

# 74LVC2G74-Q100

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

Rev. 3 — 3 October 2018

Product data sheet

## 1. General description

The 74LVC2G74-Q100 is a single positive-edge triggered D-type flip-flop. It has individual data (D) inputs, clock (CP) inputs, set ( $\bar{S}D$ ) and reset ( $\bar{R}D$ ) inputs, and complementary Q and  $\bar{Q}$  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 to slower input rise and fall times.

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 1.65 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:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V ( $C = 200 \text{ pF}$ ,  $R = 0 \Omega$ )
- $\pm 24 \text{ mA}$  output drive ( $V_{CC} = 3.0 \text{ V}$ )
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V

### 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC2G74DP-Q100	-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
74LVC2G74DC-Q100	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1

### 4. Marking

Table 2. Marking codes

Type number	Marking code [1]
74LVC2G74DP-Q100	V74
74LVC2G74DC-Q100	V74

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

### 5. Functional diagram

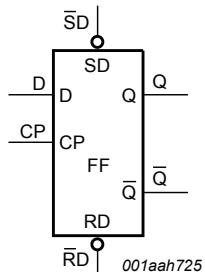


Fig. 1. Logic symbol

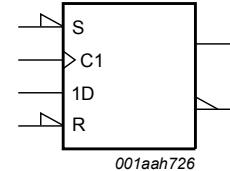


Fig. 2. IEC logic symbol

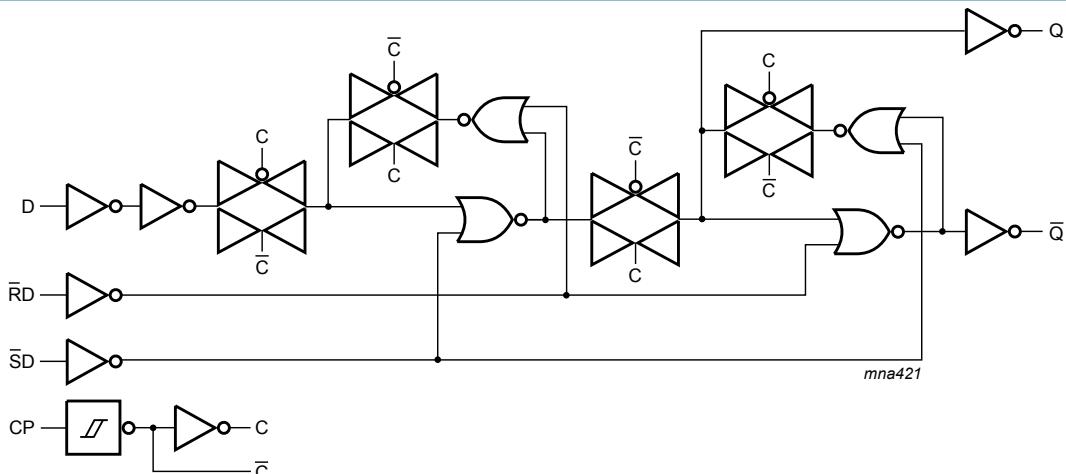


Fig. 3. Logic diagram

## 6. Pinning information

### 6.1. Pinning

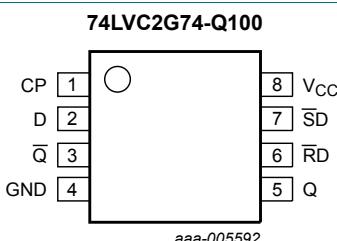


Fig. 4. Pin configuration SOT505-2 (TSSOP8) and SOT765-1 (VSSOP8)

### 6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
CP	1	clock input (LOW-to-HIGH, edge-triggered)
D	2	data input
$\bar{Q}$	3	complement output
GND	4	ground (0 V)
Q	5	true output
$\bar{R}D$	6	asynchronous reset-direct input (active LOW)
$\bar{S}D$	7	asynchronous set-direct input (active LOW)
V <sub>CC</sub>	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	
$\bar{S}D$	$\bar{R}D$	CP	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H

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	
$\bar{S}D$	$\bar{R}D$	CP	D	$Q_{n+1}$	$\bar{Q}_{n+1}$
H	H	$\uparrow$	L	L	H
H	H	$\uparrow$	H	H	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	
$V_I$	input voltage		[1]	-0.5	+6.5	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA	
$V_O$	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 to $V_{CC}$	-	$\pm 50$	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.

## 9. Recommended operating conditions

**Table 7. Operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		1.65	5.5	V
$V_I$	input voltage		0	5.5	V
$V_O$	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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	-	20	ns/V
		$V_{CC} = 2.7$ V to 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 <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35V <sub>CC</sub>	-	0.35V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = -100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	1.54	-	0.95	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	2.15	-	1.7	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	2.50	-	1.9	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	2.62	-	2.0	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	4.11	-	3.4	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.10	-	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	0.07	0.45	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	0.12	0.30	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	0.17	0.40	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	0.33	0.55	-	0.80	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	0.39	0.55	-	0.80	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	±0.1	±1	-	±1	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	±0.1	±2	-	±2	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A	-	0.1	4	-	4	µA
ΔI <sub>CC</sub>	additional supply current	per pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.3 V to 5.5 V	-	5	500	-	500	µA
C <sub>I</sub>	input capacitance		-	4.0	-	-	-	pF

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Fig. 7](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	CP to Q, $\bar{Q}$ ; see <a href="#">Fig. 5</a> [2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.5	6.0	13.4	1.5	13.4	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.0	3.5	7.1	1.0	7.1	ns
		$V_{CC} = 2.7 \text{ V}$	1.0	3.5	7.1	1.0	7.1	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.0	3.5	5.9	1.0	5.9	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	2.5	4.1	1.0	4.1	ns
		SD to Q, $\bar{Q}$ ; see <a href="#">Fig. 6</a> [2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.5	6.0	12.9	1.5	12.9	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.0	3.5	7.0	1.0	7.0	ns
		$V_{CC} = 2.7 \text{ V}$	1.0	3.5	7.0	1.0	7.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.0	3.0	5.9	1.0	5.9	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	2.5	4.1	1.0	4.1	ns
		RD to Q, $\bar{Q}$ ; see <a href="#">Fig. 6</a> [2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.5	5.0	12.9	1.5	12.9	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.0	3.5	7.0	1.0	7.0	ns
		$V_{CC} = 2.7 \text{ V}$	1.0	3.5	7.0	1.0	7.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.0	3.0	5.9	1.0	5.9	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	2.5	4.1	1.0	4.1	ns
t <sub>w</sub>	pulse width	CP HIGH or LOW; see <a href="#">Fig. 5</a>						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	6.2	-	-	6.2	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	2.7	-	-	2.7	-	ns
		$V_{CC} = 2.7 \text{ V}$	2.7	-	-	2.7	-	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	2.7	1.3	-	2.7	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	ns
		SD and RD LOW; see <a href="#">Fig. 6</a>						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	6.2	-	-	6.2	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	2.7	-	-	2.7	-	ns
		$V_{CC} = 2.7 \text{ V}$	2.7	-	-	2.7	-	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	2.7	1.6	-	2.7	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	ns
t <sub>rec</sub>	recovery time	SD or RD; see <a href="#">Fig. 6</a>						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.9	-	-	1.9	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.4	-	-	1.4	-	ns
		$V_{CC} = 2.7 \text{ V}$	1.3	-	-	1.3	-	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	+1.2	-3.0	-	+1.2	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	-	-	1.0	-	ns

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t <sub>su</sub>	set-up time	D to CP; see Fig. 5						
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.9	-	-	2.9	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	ns
		V <sub>CC</sub> = 2.7 V	1.7	-	-	1.7	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.3	0.5	-	1.3	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.1	-	-	1.1	-	ns
t <sub>h</sub>	hold time	D to CP; see Fig. 5						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	-	-	1.5	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	-	-	1.0	-	ns
		V <sub>CC</sub> = 2.7 V	1.0	-	-	1.0	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	0.6	-	1.0	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.0	-	-	1.0	-	ns
f <sub>max</sub>	maximum frequency	CP; see Fig. 5						
		V <sub>CC</sub> = 1.65 V to 1.95 V	80	-	-	80	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	175	-	-	175	-	MHz
		V <sub>CC</sub> = 2.7 V	175	-	-	175	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	175	280	-	175	-	MHz
		V <sub>CC</sub> = 4.5 V to 5.5 V	200	-	-	200	-	MHz
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V [3]	-	15	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

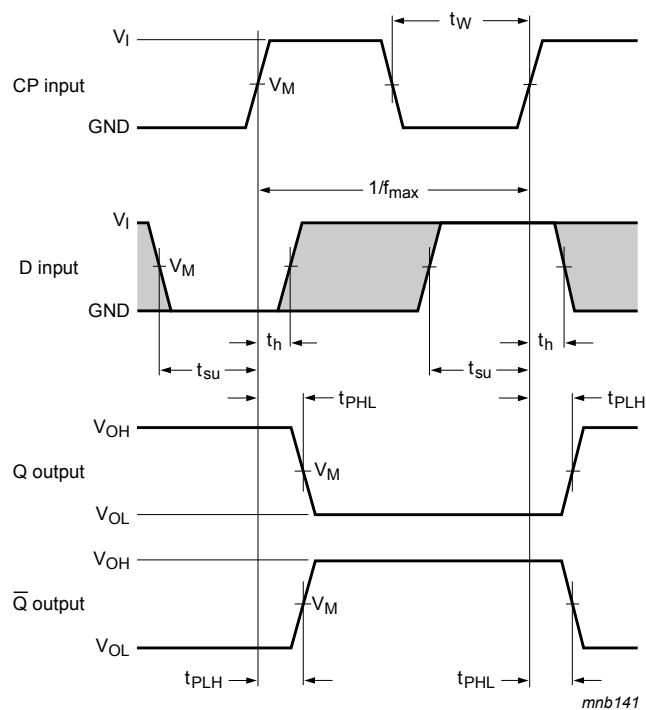
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

### 11.1. Waveforms and test circuit



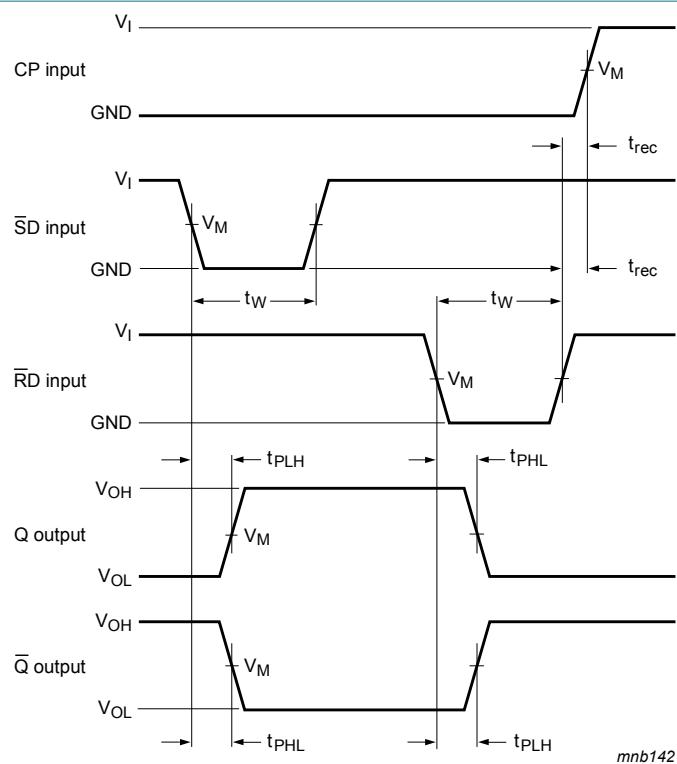
Measurement points are given in [Table 10](#).

The shaded areas indicate when the input is permitted to change for predictable output performance.

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

**Fig. 5. The clock input (CP) to output (Q,  $\bar{Q}$ ) propagation delays, the clock pulse width, the D to CP set-up time, the CP to D hold time and the CP maximum frequency**

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



Measurement points are given in [Table 10](#).

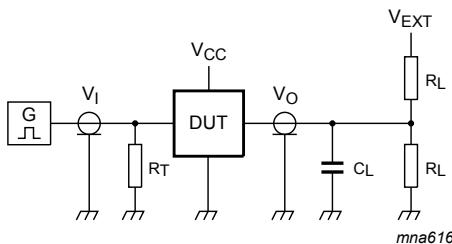
$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig. 6. The set (SD) and reset (RD) input to output (Q, Q̄) propagation delays, the set and reset pulse widths and the 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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

## 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. 7. Test circuit for measuring switching times**

**Table 11. Test data**

Supply voltage	Input	Load	$V_{EXT}$				
$V_{CC}$	$V_I$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$	
1.65 V to 1.95 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	1 k $\Omega$	open	GND	$2V_{CC}$
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 $\Omega$	open	GND	$2V_{CC}$
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	GND	6 V
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	GND	6 V
4.5 V to 5.5 V	$V_{CC}$	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	GND	$2V_{CC}$

## 12. Package outline

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

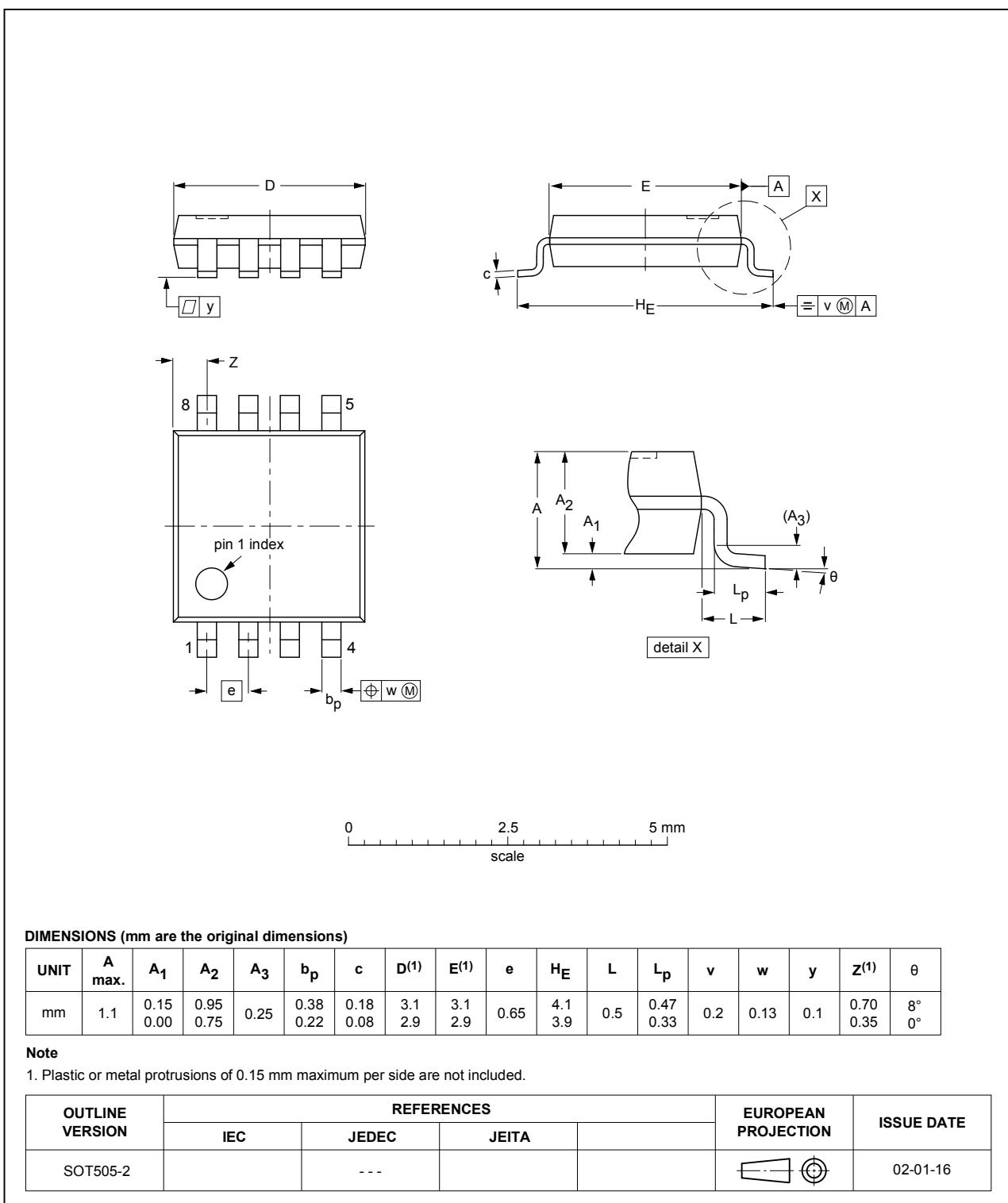


Fig. 8. Package outline SOT505-2 (TSSOP8)

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

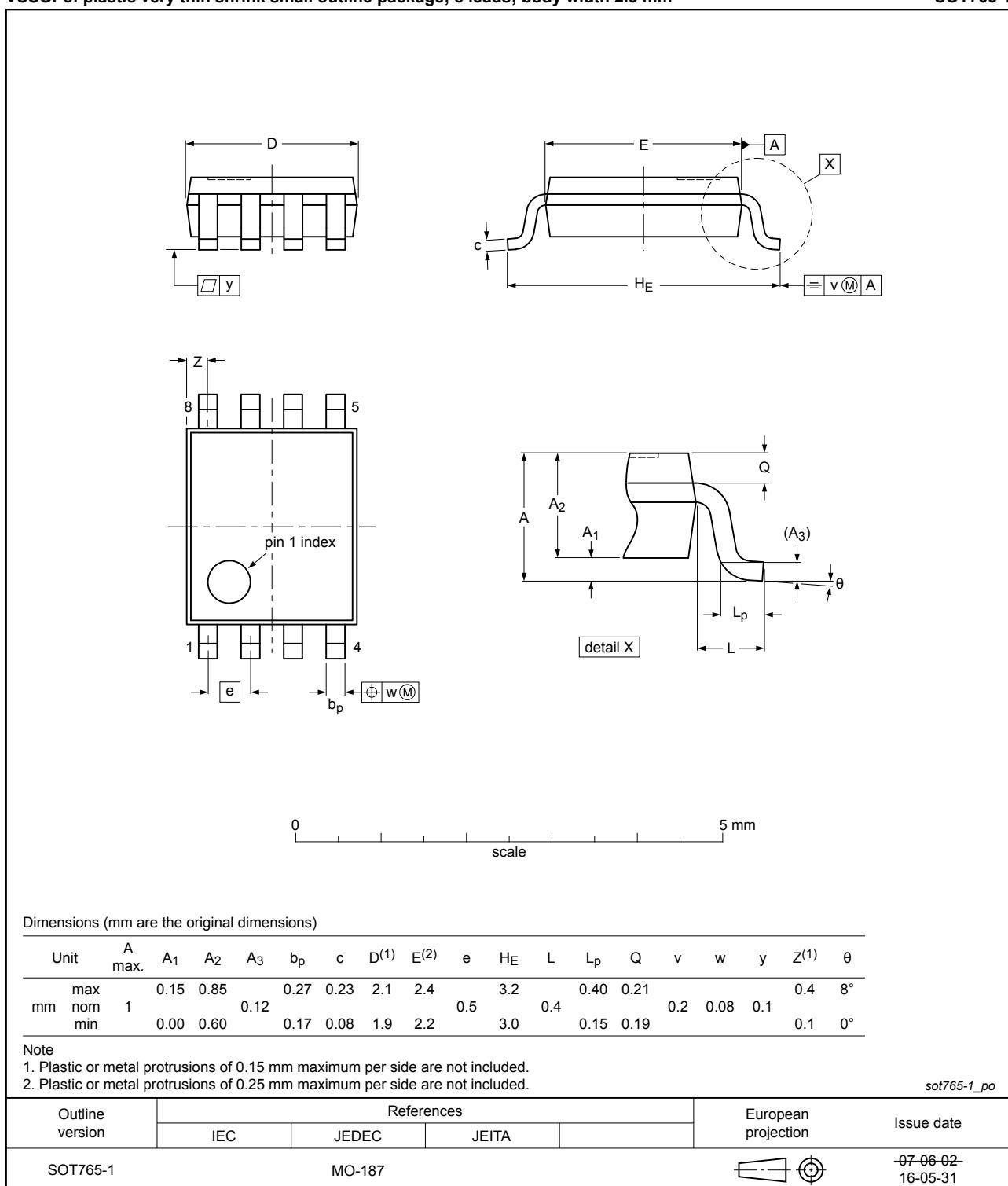


Fig. 9. Package outline SOT765-1 (VSSOP8)

## 13. Abbreviations

**Table 12. 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

## 14. Revision history

**Table 13. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G74_Q100 v.3	20181003	Product data sheet	-	74LVC2G74_Q100 v.2
Modifications:				<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>
74LVC2G74_Q100 v.2	20161214	Product data sheet	-	74LVC2G74_Q100 v.1
Modifications:				<ul style="list-style-type: none"> <li><a href="#">Table 8</a>: The maximum limits for leakage current and supply current have changed.</li> </ul>
74LVC2G74_Q100 v.1	20121224	Product data sheet	-	-

## 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.

- [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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