V}$ ; $I_{OL} = 16\text{ mA}$	-	0.25	0.4	V
		$V_{CC} = 3.0\text{ V}$ ; $I_{OL} = 32\text{ mA}$	-	0.3	0.5	V
		$V_{CC} = 3.0\text{ V}$ ; $I_{OL} = 64\text{ mA}$	-	0.4	0.55	V
$I_I$	input leakage current	control and data pins				
		$V_{CC} = 0\text{ V or }3.6\text{ V}$ ; $V_I = 5.5\text{ V}$	-	1	10	$\mu\text{A}$
		control pins				
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}\text{ or GND}$	-	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	$V_{CC} = 0\text{ V}$ ; $V_I\text{ or }V_O = 0\text{ V to }4.5\text{ V}$	-	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	$\mu\text{A}$
$I_{LO}$	output leakage current	$V_O = 5.5\text{ V}$ ; $V_{CC} = 3.0\text{ V}$ ; output HIGH	-	60	125	$\mu\text{A}$
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq 1.2\text{ V}$ ; $V_O = 0.5\text{ V to }V_{CC}$ ; $V_I = \text{GND or }V_{CC}$ ; $1\overline{\text{OE}}$ , $2\text{OE} = \text{don't care}$ [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	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}\text{ or GND}$ ; $I_O = 0\text{ A}$				
		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 $V_{CC}\text{ or GND}$ [6]	-	0.1	0.25	mA
$C_I$	input capacitance	$1\overline{\text{OE}}$ and $2\text{OE}$ inputs; outputs disabled; $V_I = 0\text{ V or }3.0\text{ V}$	-	4	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$C_{I/O}$	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  $T_{amb} = 25\text{ °C}$ .

[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  $0\text{ V}$  and  $1.2\text{ V}$  with a transition time of up to  $10\text{ ms}$ .

From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  a transition time of  $100\text{ ms}$  is permitted. This parameter is valid for  $T_{amb} = +25\text{ °C}$  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

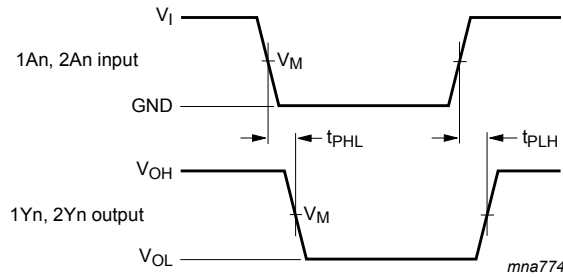
**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground =  $0\text{ V}$ ). For test circuit see Fig. 8;  $T_{amb} = -40\text{ °C}$  to  $+85\text{ °C}$ .

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$t_{PLH}$	LOW to HIGH propagation delay	1An to 1Yn, 2An to 2Yn; see Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	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 Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	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 Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	5.0	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.2	4.4	ns
		2OE to 2Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.6	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$1\overline{OE}$ to 1Yn; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	4.9	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	3.1	4.3	ns
		2OE to 2Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.4	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$1\overline{OE}$ to 1Yn; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	5.4	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2.0	3.6	5.2	ns
		2OE to 2Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.0	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$1\overline{OE}$ to 1Yn; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	-	-	4.3	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.6	2.9	4.2	ns
		2OE to 2Yn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	4.3	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	2.8	4.0	ns

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

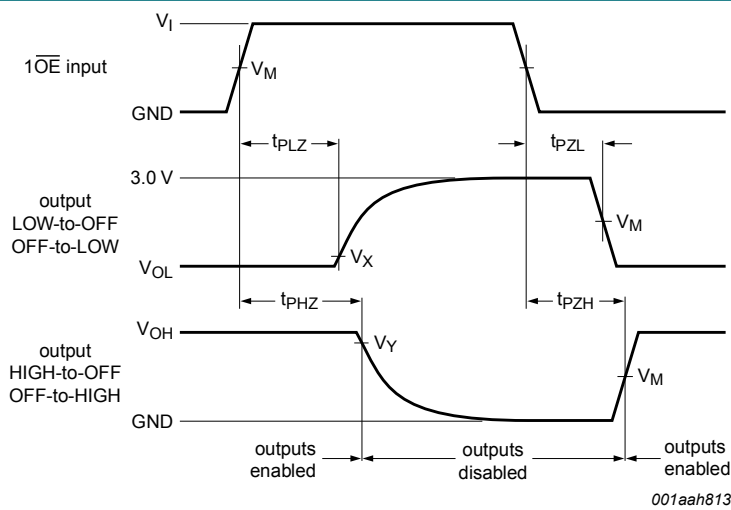
10.1. Waveforms and test circuit



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

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

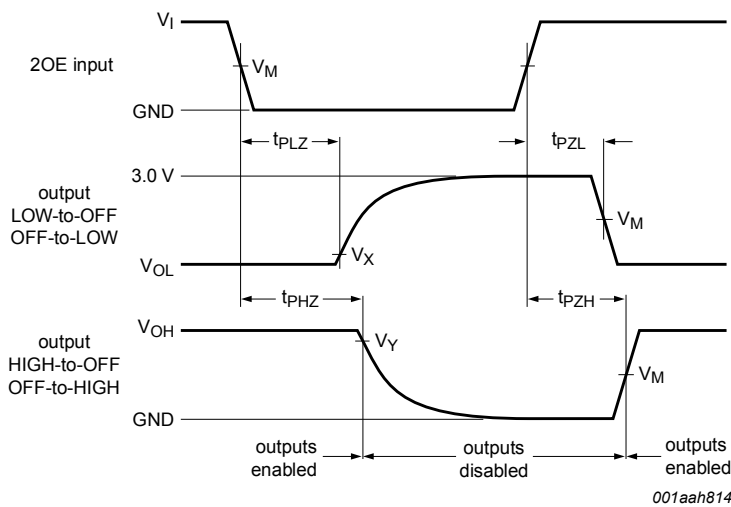
**Fig. 5. Input (1An, 2An) to output (1Yn, 2Yn) propagation delays and output transition times**



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**



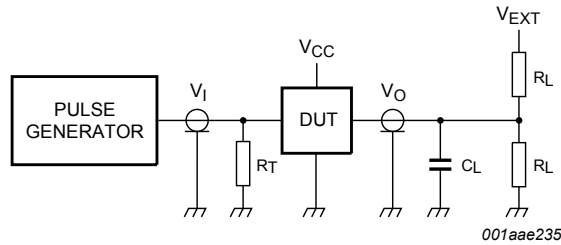
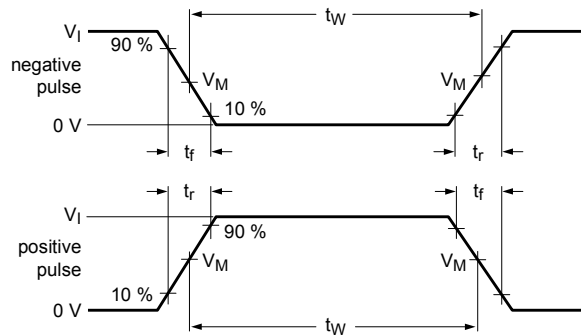
See [Table 8](#) for measurement points.

$V_{OL}$  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 <sub>CC</sub>	Input	Output		
	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>	V <sub>M</sub>
2.7 V to 3.6 V	1.5 V	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V	1.5 V



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

Definitions test circuit:

R<sub>L</sub> = Load resistance.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.

V<sub>EXT</sub> = External voltage for measuring switching times.

Fig. 8. Test circuit for switching times

Table 9. Test data

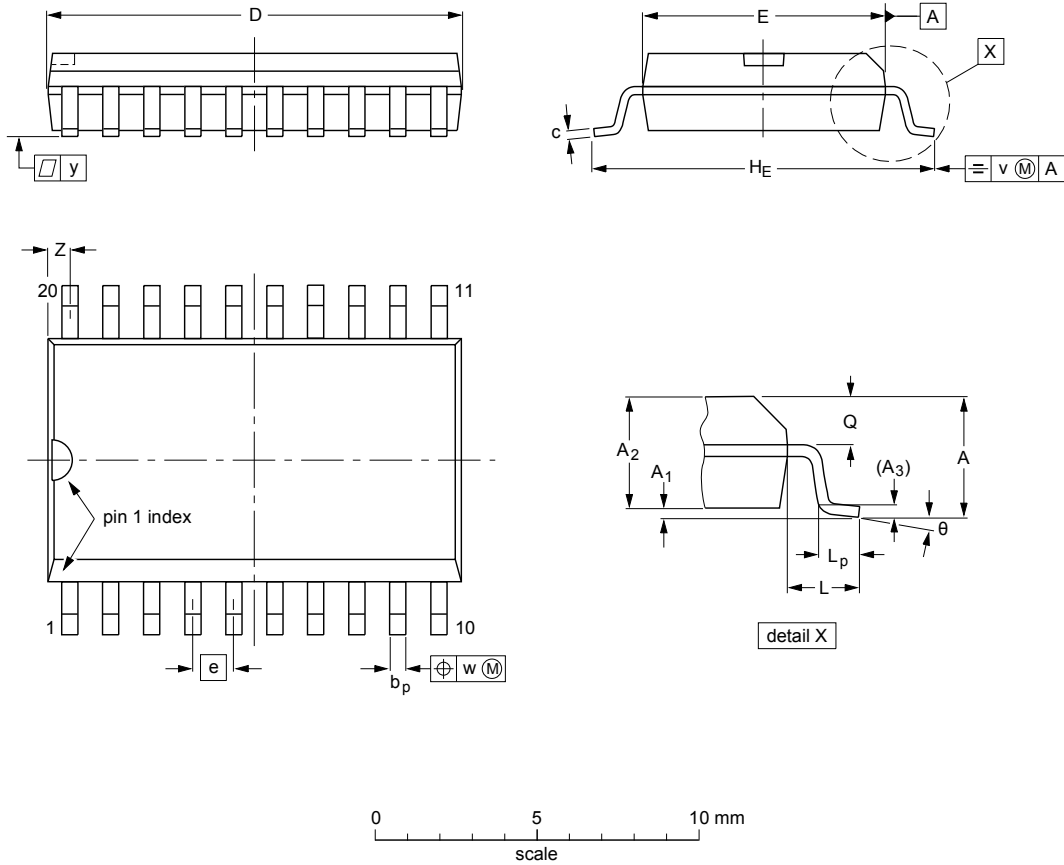
Input				Load		V <sub>EXT</sub>		
V <sub>I</sub>	f <sub>i</sub>	t <sub>w</sub>	t <sub>r</sub> , t <sub>f</sub>	R <sub>L</sub>	C <sub>L</sub>	t <sub>PHZ</sub> , t <sub>PZH</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	500 Ω	50 pF	GND	6 V	open



11. Package outline

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

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

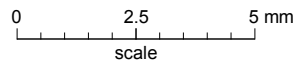
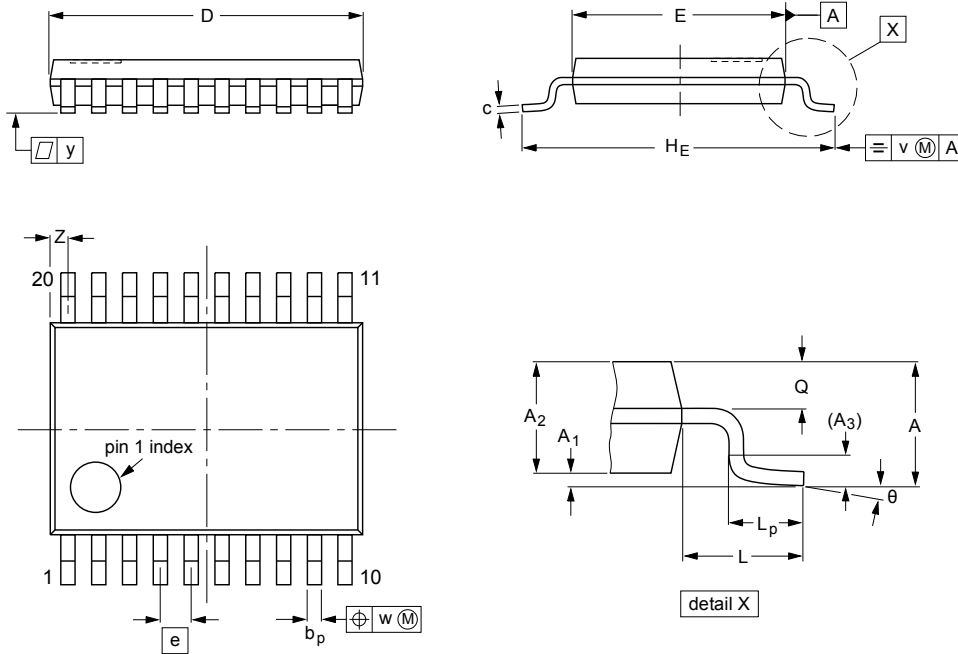
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				-99-12-27 03-02-19

Fig. 9. Package outline SOT163-1 (SO20)

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

SOT360-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

**Notes**

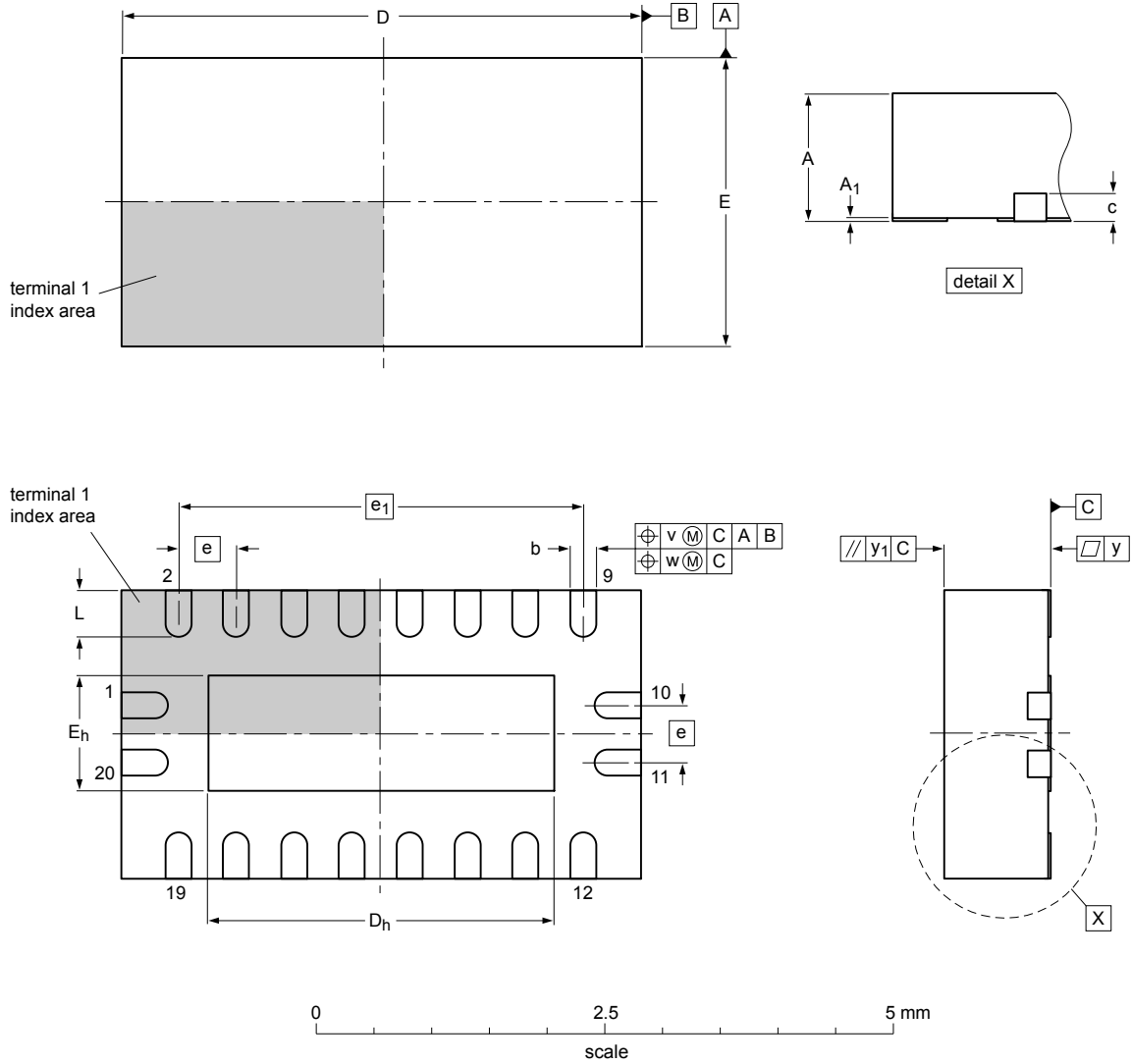
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT360-1		MO-153				99-12-27 03-02-19

Fig. 10. 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



Dimensions (mm are the original dimensions)

Unit	A <sup>(1)</sup>	A <sub>1</sub>	b	c	D <sup>(1)</sup>	D <sub>h</sub>	E <sup>(1)</sup>	E <sub>h</sub>	e	e <sub>1</sub>	L	v	w	y	y <sub>1</sub>
max	1.00	0.05	0.30		4.6	3.15	2.6	1.15			0.5				
nom	0.90	0.02	0.25	0.2	4.5	3.00	2.5	1.00	0.5	3.5	0.4	0.1	0.05	0.05	0.1
min	0.80	0.00	0.18		4.4	2.85	2.4	0.85			0.3				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot764-1\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT764-1	---	MO-241	---			-03-01-27- 14-12-12

Fig. 11. Package outline SOT764-1 (DHVQFN20)

## 12. 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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT241 v. 3	20190327	Product data sheet		74LVT241 v. 3
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> <li><a href="#">Fig. 11</a>: package outline drawing SOT764-1 (DHVQFN20) updated.</li> <li>Type number 74LVT241DB (SOT339-1) removed.</li> </ul>			
74LVT241 v. 3	20080507	Product data sheet	ECN07_046	74LVT241 v. 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</a> and <a href="#">Section 11</a>.</li> </ul>			
74LVT241 v. 2	19980219	Product specification	-	74LVT241 v. 1
74LVT241 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.
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 <https://www.nexperia.com>.

### Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

**Right to make changes** — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal

injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale** — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products** — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

### Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.