

74LVC374A-Q100

Octal D-type flip-flop; 5 V tolerant inputs/outputs;
positive-edge trigger; 3-state

Rev. 2 — 24 August 2020

Product data sheet

1. General description

The 74LVC374A-Q100 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. 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 1.2 V to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- CMOS low power dissipation
- Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- 8-bit positive edge-triggered register
- Independent register and 3-state buffer 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:
 - 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 Ω)
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC374AD-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC374APW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC374ABQ-Q100	-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

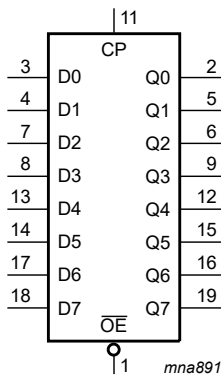


Fig. 1. Logic symbol

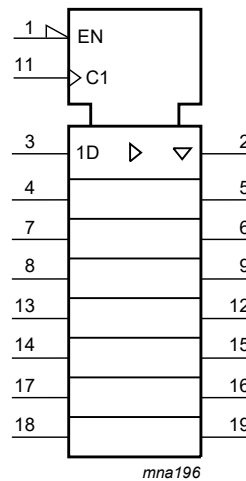


Fig. 2. IEC logic symbol

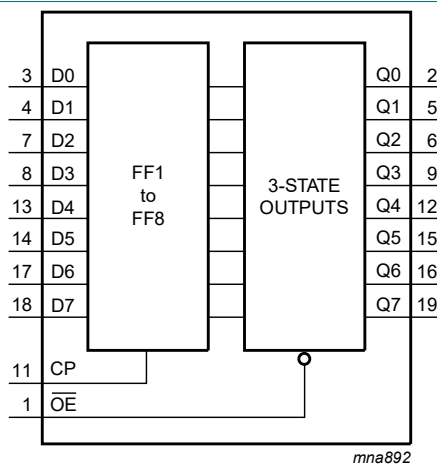


Fig. 3. Functional diagram

Octal D-type flip-flop; 5 V tolerant inputs/outputs; positive-edge trigger; 3-state

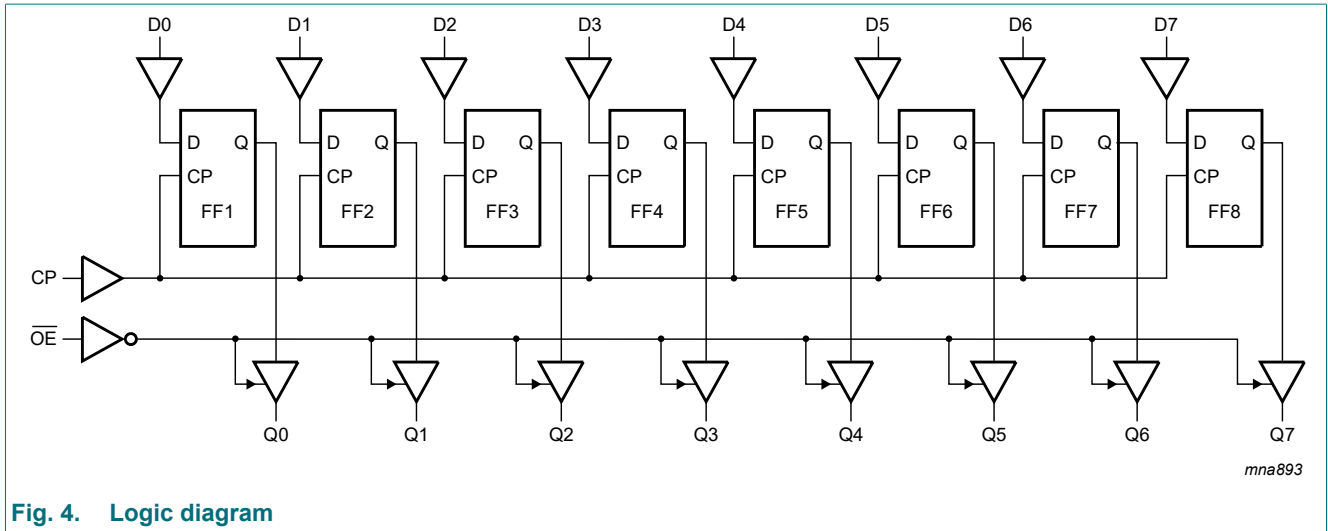


Fig. 4. Logic diagram

5. Pinning information

5.1. Pinning

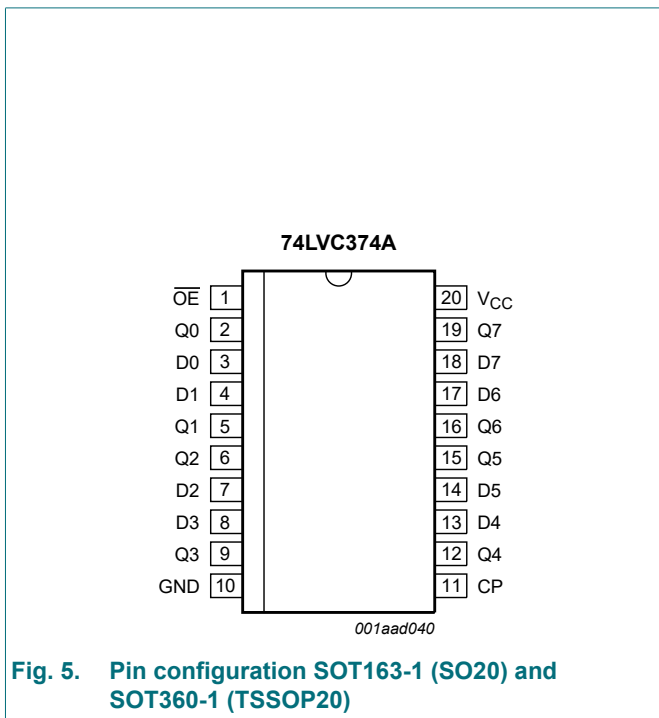


Fig. 5. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)

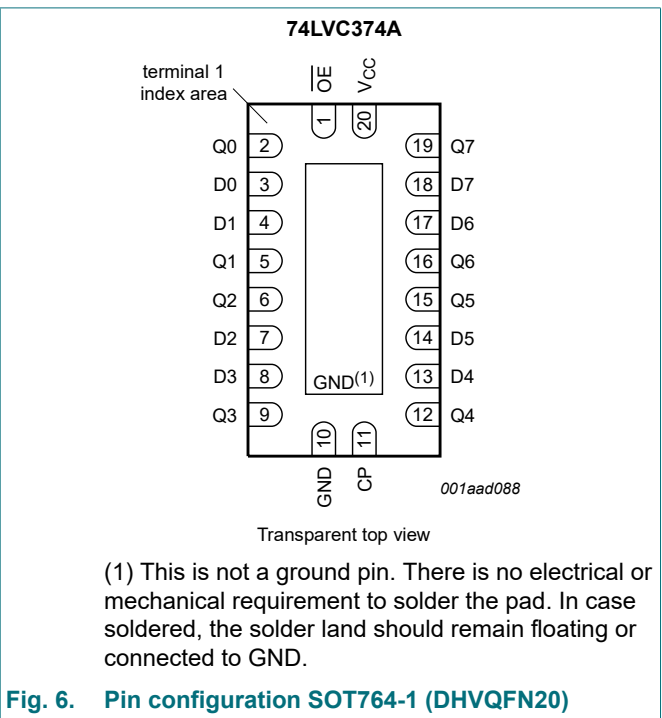


Fig. 6. Pin configuration SOT764-1 (DHVQFN20)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
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
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data input
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH, edge-triggered)
V _{CC}	20	supply voltage

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	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V _I	input voltage	[1]	-0.5	+6.5	V
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	+6.5	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 +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
V _O	output voltage	output HIGH or LOW state	0	-	V _{CC}	V
		output 3-state	0	-	5.5	V
T _{amb}	ambient temperature	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.65 V to 2.7 V	0	-	20	ns/V
		V _{CC} = 2.7 V to 3.6 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	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.2 V	1.08	-	-	1.08	-	V
		V _{CC} = 1.65 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{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} = 1.2 V	-	-	0.12	-	0.12	V
		V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{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 μA; V _{CC} = 1.65 V to 3.6 V	V _{CC} - 0.2	-	-	V _{CC} - 0.3	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	1.05	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.8	-	-	1.65	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	2.05	-	V
		I _O = -18 mA; V _{CC} = 3.0 V	2.4	-	-	2.25	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.2	-	-	2.0	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.65	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.6	-	0.8	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	-	0.6	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.8	V
I _I	input leakage current	V _{CC} = 3.6 V; V _I = 5.5 V or GND	-	±0.1	±5	-	±20	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _{CC} = 3.6 V; V _O = 5.5 V or GND;	-	±0.1	±5	-	±20	μA

Octal D-type flip-flop; 5 V tolerant inputs/outputs; 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_{OFF}	power-off leakage current	$V_{CC} = 0\text{ V}$; V_I or $V_O = 5.5\text{ V}$	-	± 0.1	± 10	-	± 20	μA
I_{CC}	supply current	$V_{CC} = 3.6\text{ V}$; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$	-	0.1	10	-	40	μA
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 2.7\text{ V}$ to 3.6 V ; $V_I = V_{CC} - 0.6\text{ V}$; $I_O = 0\text{ A}$	-	5	500	-	5000	μA
C_I	input capacitance	$V_{CC} = 0\text{ V}$ to 3.6 V ; $V_I = \text{GND}$ to V_{CC}	-	4.0	-	-	-	pF

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 10.

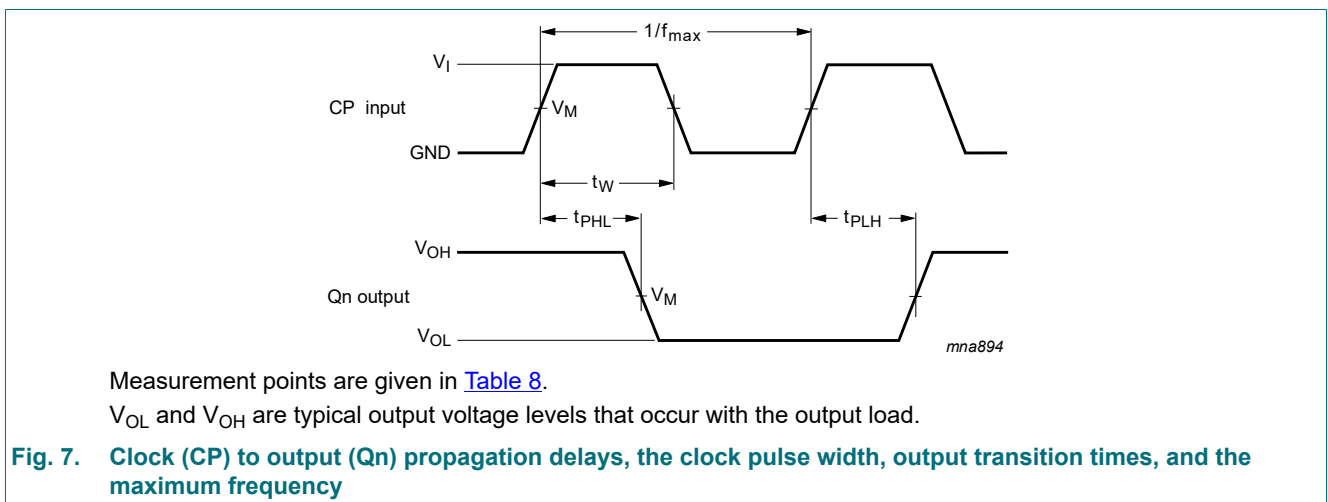
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	CP to Qn; see Fig. 7 [2]						
		$V_{CC} = 1.2\text{ V}$	-	16	-	-	-	ns
		$V_{CC} = 1.65\text{ V}$ to 1.95 V	2.2	7.4	16.3	2.2	18.8	ns
		$V_{CC} = 2.3\text{ V}$ to 2.7 V	1.5	3.9	8.4	1.5	9.7	ns
		$V_{CC} = 2.7\text{ V}$	1.5	3.5	8.0	1.5	10.0	ns
t_{en}	enable time	\overline{OE} to Qn; see Fig. 8 [2]						
		$V_{CC} = 1.2\text{ V}$	-	19	-	-	-	ns
		$V_{CC} = 1.65\text{ V}$ to 1.95 V	1.5	6.6	16.7	1.5	19.3	ns
		$V_{CC} = 2.3\text{ V}$ to 2.7 V	1.5	3.7	9.3	1.5	10.8	ns
		$V_{CC} = 2.7\text{ V}$	1.5	3.8	8.5	1.5	11.0	ns
t_{dis}	disable time	\overline{OE} to Qn; see Fig. 8 [2]						
		$V_{CC} = 1.2\text{ V}$	-	8.0	-	-	-	ns
		$V_{CC} = 1.65\text{ V}$ to 1.95 V	2.3	4.0	10.1	2.3	11.7	ns
		$V_{CC} = 2.3\text{ V}$ to 2.7 V	1.0	2.2	5.7	1.0	6.7	ns
		$V_{CC} = 2.7\text{ V}$	1.5	3.1	6.5	1.5	9.0	ns
t_{W}	pulse width	CP HIGH or LOW; see Fig. 7						
		$V_{CC} = 1.65\text{ V}$ to 1.95 V	5.0	-	-	5.0	-	ns
		$V_{CC} = 2.3\text{ V}$ to 2.7 V	4.0	-	-	4.0	-	ns
		$V_{CC} = 2.7\text{ V}$	3.0	-	-	4.5	-	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	3.0	1.5	-	4.5	-	ns
t_{su}	set-up time	Dn to CP; see Fig. 9						
		$V_{CC} = 1.65\text{ V}$ to 1.95 V	4.0	-	-	4.0	-	ns
		$V_{CC} = 2.3\text{ V}$ to 2.7 V	3.0	-	-	3.0	-	ns
		$V_{CC} = 2.7\text{ V}$	2.0	-	-	2.0	-	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	2.0	0	-	2.0	-	ns

Octal D-type flip-flop; 5 V tolerant inputs/outputs; 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. 9						
		V _{CC} = 1.65 V to 1.95 V	3.0	-	-	3.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.0	-	-	2.0	-	ns
		V _{CC} = 2.7 V	1.5	-	-	1.5	-	ns
f _{max}	maximum frequency	see Fig. 7						
		V _{CC} = 1.65 V to 1.95 V	100	-	-	64	-	MHz
		V _{CC} = 2.3 V to 2.7 V	125	-	-	100	-	MHz
		V _{CC} = 2.7 V	150	-	-	120	-	MHz
t _{sk(o)}	output skew time	V _{CC} = 3.0 V to 3.6 V [3]	-	-	1.0	-	1.5	ns
C _{PD}	power dissipation capacitance	per flip-flop; V _I = GND to V _{CC} [4]						
		V _{CC} = 1.65 V to 1.95 V	-	11.6	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	13.6	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	15.4	-	-	-	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] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
- [4] 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 Volt
N = number of inputs switching
Σ(C_L × V_{CC}² × f_o) = sum of the outputs

10.1. Waveforms and test circuit



Octal D-type flip-flop; 5 V tolerant inputs/outputs; positive-edge trigger; 3-state

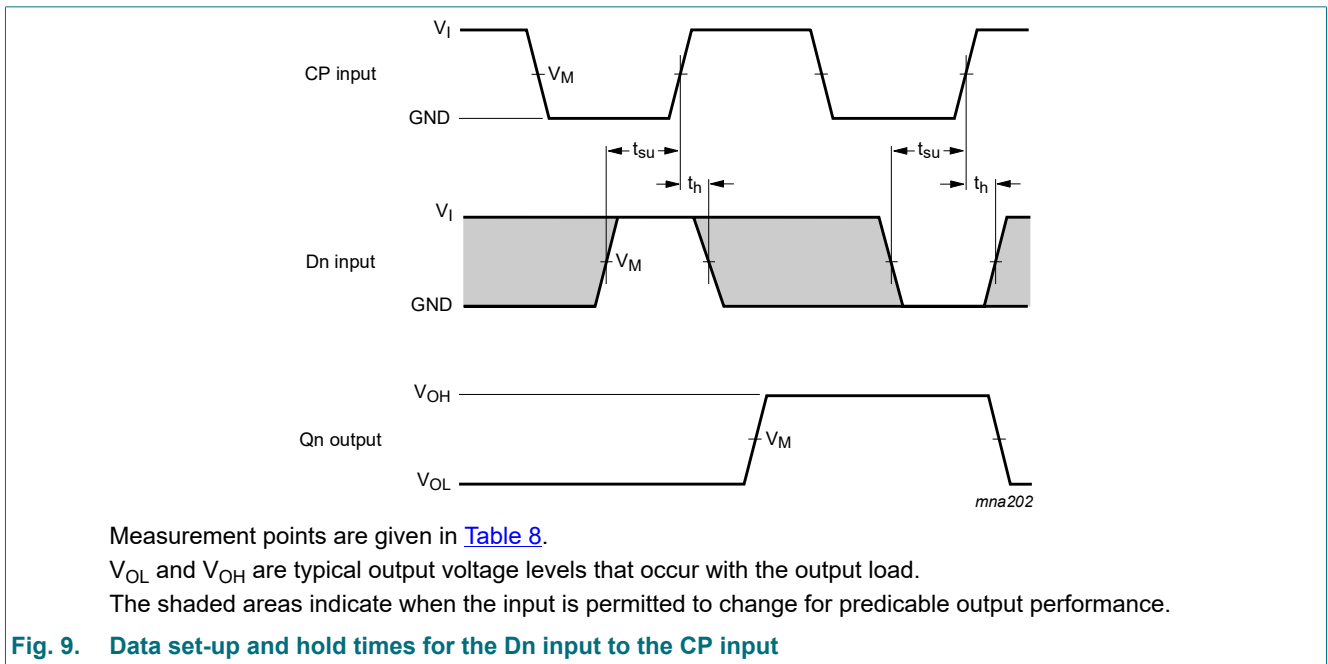
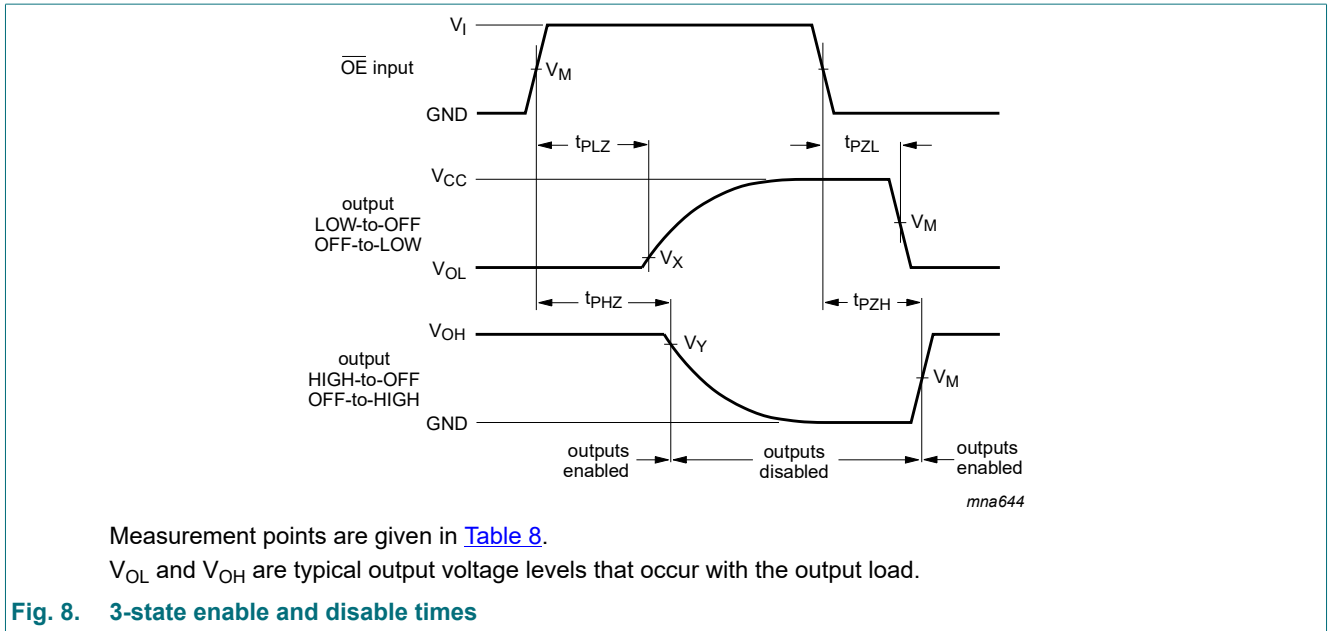
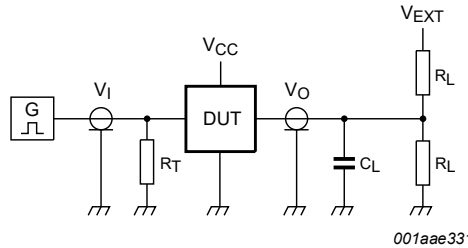
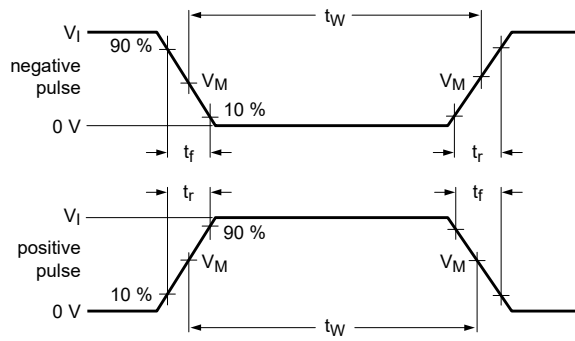


Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
1.2 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 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	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

Octal D-type flip-flop; 5 V tolerant inputs/outputs; positive-edge trigger; 3-state



001aae331

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. 10. 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}
1.2 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

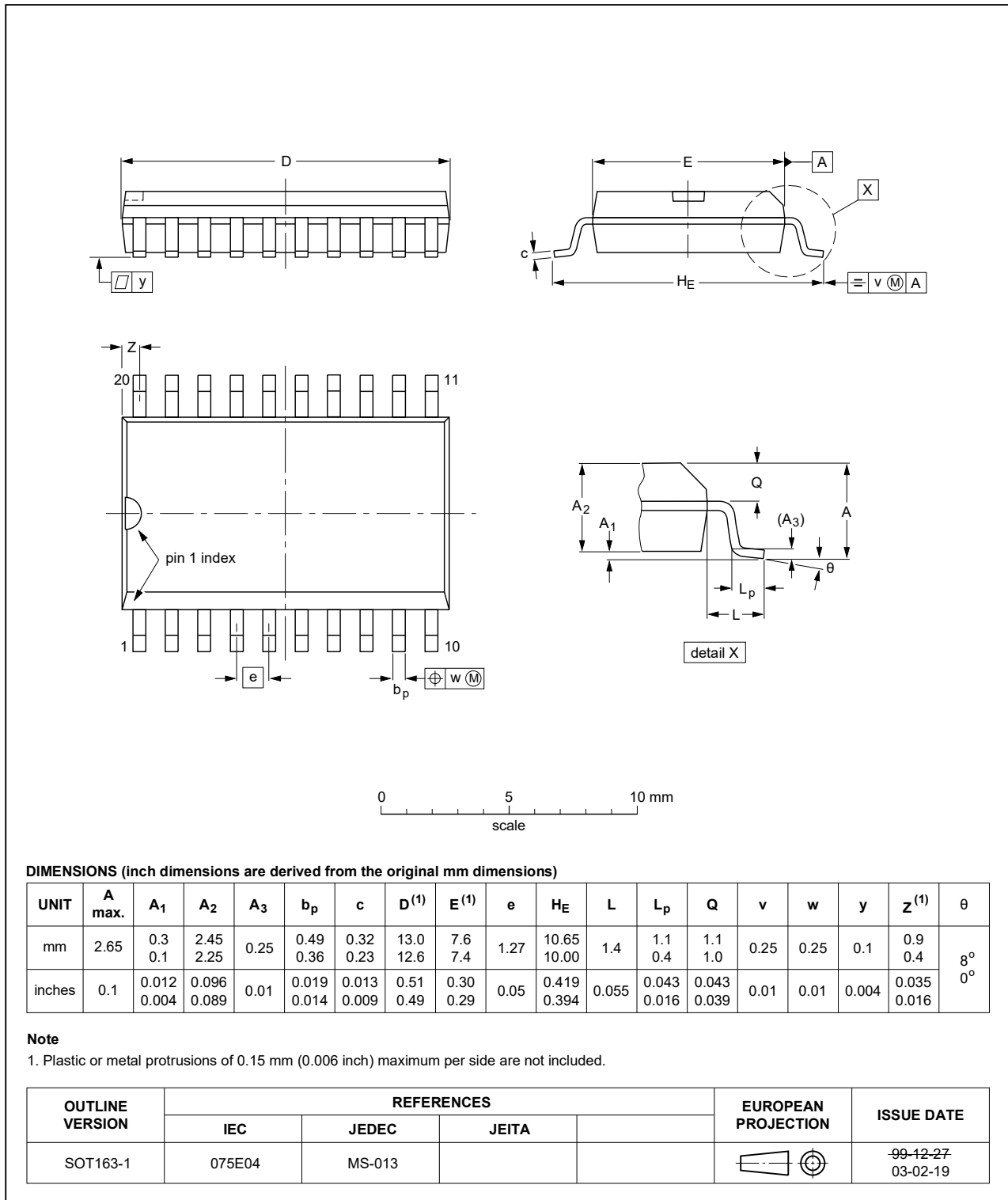


Fig. 11. Package outline SOT163-1 (SO20)

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

SOT360-1

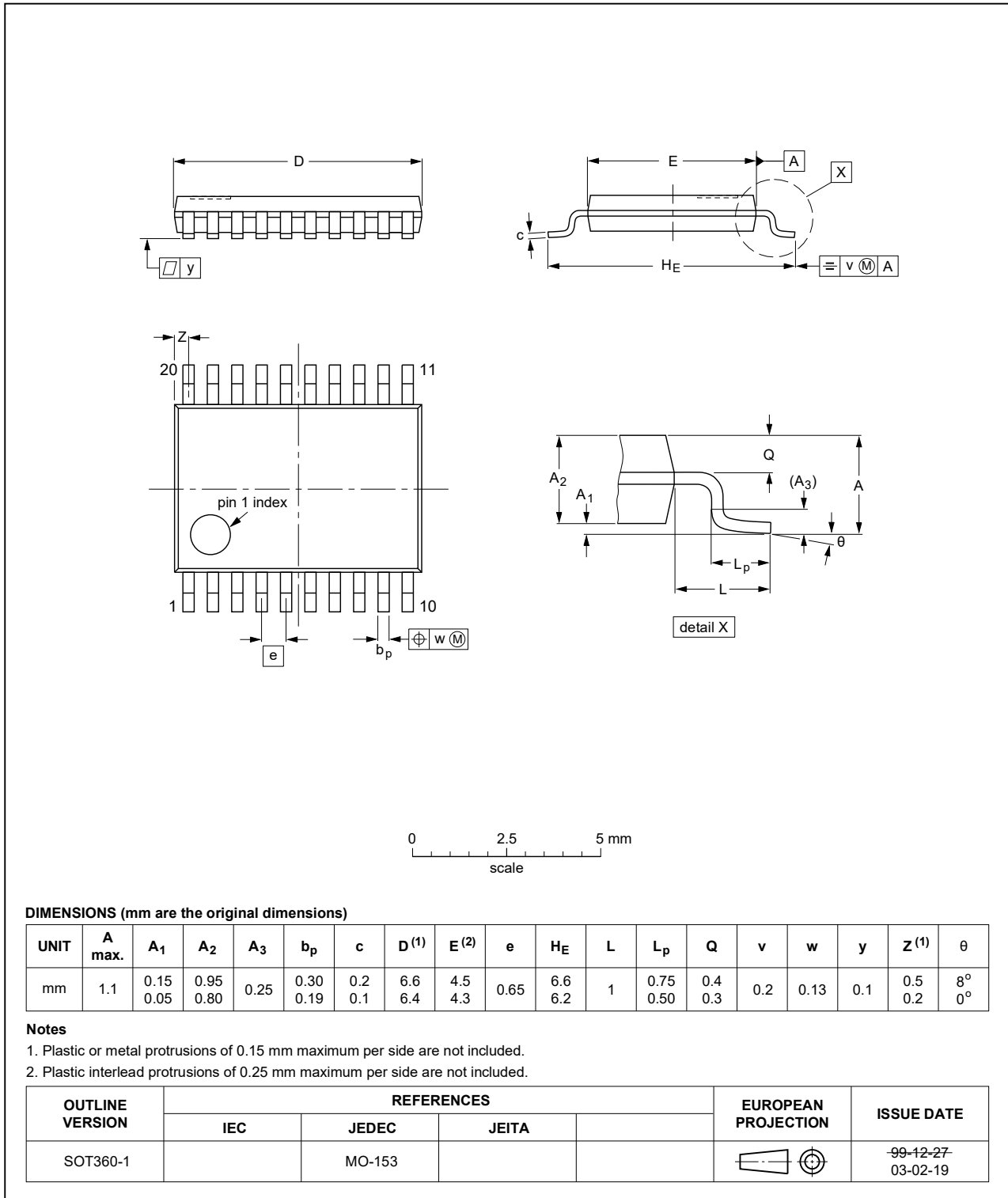


Fig. 12. Package outline SOT360-1 (TSSOP20)

Octal D-type flip-flop; 5 V tolerant inputs/outputs; positive-edge trigger; 3-state

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

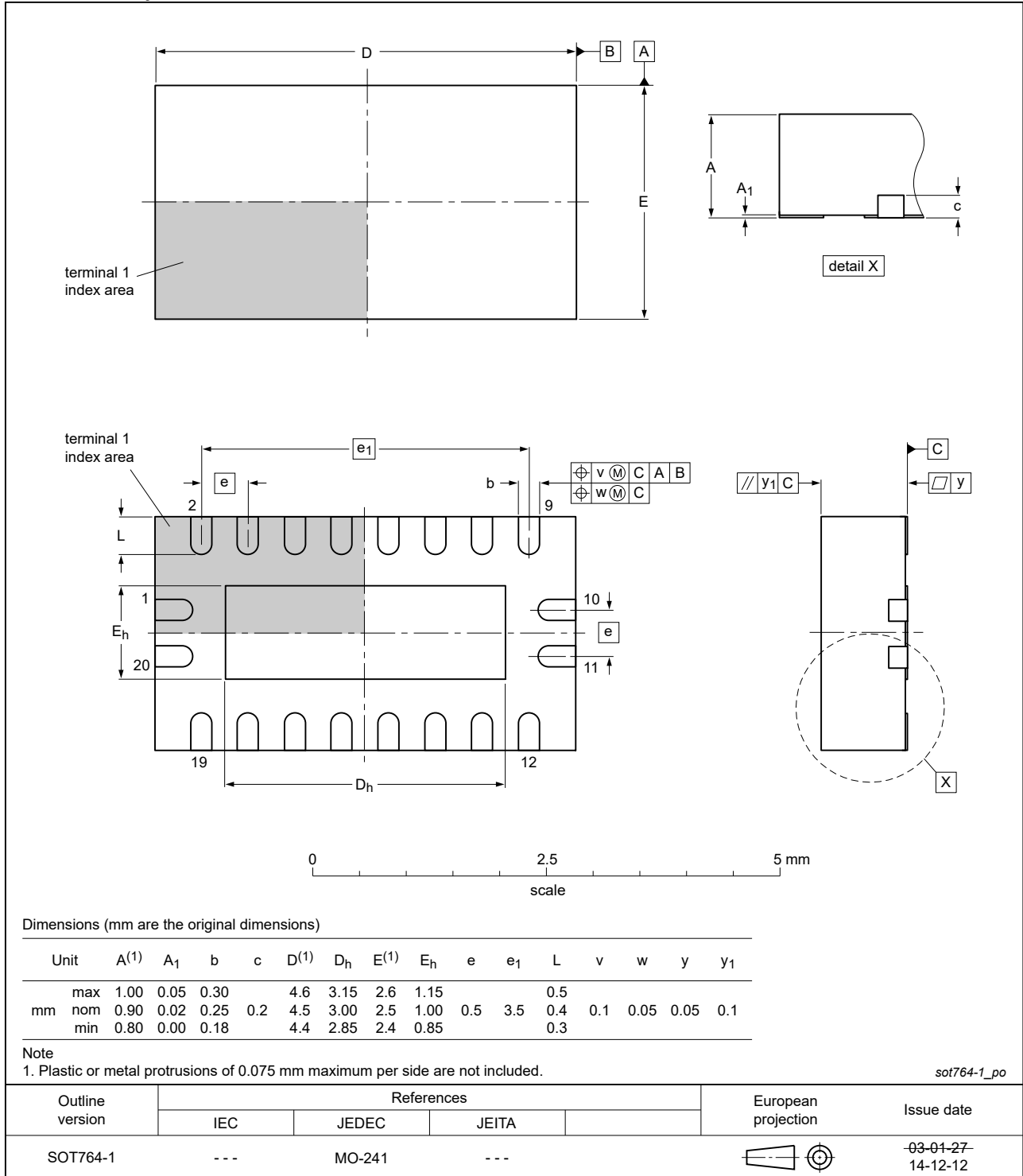


Fig. 13. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
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
74LVC374A_Q100 v.2	20200824	Product data sheet	-	74LVC374A_Q100 v.1
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 and Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation have been updated. Package outline drawing of SOT764-1 (Fig. 13) updated. 			
74LVC374A_Q100 v.1	20121122	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".
- [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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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

Date of release: 24 August 2020