

# 74ALVC541-Q100

Octal buffer/line driver; 3-state

Rev. 3 — 30 April 2021

Product data sheet

## 1. General description

The 74ALVC541-Q100 is an octal non-inverting buffer/line drivers with 3-state bus compatible outputs. The 3-state outputs are controlled by the output enable inputs  $\overline{OE}0$  and  $\overline{OE}1$ . A HIGH on  $\overline{OE}n$  causes the outputs to assume a high-impedance OFF-state.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
  - Specified from -40 °C to +85 °C
- Wide supply voltage range from 1.65 V to 3.6 V
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V )
  - JESD8-5 (2.3 V to 2.5 V)
  - JESD8B (2.7 V to 3.6 V)
- 3.6 V tolerant inputs/outputs
- CMOS LOW power consumption
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Latch-up performance exceeds 250 mA
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ALVC541D-Q100	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74ALVC541PW-Q100	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74ALVC541BQ-Q100	-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

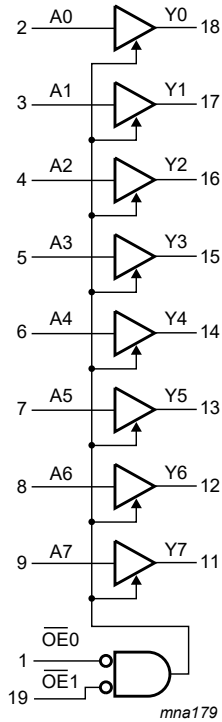


Fig. 1. Logic symbol

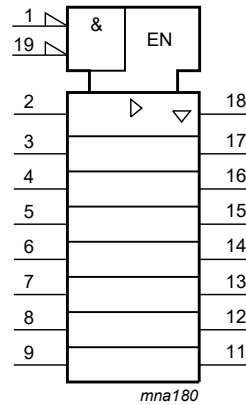


Fig. 2. IEC logic symbol

### 5. Pinning information

#### 5.1. Pinning

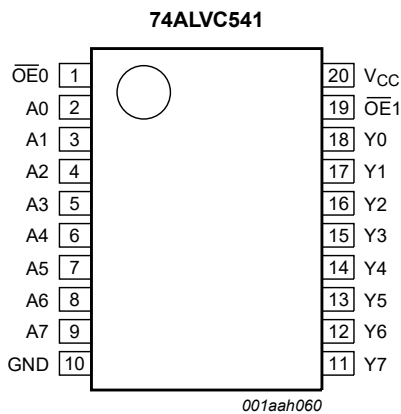
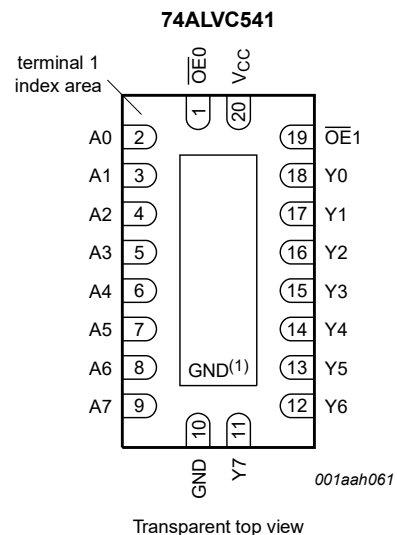


Fig. 3. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)



(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 SOT764-1 (DHVQFN20)

## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
OE0	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	data output
OE1	19	output enable input (active LOW)
V <sub>CC</sub>	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.

Control		Input	Output
OE0	OE1	An	Yn
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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage	[1]	-0.5	+4.6	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> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	-	±50	mA
V <sub>O</sub>	output voltage	output HIGH or LOW state [2]	-0.5	V <sub>CC</sub> + 0.5	V
		output 3-state [2]	-0.5	+4.6	V
		power-down mode; V <sub>CC</sub> = 0 V	-0.5	+4.6	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
I <sub>GND</sub>	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	-	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.

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		1.65	3.6	V
$V_I$	input voltage		0	3.6	V
$V_O$	output voltage	output HIGH or LOW state	0	$V_{CC}$	V
		output 3-state	0	3.6	V
		power-down mode; $V_{CC} = 0$ V	0	3.6	V
$T_{amb}$	ambient temperature		-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	-	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 V	-	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	$T_{amb} = -40$ °C to +85 °C			Unit
			Min	Typ[1]	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100$ $\mu$ A; $V_{CC} = 1.65$ V to 3.6 V	$V_{CC} - 0.2$	-	-	V
		$I_O = 6$ mA; $V_{CC} = 1.65$ V	1.25	-	-	V
		$I_O = 12$ mA; $V_{CC} = 2.3$ V	1.8	-	-	V
		$I_O = 18$ mA; $V_{CC} = 2.3$ V	1.7	-	-	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	2.2	-	-	V
		$I_O = 18$ mA; $V_{CC} = 3.0$ V	2.4	-	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -100$ $\mu$ A; $V_{CC} = 1.65$ V to 3.6 V	-	-	0.2	V
		$I_O = -6$ mA; $V_{CC} = 1.65$ V	-	-	0.3	V
		$I_O = -12$ mA; $V_{CC} = 2.3$ V	-	-	0.4	V
		$I_O = -18$ mA; $V_{CC} = 2.3$ V	-	-	0.6	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	-	-	0.4	V
		$I_O = -18$ mA; $V_{CC} = 3.0$ V	-	-	0.4	V
$I_{OZ}$	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 3.6$ V	-	$\pm 0.1$	$\pm 10.0$	$\mu$ A
		$V_I = V_{CC}$ or GND; $V_{CC} = 3.6$ V	-	$\pm 0.1$	$\pm 5.0$	$\mu$ A
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 0$ V to 3.6 V; $V_{CC} = 0$ V	-	$\pm 0.1$	$\pm 10.0$	$\mu$ A

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.6 V	-	0.2	10	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3.0 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	750	μA
C <sub>I</sub>	input capacitance		-	3.5	-	pF

[1] All typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V and 3.3 V.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
t <sub>pd</sub>	propagation delay	An to Yn; see Fig. 5 [2]				
		V <sub>CC</sub> = 1.65V to 1.95 V	1.0	3.0	4.6	ns
		V <sub>CC</sub> = 2.3V to 2.7 V	1.0	2.2	3.3	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.5	3.3	ns
t <sub>en</sub>	enable time	OE <sub>n</sub> to Yn; see Fig. 6 [2]				
		V <sub>CC</sub> = 1.65V to 1.95 V	1.0	4.2	7.5	ns
		V <sub>CC</sub> = 2.3V to 2.7 V	1.0	3.3	5.4	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.7	5.8	ns
t <sub>dis</sub>	disable time	OE <sub>n</sub> to Yn; see Fig. 6 [2]				
		V <sub>CC</sub> = 1.65V to 1.95 V	1.0	4.8	7.5	ns
		V <sub>CC</sub> = 2.3V to 2.7 V	1.0	3.1	4.5	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.1	4.8	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V [3]				
		outputs enabled	-	25	-	pF
		outputs disabled	-	0	-	pF

[1] All typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V and 3.3 V.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

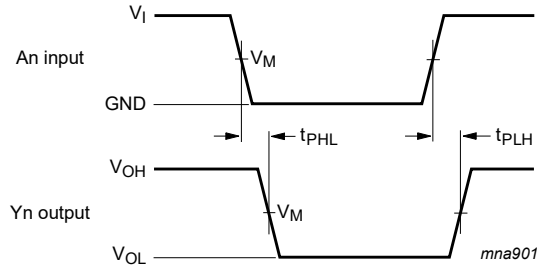
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

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

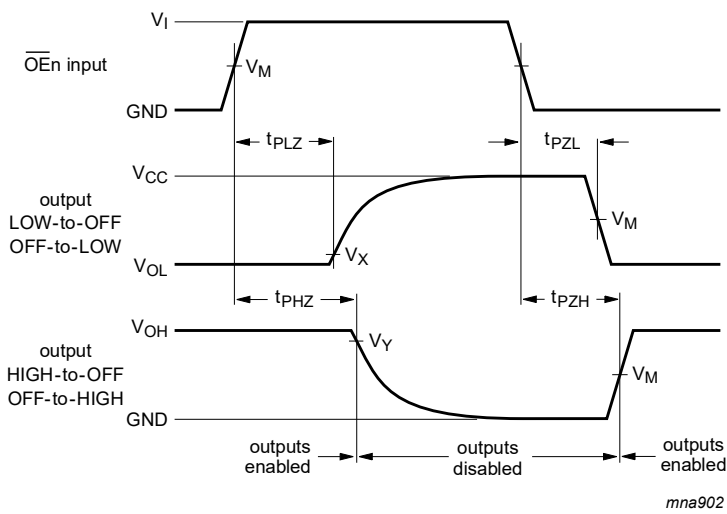
10.1. Waveforms and test circuit



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

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

Fig. 5. Propagation delay input (An) to output (Yn)



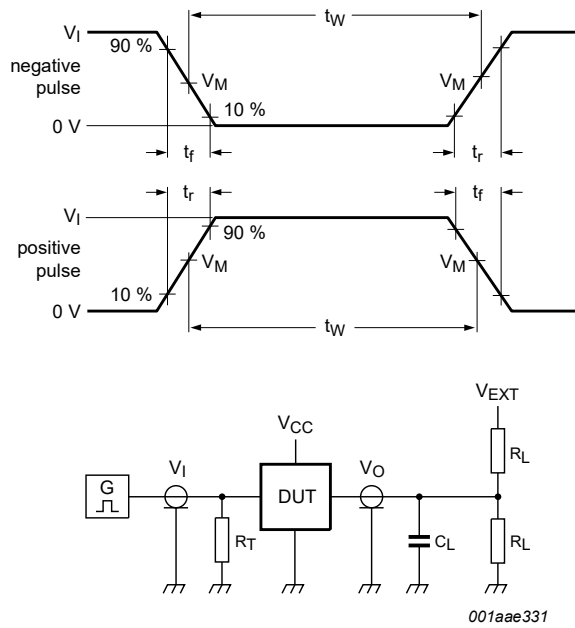
Measurement points are given in [Table 8](#).

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

Fig. 6. Enable and disable times

Table 8. Measurement points

Supply voltage	Input		Output		
$V_{CC}$	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
1.65 V to 1.65V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



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

Definitions test circuit:

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

$C_L$  = Load capacitance including jig and probe capacitance

$R_L$  = Load resistor

**Fig. 7. Test circuit for measuring switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.65 V to 1.95 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	6 V	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	6 V	GND

11. Package outline

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

SOT163-1

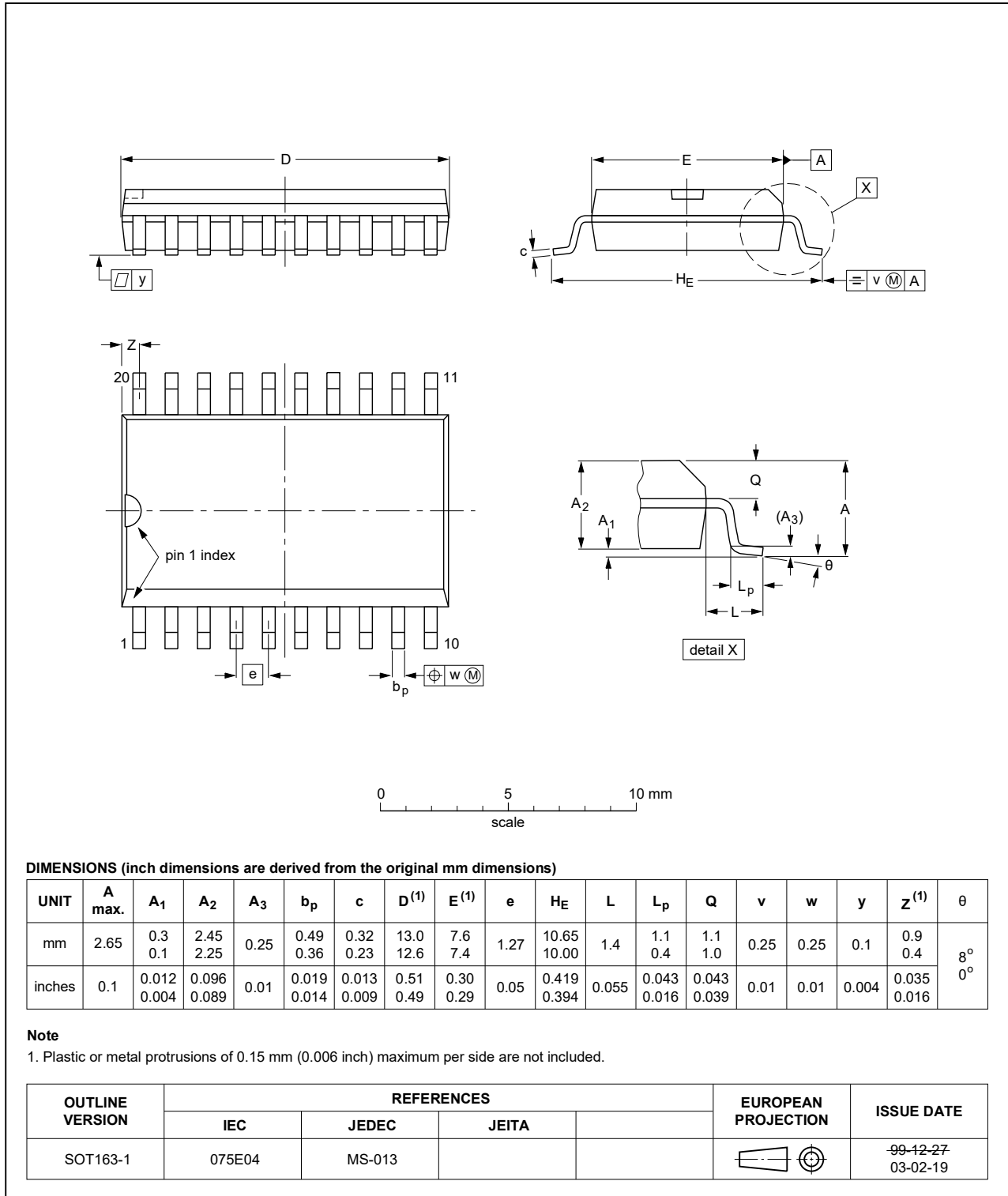


Fig. 8. Package outline SOT163-1 (SO20)



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

SOT360-1

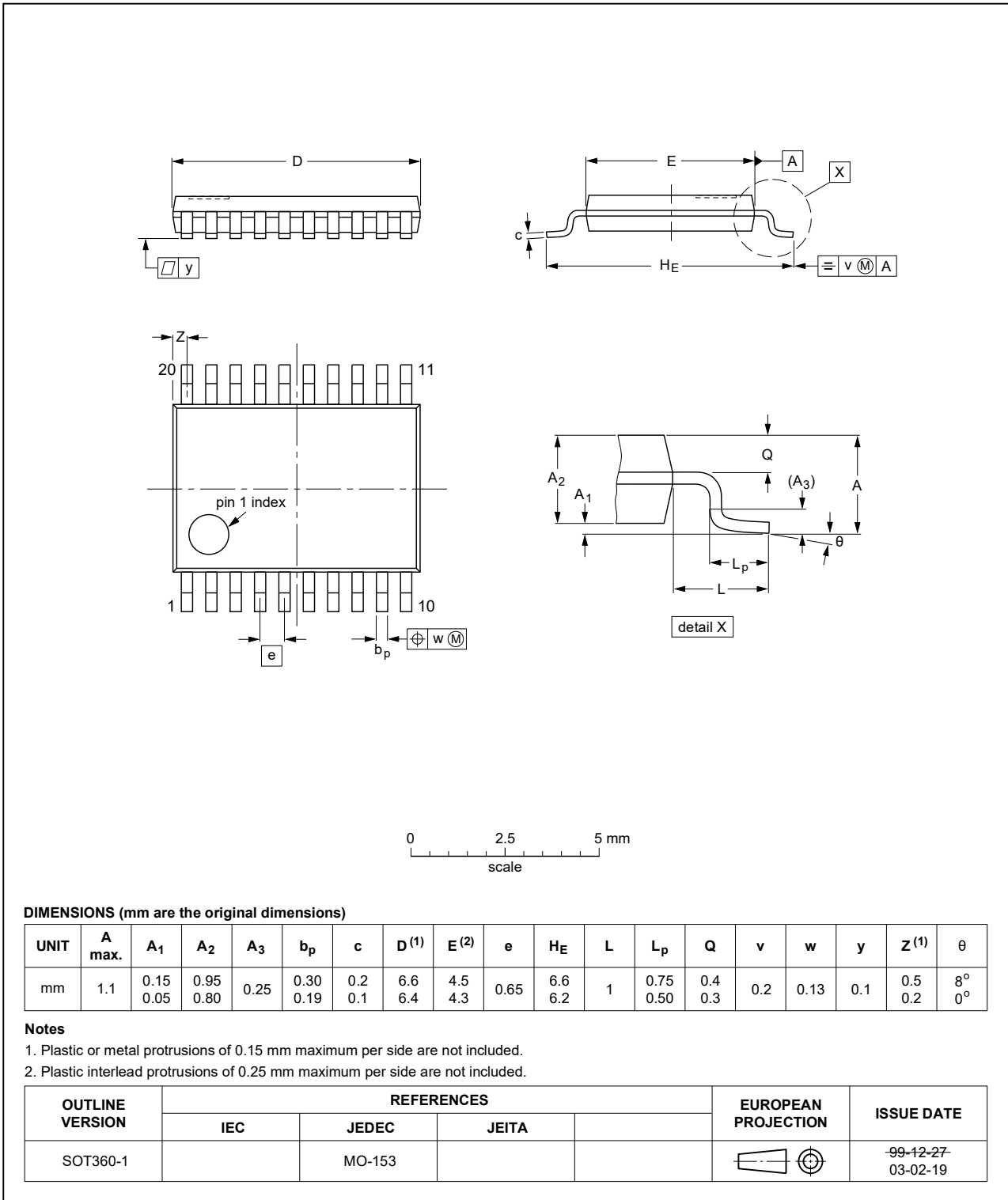


Fig. 9. Package outline SOT360-1 (TSSOP20)



## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC541_Q100 v.3	20210430	Product data sheet	-	74ALVC541_Q100 v.2
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 2</a>: Reference to JESD36 removed.</li> <li>• <a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation removed (errata).</li> </ul>			
74ALVC541_Q100 v.2	20200930	Product data sheet	-	74ALVC541_Q100 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> <li>• <a href="#">Section 2</a> updated.</li> <li>• <a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li> <li>• <a href="#">Table 6</a>: typo corrected.</li> <li>• <a href="#">Table 7</a>: typo corrected.</li> <li>• Package outline drawing of SOT764-1 (<a href="#">Fig. 10</a>) updated.</li> </ul>			
74ALVC541_Q100 v.1	20140519	Product data sheet	-	-

## 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".
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