

74LVC2G17-Q100

Dual non-inverting Schmitt trigger with 5 V tolerant input

Rev. 1 — 7 August 2012

Product data sheet

1. General description

The 74LVC2G17-Q100 provides two non-inverting buffers with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators 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.

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant input/output 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)
 - ◆ JESD-8B/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 ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)
- $\pm 24\text{ mA}$ output drive ($V_{CC} = 3.0\text{ V}$)
- CMOS low-power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Multiple package options

3. Applications

- Wave and pulse shapers for highly noisy environments



4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC2G17GW-Q100	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74LVC2G17GV-Q100	-40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457

5. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74LVC2G17GW-Q100	VV
74LVC2G17GV-Q100	VV

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

6. Functional diagram

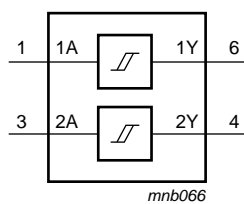


Fig 1. Logic symbol

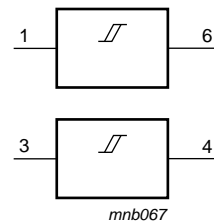


Fig 2. IEC logic symbol

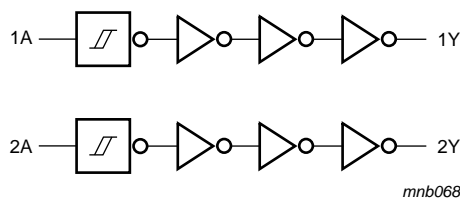


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

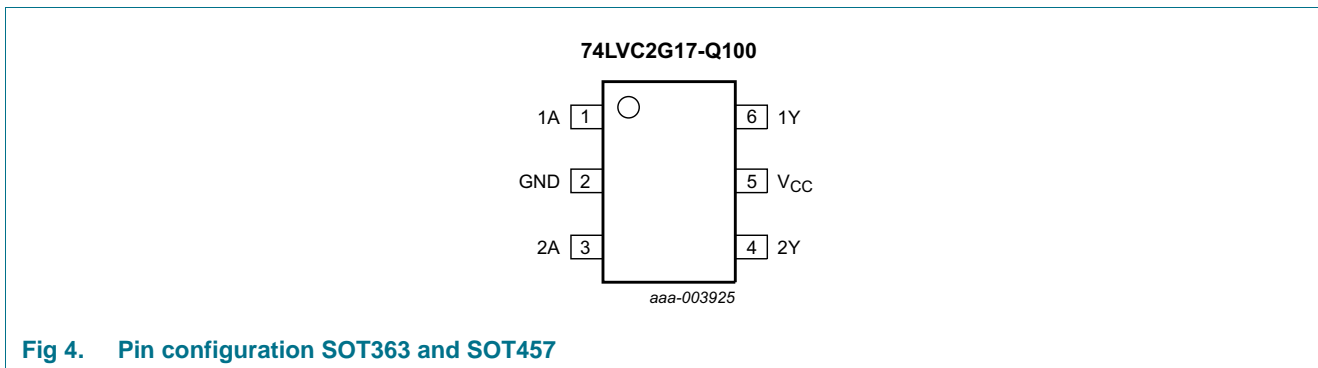


Fig 4. Pin configuration SOT363 and SOT457

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1A	1	data input
GND	2	ground (0 V)
2A	3	data input
2Y	4	data output
V _{CC}	5	supply voltage
1Y	6	data input

8. Functional description

Table 4. Function table^[1]

Input	Output
nA	nY
L	L
H	H

[1] H = HIGH voltage level; L = LOW voltage level.

9. 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	$V_O < 0$ 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
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C	[3] -	300	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.

[3] For SC-88 and SC-74 packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

10. 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		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	-	+125	°C

11. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40\text{ °C to }+85\text{ °C}$[1]						
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = 100\ \mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$	-	-	0.1	V
		$I_O = 4\text{ mA}; V_{CC} = 1.65\text{ V}$	-	-	0.45	V
		$I_O = 8\text{ mA}; V_{CC} = 2.3\text{ V}$	-	-	0.3	V
		$I_O = 12\text{ mA}; V_{CC} = 2.7\text{ V}$	-	-	0.4	V
		$I_O = 24\text{ mA}; V_{CC} = 3.0\text{ V}$	-	-	0.55	V
$I_O = 32\text{ mA}; V_{CC} = 4.5\text{ V}$	-	-	0.55	V		
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = -100\ \mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$	$V_{CC} - 0.1$	-	-	V
		$I_O = -4\text{ mA}; V_{CC} = 1.65\text{ V}$	1.2	-	-	V
		$I_O = -8\text{ mA}; V_{CC} = 2.3\text{ V}$	1.9	-	-	V
		$I_O = -12\text{ mA}; V_{CC} = 2.7\text{ V}$	2.2	-	-	V
		$I_O = -24\text{ mA}; V_{CC} = 3.0\text{ V}$	2.3	-	-	V
$I_O = -32\text{ mA}; V_{CC} = 4.5\text{ V}$	3.8	-	-	V		
I_I	input leakage current	$V_I = 5.5\text{ V or GND}; V_{CC} = 5.5\text{ V}$	-	± 0.1	± 5	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5\text{ V}; V_{CC} = 0\text{ V}$	-	± 0.1	± 10	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}; V_{CC} = 5.5\text{ V}$	-	0.1	10	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6\text{ V}; I_O = 0\text{ A}; V_{CC} = 2.3\text{ V to }5.5\text{ V}$	-	5	500	μA
C_I	input capacitance		-	3.5	-	pF
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = 100\ \mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$	-	-	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
$I_O = 32\text{ mA}; V_{CC} = 4.5\text{ V}$	-	-	0.80	V		
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = -100\ \mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$	$V_{CC} - 0.1$	-	-	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
$I_O = -32\text{ mA}; V_{CC} = 4.5\text{ V}$	3.4	-	-	V		
I_I	input leakage current	$V_I = 5.5\text{ V or GND}; V_{CC} = 5.5\text{ V}$	-	± 0.1	± 20	μA

Table 7. Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	-	±20	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	40	µA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	-	5	mA

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

12. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 6](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	nA to nY; see Figure 5 ^[2]						
		$V_{CC} = 1.65$ V to 1.95 V	1.5	5.6	10.5	1.5	13.1	ns
		$V_{CC} = 2.3$ V to 2.7 V	1.0	3.7	6.5	1.0	8.5	ns
		$V_{CC} = 2.7$ V	1.0	3.8	6.5	1.0	8.5	ns
		$V_{CC} = 3.0$ V to 3.6 V	1.0	3.6	5.7	1.0	7.1	ns
		$V_{CC} = 4.5$ V to 5.5 V	1.0	2.7	4.3	1.0	5.4	ns
C_{PD}	power dissipation capacitance	per buffer; $V_{CC} = 3.3$ V; $V_I = GND$ to V_{CC} ^[3]	-	16.3	-	-	-	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;

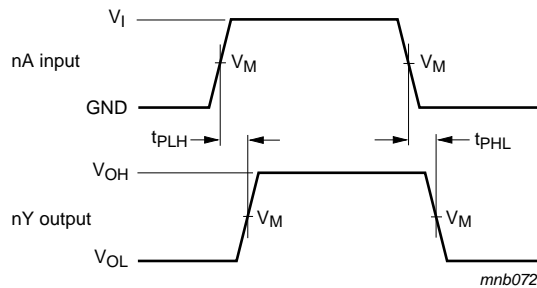
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

13. Waveforms

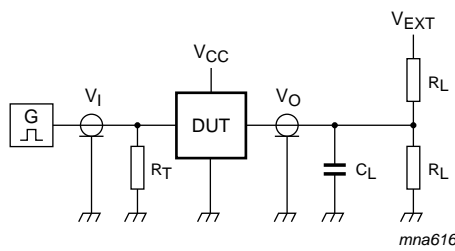


Measurement points are given in [Table 9](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 5. The input (nA) to output (nY) propagation delays and the output transition times

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



Measurement points are 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 output impedance Z_o of the pulse generator.
 V_{EXT} = External voltage for measuring switching times.

Fig 6. Test circuit for measuring 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}	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V _{CC}	≤ 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 _{CC}	≤ 2.5 ns	50 pF	500 Ω	open

14. Transfer characteristics

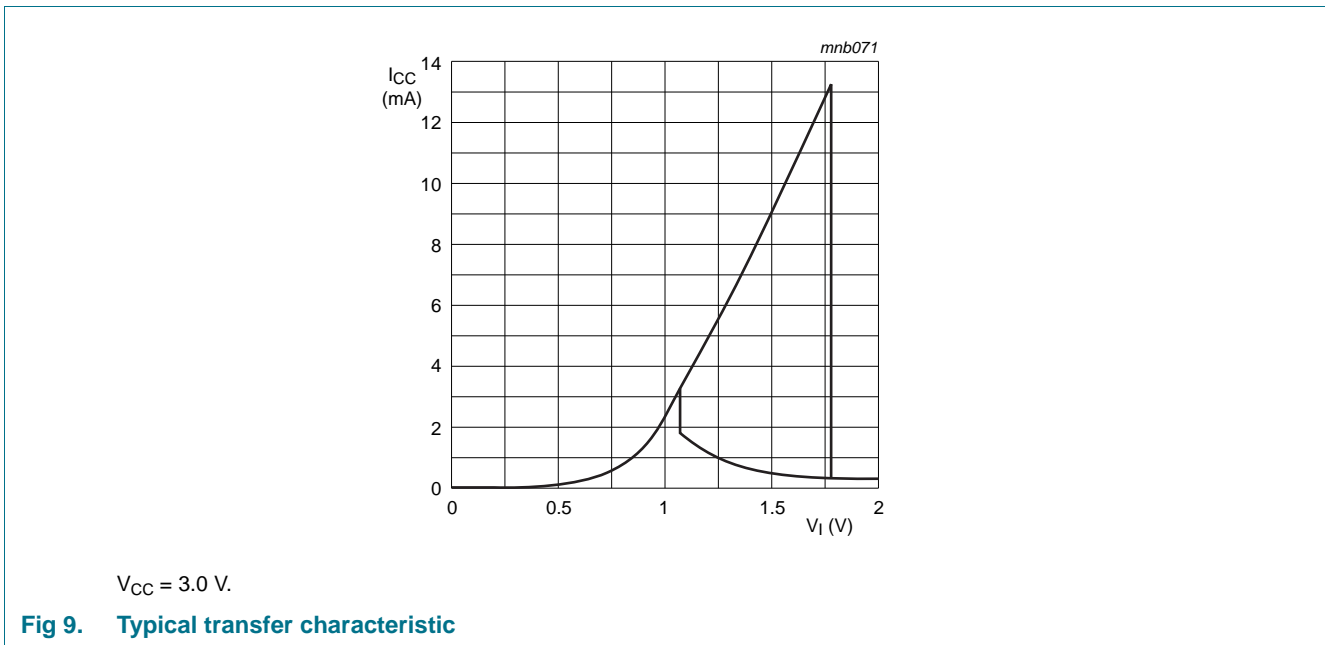
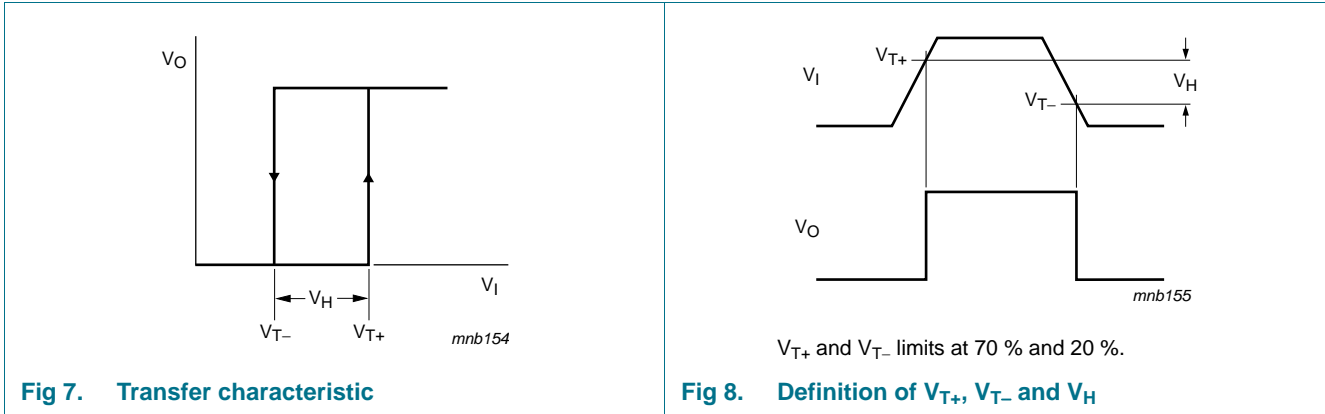
Table 11. Transfer characteristics

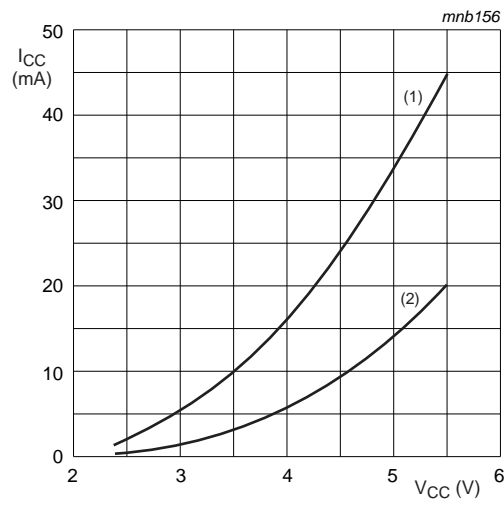
At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
V _{T+}	positive-going threshold voltage	see Figure 7 and Figure 8						
		V _{CC} = 1.8 V	0.70	1.10	1.50	0.70	1.70	V
		V _{CC} = 2.3 V	1.00	1.40	1.80	1.00	2.00	V
		V _{CC} = 3.0 V	1.30	1.76	2.20	1.30	2.40	V
		V _{CC} = 4.5 V	1.90	2.47	3.10	1.90	3.30	V
V _{T-}	negative-going threshold voltage	see Figure 7 and Figure 8						
		V _{CC} = 1.8 V	0.25	0.61	0.90	0.25	1.10	V
		V _{CC} = 2.3 V	0.40	0.80	1.15	0.40	1.35	V
		V _{CC} = 3.0 V	0.60	1.04	1.50	0.60	1.70	V
		V _{CC} = 4.5 V	1.00	1.55	2.00	1.00	2.20	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see Figure 7 , Figure 8 and Figure 9						
		V _{CC} = 1.8 V	0.15	0.49	1.00	0.15	1.20	V
		V _{CC} = 2.3 V	0.25	0.60	1.10	0.25	1.30	V
		V _{CC} = 3.0 V	0.40	0.73	1.20	0.40	1.40	V
		V _{CC} = 4.5 V	0.60	0.92	1.50	0.60	1.70	V
		V _{CC} = 5.5 V	0.70	1.02	1.70	0.70	1.90	V

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

15. Waveforms transfer characteristics





(1) Positive-going edge

(2) Negative-going edge

Linear change of V_I between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.

Fig 10. Average I_{CC} as a function of V_{CC}

16. Package outline

Plastic surface-mounted package; 6 leads

SOT363

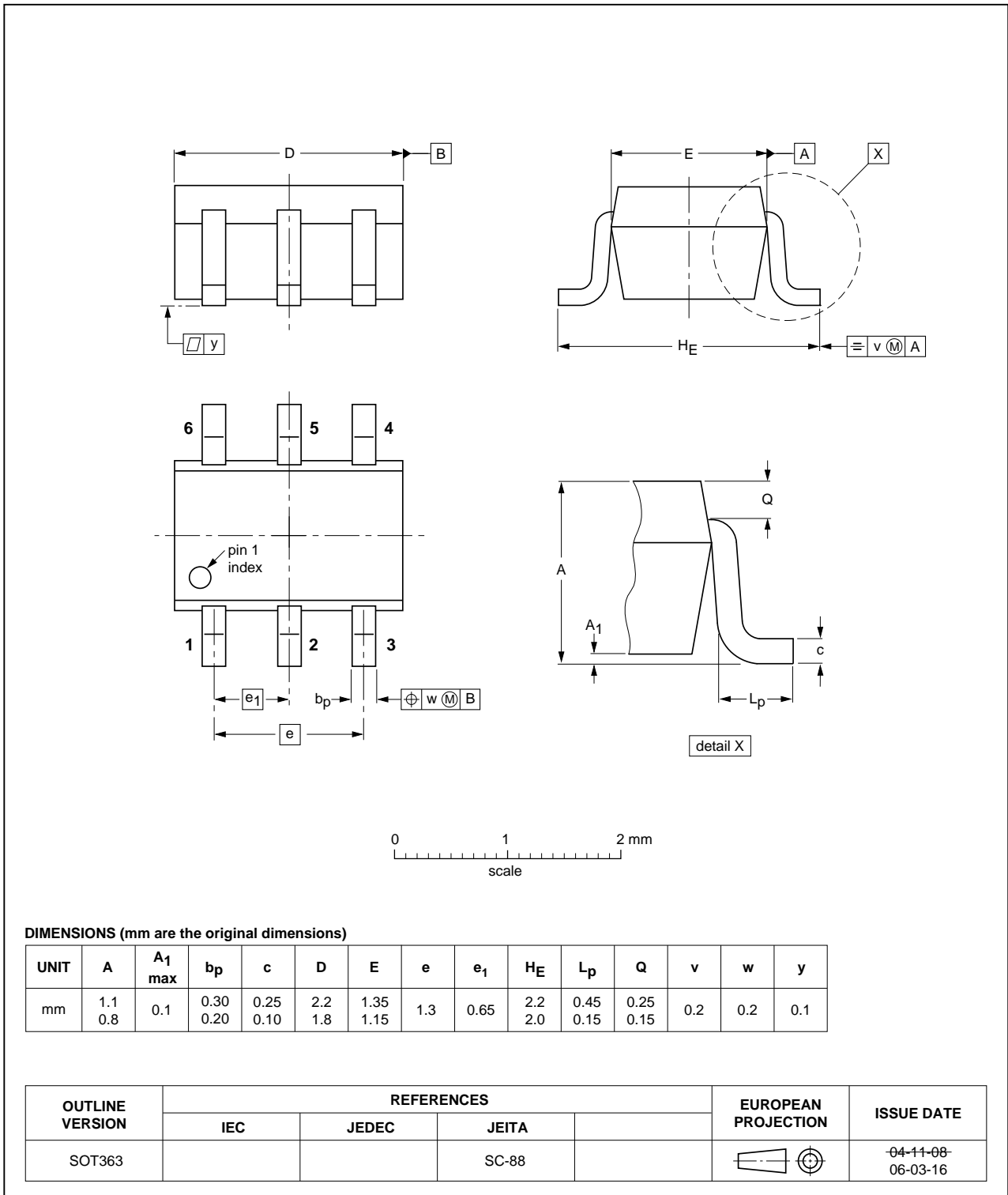


Fig 11. Package outline SOT363 (SC-88)

Plastic surface-mounted package (TSOP6); 6 leads

SOT457

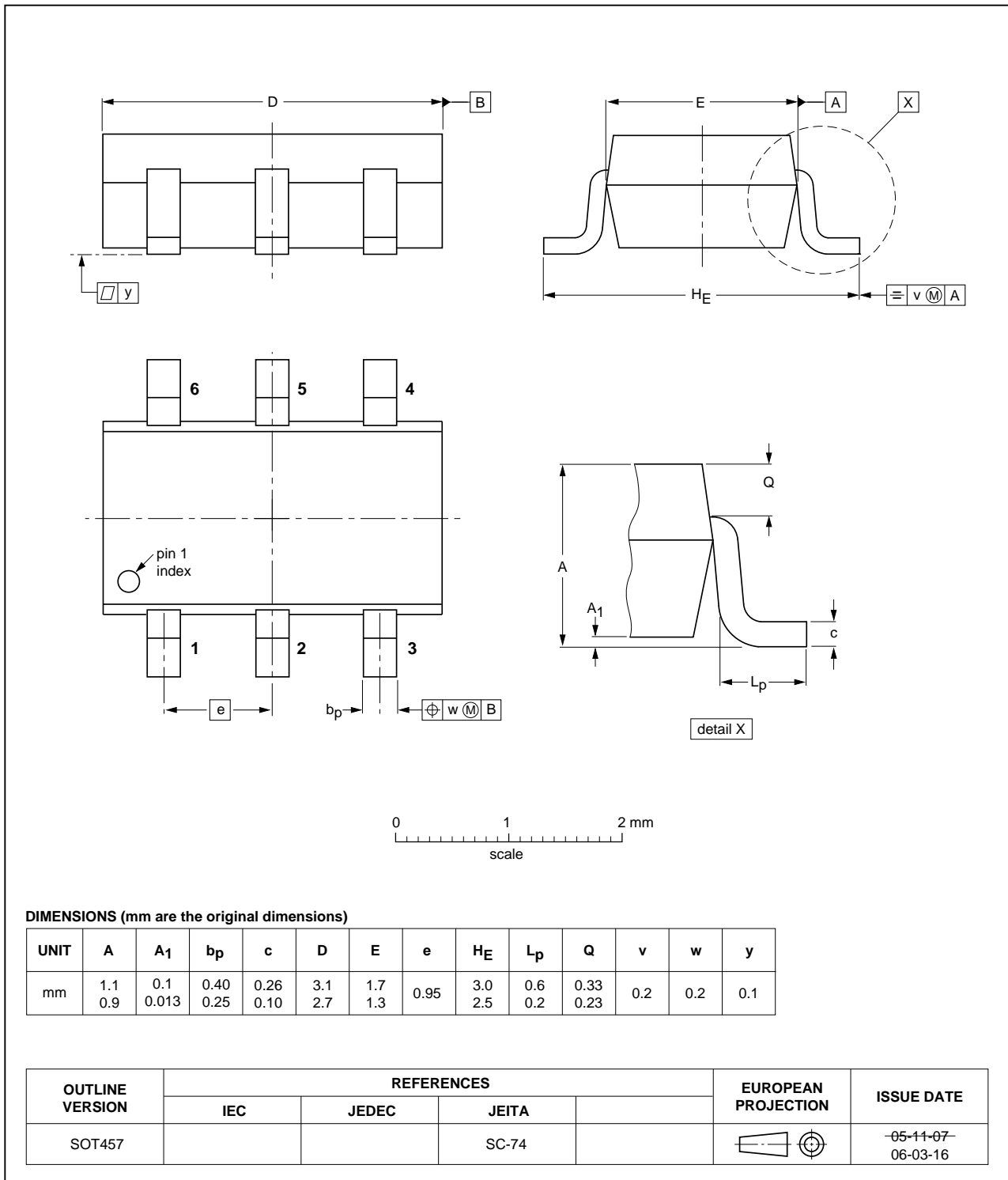


Fig 12. Package outline SOT457 (SC-74)

17. Abbreviations

Table 12. 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
MIL	Military

18. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G17_Q100 v.1	20120807	Product data sheet	-	-

19. Legal information

19.1 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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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