

74ALVC374

Octal D-type flip-flop; positive-edge trigger; 3-state

Rev. 4 — 10 July 2023

Product data sheet

1. General description

The 74ALVC374 is an octal positive-edge triggered D-type flip-flop with 3-state outputs. The device features a clock (CP) and output enable (\overline{OE}) inputs. The flip-flops will store the state of their individual D-inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A HIGH on \overline{OE} causes the outputs to assume a high-impedance OFF-state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Schmitt trigger action on all inputs makes the device tolerant of slow 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

- Wide supply voltage range from 1.65 V to 3.6 V
- CMOS low power dissipation
- Overvoltage tolerant inputs to 3.6 V
- Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD78 Class II.A
- Complies with JEDEC standards:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74ALVC374D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74ALVC374PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74ALVC374BQ	-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

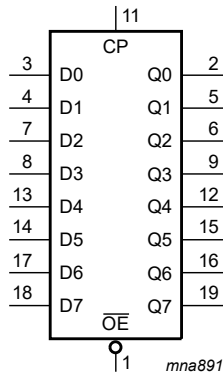


Fig. 1. Logic symbol

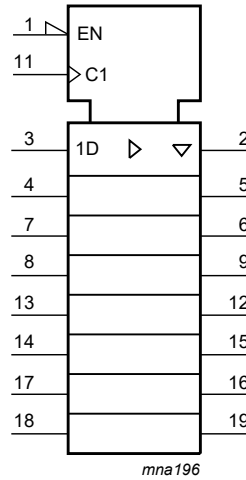


Fig. 2. IEC logic symbol

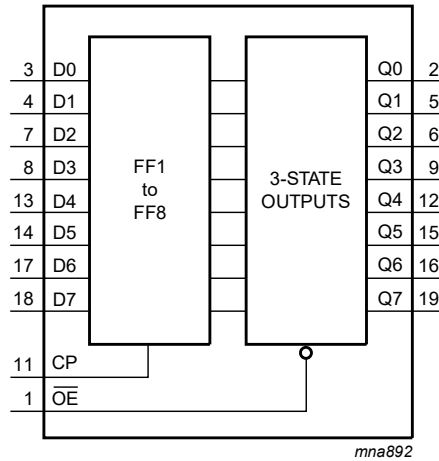


Fig. 3. Functional diagram

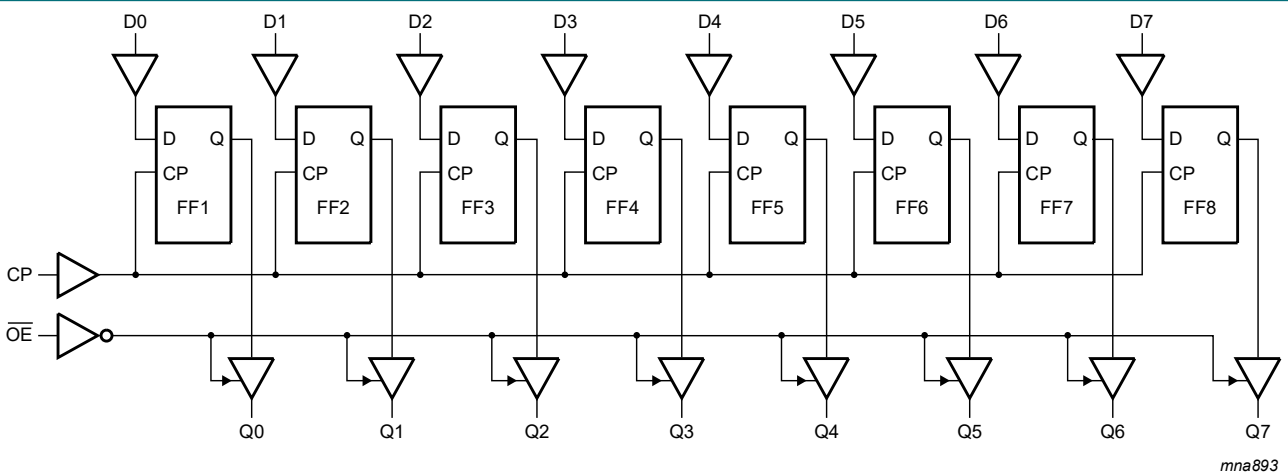
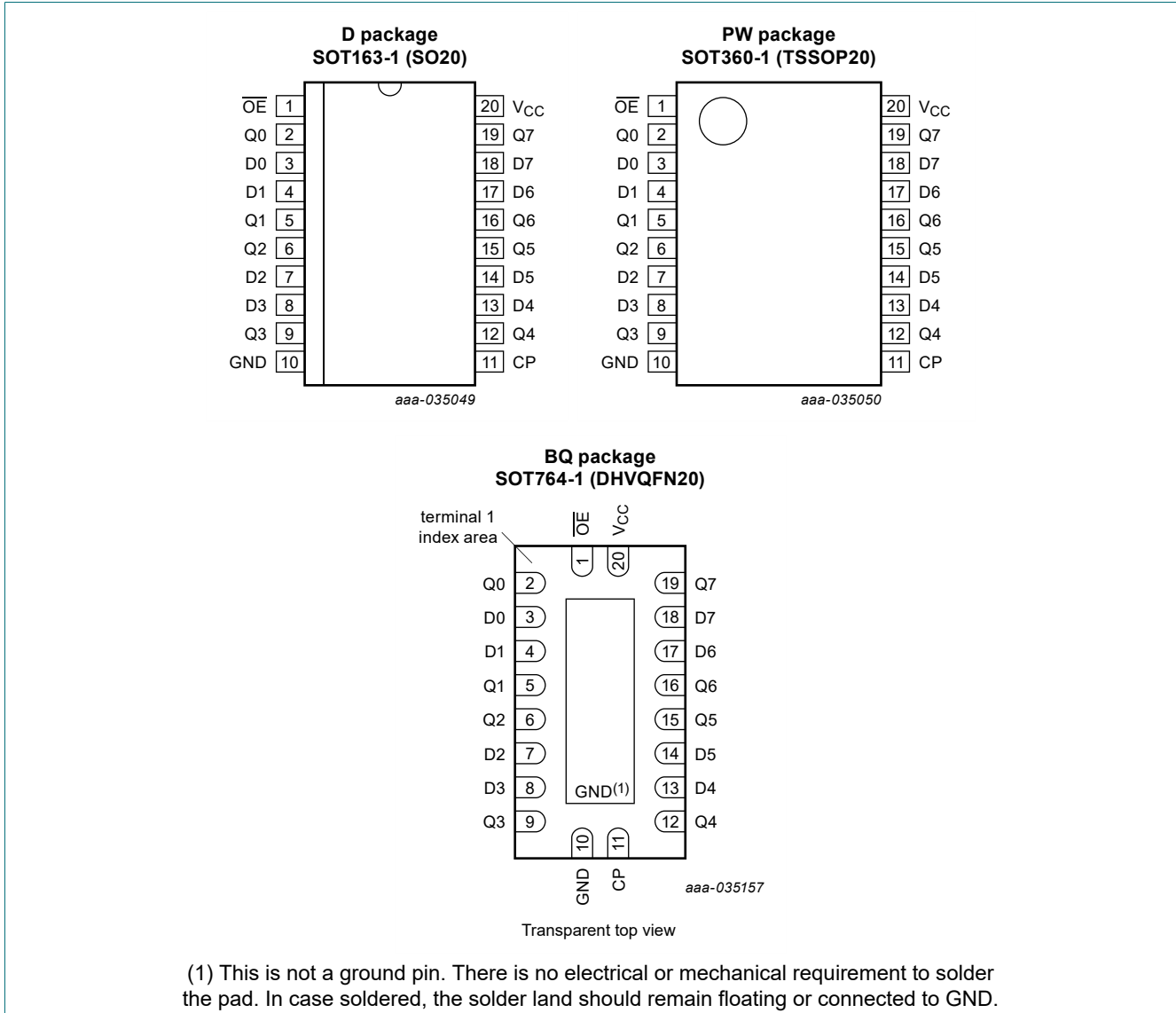


Fig. 4. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data input
CP	11	clock input (LOW to HIGH, edge-triggered)
\overline{OE}	1	output enable input (active LOW)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	2, 5, 6, 9, 12, 15, 16, 19	3-state flip-flop output
V _{CC}	20	supply voltage
GND	10	ground (0 V)

6. Functional description

Table 3. Function table

*H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW to HIGH CP transition;
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW to HIGH CP transition;
Z = high-impedance OFF-state; ↑ = LOW to HIGH clock transition.*

Operating mode	Input			Internal flip-flop	Output
	OE	CP	Dn		Qn
Load and read register	L	↑	l	L	L
	L	↑	h	H	H
Load register and disable outputs	H	↑	l	L	Z
	H	↑	h	H	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	+4.6	V
V_I	input voltage	[1]	-0.5	+4.6	V
V_O	output voltage	output HIGH or LOW state [1]	-0.5	$V_{CC} + 0.5$	V
		output 3-state	-0.5	+4.6	V
		power-down mode; $V_{CC} = 0$ V	-0.5	+4.6	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	± 50	mA
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 +125 °C [2]	-	500	mW

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

[2] 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	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	in free air	-40	+125	°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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	1.7	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	-	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	$V_{CC} - 0.2$	-	-	$V_{CC} - 0.2$	-	V
		$I_O = -6$ mA; $V_{CC} = 1.65$ V	1.25	1.51	-	1.25	-	V
		$I_O = -12$ mA; $V_{CC} = 2.3$ V	1.8	2.10	-	1.8	-	V
		$I_O = -18$ mA; $V_{CC} = 2.3$ V	1.7	2.01	-	1.7	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	2.53	-	2.2	-	V
		$I_O = -18$ mA; $V_{CC} = 3.0$ V	2.4	2.76	-	2.4	-	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	-	0.2	V
		$I_O = 6$ mA; $V_{CC} = 1.65$ V	-	0.11	0.3	-	0.3	V
		$I_O = 12$ mA; $V_{CC} = 2.3$ V	-	0.17	0.4	-	0.4	V
		$I_O = 18$ mA; $V_{CC} = 2.3$ V	-	0.25	0.6	-	0.6	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	0.16	0.4	-	0.4	V
		$I_O = 18$ mA; $V_{CC} = 3.0$ V	-	0.23	0.4	-	0.45	V
I_I	input leakage current	$V_{CC} = 3.6$ V; $V_I = 3.6$ V or GND	-	± 0.1	± 5	-	± 20	μ A

Octal D-type flip-flop; positive-edge trigger; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _{CC} = 1.65 V to 3.6 V; V _O = 3.6 V or GND	-	±0.1	±10	-	±80	μA
I _{OFF}	power-off leakage supply	V _{CC} = 0 V; V _I or V _O = 0 V to 3.6 V	-	±0.1	±10	-	±80	μA
I _{CC}	supply current	V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	0.2	10	-	80	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	-	750	μA
C _I	input capacitance		-	3.5	-	-	-	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. 8.

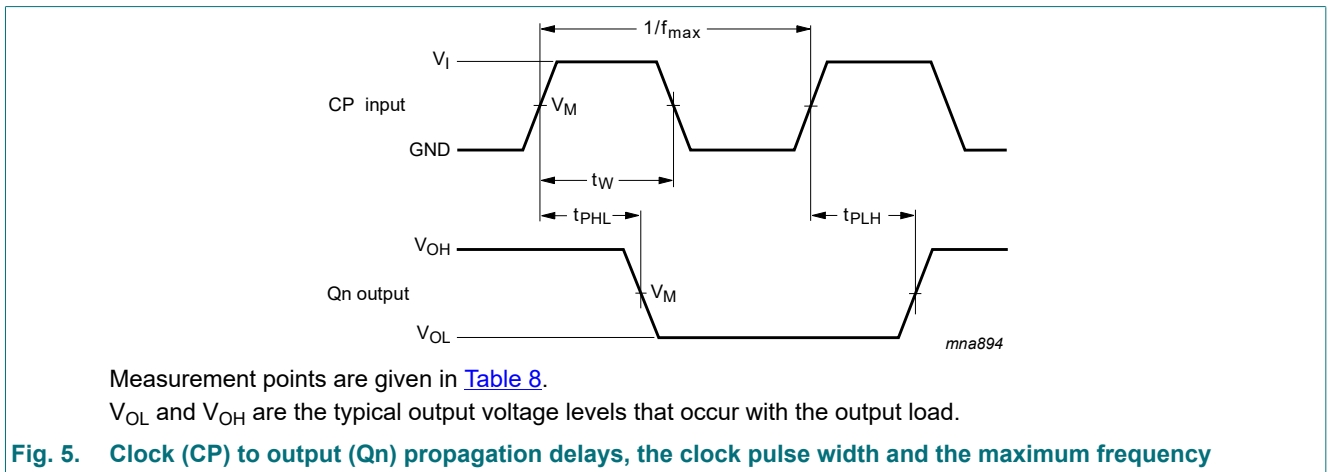
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	CP to Qn; see Fig. 5 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.1	6.4	1.0	7.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.3	3.9	1.0	4.5	ns
		V _{CC} = 2.7 V	1.0	2.5	3.6	1.0	4.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.5	3.6	1.0	4.1	ns
t _{en}	enable time	OE to Qn; see Fig. 6 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.2	6.4	1.0	7.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.6	4.5	1.0	5.2	ns
		V _{CC} = 2.7 V	1.0	3.2	4.6	1.0	5.3	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.4	4.0	1.0	4.6	ns
t _{dis}	disable time	OE to Qn; see Fig. 6 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.5	3.6	7.0	1.5	8.1	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.3	4.4	1.0	5.1	ns
		V _{CC} = 2.7 V	1.5	2.9	4.4	1.5	5.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.8	4.4	1.0	5.1	ns
t _W	pulse width	CP; HIGH or LOW; see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	3.8	1.1	-	3.8	-	ns
		V _{CC} = 2.3 V to 2.7 V	3.3	0.9	-	3.3	-	ns
		V _{CC} = 2.7 V	3.3	0.8	-	3.3	-	ns
		V _{CC} = 3.0 V to 3.6 V	3.3	1.2	-	3.3	-	ns
t _{su}	set-up time	Dn to CP; see Fig. 7						
		V _{CC} = 1.65 V to 1.95 V	0.8	-0.1	-	0.8	-	ns
		V _{CC} = 2.3 V to 2.7 V	0.8	0.1	-	0.8	-	ns
		V _{CC} = 2.7 V	0.8	0.3	-	0.8	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.8	0.0	-	0.8	-	ns

Octal D-type flip-flop; positive-edge trigger; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _h	hold time	Dn to CP; see Fig. 7						
		V _{CC} = 1.65 V to 1.95 V	0.8	-0.1	-	0.8	-	ns
		V _{CC} = 2.3 V to 2.7 V	0.8	0.1	-	0.8	-	ns
		V _{CC} = 2.7 V	0.8	0.4	-	0.8	-	ns
f _{max}	maximum frequency	see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	50	100	-	50	-	MHz
		V _{CC} = 2.3 V to 2.7 V	100	200	-	100	-	MHz
		V _{CC} = 2.7 V	100	200	-	100	-	MHz
C _{PD}	power dissipation capacitance	per flip-flop; V _I = GND to V _{CC} ; V _{CC} = 3.3 V [3]						
		outputs HIGH or LOW state	-	21	-	-	-	pF
		outputs 3-state	-	13	-	-	-	pF

- [1] Typical values are measured at T_{amb} = 25 °C
- [2] t_{pd} is the same as t_{PHL} and t_{PLH}.
t_{en} is the same as t_{PZH} and t_{PZL}.
t_{dis} is the same as t_{PHZ} and t_{PLZ}.
- [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;
 Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

10.1. Waveforms and test circuit



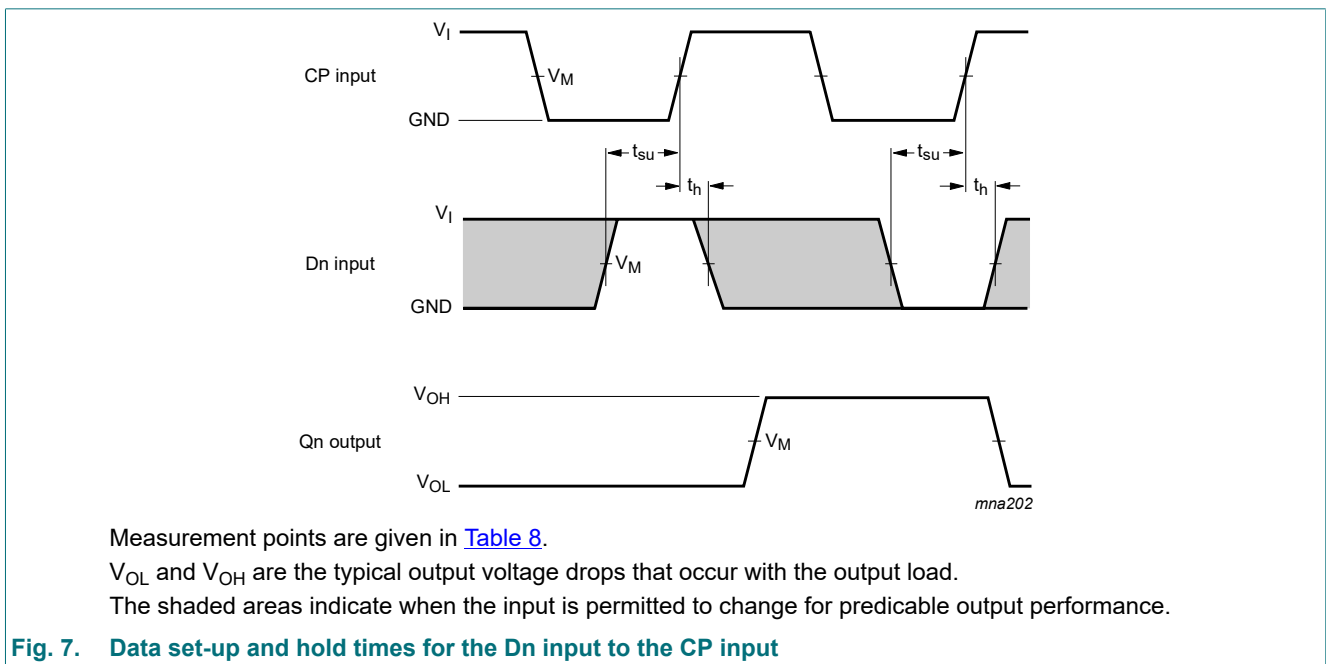
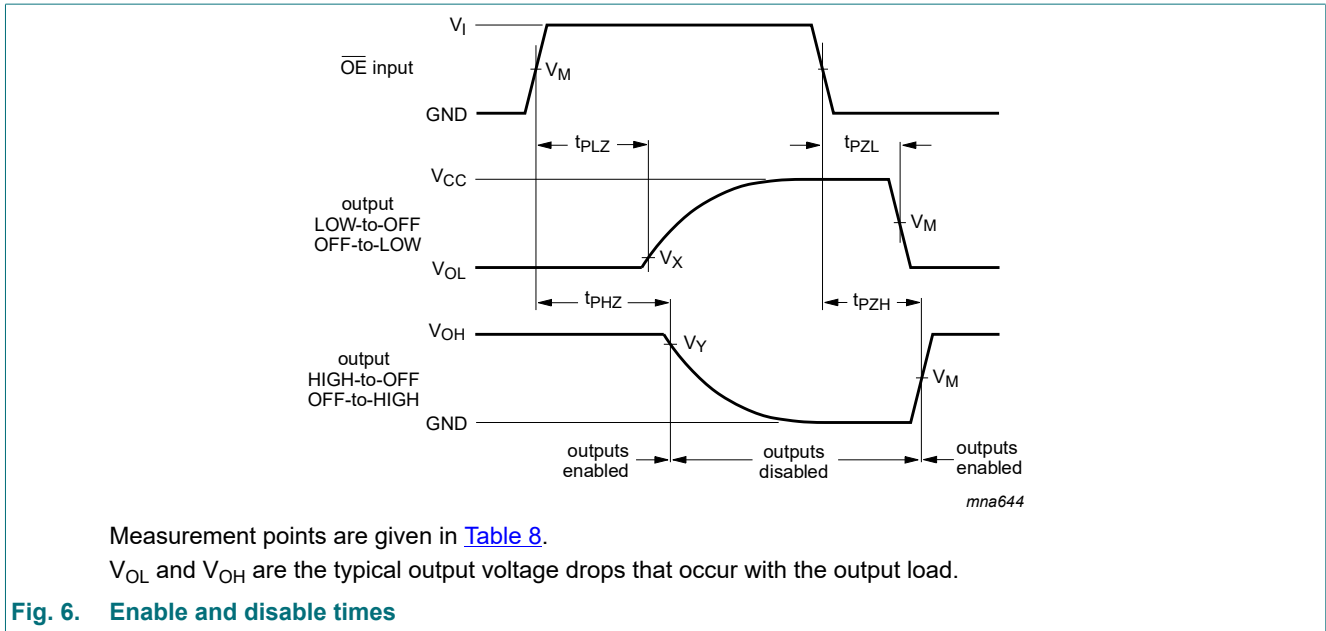
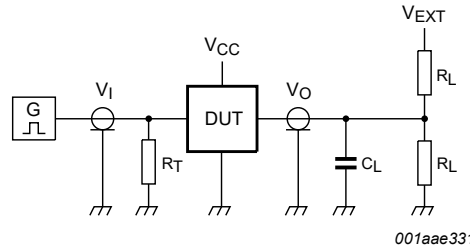
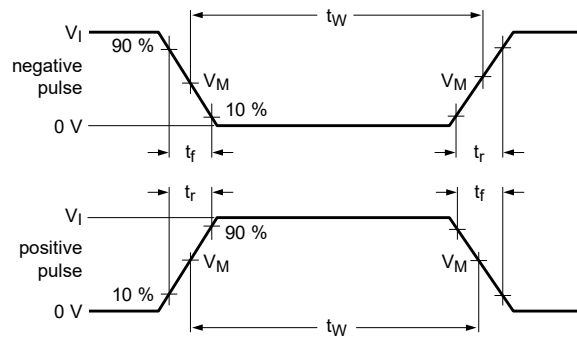


Table 8. Measurement points

Supply voltage	Input	Output		
V_{CC}	V_M	V_M	V_x	V_y
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



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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. 8. 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 V	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	6 V	GND

11. Package outline

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

SOT163-1

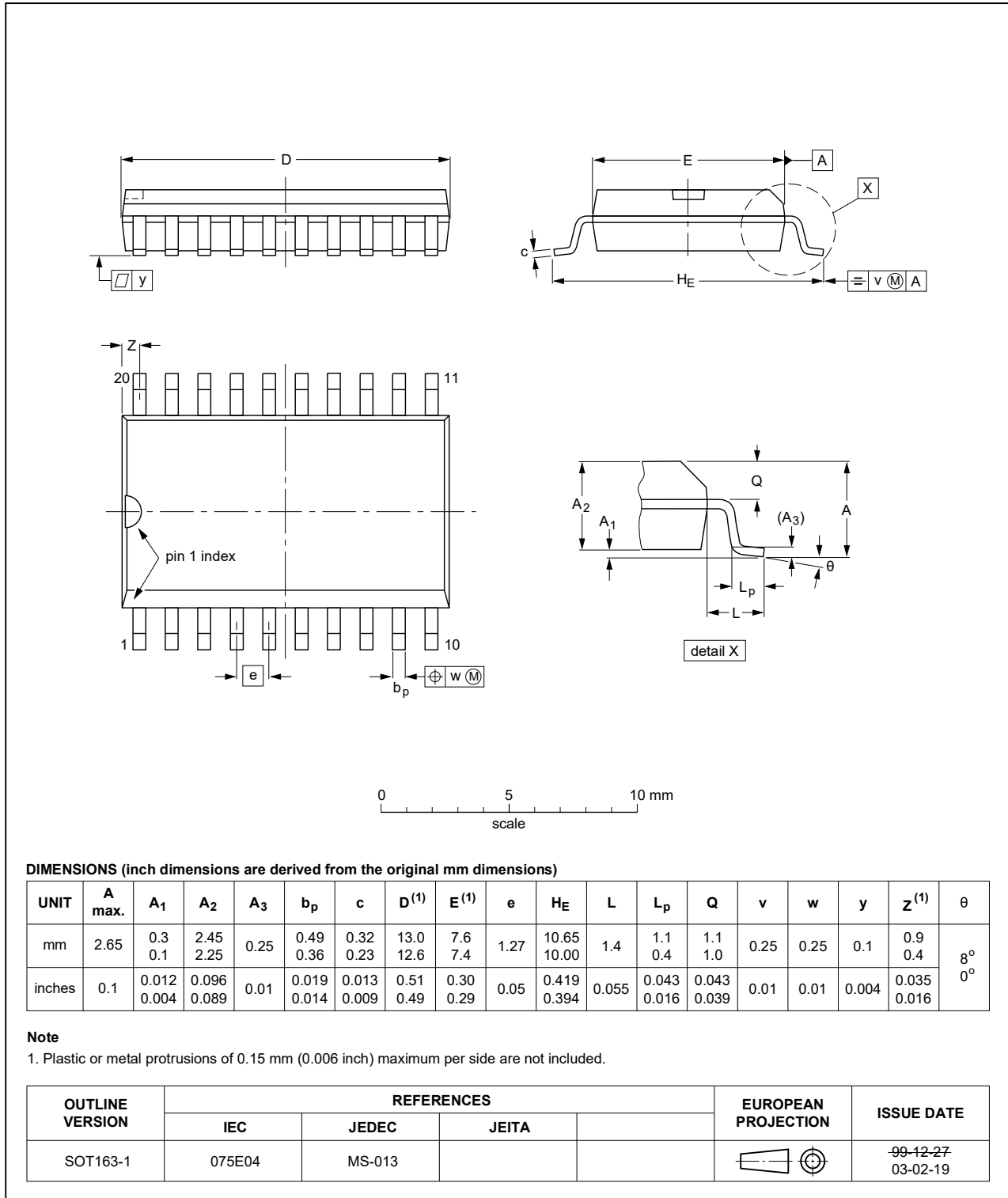


Fig. 9. Package outline SOT163-1 (SO20)

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

SOT360-1

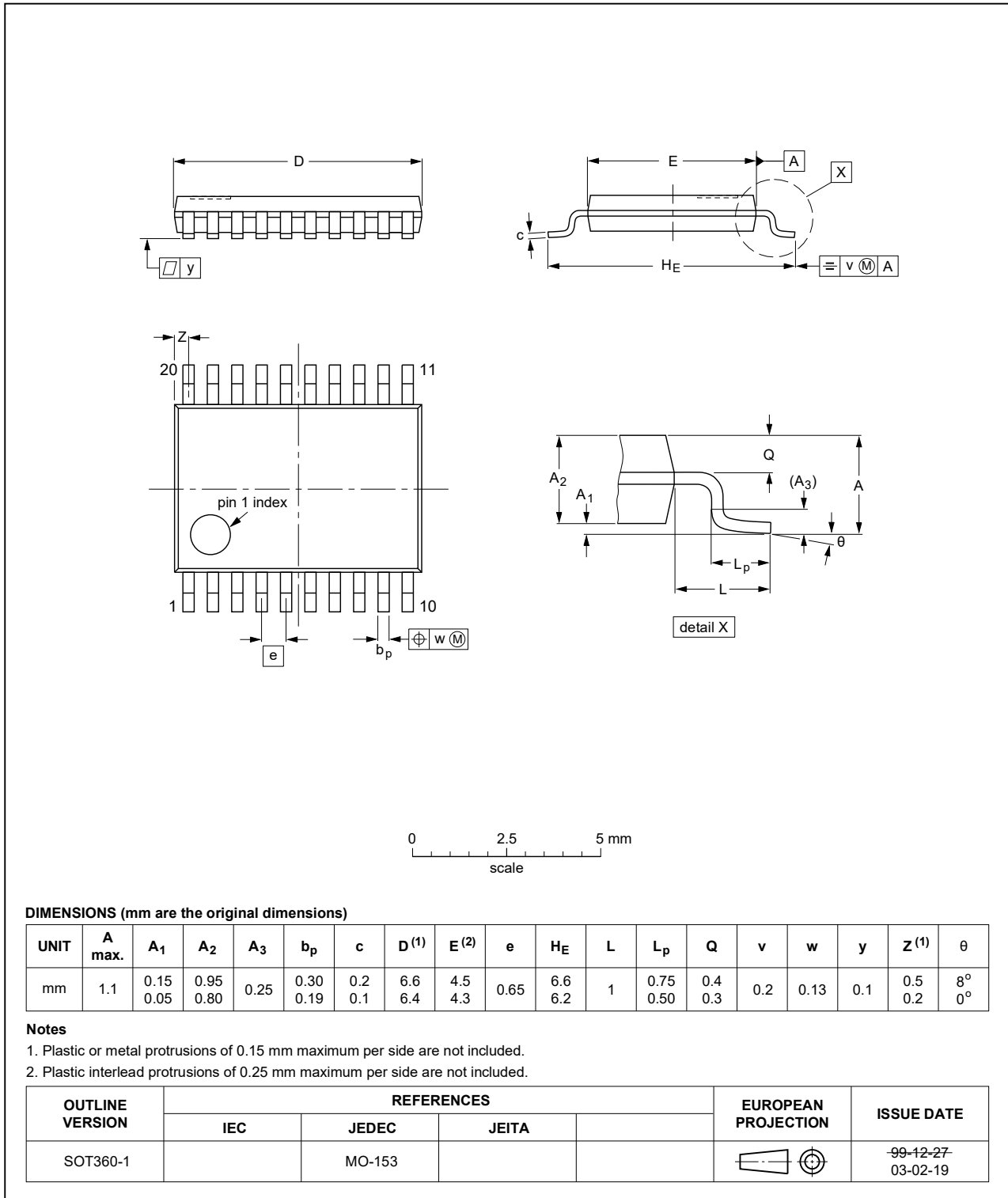


Fig. 10. Package outline SOT360-1 (TSSOP20)

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

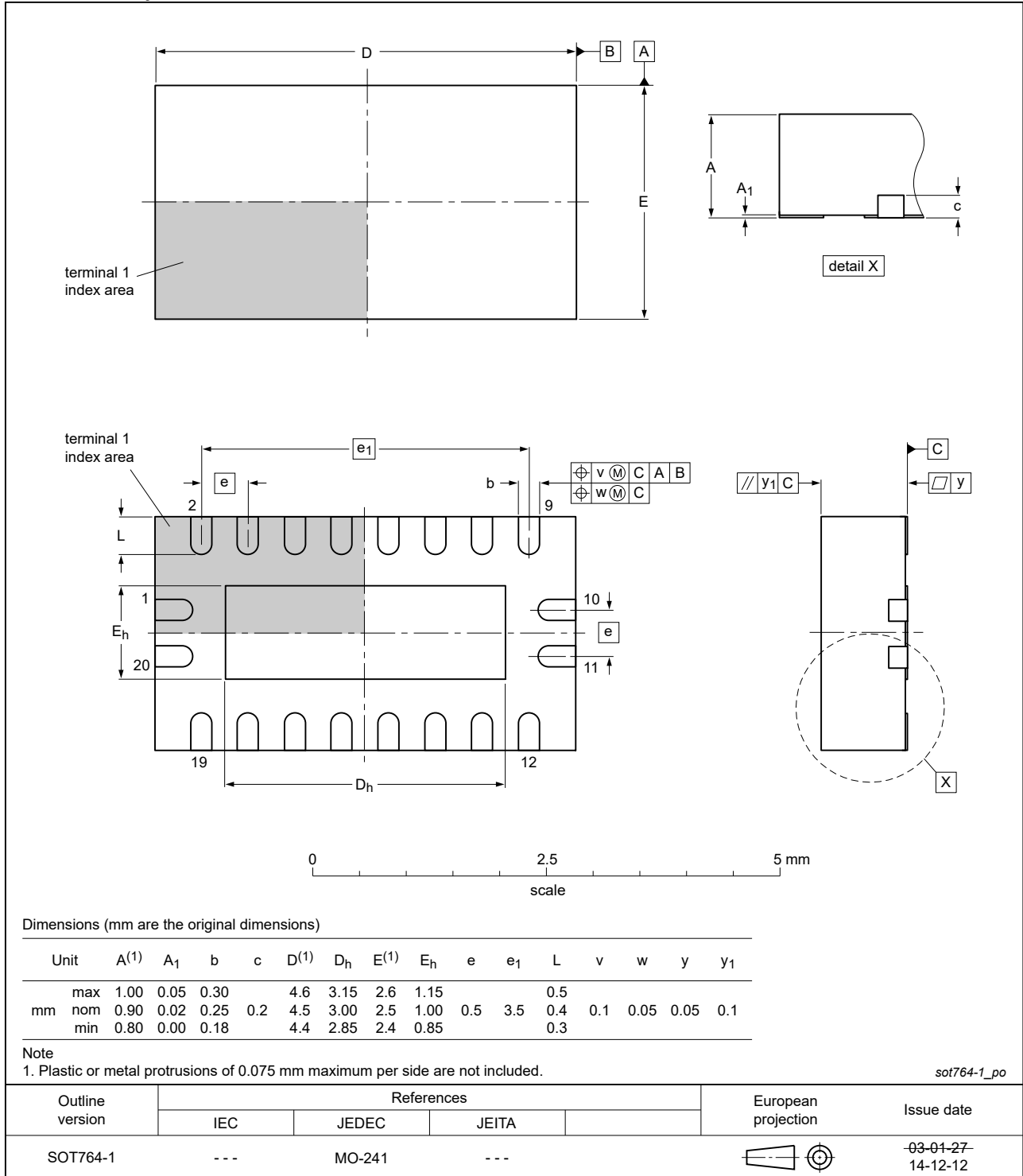


Fig. 11. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
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
74ALVC374 v.4	20230710	Product data sheet	-	74ALVC374 v.3
Modifications:	<ul style="list-style-type: none"> Specifications for -40 °C to +125 °C added. Section 1 updated. Section 2: updated; ESD specification updated according to the latest JEDEC standard. 			
74ALVC374 v.3	20210430	Product data sheet	-	74ALVC374 v.2
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. Section 1 updated. Section 2: Reference to JESD36 removed. Section 7: Derating values for P_{tot} total power dissipation removed (errata). Package outline drawing SOT764-1 (DHVQFN20) updated. 			
74ALVC374 v.2	20071017	Product data sheet	-	74ALVC374 v.1
Modifications:	<ul style="list-style-type: none"> 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. Section 3: DHVQFN20 package added. Section 7: derating values added for DHVQFN20 package. Section 11: outline drawing added for DHVQFN20 package. 			
74ALVC374 v.1	20020227	Product specification	-	-

Octal D-type flip-flop; positive-edge trigger; 3-state

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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