

74LVC1G175-Q100

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

Rev. 3 — 3 October 2019

Product data sheet

1. General description

The 74LVC1G175-Q100 is a low-power, low-voltage single positive edge triggered D-type flip-flop with individual data (D) input, clock (CP) input, master reset (\overline{MR}) input, and Q output. The master reset (\overline{MR}) is an asynchronous active LOW input and operates 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 input must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation. The inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment. This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down. Schmitt trigger action at all inputs makes the circuit highly tolerant of 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)
 - JESD8B/JESD36 (2.7 V to 3.6 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
- 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)

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G175GW-Q100	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74LVC1G175GV-Q100	-40 °C to +125 °C	SC-74	plastic surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

4. Marking

Table 2. Marking

Type number	Marking code [1]
74LVC1G175GW-Q100	YT
74LVC1G175GV-Q100	V75

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

5. Functional diagram

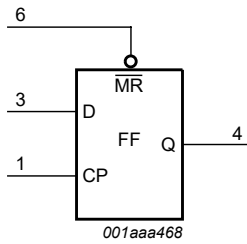


Fig. 1. Logic symbol

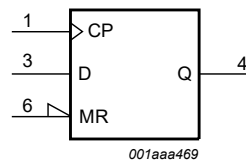


Fig. 2. IEC logic symbol

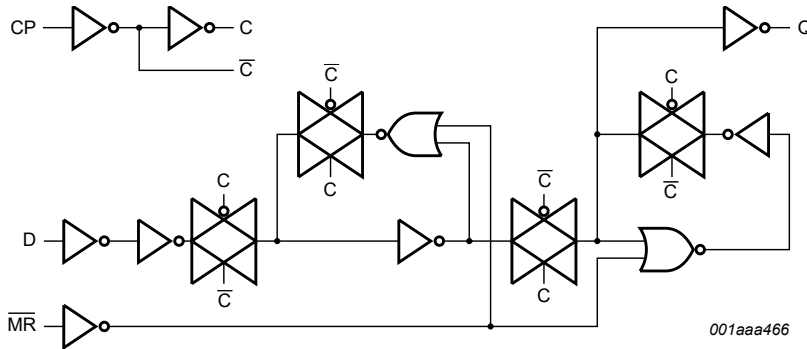


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

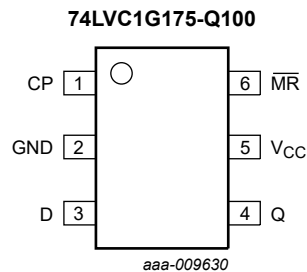


Fig. 4. Pin configuration SOT363 (SC-88) and SOT457 (SC-74)

6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
CP	1	clock input (LOW-to-HIGH, edge-triggered)
GND	2	ground (0 V)
D	3	data input
Q	4	output Q
V _{CC}	5	supply voltage
$\overline{\text{MR}}$	6	master reset input (active LOW)

7. Functional description

Table 4. 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;
 ↑ = LOW-to-HIGH CP transition; X = don't care.

Operating mode	Input			Output
	$\overline{\text{MR}}$	CP	D	Q
Reset (clear)	L	X	X	L
Load '1'	H	↑	h	H
Load '0'	H	↑	l	L

8. Limiting values

Table 5. 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	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}	-	±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]	-	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.

[2] For SOT363 (TSSOP6) packages: P_{tot} derates linearly with 3.7 mW/K above 83 °C.

For SOT457 (TSOP6) packages: P_{tot} derates linearly with 4.1 mW/K above 89 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	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 7. Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
$T_{amb} = -40$ °C to +85 °C						
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	V
		$V_{CC} = 4.5$ V to 5.5 V	$0.7 \times V_{CC}$	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	V
		$V_{CC} = 4.5$ V to 5.5 V	-	-	$0.3 \times V_{CC}$	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100$ μ A; $V_{CC} = 1.65$ V to 5.5 V	$V_{CC} - 0.1$	-	-	V
		$I_O = -4$ mA; $V_{CC} = 1.65$ V	1.2	1.54	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	2.15	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	2.50	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	2.62	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100$ μ A; $V_{CC} = 1.65$ V to 5.5 V	-	-	0.10	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	0.07	0.45	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	0.12	0.30	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	0.17	0.40	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	0.33	0.55	V
		$I_O = 32$ mA; $V_{CC} = 4.5$ V	-	0.39	0.55	V

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

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
I_I	input leakage current	$V_{CC} = 0\text{ V to }5.5\text{ V}$; $V_I = 5.5\text{ V or GND}$ [2]	-	± 0.1	± 1	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0\text{ V}$; V_I or $V_O = 5.5\text{ V}$	-	± 0.1	± 2	μA
I_{CC}	supply current	$V_{CC} = 1.65\text{ V to }5.5\text{ V}$; $I_O = 0\text{ A}$; $V_I = 5.5\text{ V or GND}$	-	0.1	4	μA
ΔI_{CC}	additional supply current	$V_{CC} = 2.3\text{ V to }5.5\text{ V}$; $V_I = V_{CC} - 0.6\text{ V}$; $I_O = 0\text{ A}$ [2]	-	5	500	μA
C_I	input capacitance	$V_{CC} = 3.3\text{ V}$; $V_I = \text{GND to }V_{CC}$	-	2.5	-	pF
$T_{amb} = -40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	-	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7 \times V_{CC}$	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	$0.3 \times V_{CC}$	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$	$V_{CC} - 0.1$	-	-	V
		$I_O = -4\text{ mA}$; $V_{CC} = 1.65\text{ V}$	0.95	-	-	V
		$I_O = -8\text{ mA}$; $V_{CC} = 2.3\text{ V}$	1.7	-	-	V
		$I_O = -12\text{ mA}$; $V_{CC} = 2.7\text{ V}$	1.9	-	-	V
		$I_O = -24\text{ mA}$; $V_{CC} = 3.0\text{ V}$	2.0	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$	-	-	0.10	V
		$I_O = 4\text{ mA}$; $V_{CC} = 1.65\text{ V}$	-	-	0.70	V
		$I_O = 8\text{ mA}$; $V_{CC} = 2.3\text{ V}$	-	-	0.45	V
		$I_O = 12\text{ mA}$; $V_{CC} = 2.7\text{ V}$	-	-	0.60	V
		$I_O = 24\text{ mA}$; $V_{CC} = 3.0\text{ V}$	-	-	0.80	V
I_I	input leakage current	$V_{CC} = 0\text{ V to }5.5\text{ V}$; $V_I = 5.5\text{ V or GND}$	-	-	± 1	μA
		$V_{CC} = 0\text{ V}$; V_I or $V_O = 5.5\text{ V}$	-	-	± 2	μA
		$V_{CC} = 1.65\text{ V to }5.5\text{ V}$; $I_O = 0\text{ A}$; $V_I = 5.5\text{ V or GND}$	-	-	4	μA
		$V_{CC} = 2.3\text{ V to }5.5\text{ V}$; $V_I = V_{CC} - 0.6\text{ V}$; $I_O = 0\text{ A}$	-	-	500	μA
		$V_{CC} = 0\text{ V to }5.5\text{ V}$; $V_I = 5.5\text{ V or GND}$	-	-	± 1	μA
		$V_{CC} = 0\text{ V}$; V_I or $V_O = 5.5\text{ V}$	-	-	± 2	μA

[1] All typical values are measured at $T_{amb} = 25\text{ }^\circ\text{C}$.

[2] These typical values are measured at $V_{CC} = 3.3\text{ V}$.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to 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	CP to Q; see Fig. 5 [2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.5	4.9	13.4	1.5	17	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.0	3.1	7.1	1.0	9.0	ns
		$V_{CC} = 2.7 \text{ V}$	1.0	3.2	7.1	1.0	9.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.0	3.1	5.7	0.5	7.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	2.2	4.0	0.5	5.5	ns
		MR to Q; see Fig. 6						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.5	4.3	12.9	1.5	17	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.0	2.8	7.0	1.0	9.0	ns
		$V_{CC} = 2.7 \text{ V}$	1.0	3.0	7.0	1.0	9.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.0	2.5	5.8	0.5	7.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	2.0	4.1	0.5	5.5	ns
t_w	pulse width	CP HIGH or LOW; see Fig. 5						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	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
		MR LOW; see Fig. 6						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	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_{rec}	recovery time	MR; see Fig. 6						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	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	0.4	-	1.2	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.0	-	-	1.0	-	ns
t_{su}	set-up time	D to CP; see Fig. 5						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	2.9	-	-	2.9	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	-	-	1.7	-	ns
		$V_{CC} = 2.7 \text{ V}$	1.7	-	-	1.7	-	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	1.3	0.5	-	1.3	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.1	-	-	1.1	-	ns

Single D-type flip-flop with 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	D to CP; see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	0.0	-	-	0.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	0.3	-	-	0.3	-	ns
		V _{CC} = 2.7 V	0.5	-	-	0.5	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.2	0.2	-	1.2	-	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	-	-	0.5	-	ns
f _{max}	maximum frequency	CP; see Fig. 5						
		V _{CC} = 1.65 V to 1.95 V	80	125	-	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	300	-	175	-	MHz
		V _{CC} = 4.5 V to 5.5 V	200	-	-	200	-	MHz
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; V _{CC} = 3.3 V [3]	-	14	-	-	-	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 μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

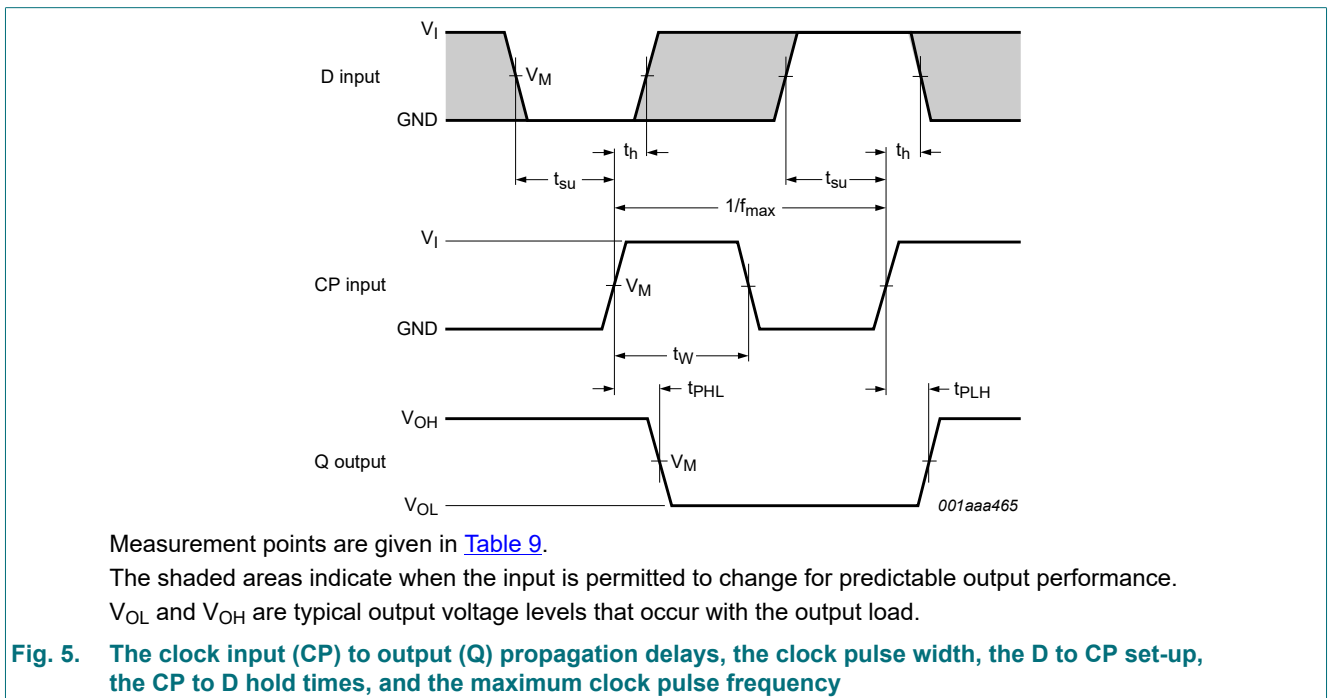
C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts;

N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of the outputs.

11.1. Waveforms

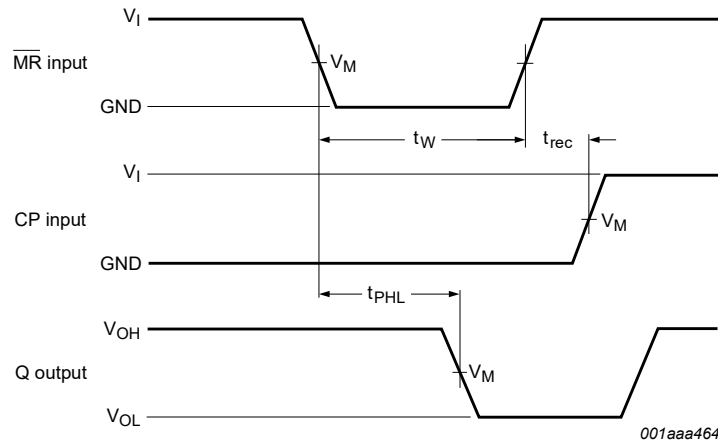


Measurement points are given in Table 9.

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) propagation delays, the clock pulse width, the D to CP set-up, the CP to D hold times, and the maximum clock pulse frequency



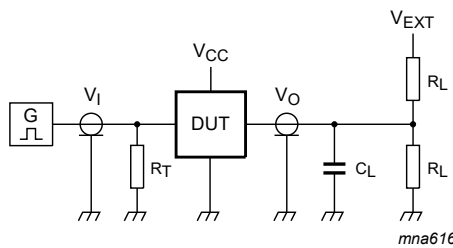
Measurement points are given in [Table 9](#).

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

Fig. 6. The master reset (\overline{MR}) input to output (Q) propagation delays, the master reset pulse width, and the \overline{MR} to CP recovery time

Table 9. 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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



Test data is given in [Table 10](#).

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 10. Test data

Supply voltage	Input		Load		V_{EXT}
	V_I	$t_r = t_f$	C_L	R_L	
V_{CC}	V_{CC}	≤ 2.0 ns	30 pF	1 k Ω	open
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open
2.3 V to 2.7 V	2.7 V	≤ 2.5 ns	50 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	V_{CC}	≤ 2.5 ns	50 pF	500 Ω	open
4.5 V to 5.5 V	V_{CC}	≤ 2.5 ns	50 pF	500 Ω	open

12. Package outline

Plastic surface-mounted package; 6 leads

SOT363

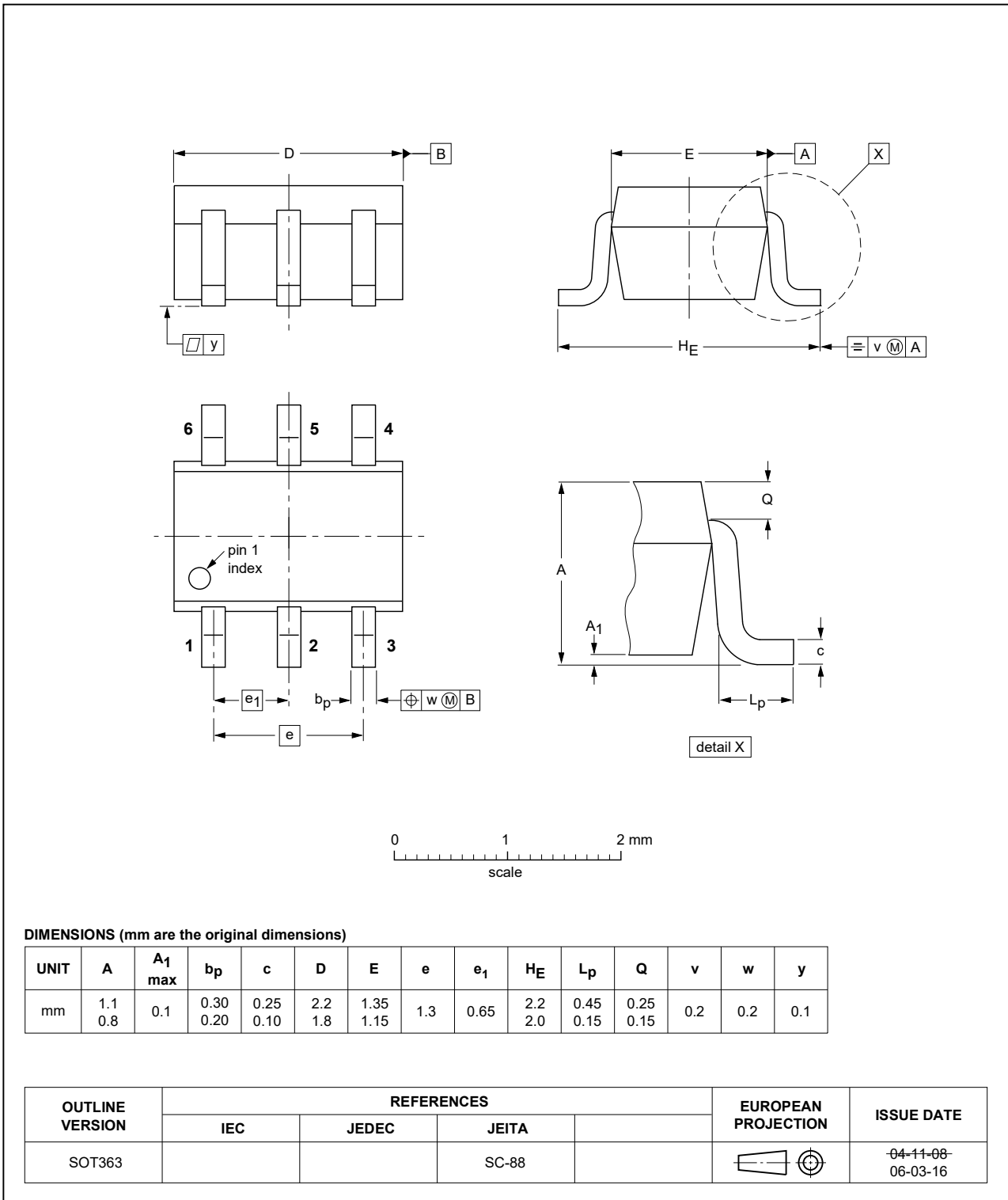


Fig. 8. Package outline SOT363 (SC-88)

Plastic, surface-mounted package (SC-74; TSOP6); 6 leads

SOT457

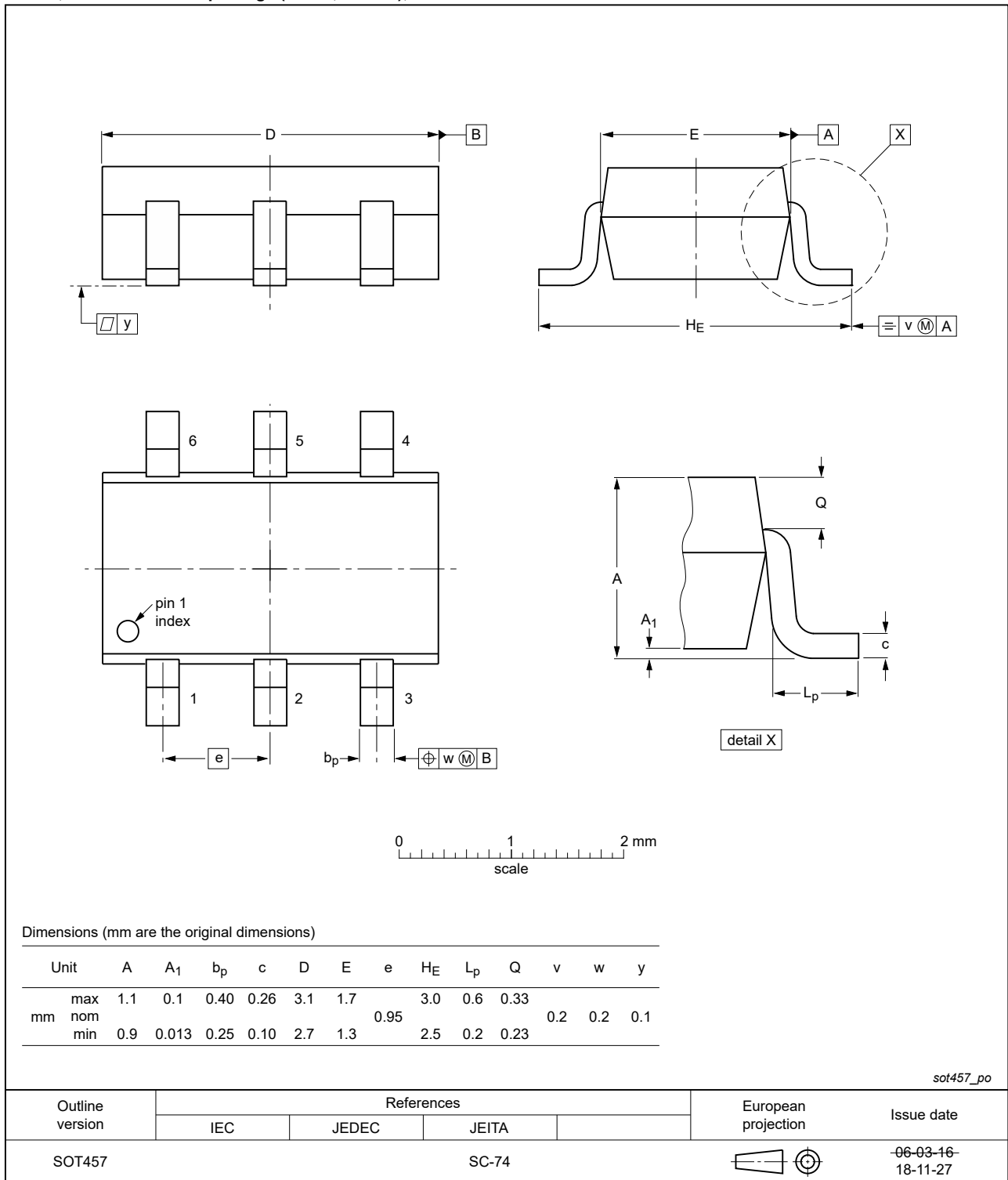


Fig. 9. Package outline SOT457 (SC-74)

13. Abbreviations

Table 11. 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 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G175_Q100 v.3	20191003	Product data sheet	-	74LVC1G175_Q100 v.2
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. Table 5: Derating values for P_{tot} total power dissipation updated. Package outline drawing SOT457 (SC-74) updated. 			
74LVC1G175_Q100 v.2	20161209	Product data sheet	-	74LVC1G175_Q100 v.1
Modifications:	<ul style="list-style-type: none"> Table 7: The maximum limits for leakage current and supply current have changed. 			
74LVC1G175_Q100 v.1	20131115	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".
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