

74ALVC541

Octal buffer/line driver; 3-state

Rev. 3 — 20 January 2014

Product data sheet

1. General description

The 74ALVC541 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.

2. Features and benefits

- 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/JESD36 (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:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V

3. Ordering information

Table 1. Ordering information

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

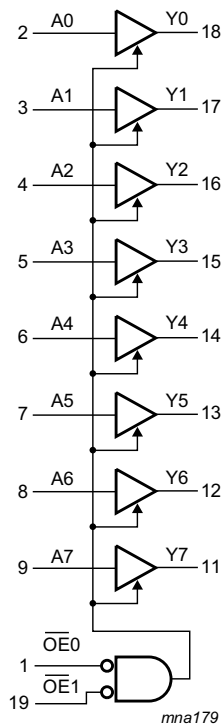


Fig 1. Logic symbol

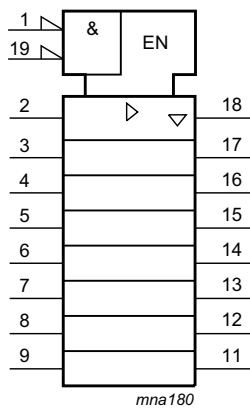
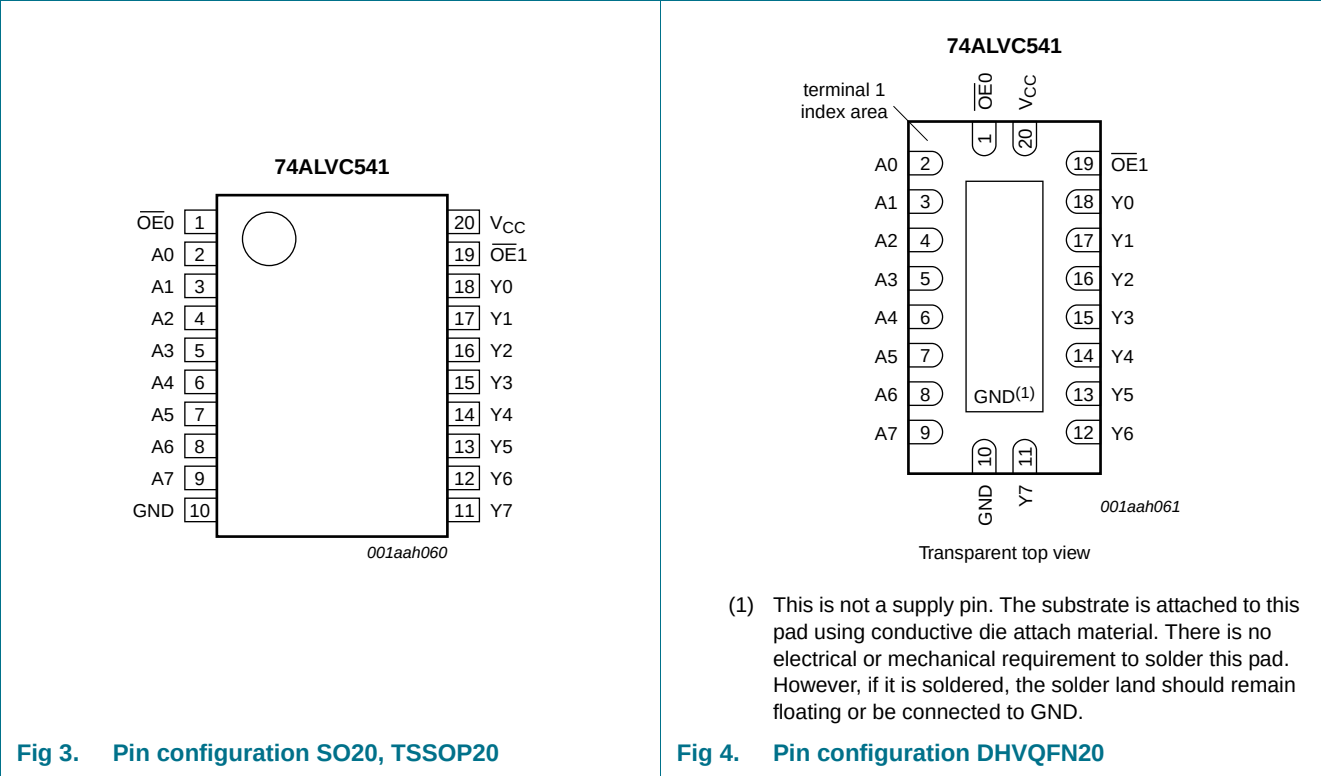


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}0$	1	output enable input (active LOW)
A[0:7]	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
Y[0:7]	18, 17, 16, 15, 14, 13, 12, 11	data output
$\overline{OE}1$	19	output enable input (active LOW)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table^[1]

Control		Input	Output
$\overline{\text{OE0}}$	$\overline{\text{OE1}}$	An	Yn
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

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

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		-0.5	+4.6	V
I_{IK}	input clamping current	$V_I < 0$ V	^[1] -50	-	mA
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	$V_{CC} + 0.5$	V
		output 3-state	^[2] -0.5	+4.6	V
		power-down mode, $V_{CC} = 0$ V	^[3] -0.5	+4.6	V
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		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +85 °C			
	SO20 package		^[4] -	500	mW
	TSSOP20 package		^[5] -	500	mW
	DHVQFN20 package		^[6] -	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] When $V_{CC} = 0$ V (Power-down mode), the output voltage can be 3.6 V in normal operation.

[4] P_{tot} derates linearly with 8 mW/K above 70 °C.

[5] P_{tot} derates linearly with 5.5 mW/K above 60 °C.

[6] P_{tot} derates linearly with 4.5 mW/K above 60 °C.

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 2.7V	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 2.7V	-	-	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}				
		$I_O = 100$ μ A; $V_{CC} = 1.65$ V to 3.6 V	$\zeta_{XX}-0.2$	-	-	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
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	2.2	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100$ μ 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
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	-	-	0.55	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	-	± 0.1	± 10.0	μ A

Table 6. Static characteristics ...continued

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	
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 3.6 V	-	±0.1	±5.0	μA
I _{OFF}	power-off leakage current	V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V	-	±0.1	±10.0	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 3.6 V	-	0.2	10	μA
ΔI _{CC}	additional supply current	per input pin; V _{CC} = 3.0 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 A;	-	5	750	μA
C _I	input capacitance		-	3.5	-	pF

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

10. Dynamic characteristics

Table 7. Dynamic characteristicsVoltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

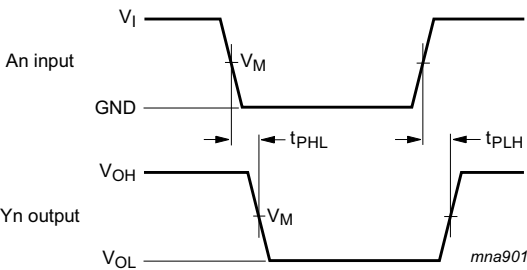
Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
t _{pd}	propagation delay	An to Yn; see Figure 5 ^[2]				
		V _{CC} = 1.65V to 1.95 V	1.0	3.0	4.6	ns
		V _{CC} = 2.3V to 2.7 V	1.0	2.2	3.3	ns
		V _{CC} = 27 V	1.0	2.5	3.3	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.3	3.0	ns
t _{en}	enable time	$\overline{\text{OEn}}$ to Yn; see Figure 6 ^[2]				
		V _{CC} = 1.65V to 1.95 V	1.0	4.2	7.5	ns
		V _{CC} = 2.3V to 2.7 V	1.0	3.3	5.4	ns
		V _{CC} = 27 V	1.0	3.7	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.3	4.9	ns
t _{dis}	disable time	$\overline{\text{OEn}}$ to Yn; see Figure 6 ^[2]				
		V _{CC} = 1.65V to 1.95 V	1.0	4.8	7.5	ns
		V _{CC} = 2.3V to 2.7 V	1.0	3.1	4.5	ns
		V _{CC} = 27 V	1.0	3.1	4.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.9	4.6	ns

Table 7. Dynamic characteristics ...continued
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
C _{PD}	power dissipation capacitance	per buffer; V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[3]				
		outputs enabled	-	25	-	pF
		outputs disabled	-	0	-	pF

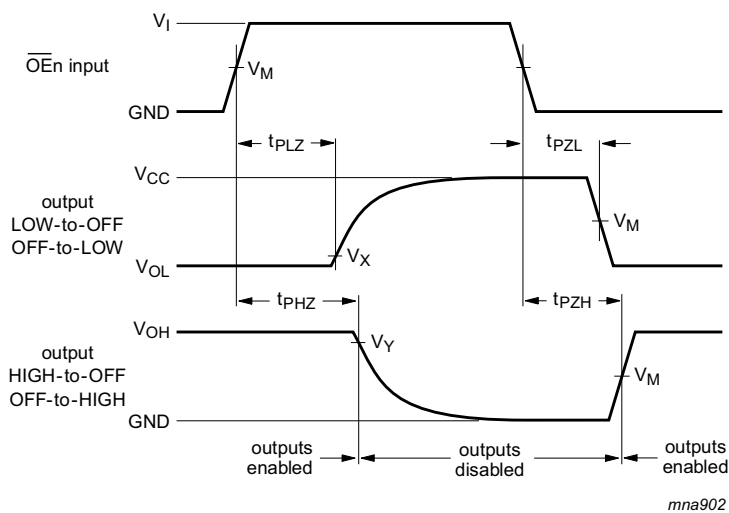
- [1] All typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.8 V, 2.5 V, 2.7 V and 3.3 V.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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.

11. Waveforms



Measurement points are given in Table 8.
VOL and VOH are typical voltage output levels that occur with the output load.

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

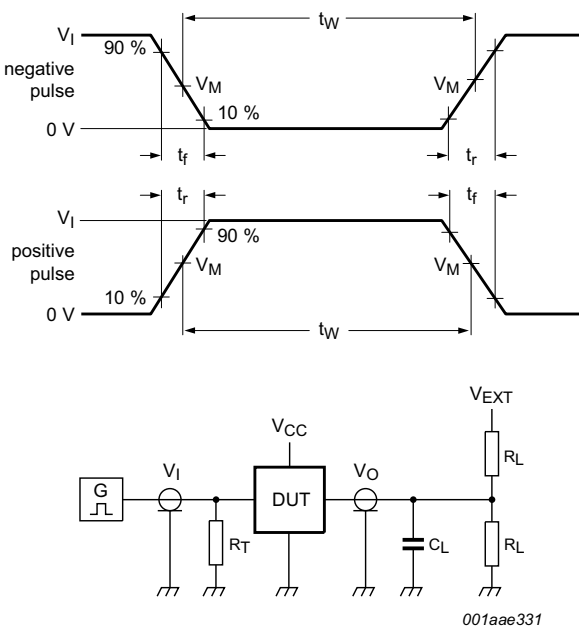


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

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}	≤ 2.0 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	≤ 2.0 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	6	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	6	GND

12. Package outline

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

SOT163-1

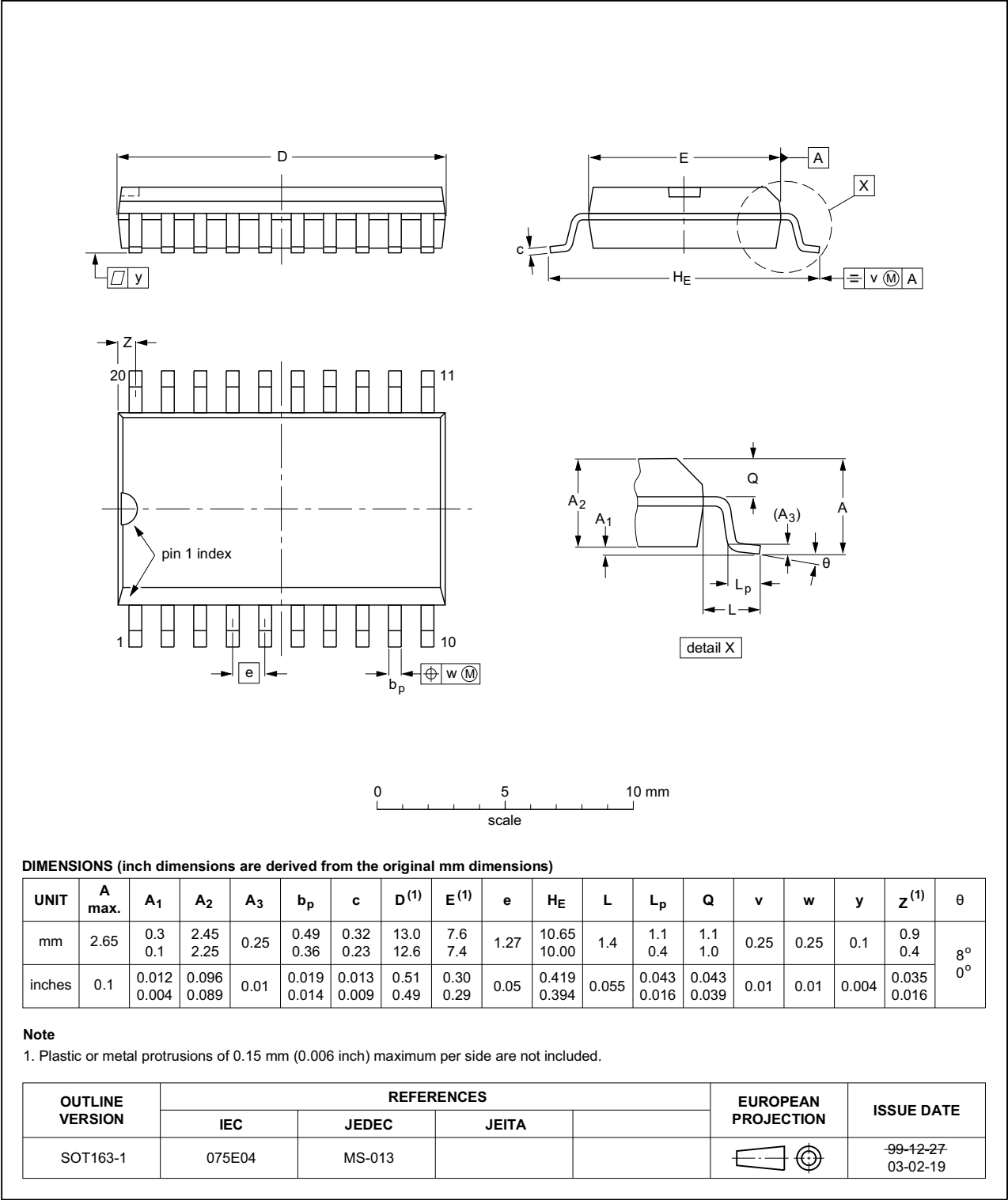


Fig 8. Package outline SOT163-1 (SO20)

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

SOT360-1

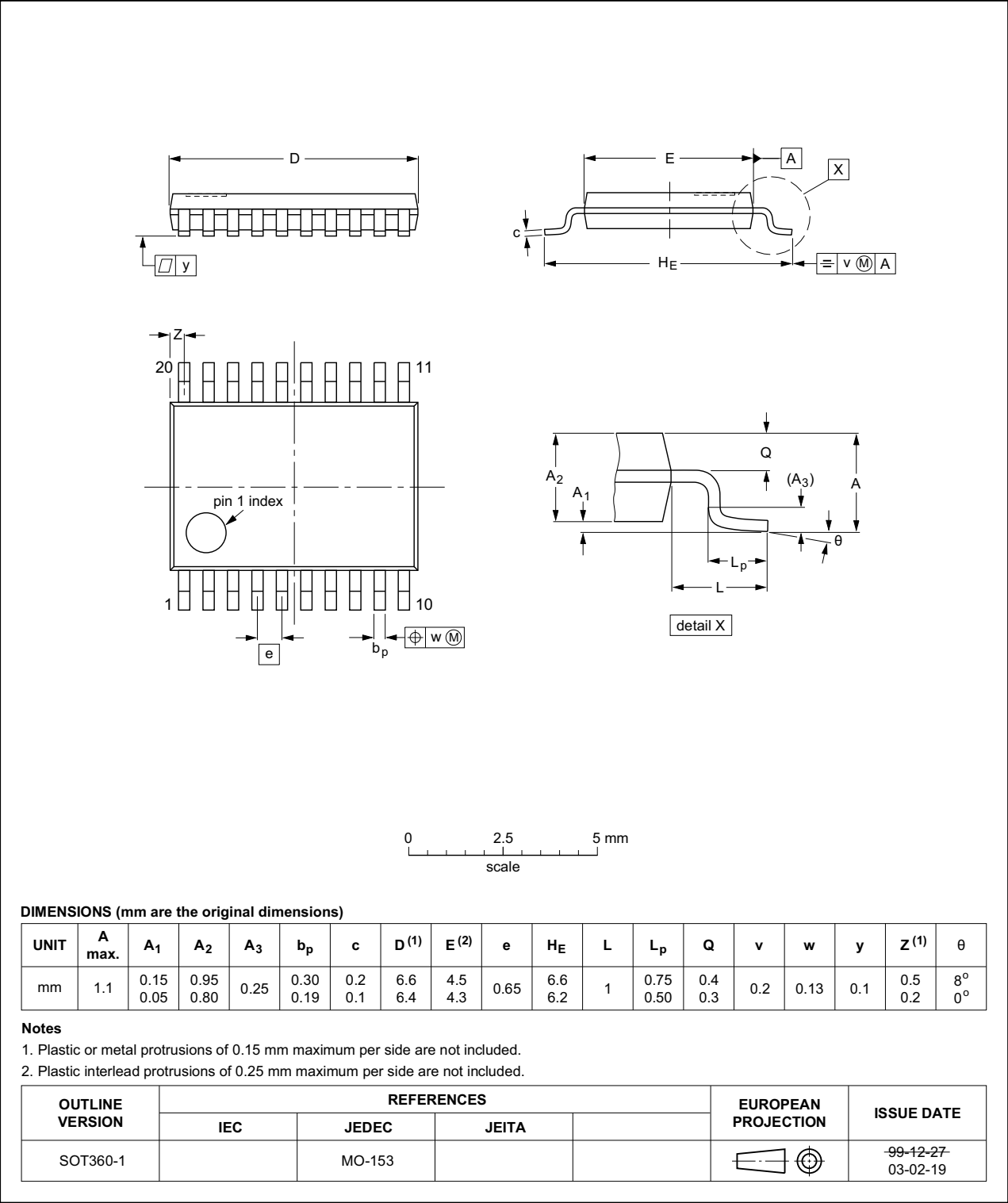


Fig 9. Package outline SOT360-1 (TSSOP20)

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

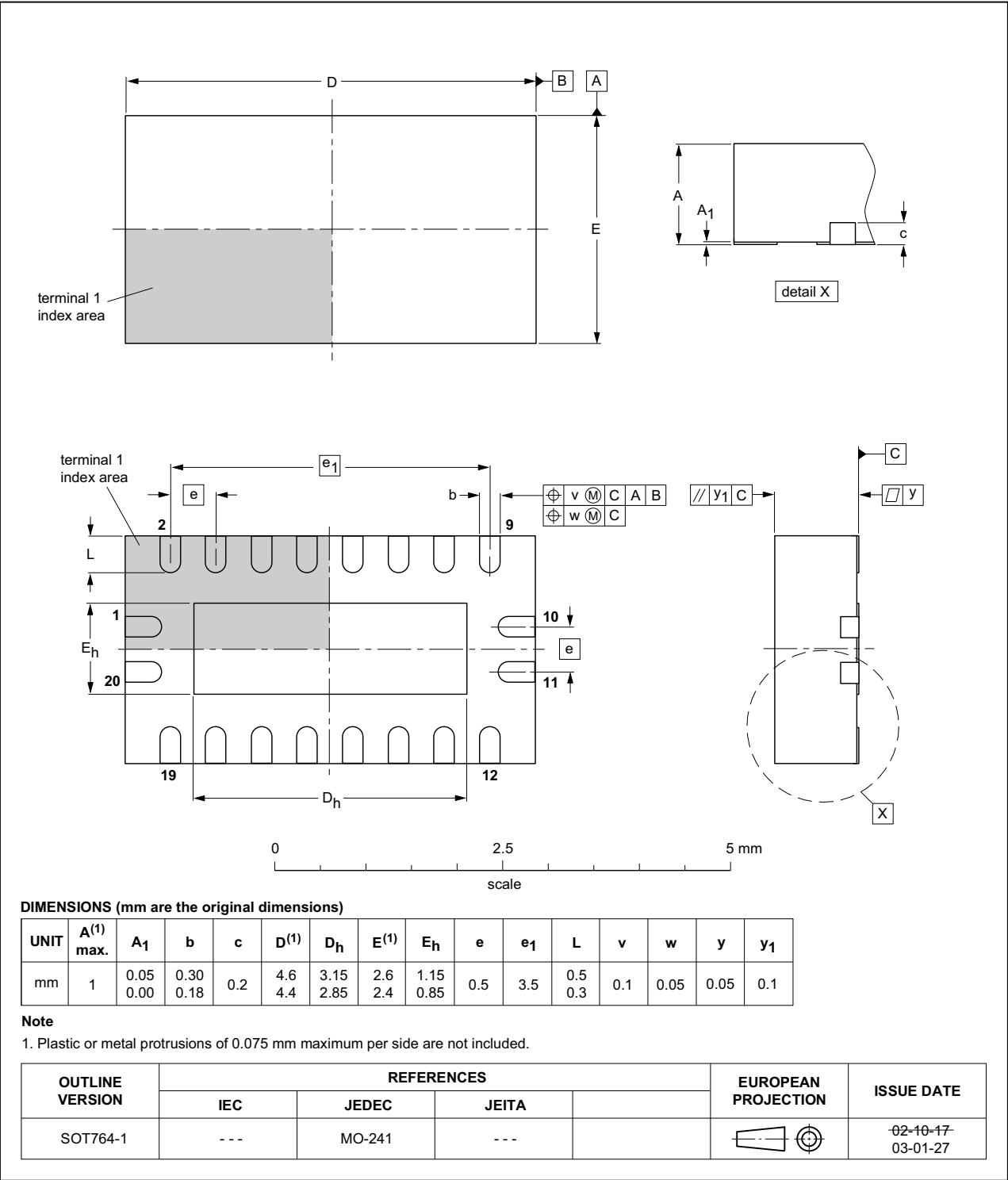


Fig 10. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charge 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

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC541 v.3	20140120	Product data sheet	-	74ALVC541 v.2
	- The format of this data sheet 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.			
74ALVC541 v.2	20071210	Product data sheet	-	74ALVC541 v.1
74ALVC541 v.1	20021115	Product specification	-	-

15. Legal information

15.1 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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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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