

# 74LVC1G11

Single 3-input AND gate

Rev. 01 — 30 November 2004

Product data sheet

## 1. General description

The 74LVC1G11 is a high-performance, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

The input 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 to slower input rise and fall times.

The 74LVC1G11 provides a single 3-input AND gate.

## 2. Features

- 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).
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V.
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C.

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### 3. Quick reference data

**Table 1: Quick reference data**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHL}$ , $t_{PLH}$	propagation delay A, B and C to Y	$C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$	1.0	2.6	4.3	ns
$C_I$	input capacitance		-	4	-	pF
$C_{PD}$	power dissipation capacitance	$V_{CC} = 3.3\text{ V}$	[1][2]	13	-	pF

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

[2] The condition is  $V_I = GND$  to  $V_{CC}$ .

### 4. Ordering information

**Table 2: Ordering information**

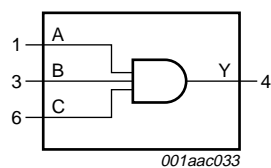
Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G11GW	-40 °C to +125 °C	SC-88	plastic surface mounted package; 6 leads	SOT363
74LVC1G11GV	-40 °C to +125 °C	SC-74	plastic surface mounted package; 6 leads	SOT457

### 5. Marking

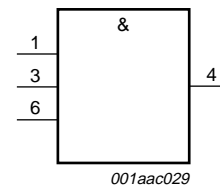
**Table 3: Marking**

Type number	Marking code
74LVC1G11GW	VU
74LVC1G11GV	V11

### 6. Functional diagram



**Fig 1. Logic symbol**



**Fig 2. IEC logic symbol**

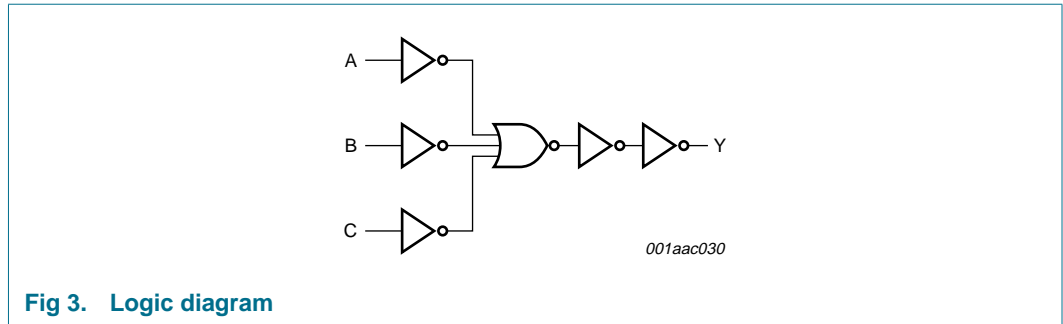


Fig 3. Logic diagram

## 7. Pinning information

### 7.1 Pinning

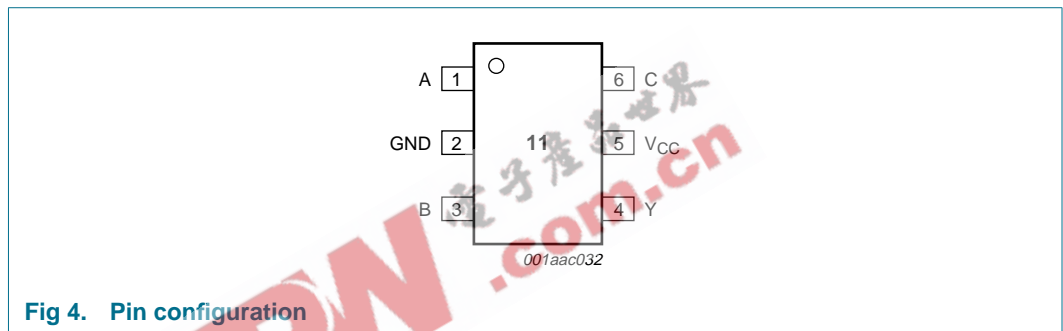


Fig 4. Pin configuration

### 7.2 Pin description

Table 4: Pin description

Symbol	Pin	Description
A	1	data input
GND	2	ground (0 V)
B	3	data input
Y	4	data output
V <sub>CC</sub>	5	supply voltage
C	6	data input

## 8. Functional description

### 8.1 Function table

Table 5: Function table <sup>[1]</sup>

Input			Output
A	B	C	Y
H	H	H	H
L	X	X	L
X	L	X	L
X	X	L	L

[1] H = HIGH voltage level;  
L = LOW voltage level;  
X = don't care.

## 9. 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
$V_I$	input voltage		<sup>[1]</sup> -0.5	+6.5	V
$V_O$	output voltage	active mode	<sup>[1][2]</sup> -0.5	$V_{CC} + 0.5$	V
		Power-down mode	<sup>[1][2]</sup> -0.5	+6.5	V
$I_{IK}$	input diode current	$V_I < 0$ V	-	-50	mA
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
$I_O$	output source or sink current	$V_O = 0$ V to $V_{CC}$	-	±50	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	±100	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	power dissipation	$T_{amb} = -40$ °C to +125 °C	-	250	mW

[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.

## 10. Recommended operating conditions

Table 7: 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
$t_r, t_f$	input rise and fall times	$V_{CC} = 1.65$ V to 2.7 V	0	-	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 V	0	-	10	ns/V

## 11. Static characteristics

Table 8: Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40$ °C to +85 °C [1]						
$V_{IH}$	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 $V_{IL}$				
		$I_O = -100$ $\mu$ 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
		$I_O = -32$ mA; $V_{CC} = 4.5$ V	3.8	4.11	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100$ $\mu$ 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
$I_{LI}$	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 5.5$ V	-	$\pm 0.1$	$\pm 5$	$\mu$ A
$I_{off}$	power-off leakage current	$V_I$ or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	$\pm 0.1$	$\pm 10$	$\mu$ A

**Table 8: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	0.1	10	$\mu$ A
$\Delta I_{CC}$	additional quiescent 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	$\mu$ A
$C_I$	input capacitance		-	4	-	pF
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>						
$V_{IH}$	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 $V_{IL}$				
		$I_O = -100$ $\mu$ A; $V_{CC} = 1.65$ V to 5.5 V	$V_{CC} - 0.1$	-	-	V
		$I_O = -4$ mA; $V_{CC} = 1.65$ V	0.95	-	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.7	-	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	1.9	-	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.0	-	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100$ $\mu$ A; $V_{CC} = 1.65$ V to 5.5 V	-	-	0.10	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	-	0.70	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	-	0.45	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	-	0.60	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	-	0.80	V
$I_{LI}$	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 5.5$ V	-	-	$\pm 100$	$\mu$ A
		$V_I$ or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	-	$\pm 200$	$\mu$ A
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	200	$\mu$ A
$\Delta I_{CC}$	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	-	5000	$\mu$ A

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

## 12. Dynamic characteristics

**Table 9: Dynamic characteristics**  
*GND = 0 V; see Figure 6 for test circuit.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C [1]</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay A, B and C to Y	see Figure 5				
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	4.7	17.2	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	3.0	6.2	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.0	6.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.6	4.9	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.0	1.9	3.5	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>CC</sub> = 3.3 V	[2] [3] -	13	-	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay A, B and C to Y	see Figure 5				
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	-	21.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	-	7.8	ns
		V <sub>CC</sub> = 2.7 V	1.0	-	7.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	-	6.2	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.0	-	4.4	ns

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

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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;

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

[3] The condition is V<sub>I</sub> = GND to V<sub>CC</sub>.

13. Waveforms

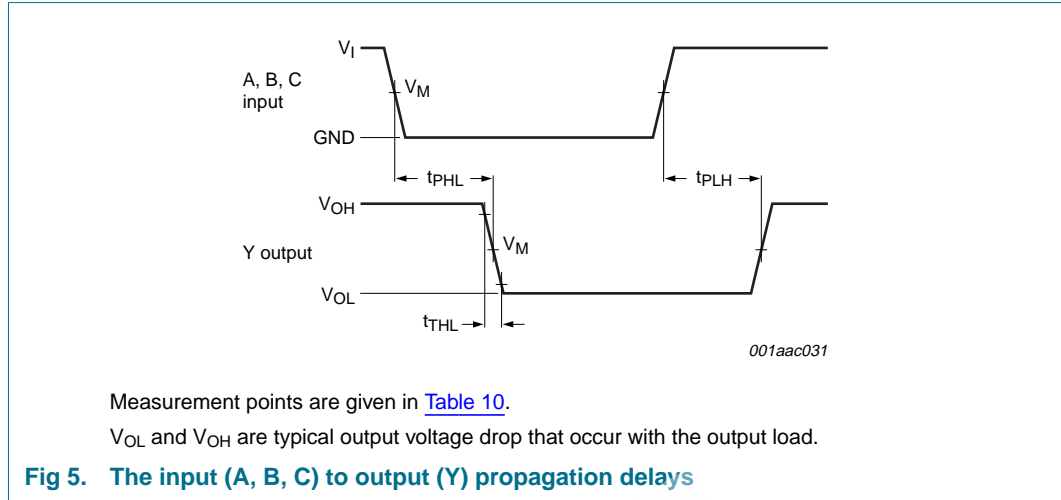


Table 10: Measurement points

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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

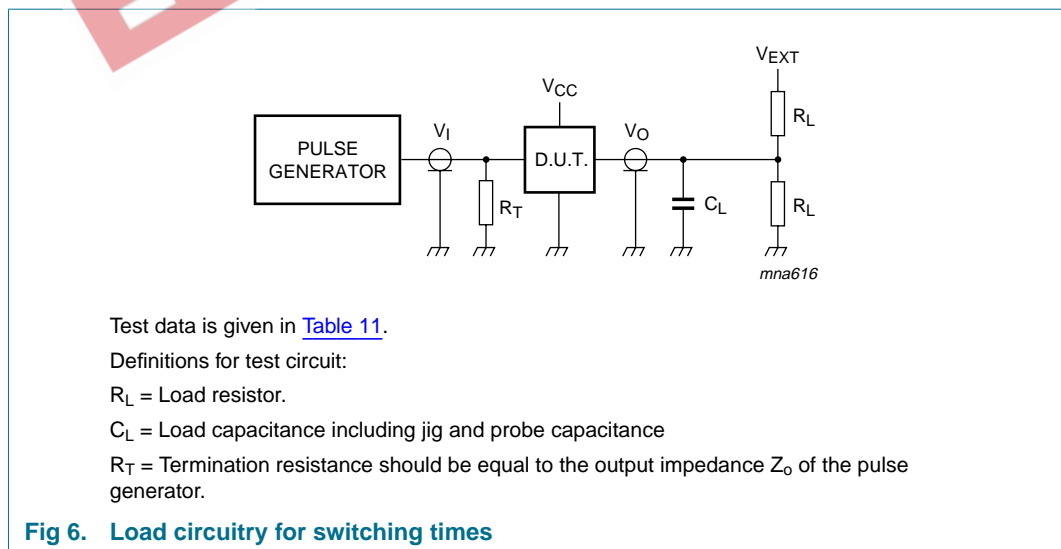




Table 11: Test data

Supply voltage	Input		Load		V <sub>EXT</sub>
V <sub>CC</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2.0 ns	30 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	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open
4.5 V to 5.5 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open

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14. Package outline

Plastic surface mounted package; 6 leads

SOT363

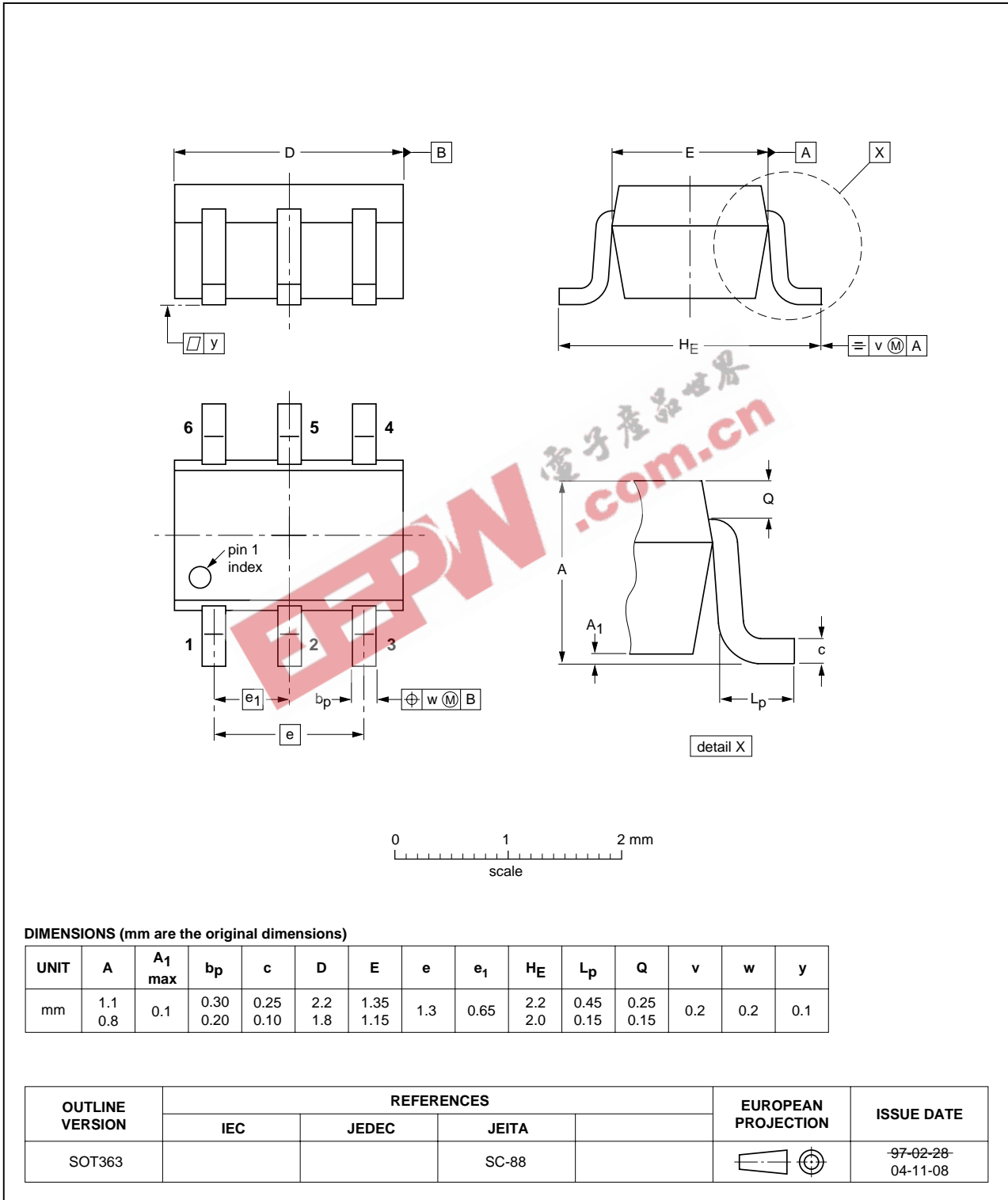


Fig 7. Package outline SOT363 (SC-88)

Plastic surface mounted package; 6 leads

SOT457

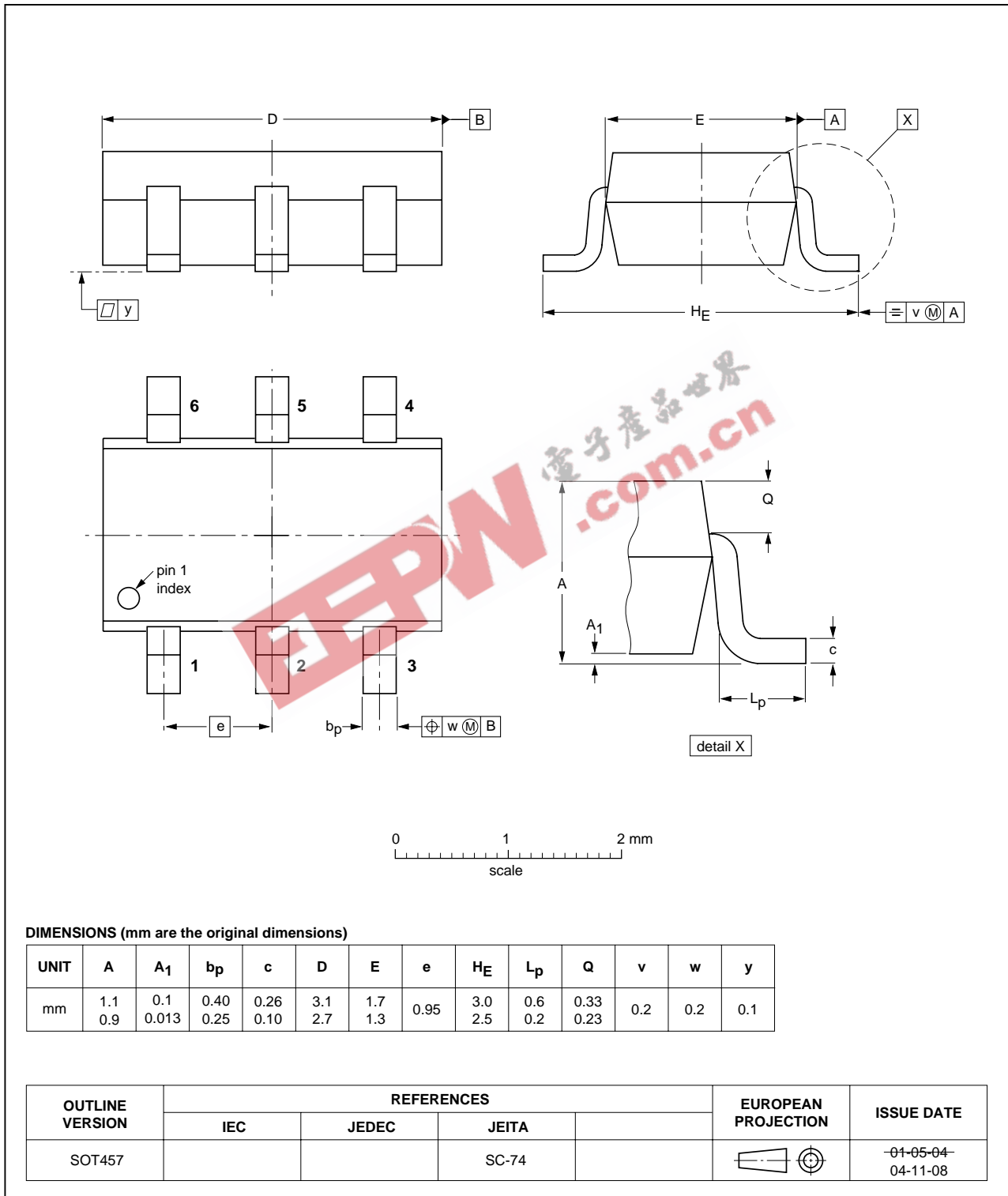


Fig 8. Package outline SOT457 (SC-74)

## 15. Revision history

Table 12: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74LVC1G11_1	20041130	Product data sheet	-	9397 750 14209	-

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## 16. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 17. 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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