

# DATA SHEET

## **74LVC1G79**

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

Product specification  
File under Integrated Circuits, IC24

2001 Apr 04

## Single D-type flip-flop; positive-edge trigger

## 74LVC1G79

## FEATURES

- Wide supply voltage range from 1.65 to 5.5 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 to 1.95 V)
  - JESD8-5 (2.3 to 2.7 V)
  - JESD8B/JESD36 (2.7 to 3.6 V).
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- CMOS low power consumption
- Latch-up performance  $\leq 250$  mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- SOT353 package.

## DESCRIPTION

The 74LVC1G79 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3 or 5 V devices. This feature allows the use of this device in a mixed 3.3 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.

The 74LVC1G79 provides a single positive-edge triggered D-type flip-flop.

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.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C;  $t_r = t_f \leq 2.5$  ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	propagation delay CP to Q	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k $\Omega$	3.6	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ $\Omega$	2.3	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ $\Omega$	2.2	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ $\Omega$	1.7	ns
$C_I$	input capacitance		5	pF
$C_{PD}$	power dissipation capacitance per buffer	$V_{CC} = 3.3$ V; note 1	17	pF

## Note

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

$P_D = C_{PD} \times V_{CC}^2 \times f_i + (C_L \times V_{CC}^2 \times f_o)$  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 Volts.

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## FUNCTION TABLE

See note 1.

INPUT		OUTPUT
CP	D	Q
↑	L	L
↑	H	H
L	X	q

## Note

1. H = HIGH voltage level;

L = LOW voltage level;

↑ = LOW-to-HIGH CP transition;

X = don't care;

q = lower case indicates the state of referenced input, one set-up time prior to the LOW-to-HIGH CP transition.

## ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC1G79GW	−40 to +85 °C	5	SC-88A	plastic	SOT353	VP

## PINNING

PIN	SYMBOL	DESCRIPTION
1	D	data input D
2	CP	clock pulse input CP
3	GND	ground (0 V)
4	Q	data output Q
5	V <sub>CC</sub>	supply voltage

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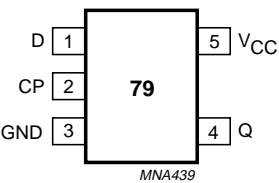


Fig.1 Pin configuration.

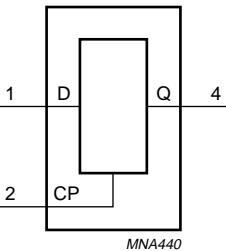


Fig.2 Logic symbol.

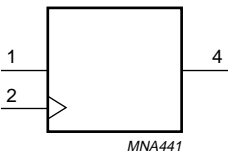


Fig.3 IEE/IEC logic symbol.

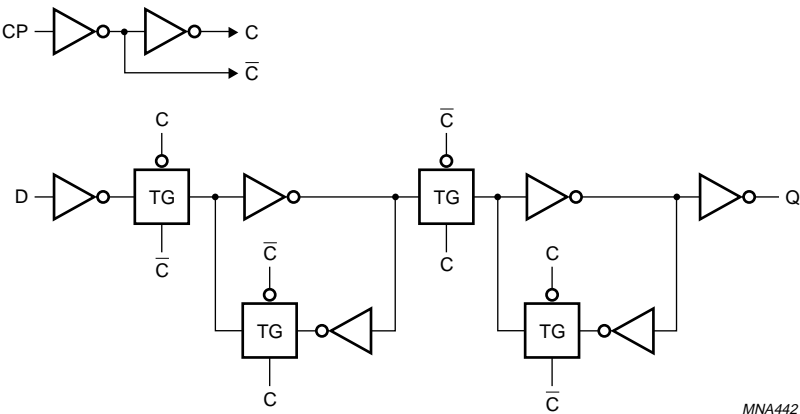


Fig.4 Logic diagram.

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## RECOMMENDED 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
$T_{amb}$	operating ambient temperature		-40	+85	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 1.65$ to $2.7$ V	0	20	ns/V
		$V_{CC} = 2.7$ to $5.5$ V	0	10	ns/V

## 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 diode current	$V_I < 0$	—	-50	mA
$V_I$	input voltage	note 1	-0.5	+6.5	V
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$	—	±50	mA
$V_O$	output voltage	active mode; notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
$I_O$	output source or sink current	$V_O = 0$ to $V_{CC}$	—	±50	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		—	±100	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_D$	power dissipation per package	for temperature range from -40 to +85 °C; note 3	—	200	mW

## Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. When  $V_{CC}$  is powered-down to 0 V, the output voltage can be 5.5 V in normal operation.
3. Above 55 °C the value of  $P_D$  derates linearly with 2.5 mW/K.

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## DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		T <sub>amb</sub> (°C)			UNIT
		OTHER	V <sub>CC</sub> (V)	–40 to +85			
				MIN.	TYP. <sup>(1)</sup>	MAX.	
V <sub>IH</sub>	HIGH-level input voltage		1.65 to 1.95	0.65 × V <sub>CC</sub>	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2.0	–	–	V
			4.5 to 5.5	0.7 × V <sub>CC</sub>	–	–	V
V <sub>IL</sub>	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V <sub>CC</sub>	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
			4.5 to 5.5	–	–	0.3 × V <sub>CC</sub>	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	1.65 to 5.5	–	–	0.1	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 4 mA	1.65	–	–	0.45	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 8 mA	2.3	–	–	0.3	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12 mA	2.7	–	–	0.4	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24 mA	3.0	–	–	0.55	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 32 mA	4.5	–	–	0.55	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	1.65 to 5.5	V <sub>CC</sub> – 0.1	–	–	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = –4 mA	1.65	1.2	–	–	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = –8 mA	2.3	1.9	–	–	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = –12 mA	2.7	2.2	–	–	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = –24 mA	3.0	2.3	–	–	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = –32 mA	4.5	3.8	–	–	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND	3.6	–	±0.1	±5	μA
I <sub>off</sub>	power OFF leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0	–	±0.1	±10	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	0.1	10	μA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0	2.3 to 5.5	–	5	500	μA

## Note

1. All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

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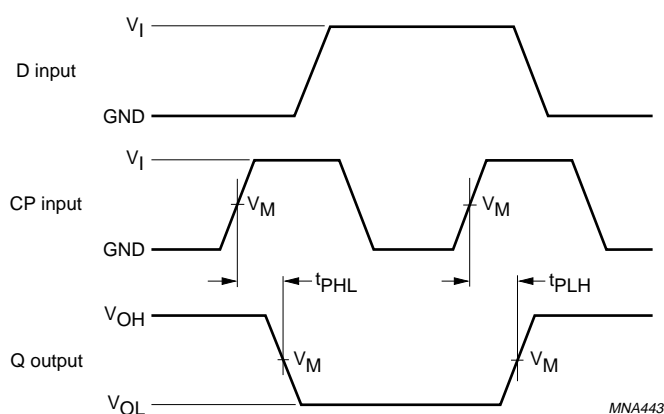
**AC CHARACTERISTICS**GND = 0 V;  $t_r = t_f \leq 2.0$  ns; unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS		T <sub>amb</sub> (°C)			UNIT
		WAVEFORMS	V <sub>CC</sub> (V)	–40 to +85			
				MIN.	TYP.	MAX.	
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay CP to Q	see Figs 5 and 7	1.65 to 1.95	1.0	3.6	9.9	ns
			2.3 to 2.7	1.5	2.3	7.0	ns
			2.7	1.5	2.6	6.0	ns
			3.0 to 3.6	0.5	2.2	5.2	ns
			4.5 to 5.5	0.5	1.7	4.5	ns
t <sub>su</sub>	set-up time D to CP	see Figs 6 and 7	1.65 to 1.95	3.0	1.4	–	ns
			2.3 to 2.7	2.5	0.9	–	ns
			2.7	2.5	0.9	–	ns
			3.0 to 3.6	2.0	0.6	–	ns
			4.5 to 5.5	2.0	0.6	–	ns
t <sub>h</sub>	hold time D to CP	see Figs 6 and 7	1.65 to 1.95	0	–0.7	–	ns
			2.3 to 2.7	0	–0.4	–	ns
			2.7	0.5	–0.3	–	ns
			3.0 to 3.6	0.5	–0.3	–	ns
			4.5 to 5.5	0.5	–0.2	–	ns
t <sub>w</sub>	clock pulse with HIGH or LOW	see Figs 6 and 7	1.65 to 1.95	3.0	1.1	–	ns
			2.3 to 2.7	2.5	0.7	–	ns
			2.7	2.5	0.6	–	ns
			3.0 to 3.6	2.5	0.6	–	ns
			4.5 to 5.5	2.0	0.5	–	ns
f <sub>max</sub>	maximum clock pulse frequency	see Figs 6 and 7	1.65 to 1.95	100	250	–	MHz
			2.3 to 2.7	150	300	–	MHz
			2.7	150	350	–	MHz
			3.0 to 3.6	150	450	–	MHz
			4.5 to 5.5	200	500	–	MHz

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## AC WAVEFORMS



$V_{CC}$	$V_M$	INPUT	
		$V_I$	$t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns
2.7 V	1.5 V	2.7 V	$\leq 2.5$ ns
3.0 to 3.6 V	1.5 V	2.7 V	$\leq 2.5$ ns
4.5 to 5.5 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.5$ ns

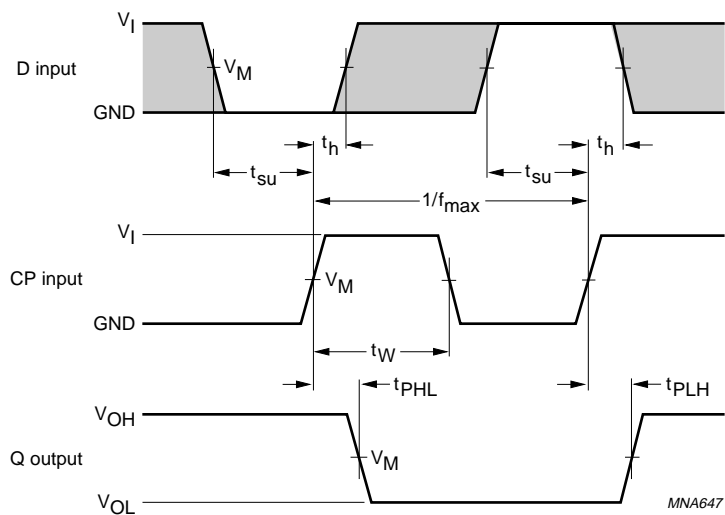
$V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

Fig.5 Clock CP to output Q propagation delay times.



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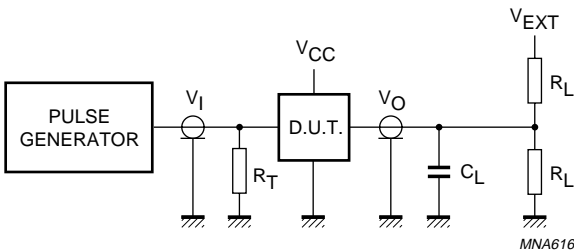
$V_{CC}$	$V_M$	INPUT	
		$V_I$	$t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns
2.7 V	1.5 V	2.7 V	$\leq 2.5$ ns
3.0 to 3.6 V	1.5 V	2.7 V	$\leq 2.5$ ns
4.5 to 5.5 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.5$ ns

The shaded areas indicate when the input is permitted to change for predictable output performance.  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

Fig.6 Clock (CP) to output (Q) propagation delays, clock pulse width, D to CP set-up times, the CP to D hold times and maximum clock pulse frequency.

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$V_{CC}$	$V_I$	$C_L$	$R_L$	$V_{EXT}$		
				$t_{PLH}/t_{PHL}$	$t_{PZH}/t_{PHZ}$	$t_{PZL}/t_{PLZ}$
1.65 to 1.95 V	$V_{CC}$	30 pF	1 k $\Omega$	open	GND	$2 \times V_{CC}$
2.3 to 2.7 V	$V_{CC}$	30 pF	500 $\Omega$	open	GND	$2 \times V_{CC}$
2.7 V	2.7 V	50 pF	500 $\Omega$	open	GND	6 V
3.0 to 3.6 V	2.7 V	50 pF	500 $\Omega$	open	GND	6 V
4.5 to 5.5 V	$V_{CC}$	50 pF	500 $\Omega$	open	GND	$2 \times V_{CC}$

Definitions for test circuit:  
 $R_L$  = Load resistor.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to the output impedance  $Z_o$  of the pulse generator.

Fig.7 Load circuitry for switching times.

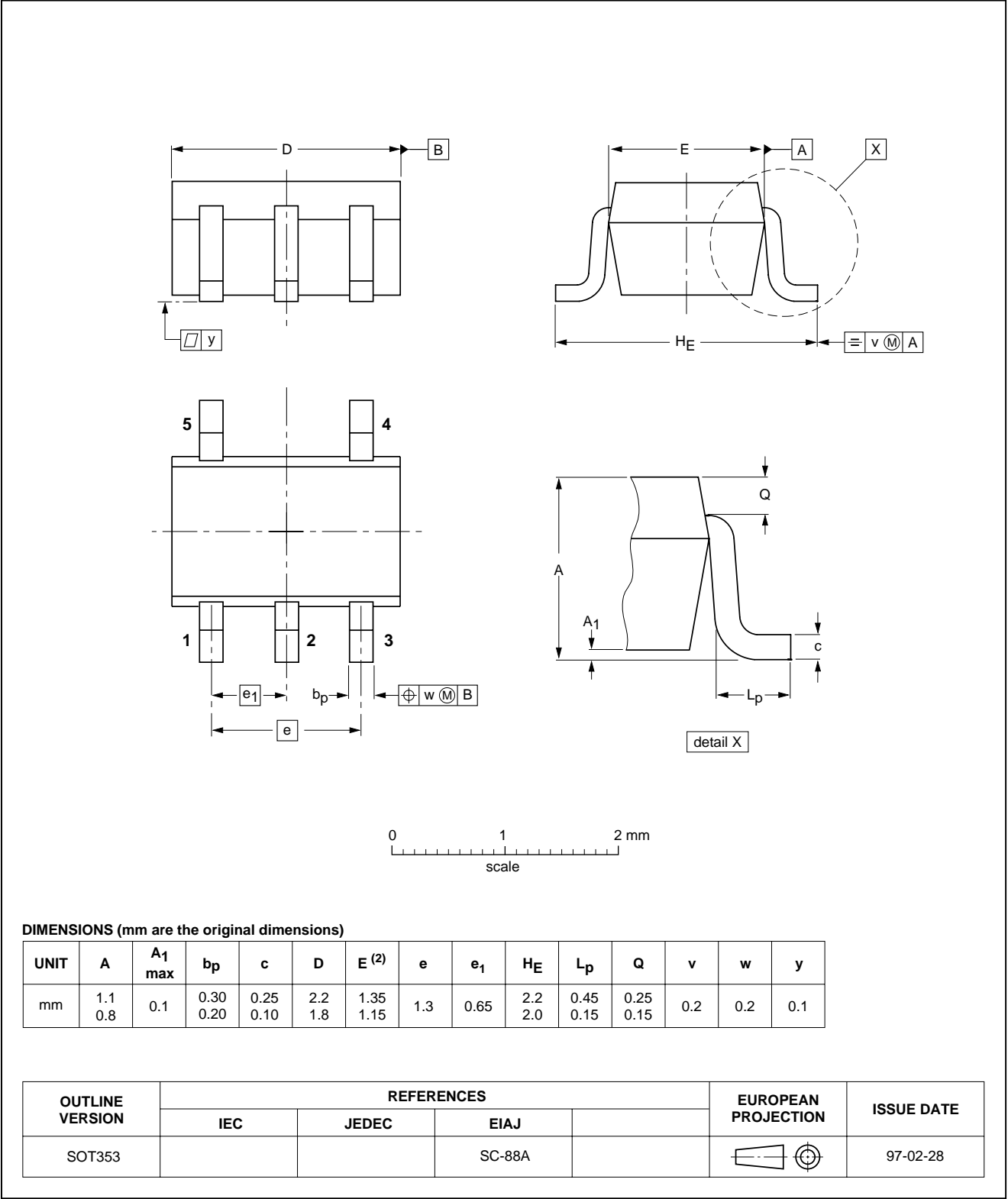
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PACKAGE OUTLINE

Plastic surface mounted package; 5 leads

SOT353



## Single D-type flip-flop; positive-edge trigger

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**SOLDERING****Introduction to soldering surface mount packages**

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

There is no soldering method that is ideal for all surface mount IC packages. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended.

**Reflow soldering**

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250 °C. The top-surface temperature of the packages should preferably be kept below 220 °C for thick/large packages, and below 235 °C for small/thin packages.

**Wave soldering**

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
  - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

**Manual soldering**

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

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## Suitability of surface mount IC packages for wave and reflow soldering methods

PACKAGE	SOLDERING METHOD	
	WAVE	REFLOW <sup>(1)</sup>
BGA, LFBGA, SQFP, TFBGA	not suitable	suitable
HBCC, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, SMS	not suitable <sup>(2)</sup>	suitable
PLCC <sup>(3)</sup> , SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended <sup>(3)(4)</sup>	suitable
SSOP, TSSOP, VSO	not recommended <sup>(5)</sup>	suitable

## Notes

1. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the *"Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods"*.
2. These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).
3. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.
4. Wave soldering is only suitable for LQFP, TQFP and QFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
5. Wave soldering is only suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

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## DATA SHEET STATUS

DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITIONS
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Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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## Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

## DEFINITIONS

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Printed in The Netherlands

613508/01/pp16

Date of release: 2001 Apr 04

Document order number: 9397 750 08066

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