

74LVC541A

Octal buffer/line driver with 5 V tolerant inputs/outputs;
3-state

Rev. 6 — 27 August 2021

Product data sheet

1. General description

The 74LVC541A is an 8-bit buffer/line driver with 3-state outputs. The device features two output enables (\overline{OE}_1 and \overline{OE}_2). A HIGH on \overline{OE}_1 causes the associated outputs to assume a high-impedance OFF-state. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all 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 potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Overvoltage tolerant inputs to 5.5 V
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- Complies with JEDEC standard:
 - JESD8-7A (1.65 V to 1.95 V)
 - JESD8-5A (2.3 V to 2.7 V)
 - JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115B exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package				Version
	Temperature range	Name	Description		
74LVC541AD	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm		SOT163-1
74LVC541APW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm		SOT360-1
74LVC541ABQ	-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

4. Functional diagram

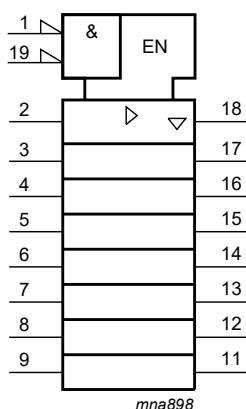


Fig. 1. IEC logic symbol

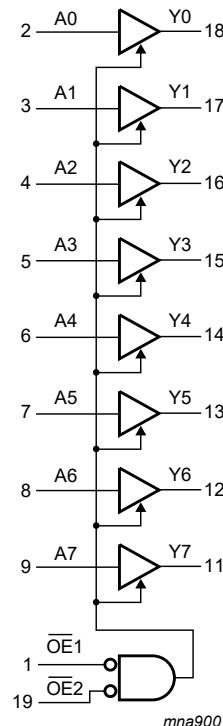


Fig. 2. Functional diagram

5. Pinning information

5.1. Pinning

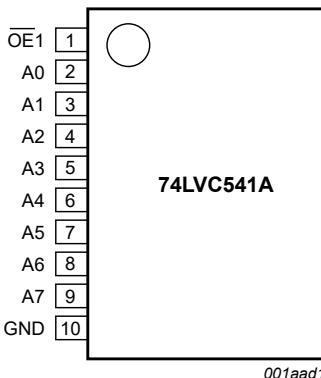
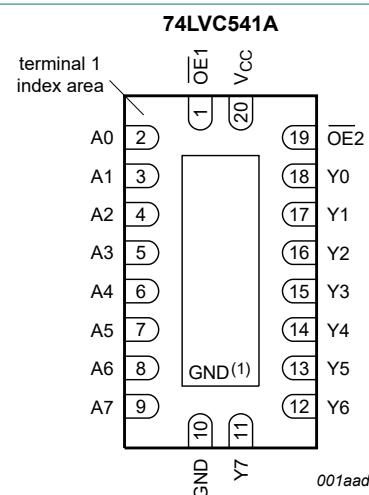


Fig. 3. Pin configuration for SOT163-1 (SO20) and SOT360-1 (TSSOP20)



Transparent top view

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

Fig. 4. Pin configuration for SOT764-1 (DHVQFN20)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
OE1	1	output enable input (active LOW)
A0, A1, A2, A3, A4, A5, A6, A7	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7	18, 17, 16, 15, 14, 13, 12, 11	bus output
OE2	19	output enable input (active LOW)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table

H = HIGH voltage level; L = LOW voltage level

X = don't care; Z = high-impedance OFF-state

Input	Output		
OE1	OE2	An	Y _n
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	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	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V _I	input voltage		[1]	-0.5	+5.5
I _{OK}	output clamping current	V _O > V _{CC} or V _O < 0 V	-	±50	mA
V _O	output voltage	output HIGH or LOW state	[2]	-0.5	V _{CC} + 0.5
		output 3-state or power-down	[2]	-0.5	+6.5
I _O	output current	V _O = 0 V to V _{CC}	-	±50	mA
I _{CC}	supply current		-	100	mA
I _{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-60	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C	[3]	-	500
					mW

[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.

For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
V_I	input voltage		0	-	5.5	V
		output HIGH or LOW state	0	-	V_{CC}	V
V_O	output voltage	output 3-state	0	-	5.5	V
		ambient temperature	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0	-	20	ns/V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	0	-	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	-40 °C to +85 °C			-40 °C to +125 °C	Unit	
			Min	Typ[1]	Max			
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.2 \text{ V}$	1.08	-	-	1.08	-	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	0.65 V_{CC}	-	-	0.65 V_{CC}	-	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	-	-	1.7	-	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2.0	-	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.2 \text{ V}$	-	-	0.12	-	0.12	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	-	-	0.35 V_{CC}	-	0.35 V_{CC}	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	$V_{CC} - 0.2$	-	-	$V_{CC} - 0.3$	-	V
		$I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V
		$I_O = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V
		$I_O = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V
		$I_O = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.25	-	V
		$I_O = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = 100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	V
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	0.8	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.8	V
I_I	input leakage current	$V_I = 5.5 \text{ V or GND}; V_{CC} = 3.6 \text{ V}$	-	± 0.1	± 5	-	± 20	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = 5.5 \text{ V or GND}$; $V_{CC} = 3.6 \text{ V}$	-	± 0.1	± 5	-	± 20	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5 \text{ V}; V_{CC} = 0.0 \text{ V}$	-	± 0.1	± 10	-	± 20	μA

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 3.6 V	-	0.1	10	-	40	μA
ΔI _{CC}	additional supply current	per input pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.7 V to 3.6 V	-	5	500	-	5000	μA
C _I	input capacitance		-	5.0	-	-	-	pF

[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 7.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	An to Y _n ; see Fig. 5 [2]						
		V _{CC} = 1.2 V	-	14.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.5	6.5	13.8	1.5	16.0	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.5	6.8	1.0	7.9	ns
		V _{CC} = 2.7 V	1.5	3.5	5.6	1.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.9	5.1	1.0	6.5	ns
t _{en}	enable time	OE _n to Y _n ; see Fig. 6 [2]						
		V _{CC} = 1.2 V	-	20.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.8	7.7	16.0	1.8	18.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	4.3	8.8	1.5	10.2	ns
		V _{CC} = 2.7 V	1.5	4.4	7.5	1.5	9.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.5	7.0	1.0	9.0	ns
t _{dis}	disable time	OE _n to Y _n ; see Fig. 6 [2]						
		V _{CC} = 1.2 V	-	11.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	3.0	4.9	10.3	3.0	11.9	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.7	5.9	1.0	6.8	ns
		V _{CC} = 2.7 V	1.5	3.7	7.0	1.5	9.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.3	6.0	1.0	7.5	ns
C _{PD}	power dissipation capacitance	per input; V _I = GND to V _{CC} [3]						
		V _{CC} = 1.65 V to 1.95 V	-	7.7	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	11.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	14.4	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

t_{en} is the same as t_{PZL} and t_{PZH}.

t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

P_D = C_{PD} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × f_o) where:

f_i = input frequency in MHz; f_o = output frequency in MHz

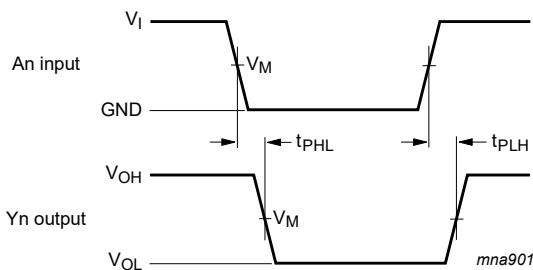
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

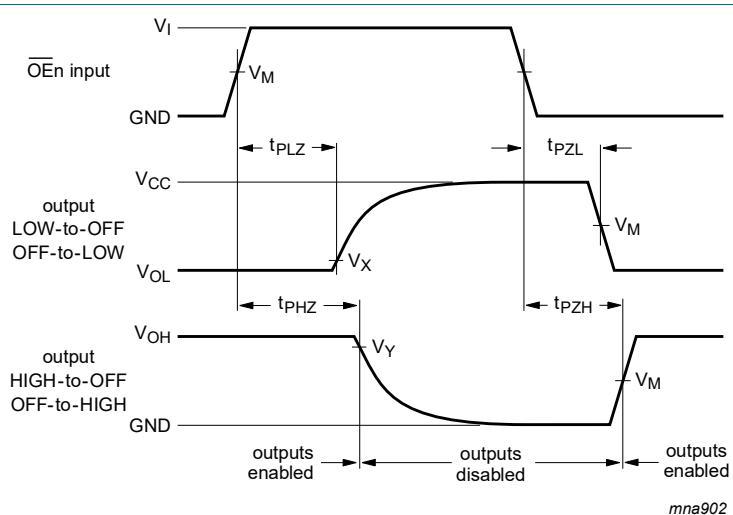
10.1. Waveforms and test circuit



Measurement points are given in [Table 8](#).

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

Fig. 5. Input (An) to output (Yn) propagation delays



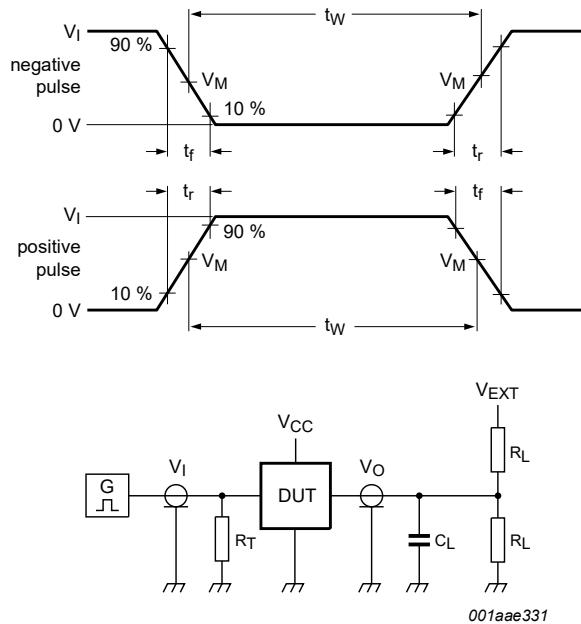
Measurement points are given in [Table 8](#).

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

Fig. 6. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input	Output		
V_{CC}	V_M	V_M	V_X	V_Y
< 2.7 V	0.5 V_{CC}	0.5 V_{CC}	$V_{OL} + 0.15$ V	$V_{OH} - 0.15$ V
≥ 2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3$ V	$V_{OH} - 0.3$ V



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

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 output impedance Z_o of the pulse generator.

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

Fig. 7. Test circuit for measuring switching times

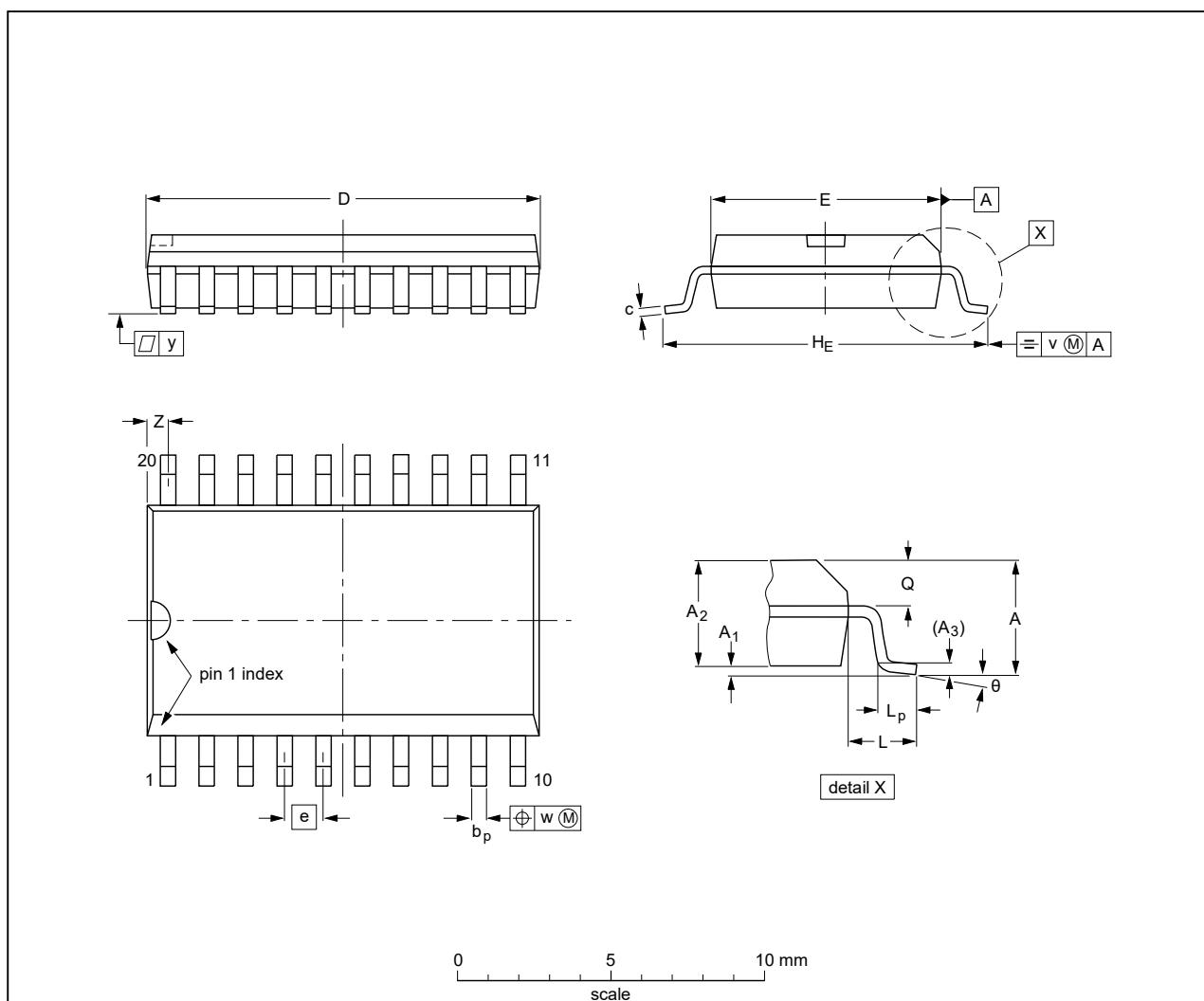
Table 9. Test data

Supply voltage	Input		Load		V_{EXT}		
	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PLZ}, t_{PZL}	t_{PHZ}, t_{PZH}
1.2 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	≤ 2 ns	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ	
mm	2.65	0.3	2.45	0.25	0.49	0.32	13.0	7.6	1.27	10.65	1.4	1.1	1.1	0.25	0.25	0.1	0.9	8°	
inches	0.1	0.012	0.096	0.01	0.019	0.013	12.6	7.4		10.00	0.4	1.0	0.4	0.016	0.039	0.01	0.01	0.004	0.016

Note

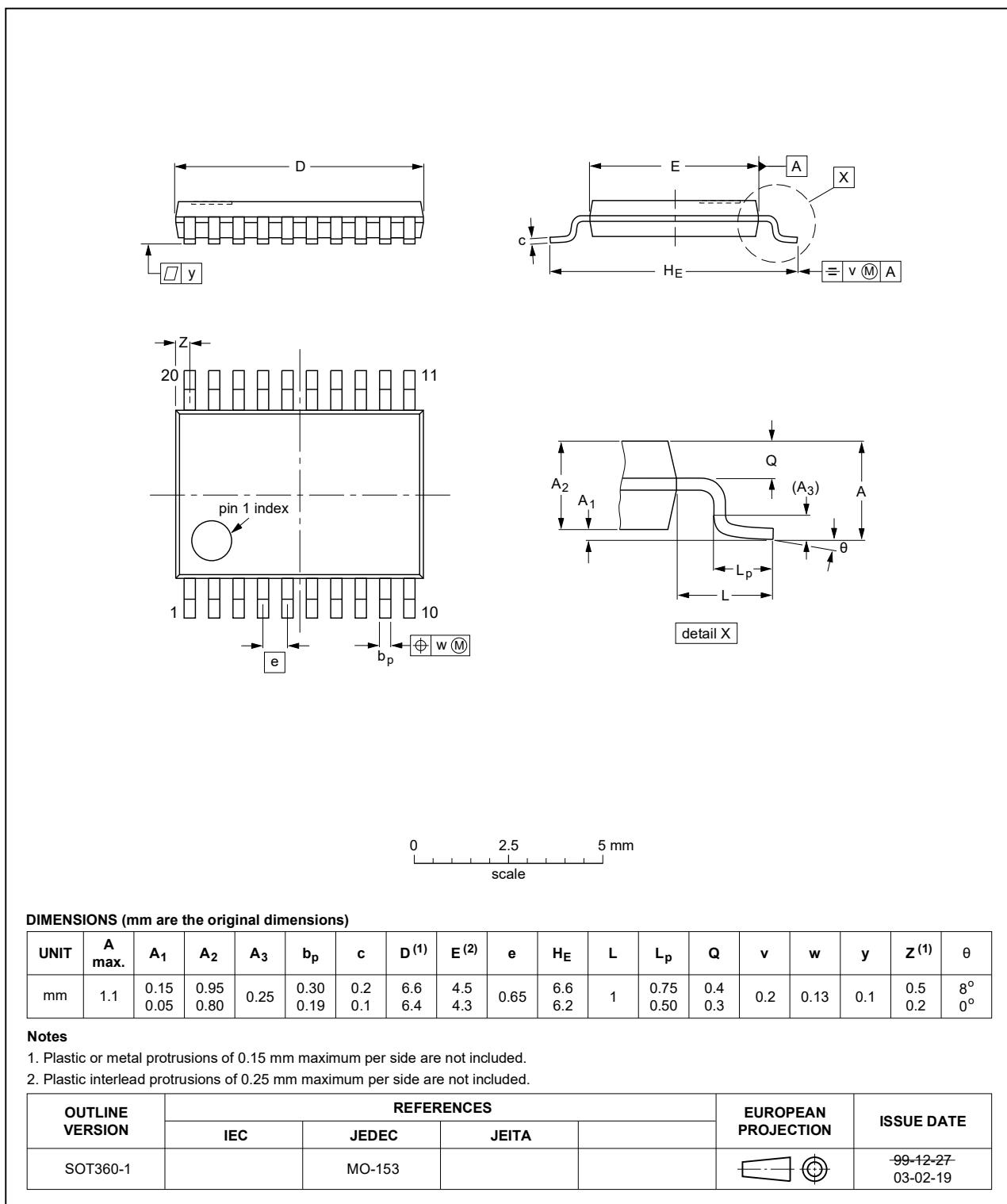
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

Fig. 8. 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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	ε	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ
mm	1.1 0.05	0.15 0.80	0.95 0.25	0.25 0.19	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. 9. 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

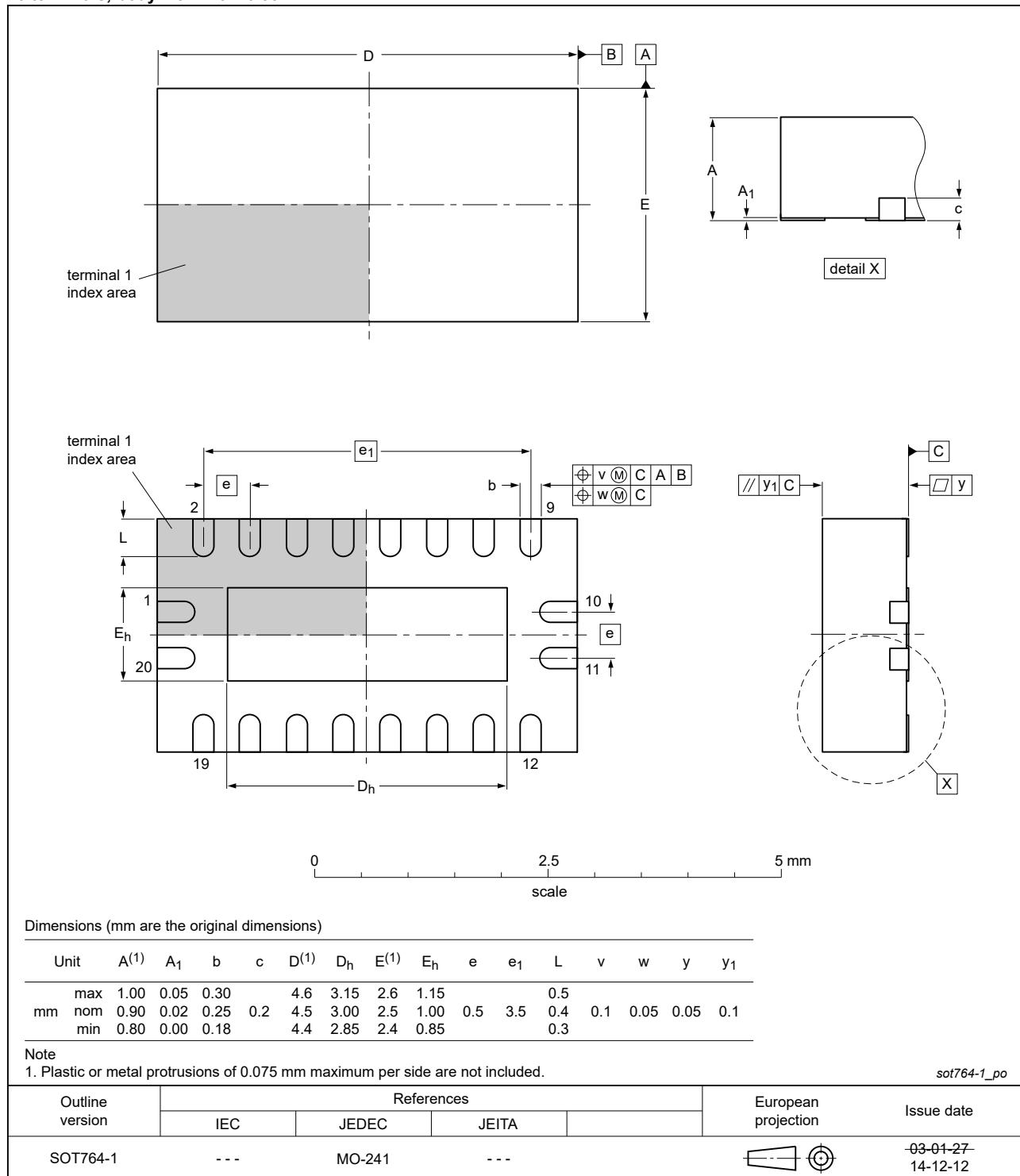


Fig. 10. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. 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
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC541A v.6	20210827	Product data sheet	-	74LVC541A v.5
Modifications:			<ul style="list-style-type: none"> • Section 1 updated. • Type number 74LVC541ADB (SOT339-1/SSOP20) removed. 	
74LVC541A v.5	20200313	Product data sheet	-	74LVC541A v.4
Modifications:			<ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Table 4: Derating values for P_{tot} total power dissipation updated. • Measurements points table added. • Package outline drawing SOT764-1 (DHVQFN20) updated. 	
74LVC541A v.4	20111125	Product data sheet	-	74LVC541A v.3
Modifications:			<ul style="list-style-type: none"> • The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Table 4, Table 5, Table 6, Table 7 and Table 9: values added for lower voltage ranges. 	
74LVC541A v.3	20031112	Product specification	-	74LVC541A v.2
74LVC541A v.2	20030514	Product specification	-	74LVC541A v.1
74LVC541A v.1	19980729	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>.

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