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

Rev. 17 — 9 August 2024

Product data sheet

1. General description

The 74LVC1G74 is a single positive edge triggered D-type flip-flop with individual data (D), clock (CP), set ($\overline{S}D$) and reset ($\overline{R}D$) 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. 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.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- · High noise immunity
- ±24 mA output drive (V_{CC} = 3.0 V)
- · CMOS low power consumption
- · Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8-B/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 -40 °C to +125 °C



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3. Ordering information

Table 1. Ordering information

Type number	Package	Package							
	Temperature range	Name	Description	Version					
74LVC1G74DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2					
74LVC1G74DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1					
74LVC1G74GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1					
74LVC1G74GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm	SOT1116					
74LVC1G74GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm	SOT1203					

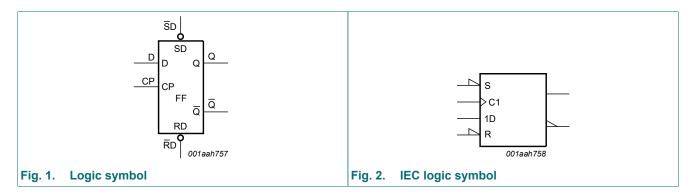
4. Marking

Table 2. Marking codes

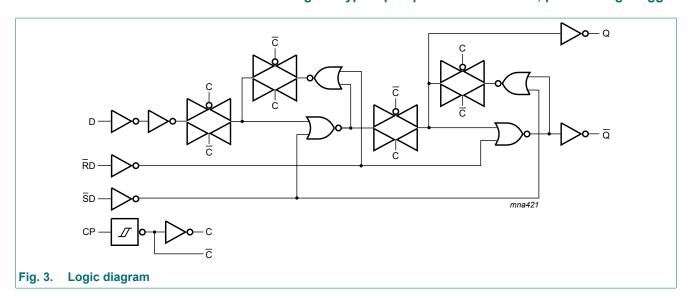
Table 21 marking coace					
Type number	Marking code [1]				
74LVC1G74DP	V74				
74LVC1G74DC	V74				
74LVC1G74GT	V74				
74LVC1G74GN	Y4				
74LVC1G74GS	Y4				

^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

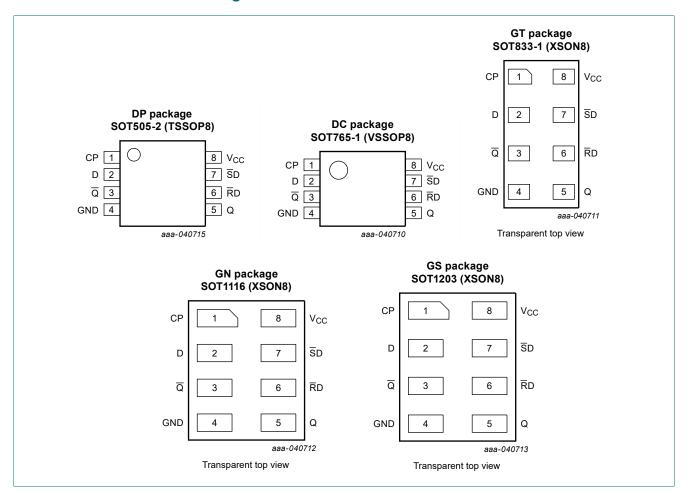


Single D-type flip-flop with set and reset; positive edge trigger



6. Pinning information

6.1. Pinning



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

6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
CP	1	clock input (LOW-to-HIGH, edge-triggered)
D	2	data input
Q	3	complement output
GND	4	ground (0 V)
Q	5	true output
RD	6	asynchronous reset-direct input (active LOW)
SD	7	asynchronous set-direct input (active LOW)
V _{CC}	8	supply voltage

7. Functional description

Table 4. Function table for asynchronous operation

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care.$

Input			Output		
SD	RD	СР	D	Q	Q
L	Н	Х	Х	Н	L
Н	L	Х	Х	L	Н
L	L	Х	Х	Н	Н

Table 5. Function table for synchronous operation

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ \uparrow = LOW-to-HIGH \ CP \ transition;$

 Q_{n+1} = state after the next LOW-to-HIGH CP transition.

Input			Output		
SD	RD	СР	D	Q _{n+1}	Q _{n+1}
Н	Н	↑	L	L	Н
Н	Н	1	Н	Н	L

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8. Limiting values

Table 6. 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
VI	input voltage	[1]	-0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$	-	±50	mA
Vo	output voltage	Active mode [1]	-0.5	V _{CC} + 0.5	V
		Power-down mode; V _{CC} = 0 V [1]	-0.5	+6.5	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I _{CC}	supply current		-	100	mA
I _{GND}	ground current		-100	-	mA
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [2]	-	250	mW
T _{stg}	storage temperature		-65	+150	°C

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

9. Recommended operating conditions

Table 7. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		1.65	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	Active mode	0	V _{CC}	V
		Power-down mode; V _{CC} = 0 V	0	5.5	V
T _{amb}	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.65 V to 2.7 V	-	20	ns/V
		V _{CC} = 2.7 V to 5.5 V	-	10	ns/V

10. Static characteristics

Table 8. Static characteristics

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

Symbol	Parameter	Conditions	T_{amb} = -40 °C to +85 °C		T _{am} -40 °C to		Unit	
			Min	Typ [1]	Max	Min	Max	
V _{IH} HIGH-level input	V _{CC} = 1.65 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	V	
	voltage	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 _{CC} = 4.5 V to 5.5 V	0.7V _{CC}	-	-	0.7V _{CC}	-	V

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^[2] For SOT505-2 (TSSOP8) package: Ptot derates linearly with 4.6 mW/K above 96 °C.

For SOT765-1 (VSSOP8) package: Ptot derates linearly with 4.9 mW/K above 99 °C.

For SOT833-1 (XSON8) package: Ptot derates linearly with 3.1 mW/K above 68 °C.

For SOT1116 (XSON8) package: P_{tot} derates linearly with 4.2 mW/K above 90 °C.

For SOT1203 (XSON8) package: Ptot derates linearly with 3.6 mW/K above 81 °C.

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{an} -40 °C to	Unit	
			Min	Typ [1]	Max	Min	Max	
V _{IL}	LOW-level input	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{CC}	V
	voltage	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 _{CC} = 4.5 V to 5.5 V	-	-	0.3V _{CC}	-	0.3V _{CC}	V
V _{OH}	HIGH-level output	V _I = V _{IH} or V _{IL}						
	voltage	I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V _{CC} - 0.1	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	1.54	-	0.95	-	V
		I_O = -8 mA; V_{CC} = 2.3 V	1.9	2.15	-	1.7	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	2.50	-	1.9	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	2.62	-	2.0	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	4.11	-	3.4	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.10	-	0.10	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	0.07	0.45	-	0.70	V
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	0.12	0.30	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	0.17	0.40	-	0.60	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	0.33	0.55	-	0.80	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	0.39	0.55	-	0.80	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	-	±1	μA
l _{OFF}	power-off leakage current	V_1 or $V_0 = 5.5 \text{ V}$; $V_{CC} = 0 \text{ V}$	-	±0.1	±2	-	±2	μΑ
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	0.1	4	-	4	μΑ
Δl _{CC}	additional supply current	per pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 5.5 V	-	5	500	-	500	μΑ
Cı	input capacitance		-	4.0	-	-	-	pF

^[1] All typical values are measured at T_{amb} = 25 °C.

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11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6.

Symbol	Parameter	Conditions	T _{amb} :	= -40 °C to	+85 °C	T _{ar} -40 °C to	Unit	
			Min Ty _l	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	CP to Q, \overline{Q} ; see Fig. 4 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.5	6.0	13.4	1.5	13.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.5	7.1	1.0	7.1	ns
		V _{CC} = 2.7 V	1.0	3.5	7.1	1.0	7.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.5	5.9	1.0	5.9	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	2.5	4.1	1.0	4.1	ns
		\overline{SD} to Q, \overline{Q} ; see $\underline{Fig. 5}$ [2]						
		V _{CC} = 1.65 V to 1.95 V	1.5	6.0	12.9	1.5	12.9	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.5	7.0	1.0	7.0	ns
		V _{CC} = 2.7 V	1.0	3.5	7.0	1.0	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.0	5.9	1.0	5.9	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	2.5	4.1	1.0	4.1	ns
		$\overline{R}D$ to Q, \overline{Q} ; see $\underline{Fig. 5}$ [2]						
		V _{CC} = 1.65 V to 1.95 V	1.5	5.0	12.9	1.5	12.9	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.5	7.0	1.0	7.0	ns
		V _{CC} = 2.7 V	1.0	3.5	7.0	1.0	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.0	5.9	1.0	5.9	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	2.5	4.1	1.0	4.1	ns
t _W	pulse width	CP HIGH or LOW; see Fig. 4						
		V _{CC} = 1.65 V to 1.95 V	6.2	-	-	6.2	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.7	-	-	2.7	-	ns
		V _{CC} = 2.7 V	2.7	-	-	2.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.7	1.3	-	2.7	-	ns
		V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	ns
		SD and RD LOW; see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	6.2	-	-	6.2	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.7	-	-	2.7	-	ns
		V _{CC} = 2.7 V	2.7	-	-	2.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.7	1.6	-	2.7	-	ns
		V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	ns
t _{rec}	recovery time	SD or RD; see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	1.9	-	-	1.9	-	ns
		V _{CC} = 2.3 V to 2.7 V	1.4	-	-	1.4	-	ns
		V _{CC} = 2.7 V	1.3	-	-	1.3	-	ns
		V _{CC} = 3.0 V to 3.6 V	+1.2	-3.0	-	+1.2	-	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	-	-	1.0	_	ns

Symbol	Parameter	Conditions	T _{amb} =	= -40 °C to	+85 °C	T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{su}	set-up time	D to CP; see Fig. 4						
		V _{CC} = 1.65 V to 1.95 V	2.9	-	-	2.9	-	ns
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	ns
		V _{CC} = 2.7 V	1.7	-	-	1.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.3	0.5	-	1.3	-	ns
		V _{CC} = 4.5 V to 5.5 V	1.1	-	-	1.1	-	ns
t _h	hold time	D to CP; see Fig. 4						
		V _{CC} = 1.65 V to 1.95 V	1.5	-	-	1.5	-	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	-	-	1.0	-	ns
		V _{CC} = 2.7 V	1.0	-	-	1.0	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	0.6	-	1.0	-	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	-	-	1.0	-	ns
f _{max}	maximum	CP; see Fig. 4						
	frequency	V _{CC} = 1.65 V to 1.95 V	80	-	-	80	-	MHz
		V _{CC} = 2.3 V to 2.7 V	175	-	-	175	-	MHz
		V _{CC} = 2.7 V	175	-	-	175	-	MHz
		V _{CC} = 3.0 V to 3.6 V	175	280	-	175	-	MHz
		V _{CC} = 4.5 V to 5.5 V	200	-	-	200	-	MHz
C _{PD}	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V} [3]$	-	15	-	-	-	pF

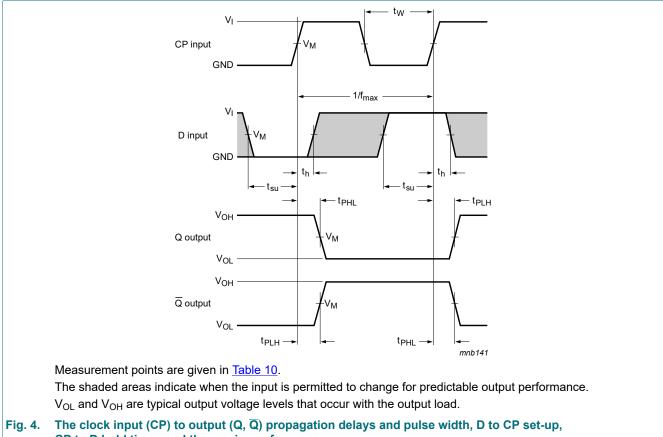
Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

 t_{pd} is the same as t_{PLH} and t_{PHL} . 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.

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11.1. Waveforms and test circuit



CP to D hold times and the maximum frequency

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

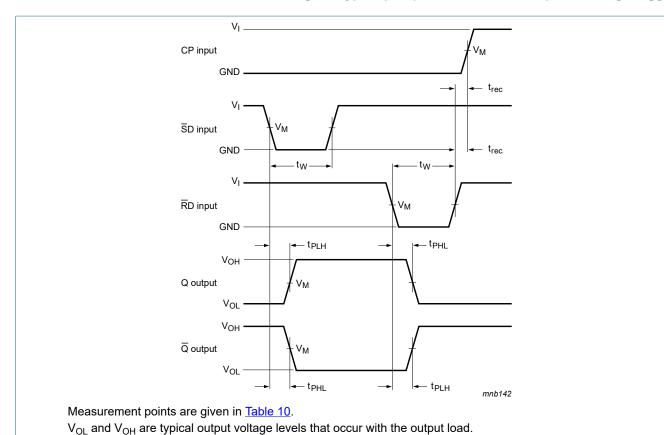
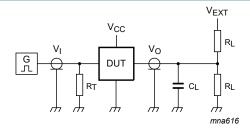


Fig. 5. The set (\overline{SD}) and reset (\overline{RD}) input to output (Q, \overline{Q}) propagation delays, pulse widths and the \overline{RD} to \overline{CP} recovery time

Table 10. Measurement points

Supply voltage	Input	Output	
V _{CC}	V _M	V _M	
1.65 V to 1.95 V	0.5 × V _{CC}	0.5 × V _{CC}	
2.3 V to 2.7 V	0.5 × V _{CC}	0.5 × V _{CC}	
2.7 V	1.5 V	1.5 V	
3.0 V to 3.6 V	1.5 V	1.5 V	
4.5 V to 5.5 V	0.5 × V _{CC}	0.5 × V _{CC}	

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



Test data is given in Table 11.

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 the output impedance Z_o of the pulse generator.

 V_{EXT} = External voltage for measuring switching times.

Fig. 6. Test circuit for measuring switching times

Table 11. Test data

Supply voltage	Input		Load	Load		V _{EXT}		
V _{CC}	VI	t _r , t _f	CL	R _L	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}	
1.65 V to 1.95 V	V _{CC}	≤ 2.0 ns	30 pF	1 kΩ	open	GND	2 × V _{CC}	
2.3 V to 2.7 V	V _{CC}	≤ 2.0 ns	30 pF	500 Ω	open	GND	2 × V _{CC}	
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V	
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V	
4.5 V to 5.5 V	V _{CC}	≤ 2.5 ns	50 pF	500 Ω	open	GND	2 × V _{CC}	

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

12. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

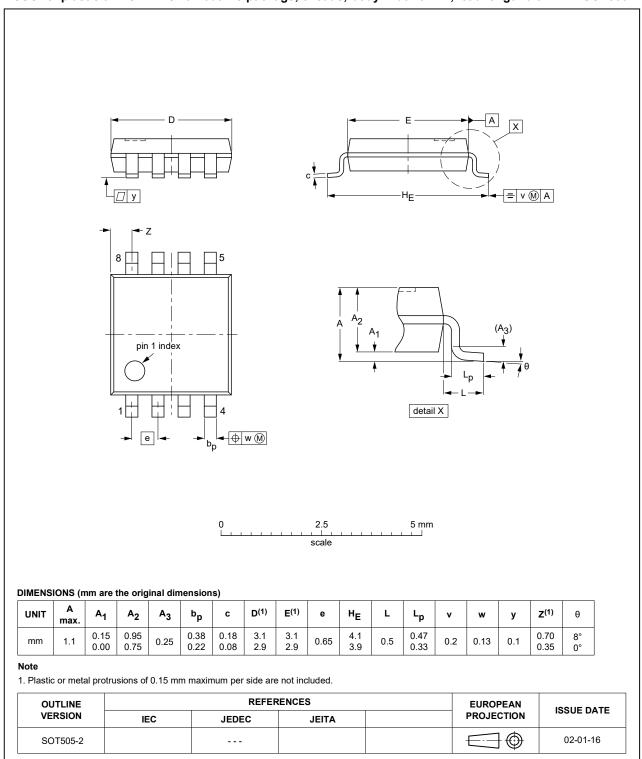


Fig. 7. Package outline SOT505-2 (TSSOP8)

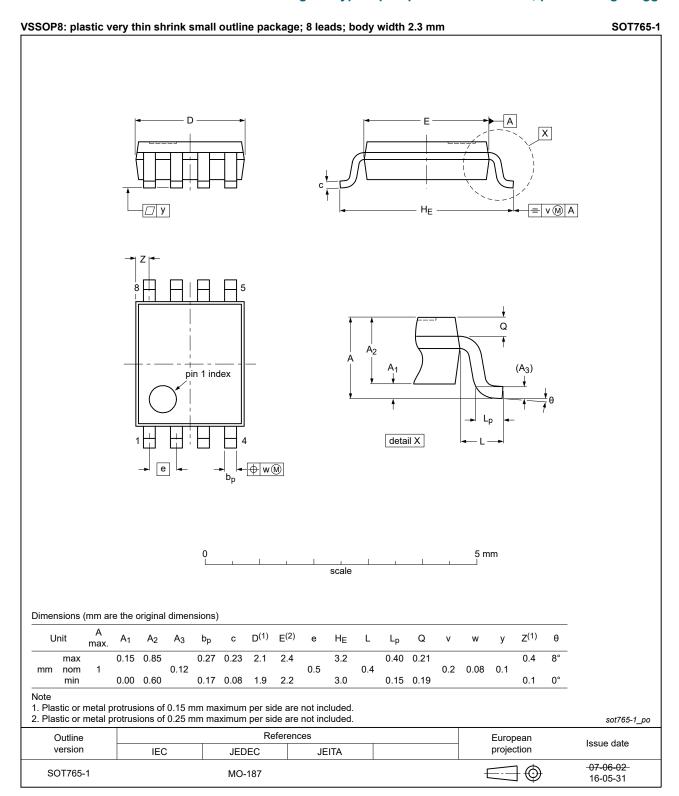


Fig. 8. Package outline SOT765-1 (VSSOP8)

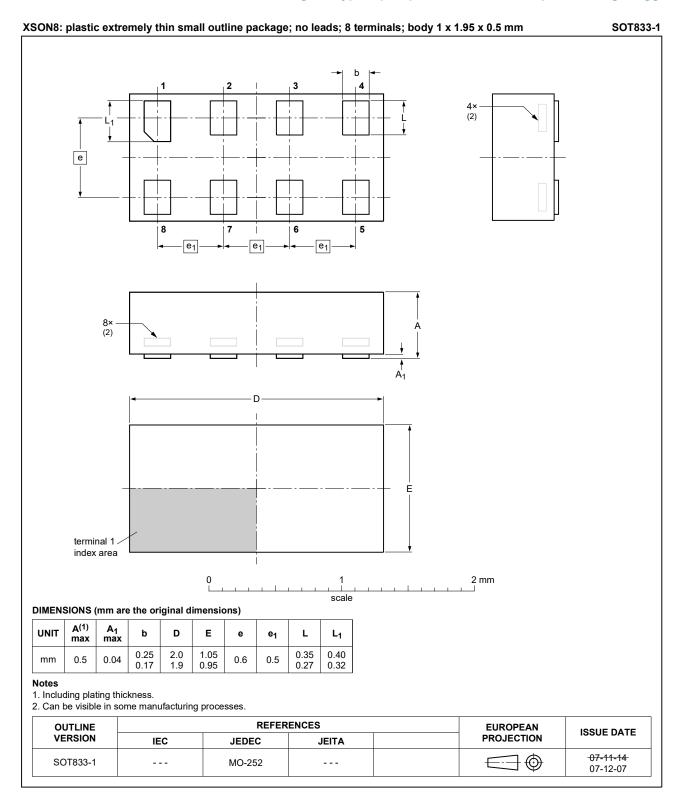


Fig. 9. Package outline SOT833-1 (XSON8)

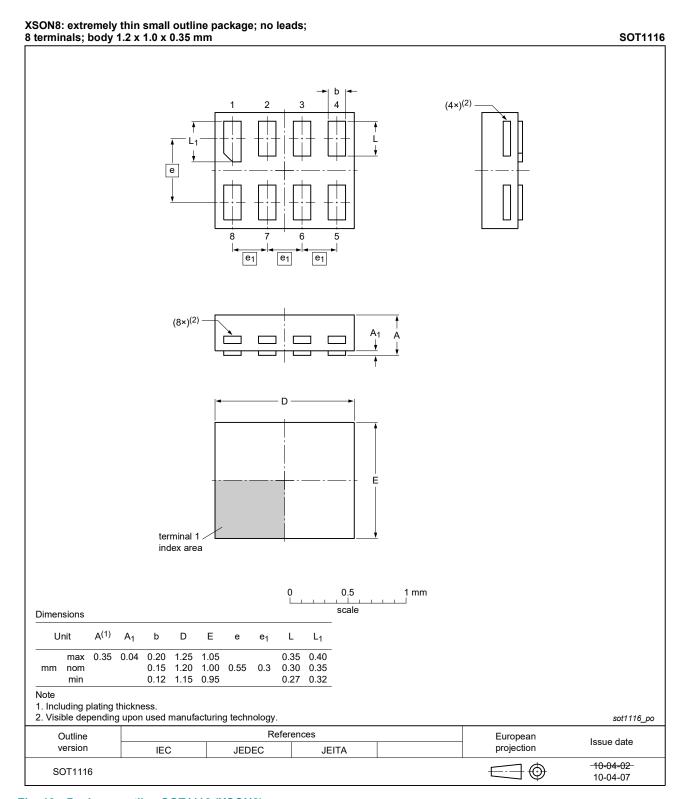


Fig. 10. Package outline SOT1116 (XSON8)

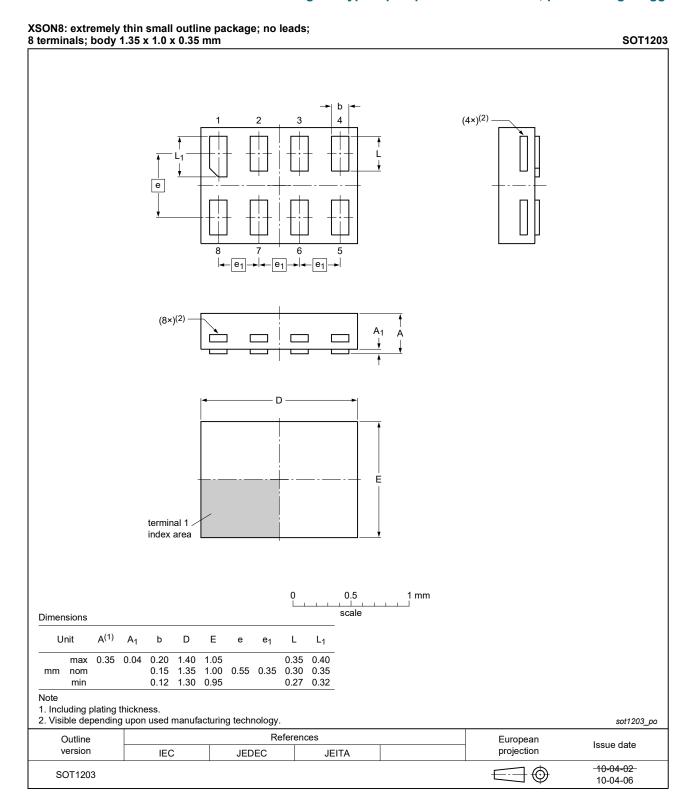


Fig. 11. Package outline SOT1203 (XSON8)

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

13. Abbreviations

Table 12. Abbreviations

Acronym	Description			
ANSI	American National Standards Institute			
CMOS	Complementary Metal-Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
ESDA	ElectroStatic Discharge Association			
НВМ	Human Body Model			
JEDEC	Joint Electron Device Engineering Council			
TTL	Transistor-Transistor Logic			

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74LVC1G74 v.17	20240809	Product data sheet	-	74LVC1G74 v.16		
Modifications:	Type number 74LVC1G74GF (SOT1089/XSON8) removed.					
74LVC1G74 v.16	20230818	Product data sheet	-	74LVC1G74 v.15		
Modifications:	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.					
74LVC1G74 v.15	20210920	920 Product data sheet - 74LVC1G74 v.14				
Modifications:	 <u>Section 1</u> and <u>Section 2</u> updated. Type number 74LVC1G74GM (SOT902-2/XQFN8) removed. <u>Section 8</u>: P_{tot} total power dissipation and derating values updated. 					
74LVC1G74 v.14	20181227	Product data sheet	-	74LVC1G74 v.13		
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. Type number 74LVC1G74GD (SOT996-2) removed. 					
74LVC1G74 v.13	20161205	Product data sheet	-	74LVC1G74 v.12		
Modifications:	<u>Table 8</u> : The maximum limits for leakage current and supply current have changed.					
74LVC1G74 v.12	20130402	Product data sheet	-	74LVC1G74 v.11		
Modifications:	For type number 74LVC1G74GD XSON8U has changed to XSON8.					
74LVC1G74 v.11	20120604	Product data sheet - 74LVC1G74 v.10		74LVC1G74 v.10		
Modifications:	For type number 74LVC1G74GM the SOT code has changed to SOT902-2.					
74LVC1G74 v.10	20111202	Product data sheet	-	74LVC1G74 v.9		
Modifications:	Legal pages updated.					
74LVC1G74 v.9	20100805	Product data sheet	-	74LVC1G74 v.8		
74LVC1G74 v.8	20091203	Product data sheet	-	74LVC1G74 v.7		
74LVC1G74 v.7	20080626	Product data sheet	-	74LVC1G74 v.6		
74LVC1G74 v.6	20080219	Product data sheet	-	74LVC1G74 v.5		
74LVC1G74 v.5	20070809	Product data sheet	-	74LVC1G74 v.4		
74LVC1G74 v.4	20061207	Product data sheet	-	74LVC1G74 v.3		

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15. 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.

- 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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