

# 74LVC1G80

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

Rev. 08 — 29 August 2007

Product data sheet

## 1. General description

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The 74LVC1G80 provides a single positive-edge triggered D-type flip-flop.

Information on the data input is transferred to the  $\bar{Q}$  output on the LOW-to-HIGH transition of the clock pulse. The input pin D must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

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.

## 2. Features

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- Wide supply voltage range from 1.65 V to 5.5 V
- 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)
- $\pm 24$  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
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from  $-40$  °C to  $+125$  °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC1G80GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G80GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G80GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC1G80GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891

### 4. Marking

Table 2. Marking codes

Type number	Marking
74LVC1G80GW	VT
74LVC1G80GV	V80
74LVC1G80GM	VT
74LVC1G80GF	VT

### 5. Functional diagram

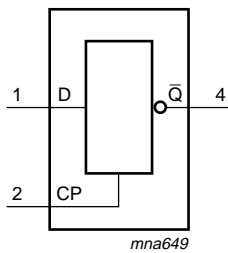


Fig 1. Logic symbol

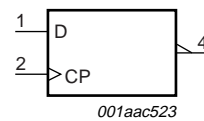


Fig 2. IEC logic symbol

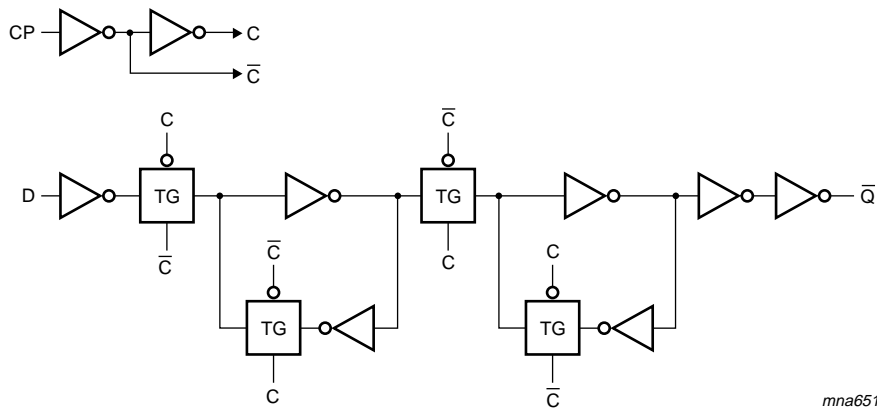


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning

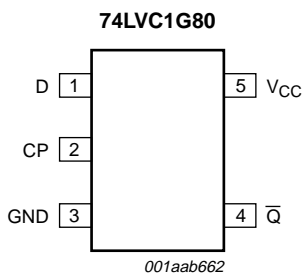


Fig 4. Pin configuration SOT353-1 and SOT753

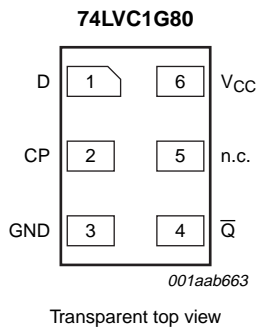


Fig 5. Pin configuration SOT886

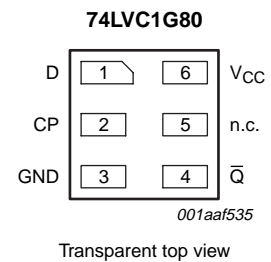


Fig 6. Pin configuration SOT891

### 6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1/SOT753	SOT886/SOT891	
D	1	1	data input
CP	2	2	data pulse input
GND	3	3	ground (0 V)
$\bar{Q}$	4	4	data output
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	supply voltage

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

Input		Output
CP	D	$\bar{Q}$
↑	L	H
↑	H	L
L	X	$\bar{q}$

- [1] H = HIGH voltage level;  
 L = LOW voltage level.  
 ↑ = LOW-to-HIGH CP transition;  
 X = don't care;  
 $\bar{q}$  = lower case letter indicates the state of referenced input, one set-up time prior to the LOW-to-HIGH CP transition.

## 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][2] -0.5	$V_{CC} + 0.5$	V
		Power-down mode	[1][2] -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	[3] -	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] When  $V_{CC} = 0$  V (Power-down mode), the output voltage can be 5.5 V in normal operation.  
 [3] For TSSOP5 and SC-74A packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.  
 For XSON6 packages: above 45 °C the value of  $P_{tot}$  derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage	Active mode	0	-	V <sub>CC</sub>	V
		V <sub>CC</sub> = 0 V; Power-down mode	0	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	-	-	20	ns/V
		V <sub>CC</sub> = 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 <sup>[1]</sup>	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3 × V <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
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	-	-	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	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.3	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	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	±5	μA
		V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	-	±0.1	±10	μA

**Table 7. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$I_{CC}$	supply current	$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$ ; $I_O = 0\text{ A}$	-	0.1	10	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per pin; $V_{CC} = 2.3\text{ V}$ to $5.5\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $I_O = 0\text{ A}$	-	5	500	$\mu\text{A}$
$C_I$	input capacitance	$V_{CC} = 3.3\text{ V}$ ; $V_I = \text{GND}$ to $V_{CC}$	-	5	-	$\text{pF}$
<b><math>T_{\text{amb}} = -40\text{ }^\circ\text{C}</math> to <math>+125\text{ }^\circ\text{C}</math></b>						
$V_{IH}$	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 $5.5\text{ V}$	-	-	0.1	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	$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 0\text{ V}$ to $5.5\text{ V}$	-	-	$\pm 100$	$\mu\text{A}$
		$V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 5.5\text{ V}$	-	-	$\pm 200$	$\mu\text{A}$
		$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$ ; $I_O = 0\text{ A}$	-	-	200	$\mu\text{A}$
		$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$ ; $I_O = 0\text{ A}$	-	-	200	$\mu\text{A}$
		$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$ ; $I_O = 0\text{ A}$	-	-	200	$\mu\text{A}$
		$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$ ; $I_O = 0\text{ A}$	-	-	200	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per pin; $V_{CC} = 2.3\text{ V}$ to $5.5\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $I_O = 0\text{ A}$	-	-	5000	$\mu\text{A}$

[1] All typical values are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ .

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	CP to $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	3.4	9.9	1.0	13.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	2.3	7.0	0.5	9.0	ns
		V <sub>CC</sub> = 2.7 V	0.5	2.5	6.0	0.5	8.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.9	2.4	5.0	0.9	6.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	1.8	4.5	0.5	6.0	ns
t <sub>su</sub>	set-up time	HIGH or LOW; D to CP; see <a href="#">Figure 8</a> <sup>[3]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.3	0.8	-	2.3	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	0.6	-	1.5	-	ns
		V <sub>CC</sub> = 2.7 V	1.5	0.5	-	1.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.3	0.4	-	1.3	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.1	0.5	-	1.1	-	ns
t <sub>h</sub>	hold time	D to CP; see <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	0	-0.6	-	0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0	-0.4	-	0	-	ns
		V <sub>CC</sub> = 2.7 V	+0.5	-0.2	-	0.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.9	0.2	-	0.9	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	+0.5	-0.1	-	0.5	-	ns
t <sub>w</sub>	pulse width	CP HIGH or LOW; see <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.0	1.1	-	3.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.5	0.7	-	2.5	-	ns
		V <sub>CC</sub> = 2.7 V	2.5	0.6	-	2.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.5	0.6	-	2.5	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	0.5	-	2.0	-	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	160	300	-	160	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	160	350	-	160	-	MHz
		V <sub>CC</sub> = 2.7 V	160	350	-	160	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	160	350	-	160	-	MHz
		V <sub>CC</sub> = 4.5 V to 5.5 V	200	400	-	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 <sup>[4]</sup>	-	17	-	-	-	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.

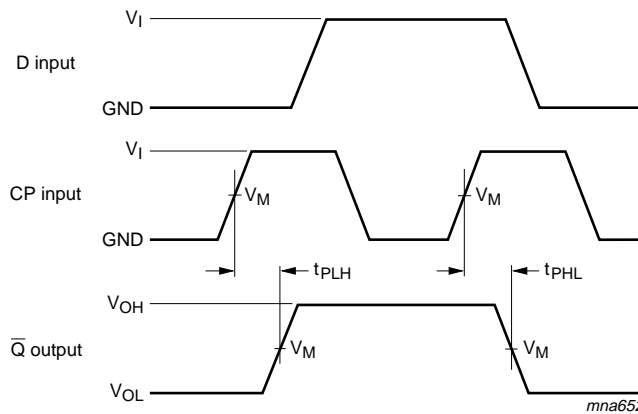
[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] t<sub>su</sub> is the same as t<sub>su(H)</sub> and t<sub>su(L)</sub>.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

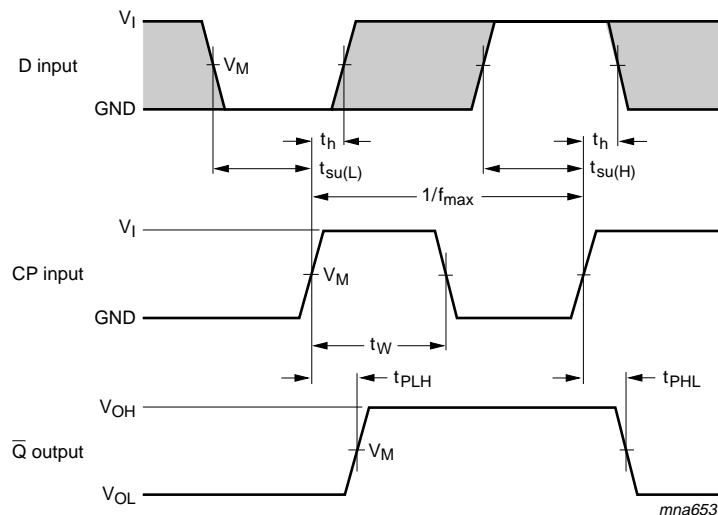
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  
 $f_o$  = output frequency in MHz;  
 $C_L$  = output load capacitance in pF;  
 $V_{CC}$  = supply voltage in V;  
 $N$  = number of inputs switching;  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 12. Waveforms



Measurement points are given in [Table 9](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output.

**Fig 7. Clock (CP) to output ( $\bar{Q}$ ) propagation delay times**



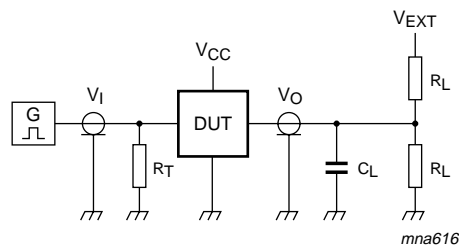
Measurement points are given in [Table 9](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output.  
 The shaded areas indicate when the input is permitted to change for predictable output performance.

**Fig 8. Clock (CP) to output ( $\bar{Q}$ ) propagation delay times, clock pulse width, D to set-up times, the CP to D hold times and maximum clock pulse frequency**



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 9. Load circuitry for switching times

Table 10. Test data

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

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

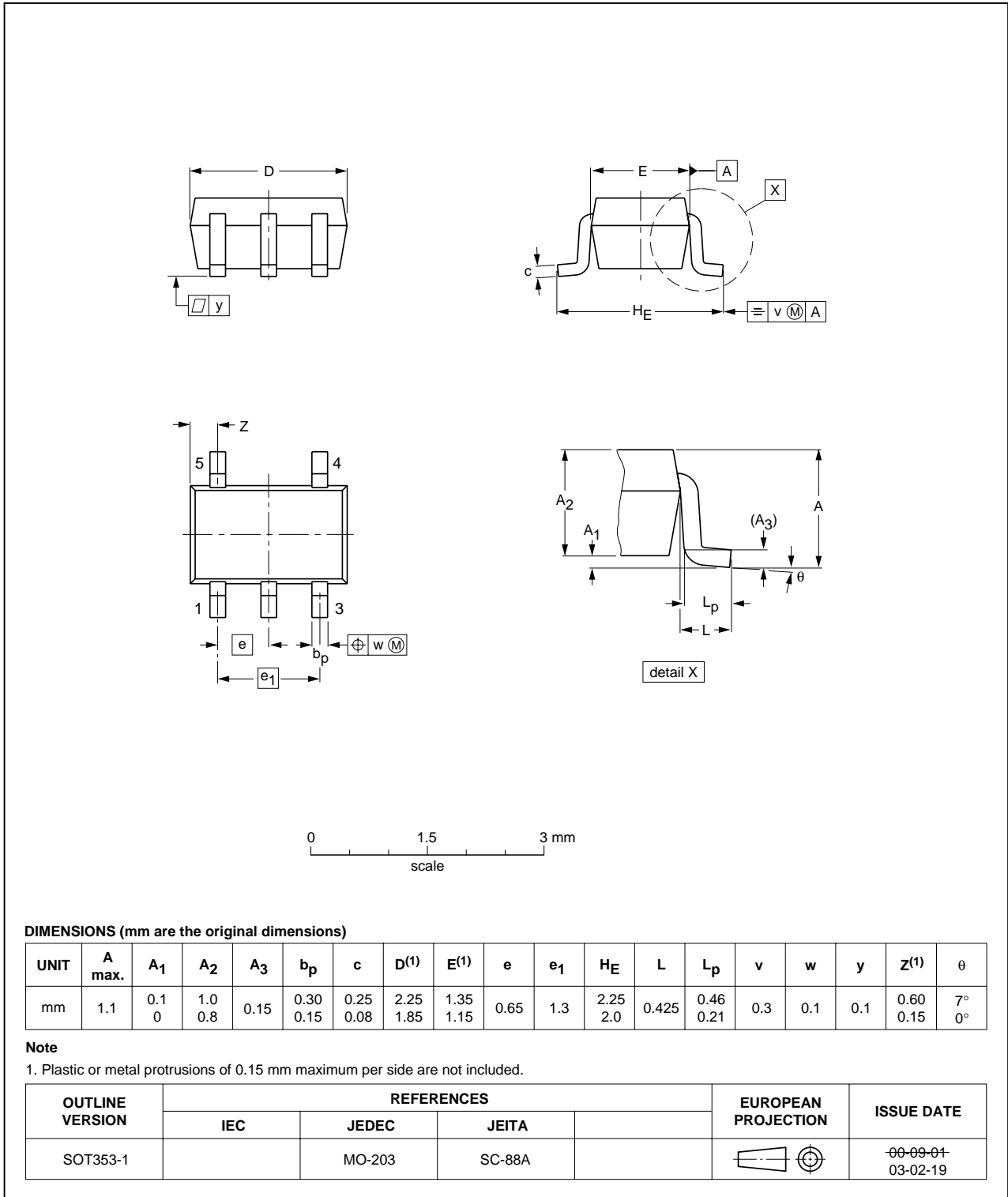


Fig 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

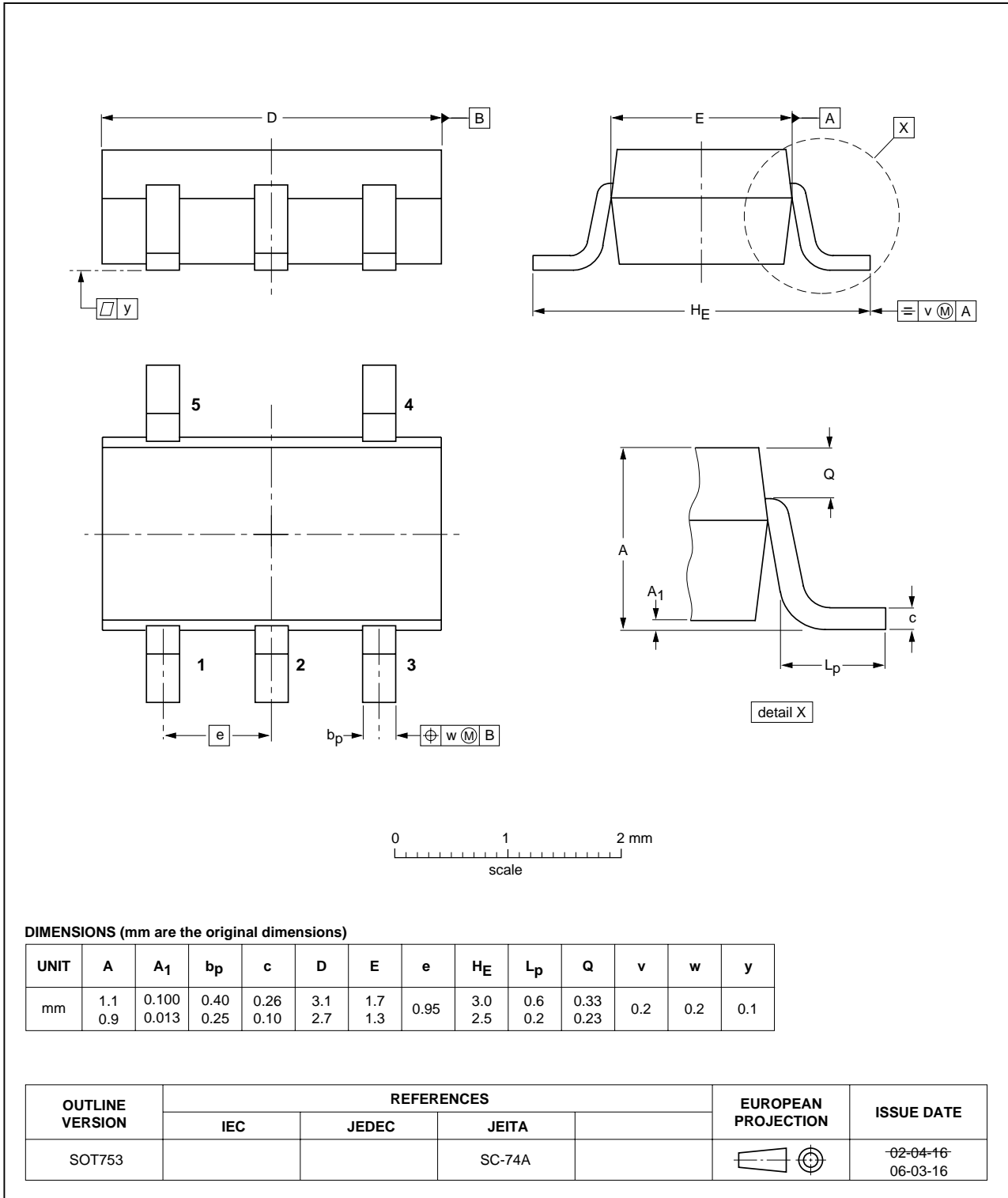


Fig 11. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



Fig 12. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891

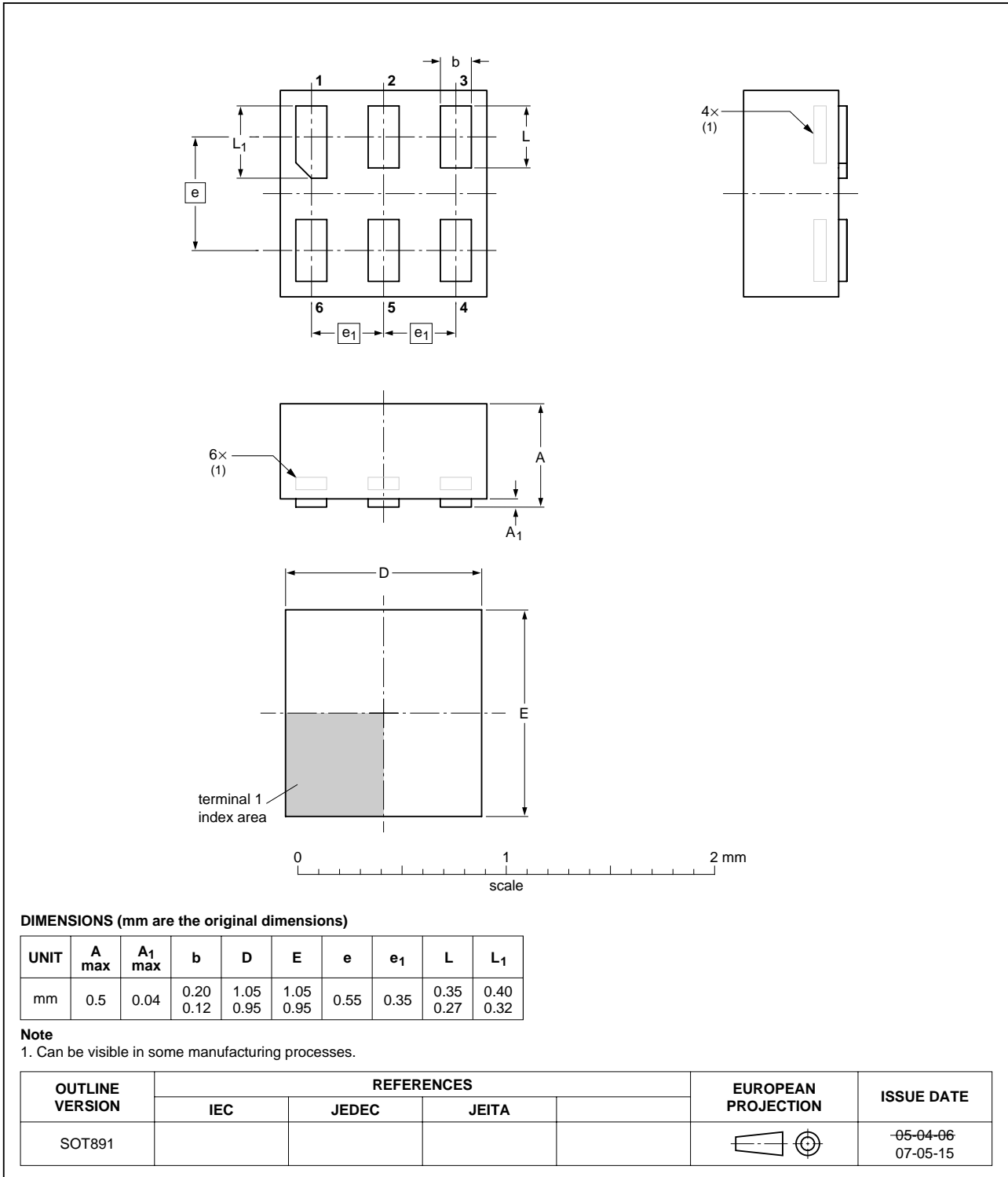


Fig 13. Package outline SOT891 (XSON6)

## 14. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G80_8	20070829	Product data sheet	-	74LVC1G80_7
Modifications:	<ul style="list-style-type: none"> <li>In <a href="#">Section 10 "Static characteristics"</a>, changed conditions for input leakage and supply current.</li> <li><a href="#">Figure 13 "Package outline SOT891 (XSON6)"</a> updated.</li> </ul>			
74LVC1G80_7	20061012	Product data sheet	-	74LVC1G80_6
74LVC1G80_6	20040910	Product specification	-	74LVC1G80_5
74LVC1G80_5	20040629	Product specification	-	74LVC1G80_4
74LVC1G80_4	20040429	Product specification	-	74LVC1G80_3
74LVC1G80_3	20030526	Product specification	-	74LVC1G80_2
74LVC1G80_2	20030130	Product specification	-	74LVC1G80_1
74LVC1G80_1	20010404	Product specification	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 URL <http://www.nxp.com>.

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