

74LVC1G386

3-input EXCLUSIVE-OR gate

Rev. 5 — 1 February 2022

Product data sheet

1. General description

The 74LVC1G386 is a single 3-input EXCLUSIVE-OR gate. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Direct interface with TTL levels
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 V)
- ESD protection:
 - HBM EIA/JESD22-A114E exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 to +85 °C and -40 to +125 °C.

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G386GW	-40 °C to +125 °C	TSSOP6	plastic thin shrink small outline package; 6 leads; body width 1.25 mm	SOT363-2
74LVC1G386GV	-40 °C to +125 °C	SC-74; TSOP6	plastic surface-mounted package; 6 leads	SOT457

4. Marking

Table 2. Marking

Type number	Marking code [1]
74LVC1G386GW	YH
74LVC1G386GV	YH

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

5. Functional diagram

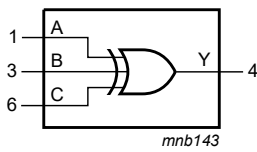


Fig. 1. Logic symbol

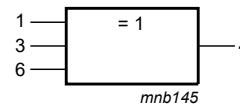


Fig. 2. IEC logic symbol

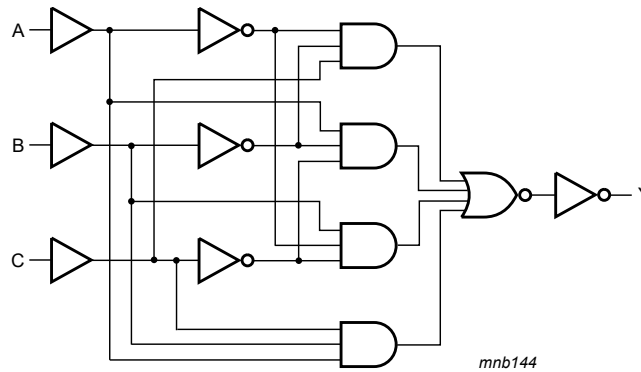


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

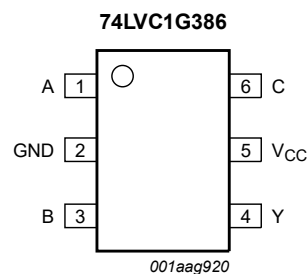


Fig. 4. Pin configuration SOT363-2 (TSSOP6) and SOT457 (SC-74; TSOP6)

6.2. Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level.

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

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 SOT363-2 (TSSOP6) package: P_{tot} derates linearly with 3.7 mW/K above 83 °C.

For SOT457 (SC-74; TSOP6) package: 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_O
		Power-down mode; $V_{CC} = 0$ V	0	-	5.5	V_O
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	-	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	-	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	-	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	-	-	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	-	-	0.1	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	-	0.45	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	-	0.3	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	-	0.4	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	-	0.55	V
I_I	input leakage current	$V_{CC} = 0$ V to 5.5 V; $V_I = 5.5$ V or GND	-	± 0.1	± 1	μ A
		$V_{CC} = 0$ V; V_I or $V_O = 5.5$ V	-	± 0.1	± 2	μ A
I_{OFF}	power-off leakage current	$V_{CC} = 0$ V; V_I or $V_O = 5.5$ V	-	± 0.1	± 2	μ A

Symbol	Parameter	Conditions	Min	Typ [1]	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	4	μA
ΔI_{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	μA
C_I	input capacitance	$V_{CC} = 3.3 \text{ V}; V_I = \text{GND to } V_{CC}$	-	4	-	pF
$T_{\text{amb}} = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}$						
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	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	$V_{CC} - 0.1$	-	-	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
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_O = 100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	-	-	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
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
I_{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}; V_I \text{ or } V_O = 5.5 \text{ V}$	-	-	± 2	μA
I_{CC}	supply current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	-	-	4	μA
ΔI_{CC}	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V};$ $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}$	-	-	500	μA

[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 Fig. 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	A, B, C to Y; see Fig. 5 [2]						
		V _{CC} = 1.65 V to 1.95 V	2.0	8.0	17.0	2.0	22.0	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	5.0	9.0	1.5	11.5	ns
		V _{CC} = 2.7 V	1.5	5.0	8.5	1.5	11.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	4.5	7.5	1.0	9.5	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	3.5	5.5	1.0	7.0	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; V _{CC} = 3.3 V [3]	-	13	-	-	-	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;

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

11.1. Waveforms and test circuit

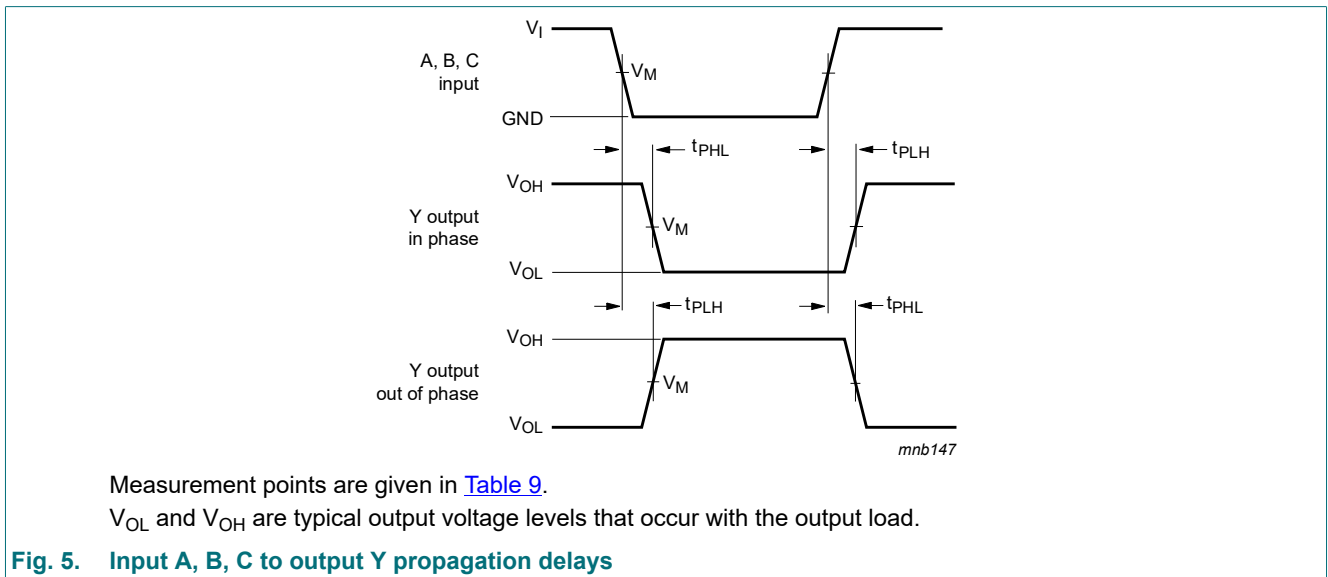
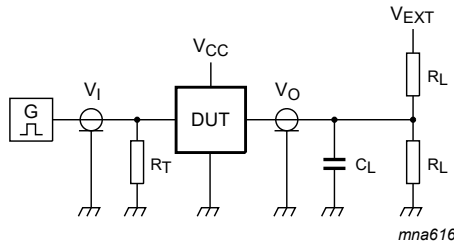


Table 9. Measurement points

V _{CC}	V _M	Input	
		V _I	t _r = t _f
1.65 V to 1.95 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.3 V to 2.7 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 V to 5.5 V	0.5 × V _{CC}	V _{CC}	≤ 2.5 ns



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. 6. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input	Load		V _{EXT}
V _{CC}	V _I	C _L	R _L	t _{PLH} , t _{PHL}
1.65 V to 1.95 V	V _{CC}	30 pF	1 kΩ	open
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open
2.7 V	2.7 V	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open
4.5 V to 5.5 V	V _{CC}	50 pF	500 Ω	open

12. Package outline

TSSOP6: plastic thin shrink small outline package; 6 leads; body width 1.25 mm

SOT363-2

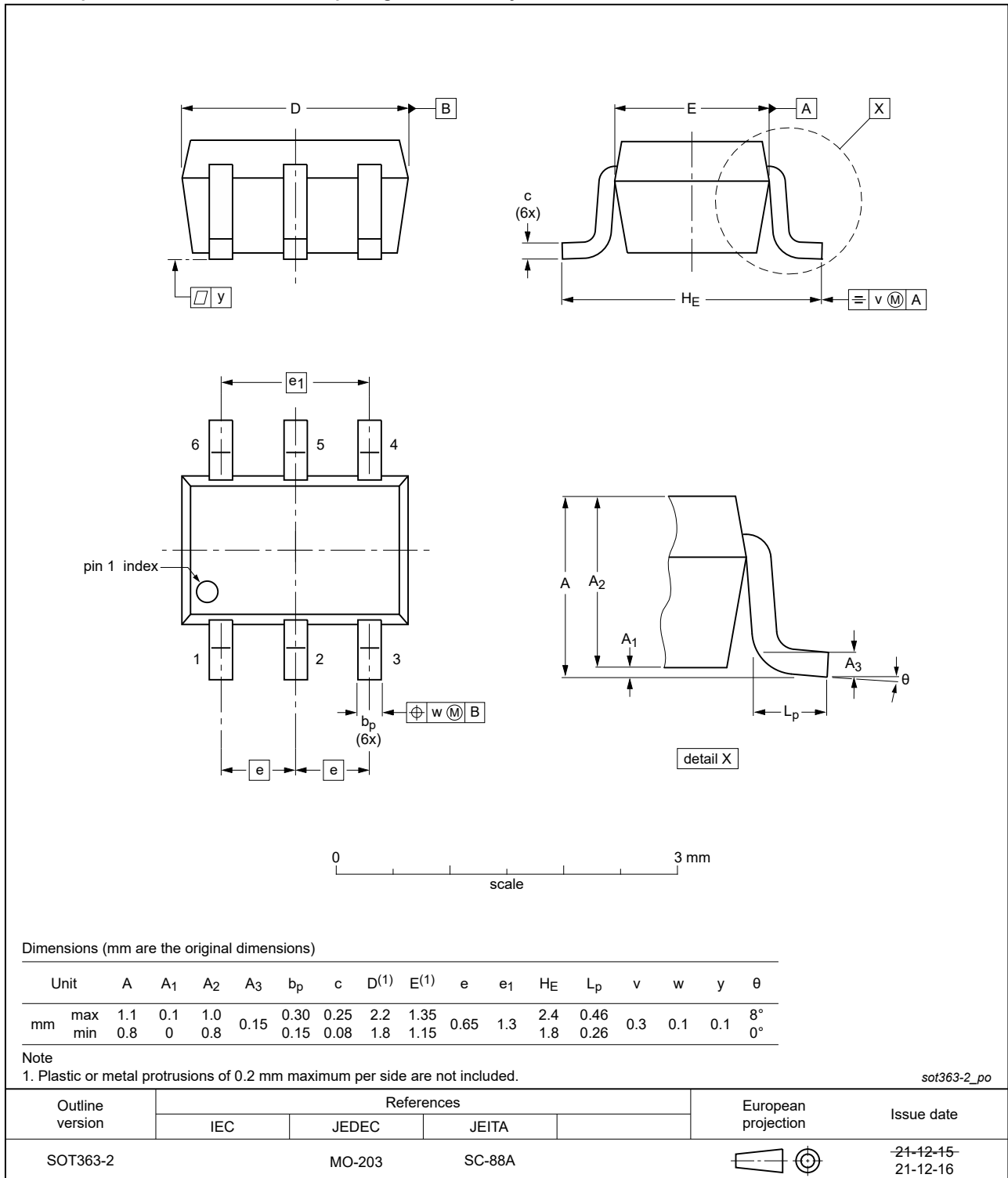


Fig. 7. Package outline SOT363-2 (TSSOP6)

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

SOT457

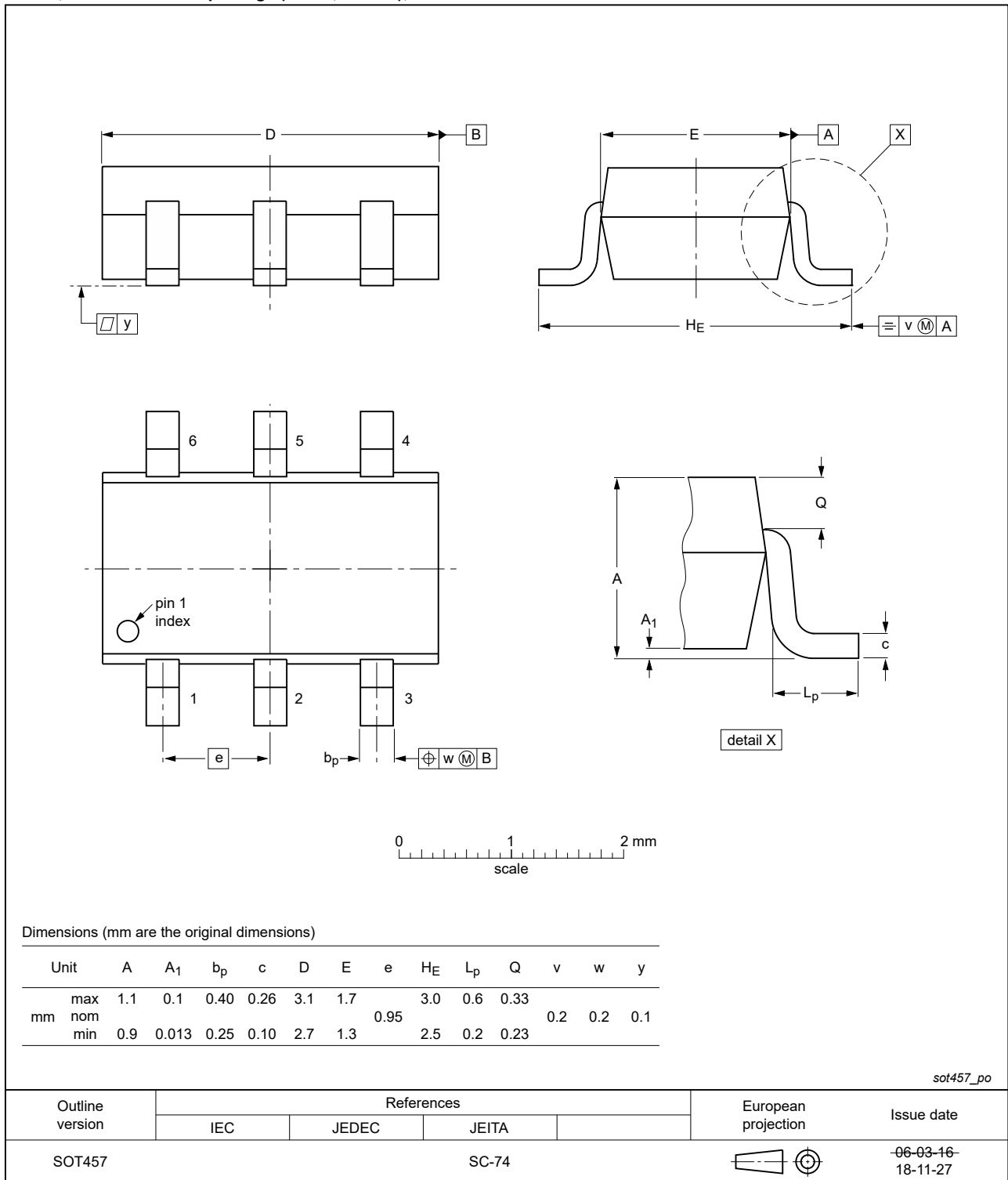


Fig. 8. Package outline SOT457 (SC-74; TSOP6)

13. 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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G386 v.5	20220201	Product data sheet	-	74LVC1G386 v.4
Modifications:	<ul style="list-style-type: none"> Package SOT363 (SC-88) changed to SOT363-2 (TSSOP6). Section 1 and Section 2 updated. Section 8: Derating values for P_{tot} total power dissipation updated. Fig. 8: Package outline drawing SOT457 (SC-74; TSOP6) updated. 			
74LVC1G386 v.4	20170509	Product data sheet	-	74LVC1G386 v.3
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 			
74LVC1G386 v.3	20161207	Product data sheet	-	74LVC1G386 v.2
Modifications:	<ul style="list-style-type: none"> Table 7: The maximum limits for leakage current and supply current have changed. 			
74LVC1G386 v.2	20121119	Product data sheet	-	74LVC1G386 v.1
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. In Section 10 "Static characteristics", changed conditions for input leakage and supply current. 			
74LVC1G386 v.1	20031104	Product specification	-	

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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