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Kind regards,

Team Nexperia

74AHC241; 74AHCT241

Octal buffer/line driver; 3-state

Rev. 01 — 11 January 2010

Product data sheet

1. General description

The 74AHC241 and 74AHCT241 are 8-bit buffer/line drivers with 3-state outputs. These devices can be used as two 4-bit buffers or one 8-bit buffer. They feature two output enables (1OE and 2OE), each controlling four of the 3-state outputs. A HIGH on 1OE or LOW on 2OE causes the associated outputs to assume a high-impedance OFF-state. Inputs are over voltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

2. Features

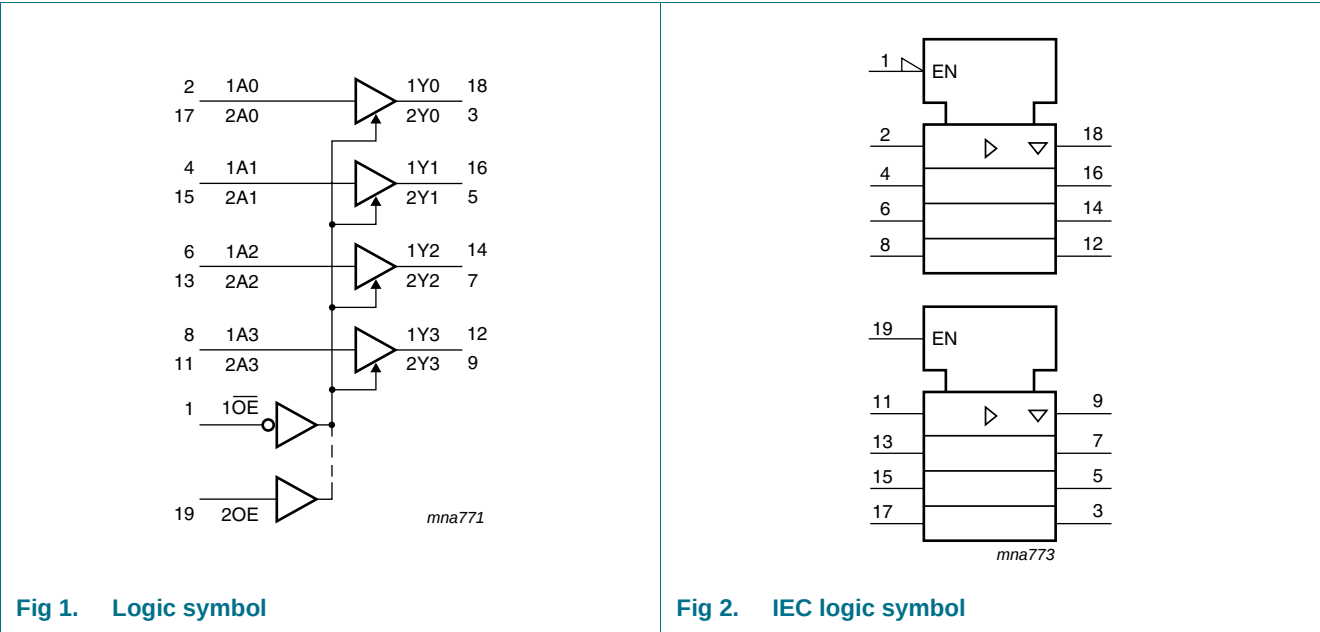
- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than V_{CC}
- For 74AHC241 only: operates with CMOS input levels
- For 74AHCT241 only: operates with TTL input levels
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ CDM JESD22-C101D exceeds 1000 V
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

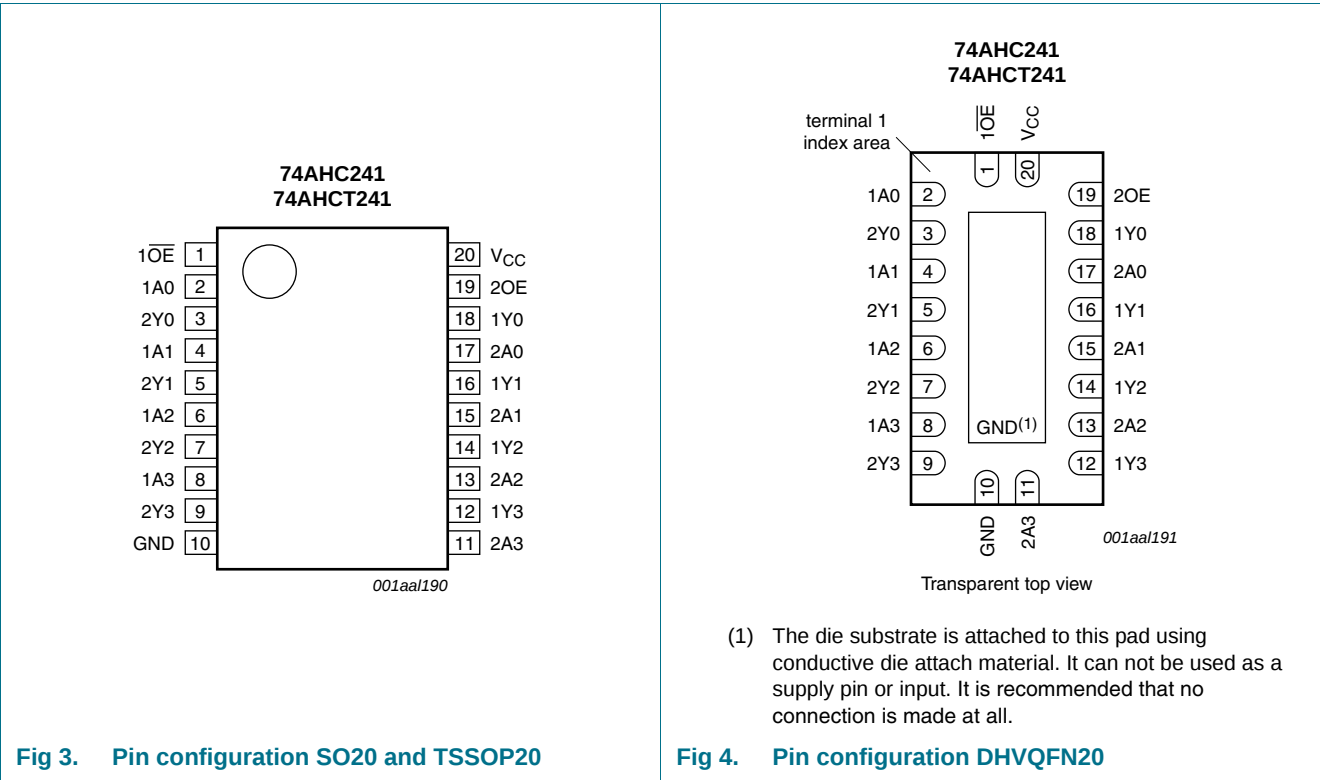
Type number	Package			
	Temperature range	Name	Description	Version
74AHC241D 74AHCT241D	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74AHC241PW 74AHCT241PW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74AHC241BQ 74AHCT241BQ	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body $2.5 \times 4.5 \times 0.85\text{ mm}$	SOT764-1

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table^[1]

Input		Output	Input		Output
$\overline{1OE}$	1An	1Yn	2OE	2An	2Yn
L	L	L	H	L	L
L	H	H	H	H	H
H	X	Z	L	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	+7.0	V
V _I	input voltage		-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	^[1] -20	-	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V	^[1] -	±20	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 V)	-	±25	mA
I _{CC}	supply current		-	75	mA
I _{GND}	ground current		-75	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C	^[2] -	500	mW

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

[2] For SO20 package: above 70 °C the value of P_{tot} derates linearly with 8.0 mW/K.
 For TSSOP20 package: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN20 package: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74AHC241						
V _{CC}	supply voltage		2.0	5.0	5.5	V
V _I	input voltage		0	-	5.5	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 3.3 V ± 0.3 V	-	-	100	ns/V
		V _{CC} = 5 V ± 0.5 V	-	-	20	ns/V
74AHCT241						
V _{CC}	supply voltage		4.5	5.0	5.5	V
V _I	input voltage		0	-	5.5	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 5 V ± 0.5 V	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC241										
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = −50 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = −50 μA; V _{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I _O = −50 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = −4.0 mA; V _{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I _O = −8.0 mA; V _{CC} = 4.5 V	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = 50 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I _O = 8.0 mA; V _{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V

Table 6. Static characteristics ...continued

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

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
I_I	input leakage current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	± 0.25	-	± 2.5	-	± 10.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	4.0	-	40	-	80	μA
C_I	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
C_O	output capacitance		-	4	-	-	-	-	-	pF
74AHCT241										
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V}$ to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
		$I_O = -50 \mu\text{A}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -8.0 \text{ mA}$	3.94	-	-	3.80	-	3.70	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
		$I_O = 50 \mu\text{A}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 8.0 \text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
I_I	input leakage current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	± 0.25	-	± 2.5	-	± 10.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	4.0	-	40	-	80	μA
ΔI_{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}$; other pins at V_{CC} or GND; $I_O = 0 \text{ A}$; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C_I	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
C_O	output capacitance		-	4	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C			–40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Max (125 °C)	
74AHC241									
t _{pd}	propagation delay	nAn to nYn; see Figure 5 ^[2]							
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	4.5	8.4	1.0	9.7	11.5	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	6.5	12.2	1.0	14.5	16.9	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.2	5.4	1.0	6.2	7.8	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	3.2	7.9	1.0	9.2	11.2	ns
t _{en}	enable time	1OE to 1Yn; see Figure 6 ^[2]							
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	8.9	10.4	1.0	12.2	14.0	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	5.5	14.8	1.0	17.8	19.6	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	6.1	6.6	1.0	7.6	9.1	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	3.9	9.4	1.0	11.0	12.2	ns
		2OE to 2Yn; see Figure 7 ^[2]							
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	6.5	10.4	1.0	12.2	14.0	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	5.6	14.8	1.0	17.8	19.6	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.2	6.6	1.0	7.6	9.1	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	4.0	9.4	1.0	11.0	12.2	ns
t _{dis}	disable time	1OE to 1Yn; see Figure 6 ^[2]							
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	5.1	10.2	1.0	11.8	13.3	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	7.2	14.4	1.0	15.8	19.2	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.6	7.3	1.0	8.2	9.2	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.1	9.9	1.0	10.8	13.0	ns
		2OE to 2Yn; see Figure 7 ^[2]							
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	5.0	10.2	1.0	11.8	13.3	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	7.1	14.4	1.0	15.8	19.2	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.6	7.3	1.0	8.2	9.2	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.1	9.9	1.0	10.8	13.0	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; C _L = 50 pF; f _i = 1 MHz ^[3]	-	9	-	-	-	-	pF
74AHCT241									
t _{pd}	propagation delay	nAn to nYn; see Figure 5 ^[2]							
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.5	5.7	1.0	6.5	7.9	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.1	7.9	1.0	9.2	11.2	ns

Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{en}	enable time	1OE to 1Yn; see Figure 6 ^[2]							
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 15 \text{ pF}$	-	3.7	6.6	1.0	7.8	9.2	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 50 \text{ pF}$	-	5.4	9.5	1.0	11.1	12.4	ns
		2OE to 2Yn; see Figure 7 ^[2]							
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 15 \text{ pF}$	-	3.7	6.6	1.0	7.8	9.2	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 50 \text{ pF}$	-	5.4	9.5	1.0	11.1	12.4	ns
t_{dis}	disable time	1OE to 1Yn; see Figure 6 ^[2]							
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 15 \text{ pF}$	-	4.8	7.8	1.0	8.8	9.7	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 50 \text{ pF}$	-	7.1	10.5	1.0	11.4	13.5	ns
		2OE to 2Yn; see Figure 7 ^[2]							
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 15 \text{ pF}$	-	4.8	7.8	1.0	8.8	9.7	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; C_L = 50 \text{ pF}$	-	7.1	10.5	1.0	11.4	13.5	ns
C_{PD}	power dissipation capacitance	$V_I = \text{GND to } V_{CC}; C_L = 50 \text{ pF}; f_i = 1 \text{ MHz}$ ^[3]	-	9	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3 \text{ V}$ and $V_{CC} = 5.0 \text{ V}$).

[2] t_{pd} is the same as t_{PLH} and t_{PHL} ; t_{en} is the same as t_{PZH} and t_{PZL} ; 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;

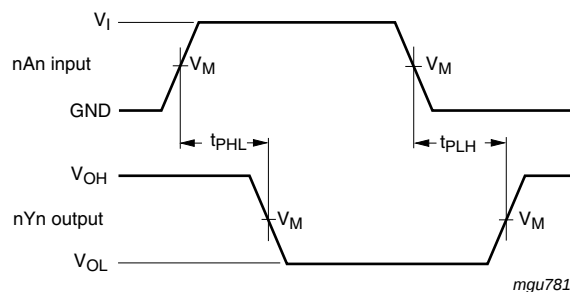
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

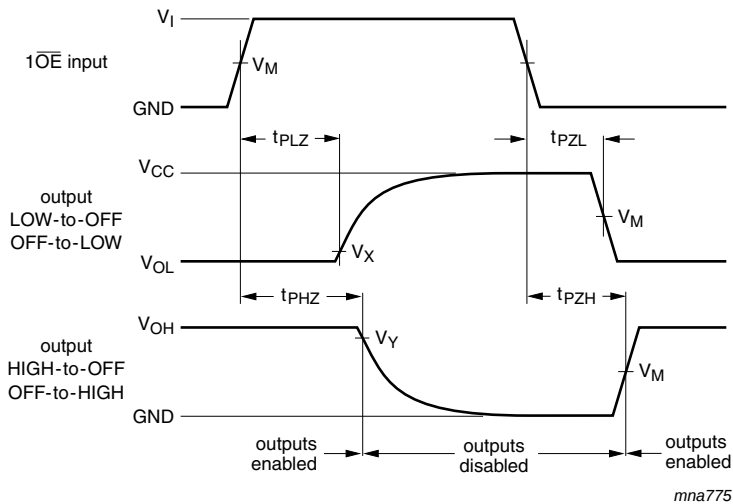
11. Waveforms



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

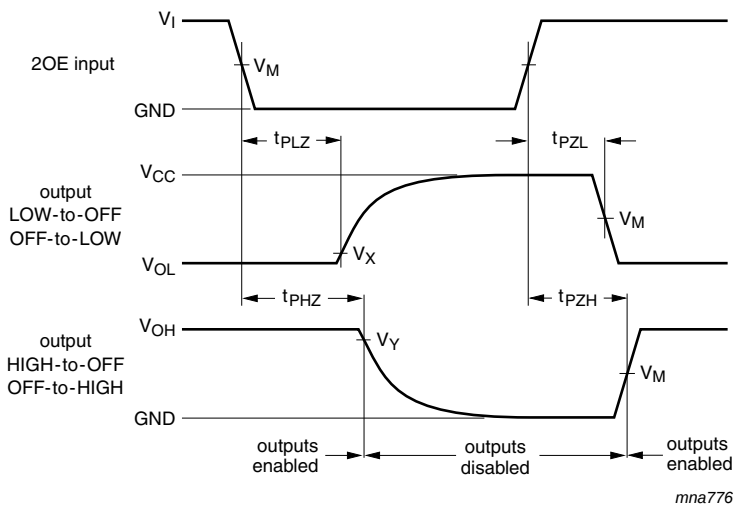
V_{OL} and V_{OH} are typical voltage output drop that occur with the output load.

Fig 5. Propagation delay input (nAn) to output (nYn)



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 for input 1OE



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

Fig 7. Enable and disable times for input 2OE

Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74AHC241	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$
74AHCT241	1.5 V	$0.5V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

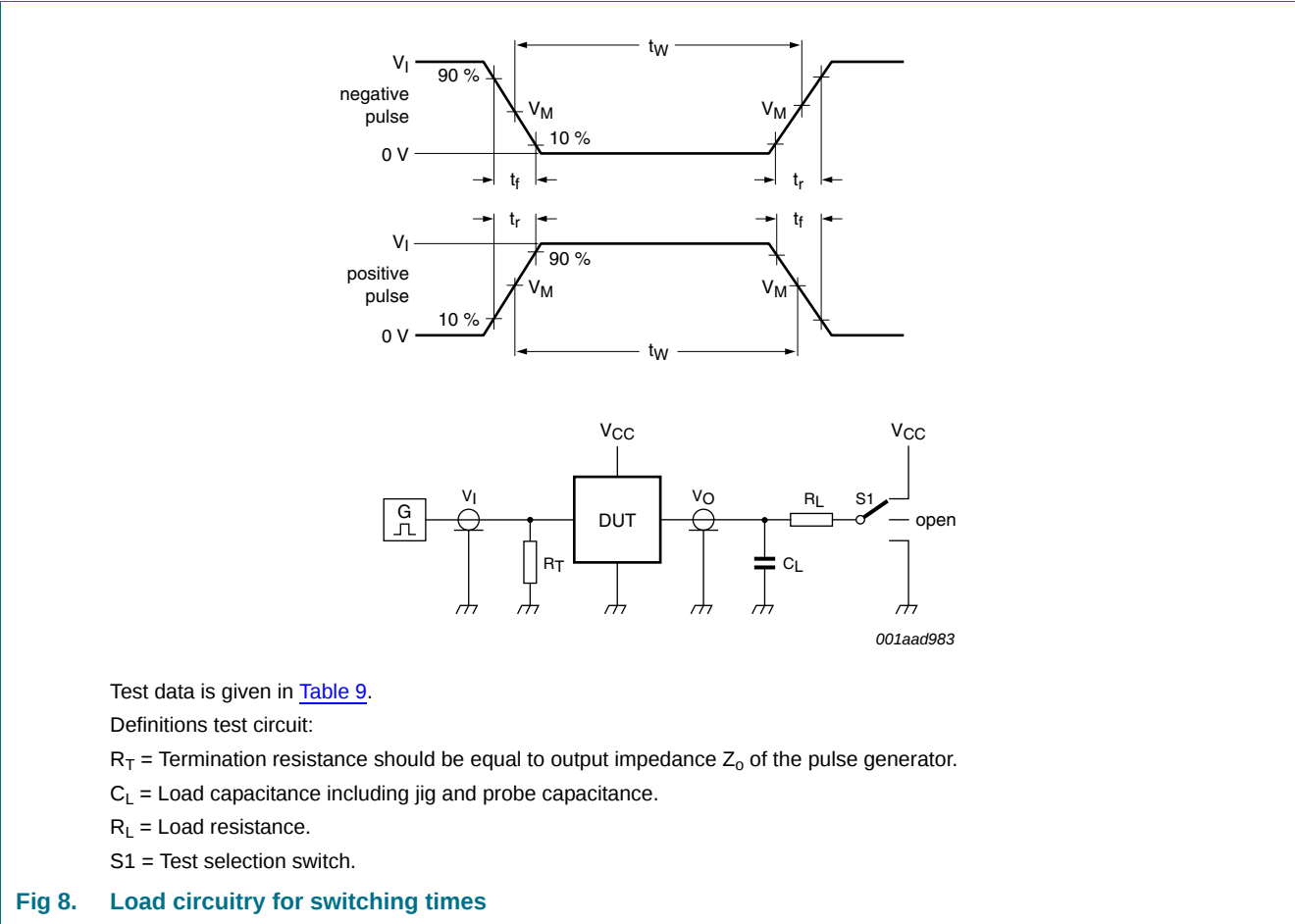


Fig 8. Load circuitry for switching times

Table 9. Test data

Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74AHC241	V_{CC}	3.0 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74AHCT241	3.0 V	3.0 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

12. Package outline

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

SOT163-1

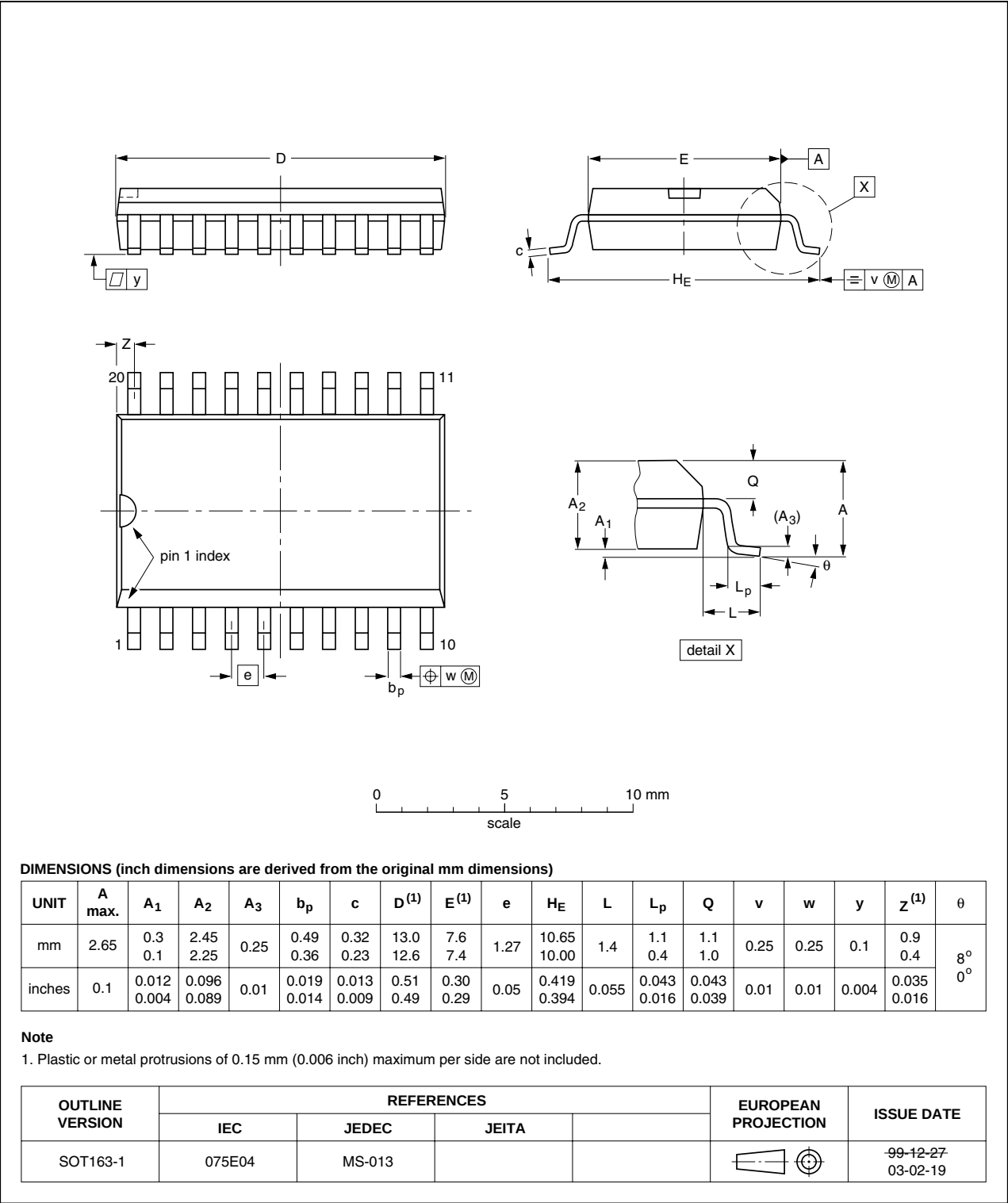


Fig 9. Package outline SOT163-1 (SO20)

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

SOT360-1

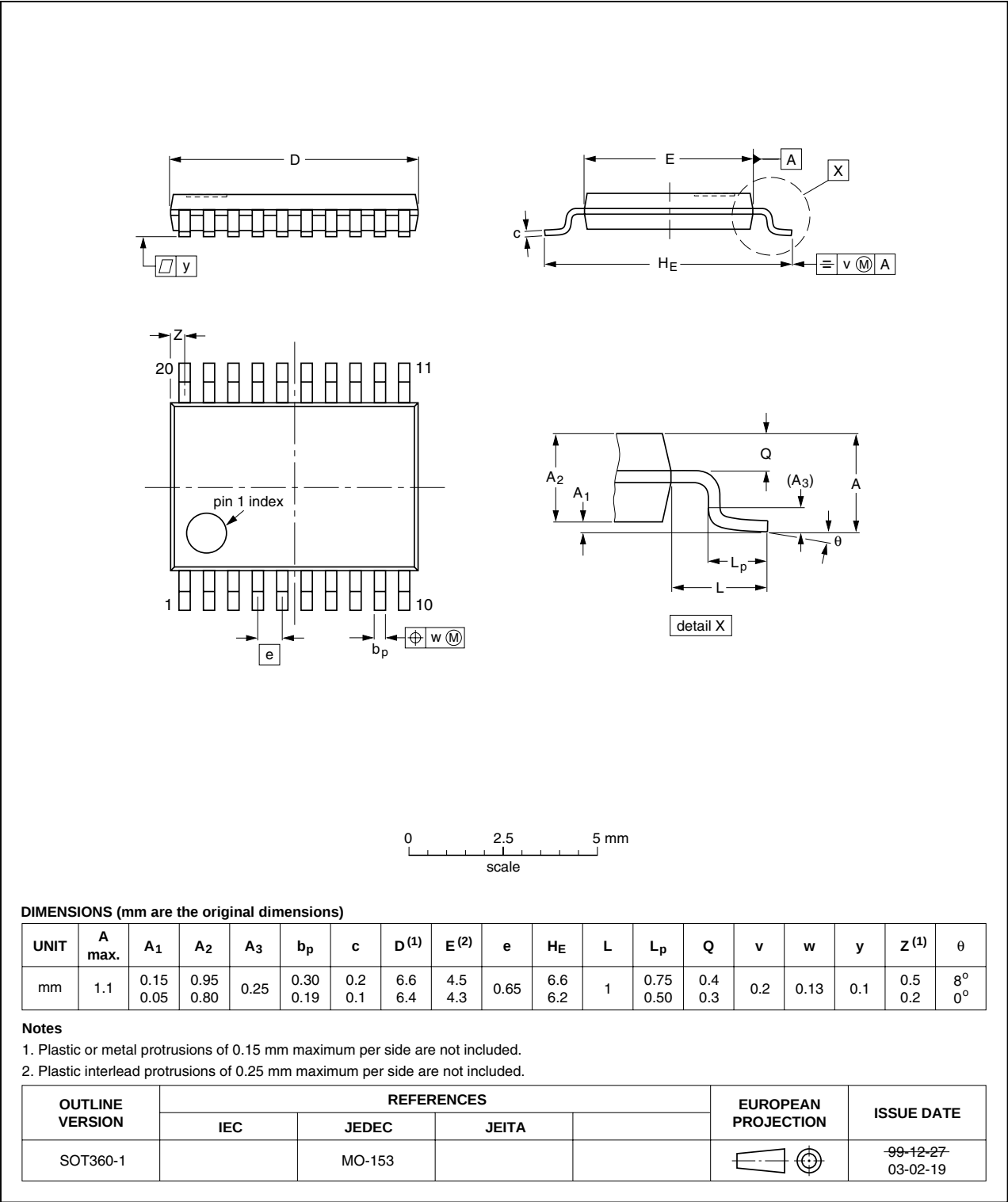


Fig 10. Package outline SOT360-1 (TSSOP20)

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

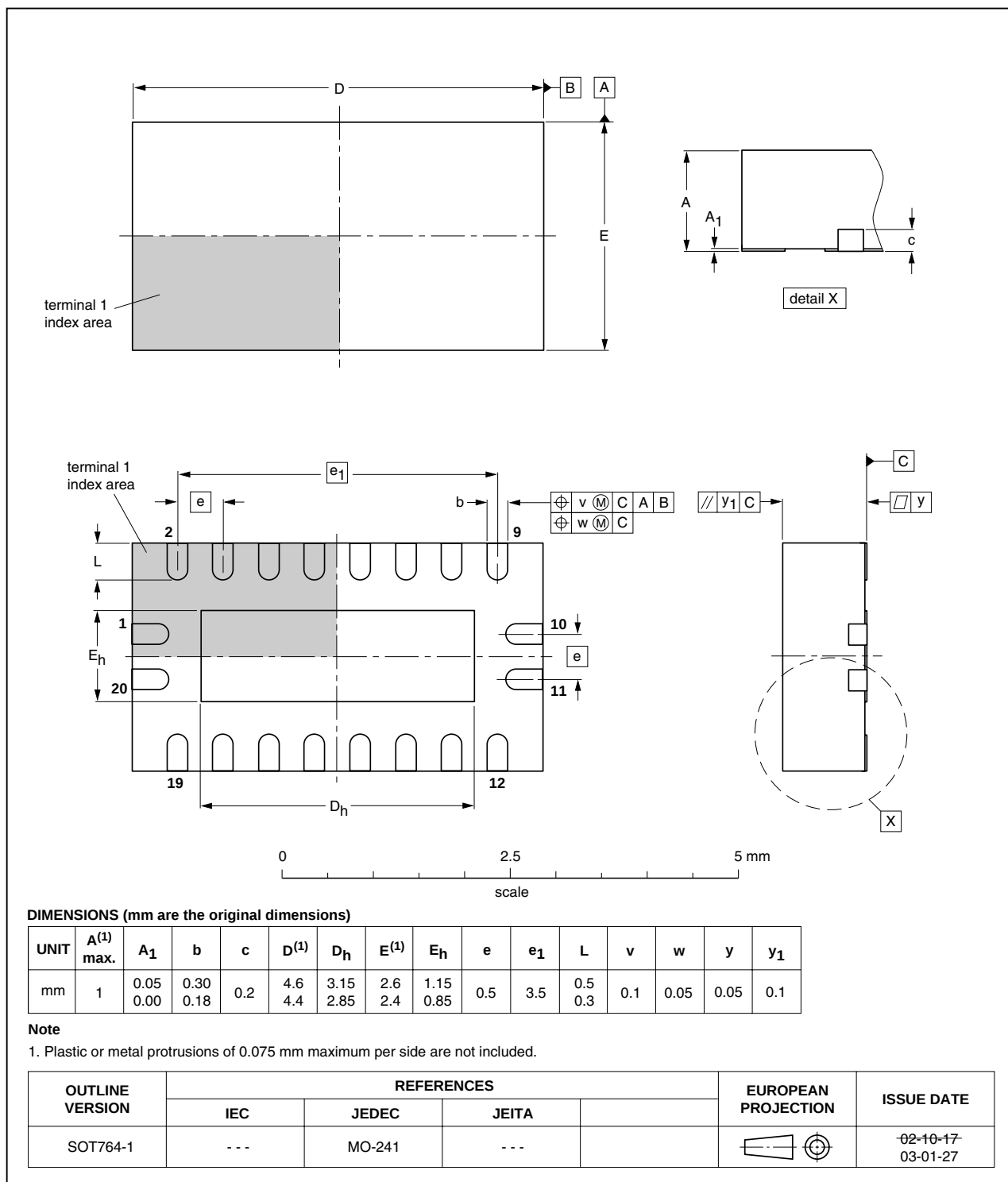


Fig 11. Package outline SOT764-1 (DHVQFN20)

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
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT241_1	20100111	Product data sheet	-	-

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.
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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