Single D-type flip-flop with set and reset; positive edge trigger Rev. 14 — 27 December 2018

Product data sheet

1. General description

The 74LVC1G74 is a single positive edge triggered D-type flip-flop with individual data (D) inputs, clock (CP) inputs, set (\overline{SD}) and reset (\overline{RD}) inputs, and complementary Q and \overline{Q} outputs.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing damaging backflow current through the device when it is powered down.

The set and reset are asynchronous active LOW inputs and operate independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D inputs must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

Schmitt trigger action at all inputs makes the circuit highly tolerant of slower input rise and fall times.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant inputs for interfacing with 5 V logic
- High noise immunity
- 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 JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 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	1. Ordering	information
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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				
74LVC1G74GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm	SOT1089				
74LVC1G74GM	-40 °C to +125 °C	XQFN8	plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-2				
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				

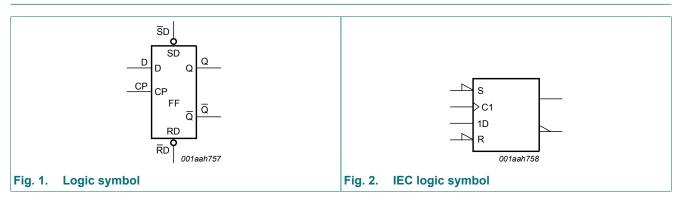
4. Marking

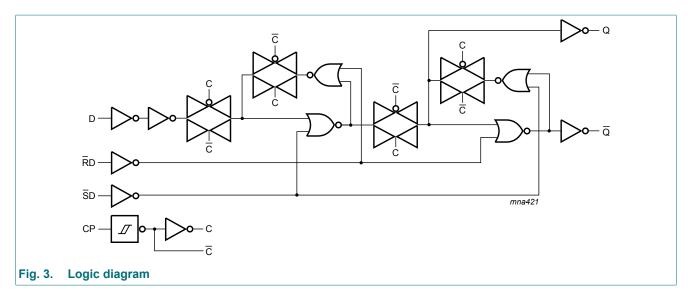
Table 2. Marking codes

Type number	Marking code [1]				
74LVC1G74DP	V74				
74LVC1G74DC	V74				
74LVC1G74GT	V74				
74LVC1G74GF	Y4				
74LVC1G74GM	V74				
74LVC1G74GN	Y4				
74LVC1G74GS	Y4				

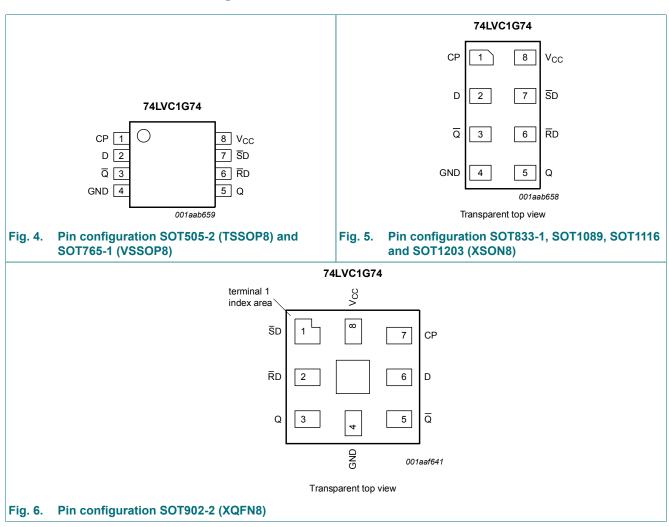
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram





6. Pinning information



6.1. Pinning

74LVC1G74

6.2. Pin description

Table	3. Pin	description

Symbol	Pin		Description		
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT1116 and SOT1203	SOT902-2			
СР	1	7	clock input (LOW-to-HIGH, edge-triggered)		
D	2	6	data input		
Q	3	5	complement output		
GND	4	4	ground (0 V)		
Q	5	3	true output		
RD	6	2	asynchronous reset-direct input (active LOW)		
<u>s</u> d	7	1	asynchronous set-direct input (active LOW)		
V _{CC}	8	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	1	L	L	Н	
Н	Н	1	Н	Н	L	

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	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 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
I _O	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 °C to +125 °C [2] -	300	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.

[2] For TSSOP8 packages: above 55 °C the value of P_{tot} derates linearly with 2.5 mW/K. For VSSOP8 packages: above 110 °C the value of P_{tot} derates linearly with 8.0 mW/K. For XSON8 and XQFN8 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

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} =	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		
			Min	Тур [1]	Max	Min	Мах		
VIH	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	
VIL	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	V _I = V _{IH} or V _{IL}							
	voltage	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 mA; V _{CC} = 2.3 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	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	-	±1	μA	
I _{OFF}	power-off leakage current	$V_{\rm I}$ or $V_{\rm O}$ = 5.5 V; $V_{\rm CC}$ = 0 V	-	±0.1	±2	-	±2	μA	
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	μA	
ΔI _{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	μA	
Cı	input capacitance		-	4.0	-	-	-	pF	

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

11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 9.

Symbol	Parameter	Conditions	T _{amb} =	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		
			Min	Typ [1]	Max	Min	Max	1	
t _{pd}	propagation delay	CP to Q, \overline{Q} ; see Fig. 7 [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	
		$V_{\rm CC}$ = 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 Fig. 8 [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{RD} to Q, \overline{Q} ; see Fig. 8 [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. 7							
		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	
		$V_{\rm CC}$ = 4.5 V to 5.5 V	2.0	-	-	2.0	-	ns	
		SD and RD LOW; see Fig. 8							
		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. 8							
		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	

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

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. 7						
		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. 7						
		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. 7						
	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	$V_1 = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$ [3]	-	15	-	-	-	pF

[1] 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.

[2] t_{pd} is the same as t_{PLH} and t_{PHL} . [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:

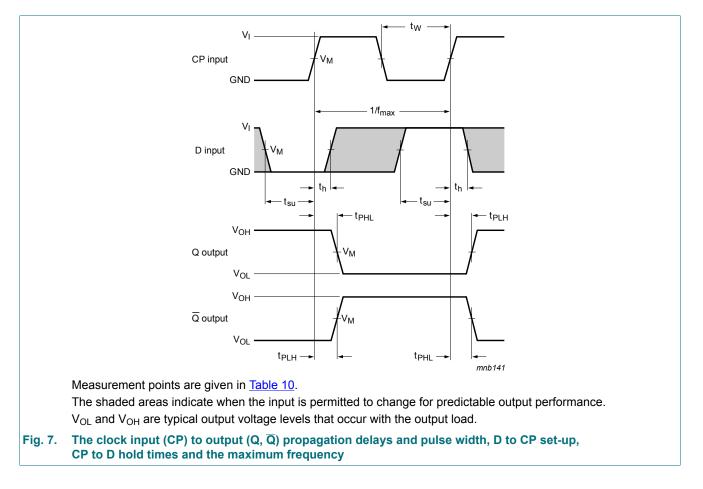
 f_i = input frequency in MHz;

 f_o = output frequency in MHz;

 C_{L} = output load capacitance in pF;

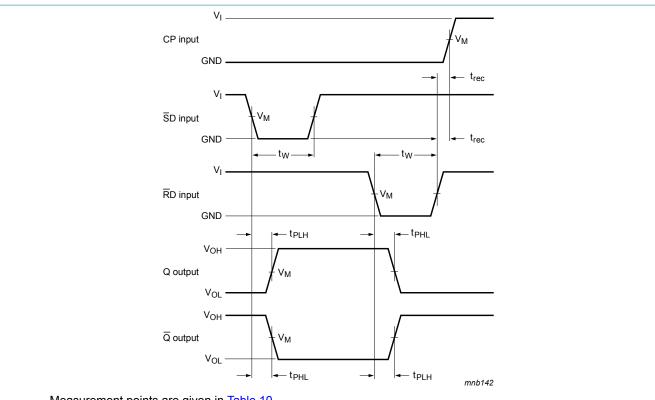
V_{CC} = supply voltage in V;

N = number of inputs switching; $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of outputs.



11.1. Waveforms and test circuit

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



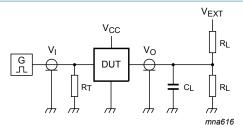
Measurement points are given in Table 10.

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

Fig. 8. The set (\overline{SD}) and reset (\overline{RD}) input to output (Q, \overline{Q}) propagation delays, pulse widths and the \overline{RD} to 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}	



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. 9. 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	RL	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	$2 \times V_{CC}$
2.3 V to 2.7 V	V _{CC}	≤ 2.0 ns	30 pF	500 Ω	open	GND	$2 \times V_{CC}$
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	$2 \times V_{CC}$

12. Package outline

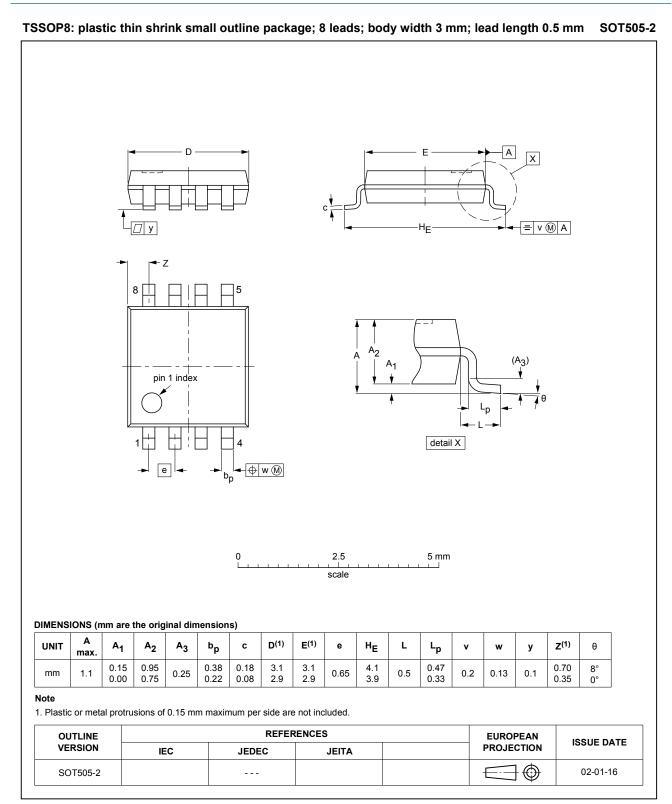
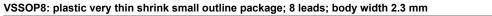


Fig. 10. Package outline SOT505-2 (TSSOP8)

74LVC1G74





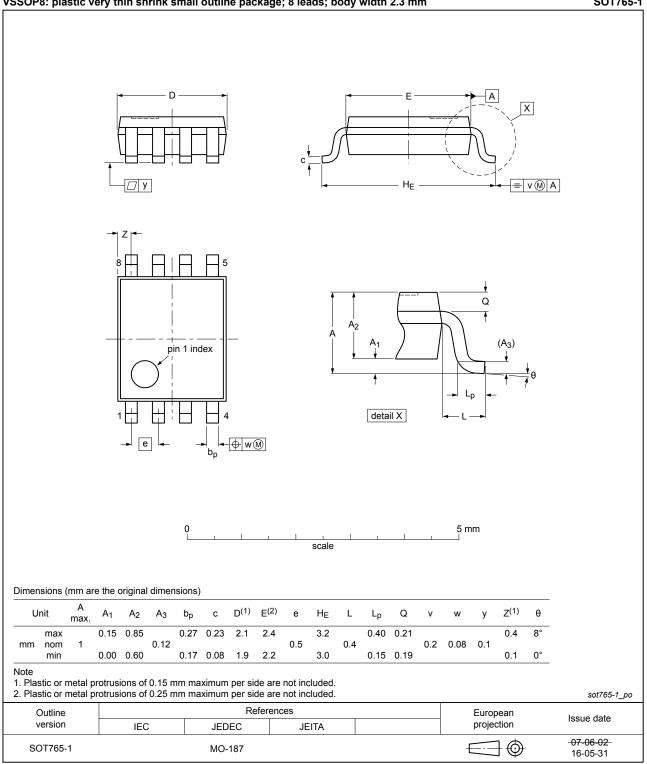


Fig. 11. Package outline SOT765-1 (VSSOP8)

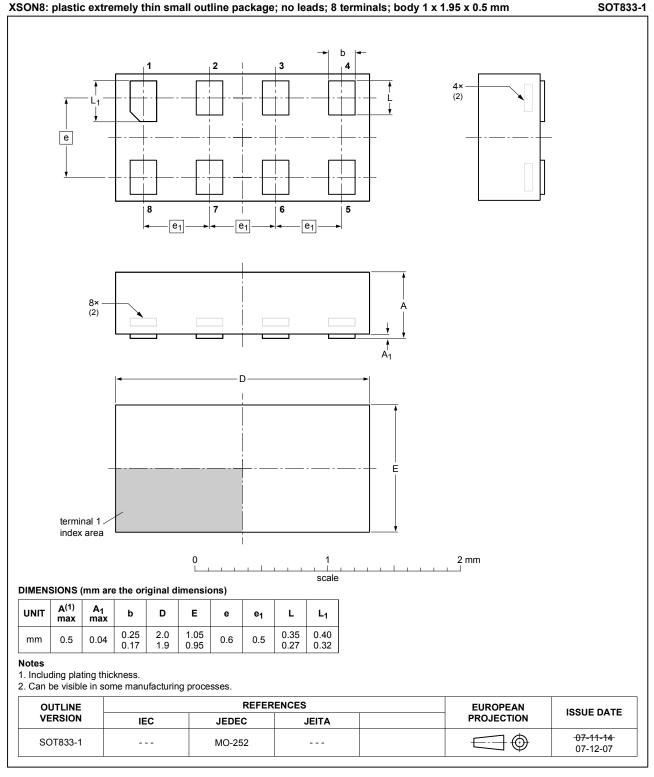


Fig. 12. Package outline SOT833-1 (XSON8)

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

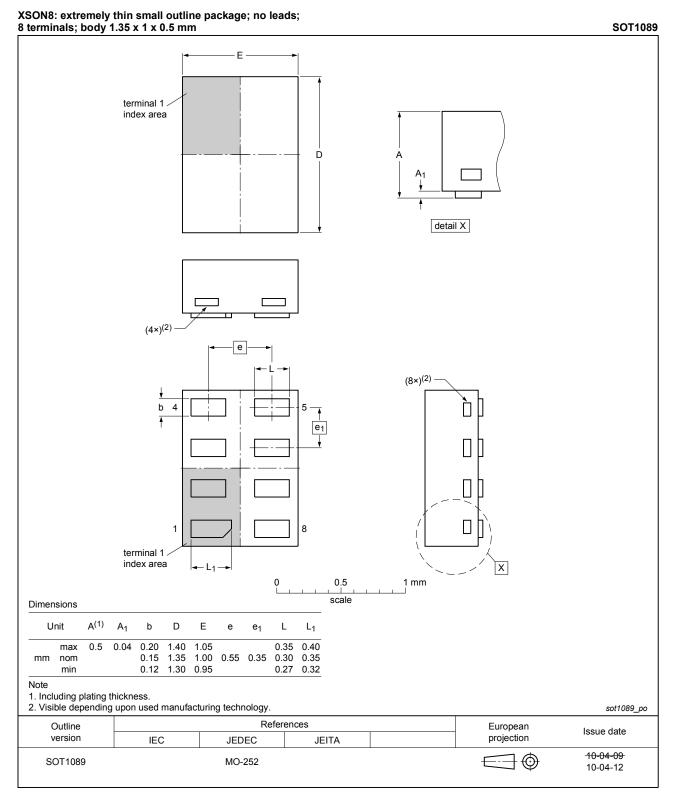


Fig. 13. Package outline SOT1089 (XSON8)

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

XQFN8: plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 x 1.6 x 0.5 mm

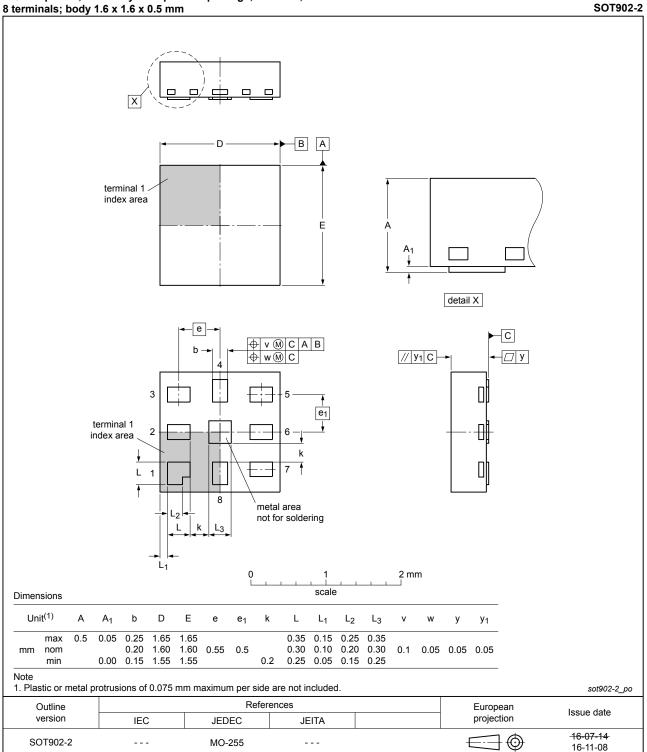


Fig. 14. Package outline SOT902-2 (XQFN8)

XSON8: extremely thin small outline package; no leads; 8 terminals; body 1.2 x 1.0 x 0.35 mm

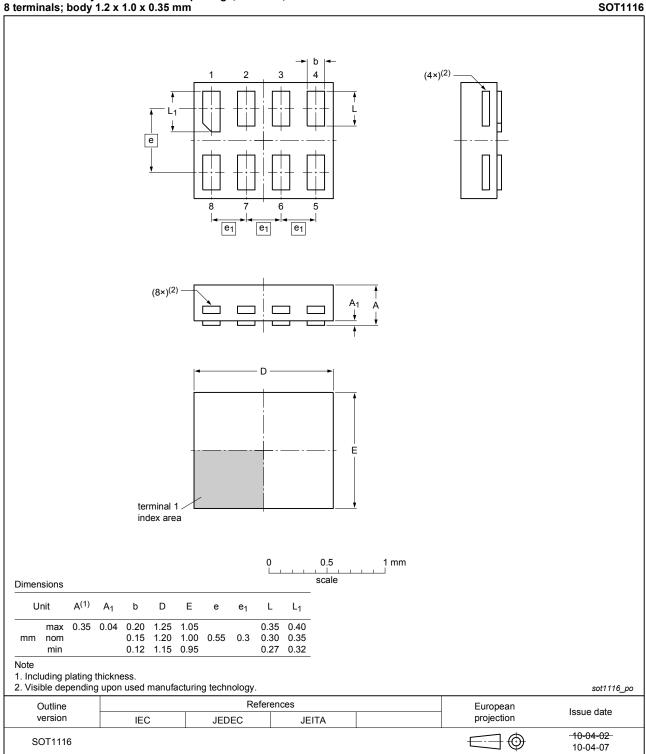
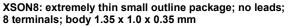


Fig. 15. Package outline SOT1116 (XSON8)



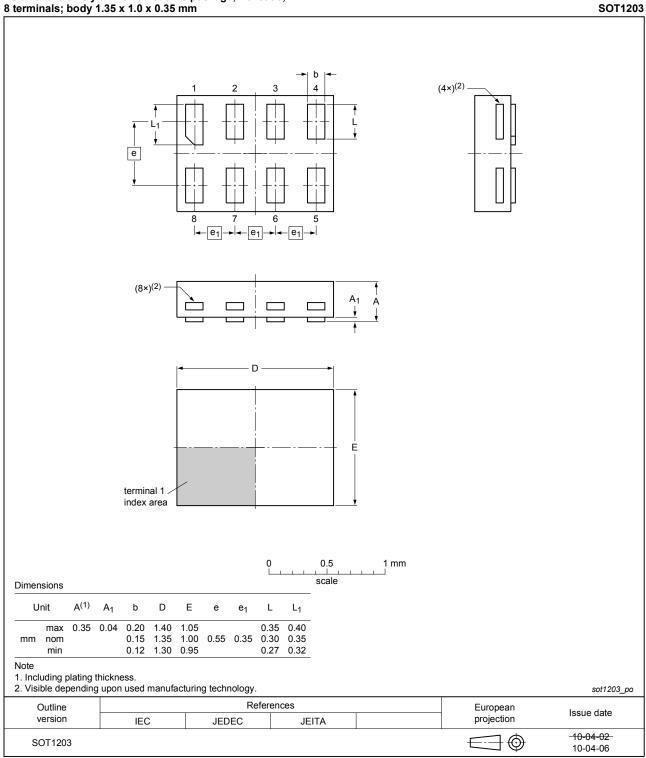


Fig. 16. Package outline SOT1203 (XSON8)

13. Abbreviations

Table 12. Abbreviations			
Acronym	Description		
CMOS	Complementary Metal-Oxide Semiconductor		
DUT	Device Under Test		
ESD	ElectroStatic Discharge		
НВМ	Human Body Model		
MM	Machine Model		
TTL	Transistor-Transistor Logic		

14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74LVC1G74 v.14	20181227	Product data sheet	-	74LVC1G74 v.13			
Modifications:	of Nexperia Legal texts 		new company nam	nply with the identity guidelines e where appropriate.			
74LVC1G74 v.13	20161205	Product data sheet	-	74LVC1G74 v.12			
Modifications:	• <u>Table 8</u> : The	• <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 nul	For type number 74LVC1G74GD XSON8U has changed to XSON8.					
74LVC1G74 v.11	20120604	Product data sheet	-	74LVC1G74 v.10			
Modifications:	For type nul	• 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	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			
74LVC1G74 v.3	20050201	Product specification	-	74LVC1G74 v.2			
74LVC1G74 v.2	20040909	Product specification	-	74LVC1G74 v.1			
74LVC1G74 v.1	20040202	Product specification	-	-			

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".
- [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 <u>https://www.nexperia.com</u>.

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