

74ALVC74

Dual D-type flip-flop with set and reset; positive-edge trigger

Rev. 8 — 5 February 2024

Product data sheet

1. General description

The 74ALVC74 is a dual positive edge triggered D-type flip-flop with individual data (D), clock (CP), set ($\overline{SD}$) and reset ($\overline{RD}$) inputs, and complementary Q and $\overline{Q}$ outputs. Data at the D-input that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition will be stored in the flip-flop and appear at the Q output.

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

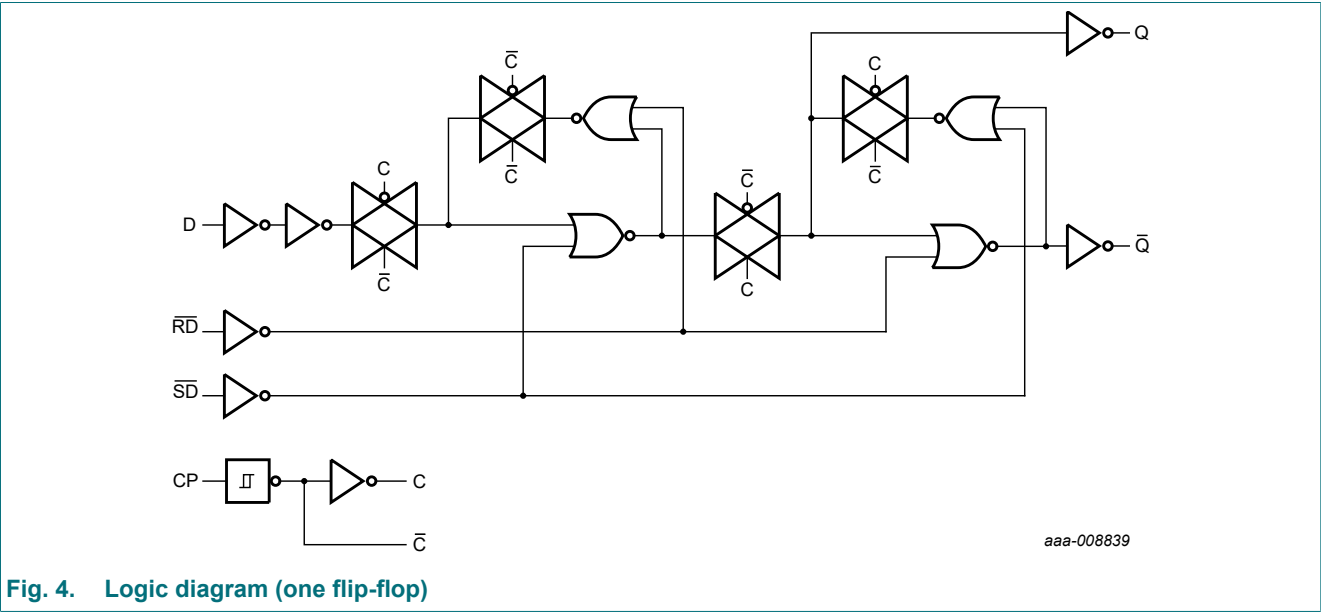
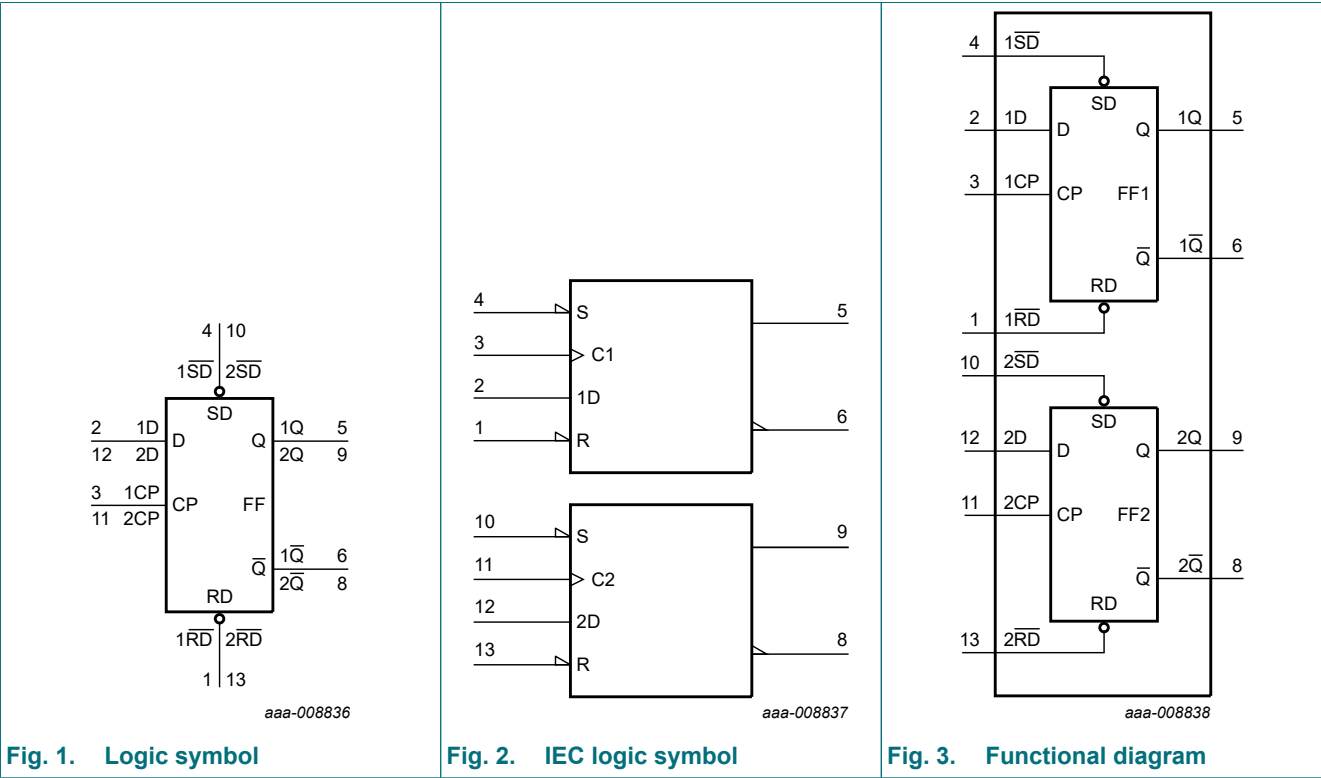
- Wide supply voltage range from 1.65 V to 3.6 V
- CMOS low power dissipation
- Overvoltage tolerant inputs to 3.6 V
- Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD78 Class II.A
- Complies with JEDEC standard:
 - JESD8-7 (1.65 to 1.95 V)
 - JESD8-5 (2.3 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
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

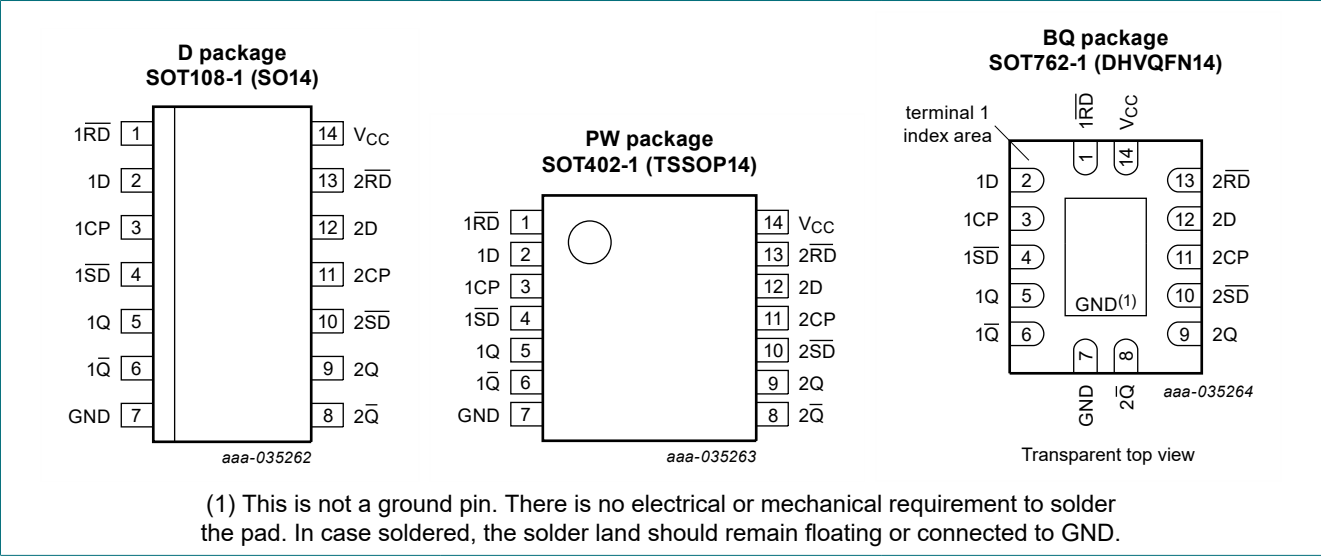
Type number	Package			
	Temperature range	Name	Description	Version
74ALVC74D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74ALVC74PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74ALVC74BQ	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1RD	1	asynchronous reset-direct input (active-LOW)
1D	2	data input
1CP	3	clock input (LOW-to-HIGH), edge-triggered
1SD	4	asynchronous set-direct input (active-LOW)
1Q	5	true flip-flop output
1Q	6	complement flip-flop output
GND	7	ground (0 V)
2Q	8	complement flip-flop output
2Q	9	true flip-flop output
2SD	10	asynchronous set-direct input (active-LOW)
2CP	11	clock input (LOW-to-HIGH), edge-triggered
2D	12	data input
2RD	13	asynchronous reset-direct input (active-LOW)
VCC	14	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; ↑ = LOW-to-HIGH clock transition;
nQ_{n+1} = state after the next LOW-to-HIGH CP transition.

Input				Output			
nSD	nRD	nCP	nD	nQ	nQ	nQ _{n+1}	nQ _{n+1}
L	H	X	X	H	L	-	-
H	L	X	X	L	H	-	-
L	L	X	X	H	H	-	-
H	H	↑	L	-	-	L	H
H	H	↑	H	-	-	H	L

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	[1]	-0.5	V _{CC} + 0.5	V
		Power-down mode; V _{CC} = 0 V	[1]	-0.5	+4.6
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 SOT108-1 (SO14) package: P_{tot} derates linearly with 10.1 mW/K above 100 °C.
For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.
For SOT762-1 (DHVQFN14) package: P_{tot} derates linearly with 9.6 mW/K above 98 °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	V _{CC} = 1.65 to 3.6 V	0	V _{CC}	V
		Power-down mode; V _{CC} = 0 V	0	3.6	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} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	0.65 × 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 × V _{CC}	-	0.35 × 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}						
		V _{CC} = 1.65 V to 3.6 V; I _O = -100 µA	V _{CC} - 0.2	-	-	V _{CC} - 0.2	-	V
		V _{CC} = 1.65 V; I _O = -6 mA	1.25	1.51	-	1.25	-	V
		V _{CC} = 2.3 V; I _O = -12 mA	1.8	2.10	-	1.8	-	V
		V _{CC} = 2.3 V; I _O = -18 mA	1.7	2.01	-	1.7	-	V
		V _{CC} = 2.7 V; I _O = -12 mA	2.2	2.53	-	2.2	-	V
		V _{CC} = 3.0 V; I _O = -18 mA	2.4	2.76	-	2.4	-	V
		V _{CC} = 3.0 V; I _O = -24 mA	2.2	2.68	-	2.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		V _{CC} = 1.65 V to 3.6 V; I _O = 100 µA	-	-	0.2	-	0.2	V
		V _{CC} = 1.65 V; I _O = 6 mA	-	0.11	0.3	-	0.3	V
		V _{CC} = 2.3 V; I _O = 12 mA	-	0.17	0.4	-	0.4	V
		V _{CC} = 2.3 V; I _O = 18 mA	-	0.25	0.6	-	0.6	V
		V _{CC} = 2.7 V; I _O = 12 mA	-	0.16	0.4	-	0.4	V
		V _{CC} = 3.0 V; I _O = 18 mA	-	0.23	0.4	-	0.45	V
		V _{CC} = 3.0 V; I _O = 24 mA	-	0.30	0.55	-	0.55	V
I _I	input leakage current	V _{CC} = 3.6 V; V _I = V _{CC} or GND	-	±0.1	±5	-	±20	µA
I _{OFF}	power-off leakage current	V _{CC} = GND; V _I or V _O = 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	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] Typical values are measured at T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V): for test circuit, see Fig. 7.

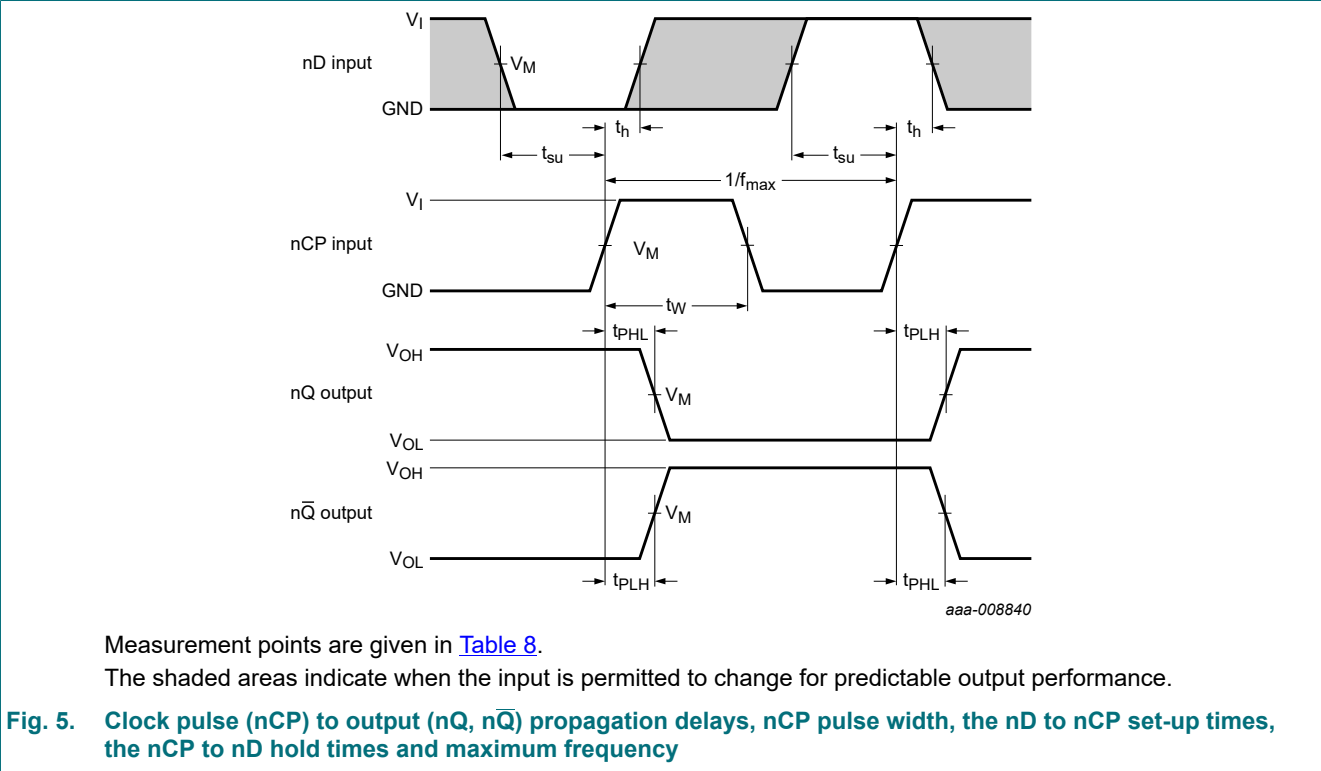
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	nCP to nQ, nQ̄; see Fig. 5 [2]						
		V _{CC} = 1.65 to 1.95 V	1.0	3.7	6.2	1.0	7.1	ns
		V _{CC} = 2.3 to 2.7 V	1.0	2.6	4.2	1.0	4.8	ns
		V _{CC} = 2.7 V	1.0	2.8	4.2	1.0	4.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.7	3.8	1.0	4.4	ns
		nSD̄ to nQ, nQ̄; see Fig. 6						
		V _{CC} = 1.65 to 1.95 V	1.0	3.4	5.4	1.0	6.2	ns
		V _{CC} = 2.3 to 2.7 V	1.0	2.4	3.8	1.0	4.4	ns
		V _{CC} = 2.7 V	1.0	3.2	4.2	1.0	4.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.3	3.5	1.0	4.0	ns
		nRD̄ to nQ, nQ̄; see Fig. 6						
		V _{CC} = 1.65 to 1.95 V	1.0	3.5	5.4	1.0	6.2	ns
		V _{CC} = 2.3 to 2.7 V	1.0	2.5	3.8	1.0	4.4	ns
		V _{CC} = 2.7 V	1.0	3.1	4.2	1.0	4.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.3	3.5	1.0	4.0	ns
t _w	pulse width	nCP; HIGH or LOW; see Fig. 5						
		V _{CC} = 1.65 to 1.95 V	2.5	0.9	-	2.5	-	ns
		V _{CC} = 2.3 to 2.7 V	2.5	0.6	-	2.5	-	ns
		V _{CC} = 2.7 V	2.5	1.3	-	2.5	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.5	1.3	-	2.5	-	ns
		nSD̄ or nRD̄; LOW; see Fig. 6						
		V _{CC} = 1.65 to 1.95 V	2.5	0.9	-	2.5	-	ns
		V _{CC} = 2.3 to 2.7 V	2.5	0.6	-	2.5	-	ns
		V _{CC} = 2.7 V	2.5	1.0	-	2.5	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.5	0.7	-	2.5	-	ns
t _{rec}	recovery time	nRD̄ to nCP; see Fig. 6						
		V _{CC} = 1.65 to 1.95 V	0.7	-0.1	-	0.7	-	ns
		V _{CC} = 2.3 to 2.7 V	0.7	-0.1	-	0.7	-	ns
		V _{CC} = 2.7 V	0.7	-0.1	-	0.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.7	-0.1	-	0.7	-	ns
t _{su}	set-up time	nD to nCP; see Fig. 5						
		V _{CC} = 1.65 to 1.95 V	1.2	0.6	-	1.2	-	ns
		V _{CC} = 2.3 to 2.7 V	1.2	0.8	-	1.2	-	ns
		V _{CC} = 2.7 V	0.9	0.5	-	0.9	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.8	0.4	-	0.8	-	ns

Dual D-type flip-flop with set and reset; positive-edge trigger

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t _h	hold time	nD to nCP; see Fig. 5						
		V _{CC} = 1.65 to 1.95 V	0.6	-0.4	-	0.6	-	ns
		V _{CC} = 2.3 to 2.7 V	0.6	-0.3	-	0.6	-	ns
		V _{CC} = 2.7 V	0.7	-0.4	-	0.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.8	-0.1	-	0.8	-	ns
f _{max}	maximum frequency	nCP; see Fig. 5						
		V _{CC} = 1.65 to 1.95 V	150	275	-	150	-	MHz
		V _{CC} = 2.3 to 2.7 V	200	325	-	200	-	MHz
		V _{CC} = 2.7 V	250	375	-	250	-	MHz
		V _{CC} = 3.0 V to 3.6 V	300	425	-	300	-	MHz
C _{PD}	power dissipation capacitance	per buffer; V _I = GND to V _{CC} ; V _{CC} = 3.3 V [3]	-	35	-	-	-	pF

- [1] Typical values are measured at T_{amb} = 25 °C.
Typical values are measured at V_{CC} = 1.8 V for V_{CC} = 1.65 V to 1.95 V.
Typical values are measured at V_{CC} = 2.5 V for V_{CC} = 2.3 V to 2.7 V.
Typical values are measured at V_{CC} = 3.3 V for V_{CC} = 3.0 V to 3.6 V
- [2] t_{pd} is the same as t_{PHL} and t_{PLH}.
- [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;
N = total load switching outputs; C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
 $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

10.1. Waveforms and test circuit



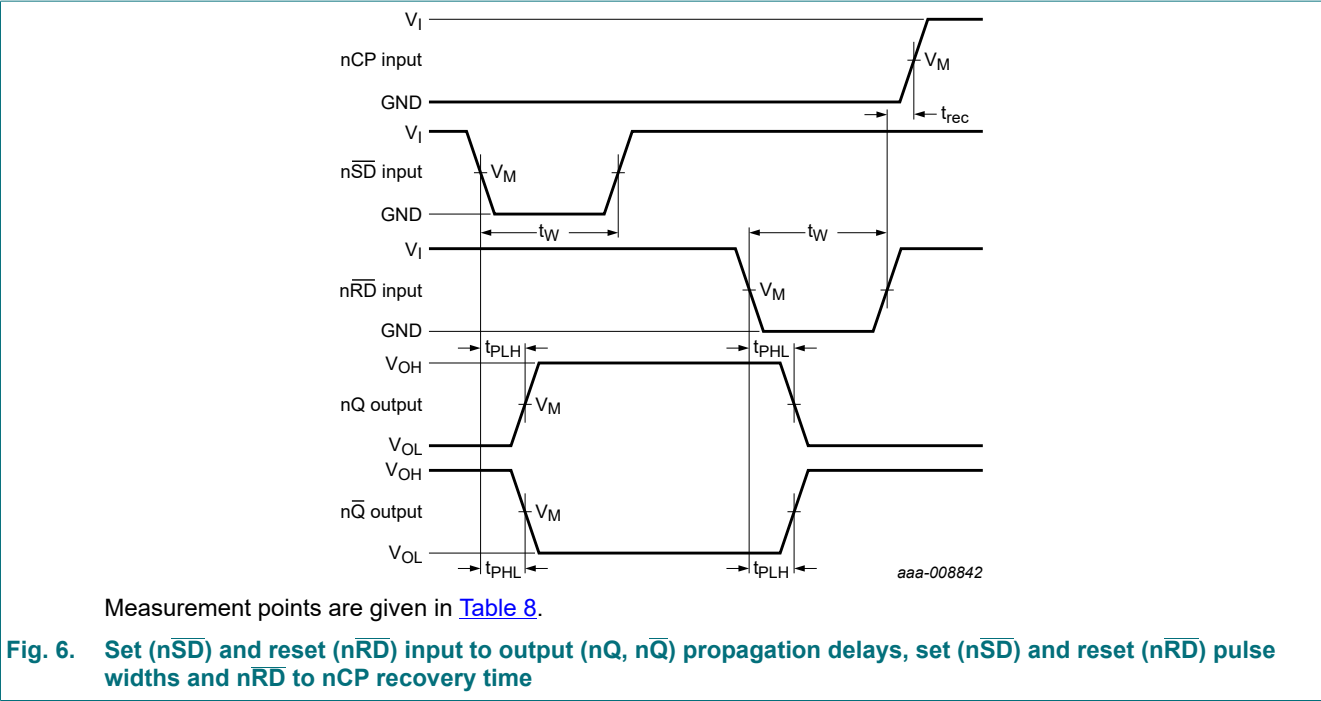
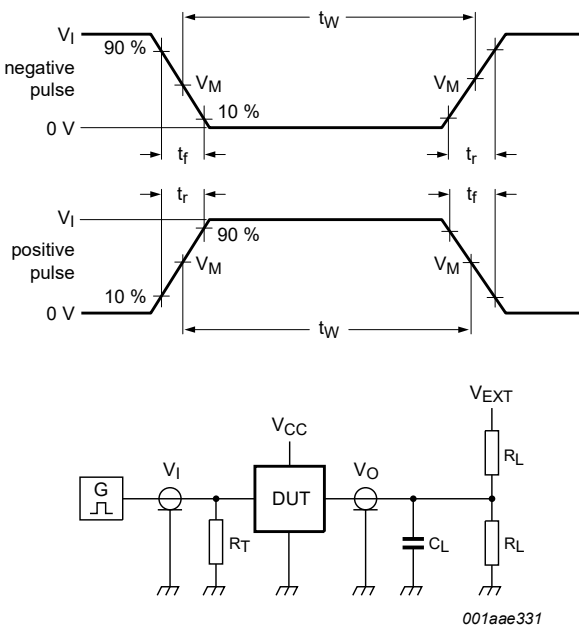


Table 8. Measurement points

Supply voltage	Input		Output
V_{CC}	V_I	V_M	V_M
1.65 V to 1.95 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.7 V	2.7 V	1.5 V	1.5 V
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V

Dual D-type flip-flop with set and reset; positive-edge trigger



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. 7. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		V_{EXT}
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 k Ω	open
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open

11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

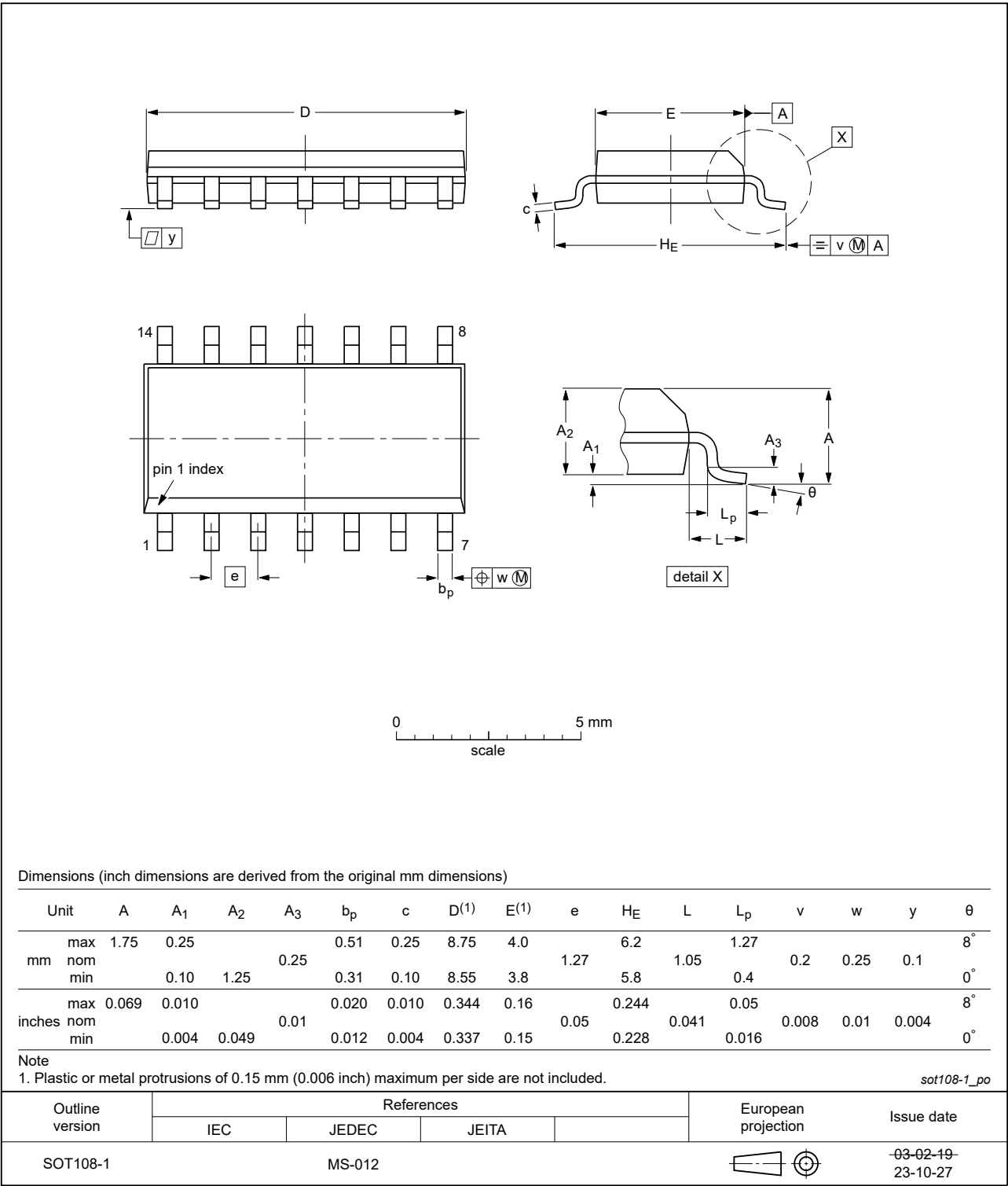


Fig. 8. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

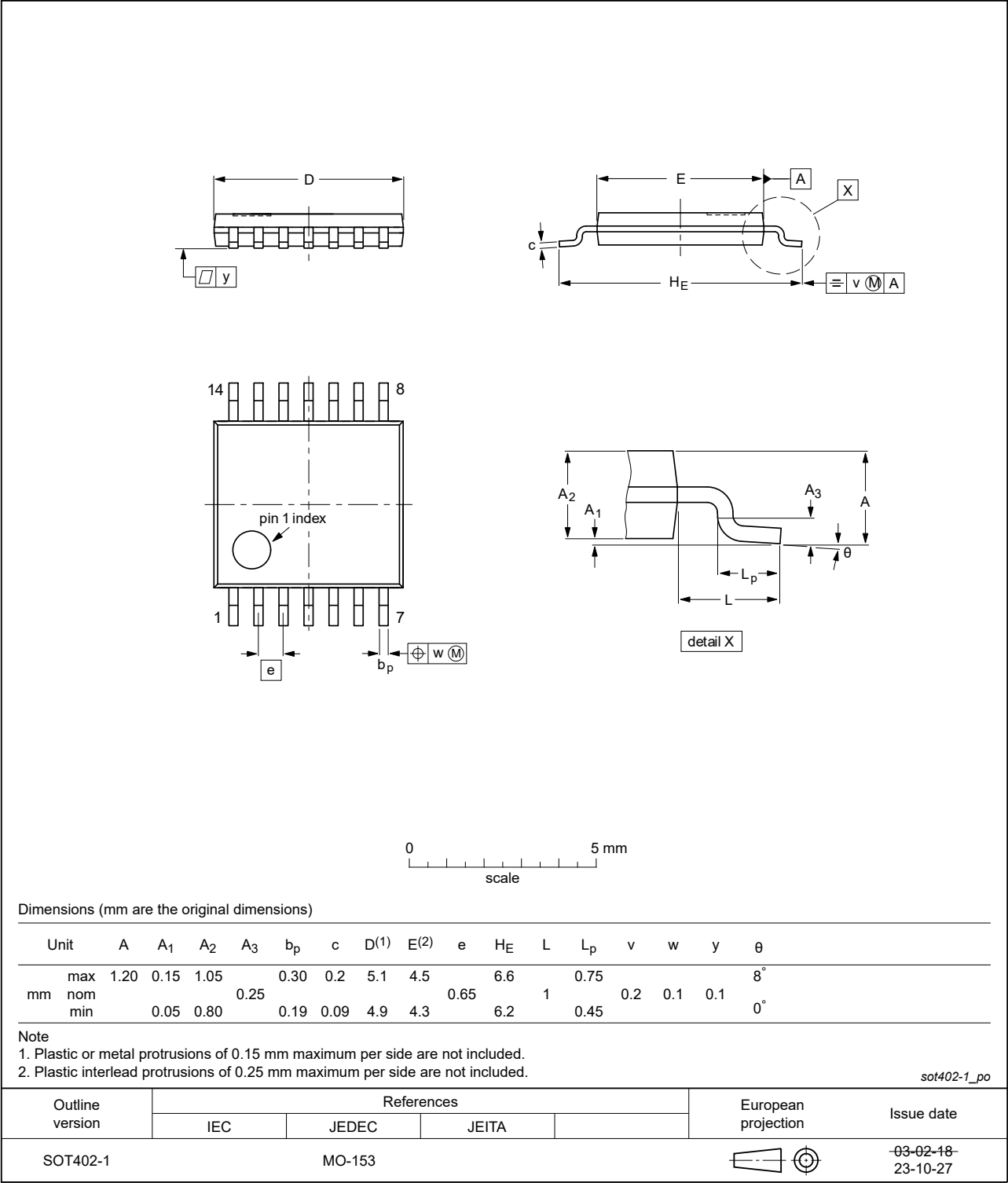


Fig. 9. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;
14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1

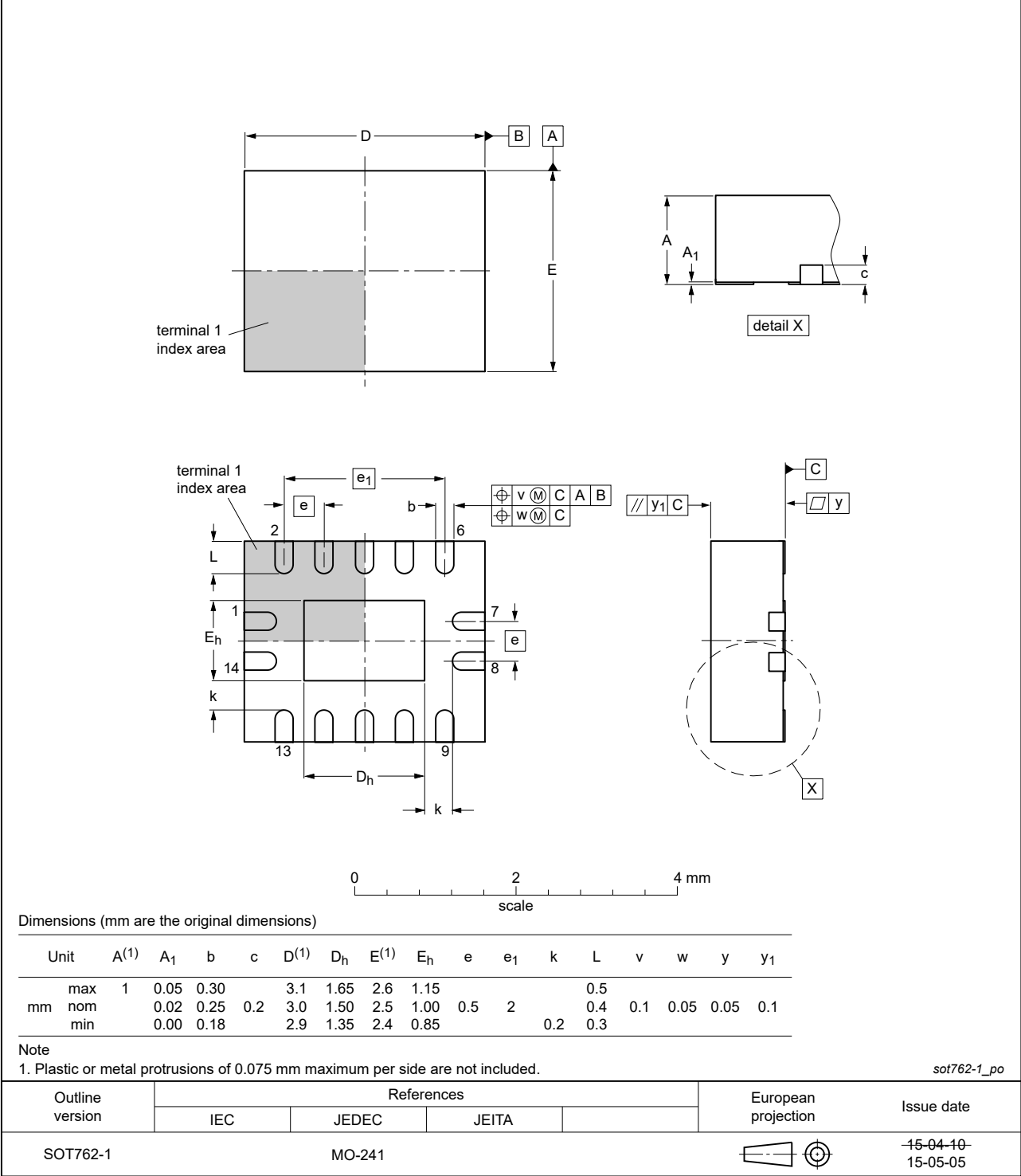


Fig. 10. Package outline SOT762-1 (DHVQFN14)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC74 v.8	20240205	Product data sheet	-	74ALVC74 v.7
Modifications:	Fig. 8, Fig. 9: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.			
74ALVC74 v.7	20230707	Product data sheet	-	74ALVC74 v.6
Modifications:	Section 1 updated. Section 2: updated; ESD specification updated according to the latest JEDEC standard. - Specifications for -40 °C to +125 °C added.			
74ALVC74 v.6	20210727	Product data sheet	-	74ALVC74 v.5
Modifications:	Section 10: Minimum set-up time ($t_{su(min)}$) at $V_{CC} = 2.7\text{ V}$ changed to 1.1 ns. (errata)			
74ALVC74 v.5	20210430	Product data sheet	-	74ALVC74 v.4
Modifications:	Section 2: Reference to JESD36 removed. Section 7: Derating values for P_{tot} total power dissipation have been updated.			
74ALVC74 v.4	20170816	Product data sheet	-	74ALVC74 v.3
Modifications:	- 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.			
74ALVC74 v.3	20030526	Product specification	-	74ALVC74 v.2
74ALVC74 v.2	20030124	Product specification	-	74ALVC74 v.1
74ALVC74 v.1	20021115	Product specification	-	-

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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