

# 74LVC1G14-Q100

## Single Schmitt trigger inverter

Rev. 6 — 4 May 2021

Product data sheet

## 1. General description

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The 74LVC1G14-Q100 is a single inverter with Schmitt-trigger inputs. 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. 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.

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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 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
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Unlimited rise and fall times
- 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:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pf, R = 0  $\Omega$ )
- Multiple package options

## 3. Applications

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- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

## 4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G14GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G14GV-Q100	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G14GM-Q100	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC1G14GX4-Q100	-40 °C to +125 °C	X2SON4	plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 × 0.6 × 0.32 mm	SOT1269-2

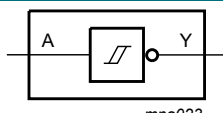
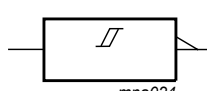
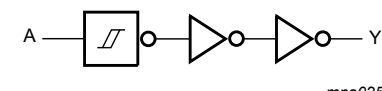
## 5. Marking

Table 2. Marking

Type number	Marking code[1]
74LVC1G14GW-Q100	VF
74LVC1G14GV-Q100	V14
74LVC1G14GM-Q100	VF
74LVC1G14GX4-Q100	VF

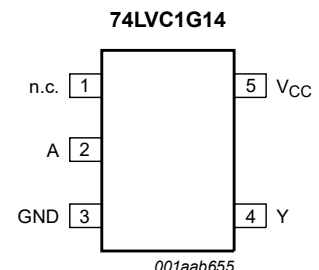
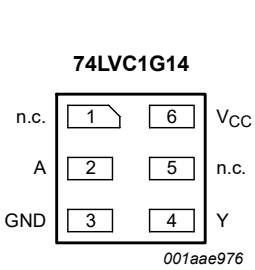
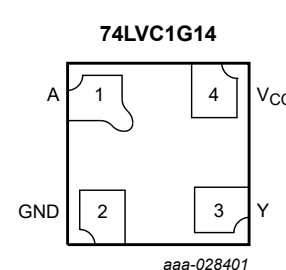
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram

 <p><i>mna023</i></p>	 <p><i>mna024</i></p>	 <p><i>mna025</i></p>
<b>Fig. 1. Logic symbol</b>	<b>Fig. 2. IEC logic symbol</b>	<b>Fig. 3. Logic diagram</b>

## 7. Pinning information

### 7.1. Pinning

 <p><b>74LVC1G14</b></p> <p><i>001aab655</i></p>	 <p><b>74LVC1G14</b></p> <p><i>001aae976</i></p> <p>Transparent top view</p>	 <p><b>74LVC1G14</b></p> <p><i>aaa-028401</i></p> <p>Transparent top view</p>
<b>Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)</b>	<b>Fig. 5. Pin configuration SOT886 (XSON6)</b>	<b>Fig. 6. Pin configuration SOT1269-2 (X2SON4)</b>

## 7.2. Pin description

Table 3. Pin description

Symbol	Pin			Description
	TSSOP5 and SC-74A	XSON6	X2SON4	
n.c.	1	1, 5	-	not connected
A	2	2	1	data input
GND	3	3	2	ground (0 V)
Y	4	4	3	data output
V <sub>CC</sub>	5	6	4	supply voltage

## 8. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	Y
L	H
H	L

## 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 <sub>CC</sub>	supply voltage		-0.5	+6.5	V
V <sub>I</sub>	input voltage	[1]	-0.5	+6.5	V
V <sub>O</sub>	output voltage	Active mode [1]	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode; V <sub>CC</sub> = 0 V [1]	-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	-	±50	mA
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±50	mA
I <sub>CC</sub>	supply current		-	+100	mA
I <sub>GND</sub>	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C			
		TSSOP5, SC-74A and XSON6 package [2]	-	250	mW
		X2SON4 package [3]	-	150	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT353-1 (TSSOP5) package: P<sub>tot</sub> derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: P<sub>tot</sub> derates linearly with 3.8 mW/K above 85 °C.

For SOT886 (XSON6) package: P<sub>tot</sub> derates linearly with 3.3 mW/K above 74 °C.

[3] For SOT1269-2 (X2SON4) package: P<sub>tot</sub> derates linearly with 1.7 mW/K above 57 °C.

## 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	Active mode	0	-	$V_{CC}$	V
		Power-down mode; $V_{CC} = 0$ V	0	-	5.5	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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$V_{OH}$	HIGH-level output voltage	$V_I = V_{T+}$ or $V_{T-}$						
		$I_O = -100 \mu\text{A}$ ; $V_{CC} = 1.65$ V to 5.5 V	$V_{CC} - 0.1$	-	-	$V_{CC} - 0.1$	-	V
		$I_O = -4$ mA; $V_{CC} = 1.65$ V	1.2	1.54	-	0.95	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	2.15	-	1.7	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	2.50	-	1.9	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	2.62	-	2.0	-	V
		$I_O = -32$ mA; $V_{CC} = 4.5$ V	3.8	4.11	-	3.4	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{T+}$ or $V_{T-}$						
		$I_O = 100 \mu\text{A}$ ; $V_{CC} = 1.65$ V to 5.5 V	-	-	0.10	-	0.10	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	0.07	0.45	-	0.70	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	0.12	0.30	-	0.45	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	0.17	0.40	-	0.60	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	0.33	0.55	-	0.80	V
		$I_O = 32$ mA; $V_{CC} = 4.5$ V	-	0.39	0.55	-	0.80	V
$I_I$	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 0$ V to 5.5 V	-	$\pm 0.1$	$\pm 1$	-	$\pm 1$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	$\pm 0.1$	$\pm 2$	-	$\pm 2$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = 5.5$ V or GND; $I_O = 0$ A; $V_{CC} = 1.65$ V to 5.5 V	-	0.1	4	-	4	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	5	500	-	500	$\mu\text{A}$
$C_I$	input capacitance	$V_{CC} = 3.3$ V; $V_I = \text{GND}$ to $V_{CC}$	-	5.0	-	-	-	pF

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

### 11.1. Transfer characteristics

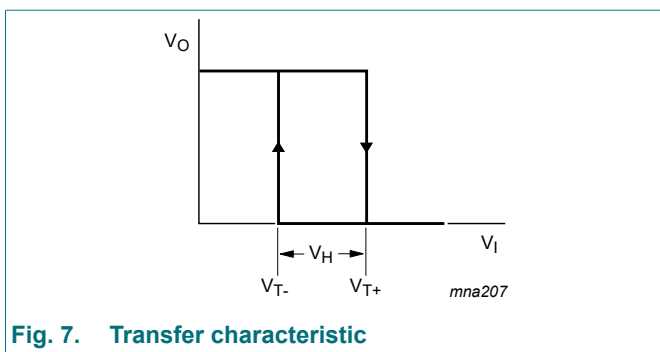
**Table 8. Transfer characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 11.

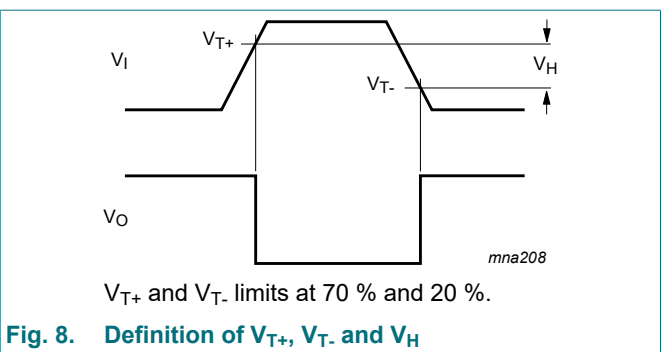
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>T+</sub>	positive-going threshold voltage	see Fig. 7 and Fig. 8						
		V <sub>CC</sub> = 1.8 V	0.82	1.0	1.14	0.79	1.14	V
		V <sub>CC</sub> = 2.3 V	1.03	1.2	1.40	1.00	1.40	V
		V <sub>CC</sub> = 3.0 V	1.29	1.5	1.71	1.26	1.71	V
		V <sub>CC</sub> = 4.5 V	1.84	2.1	2.36	1.81	2.36	V
V <sub>T-</sub>	negative-going threshold voltage	see Fig. 7 and Fig. 8						
		V <sub>CC</sub> = 1.8 V	0.46	0.6	0.75	0.46	0.78	V
		V <sub>CC</sub> = 2.3 V	0.65	0.8	0.96	0.65	0.99	V
		V <sub>CC</sub> = 3.0 V	0.88	1.0	1.24	0.88	1.27	V
		V <sub>CC</sub> = 4.5 V	1.32	1.5	1.84	1.32	1.87	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> - V <sub>T-</sub> ); see Fig. 7, Fig. 8 and Fig. 9						
		V <sub>CC</sub> = 1.8 V	0.26	0.4	0.51	0.19	0.51	V
		V <sub>CC</sub> = 2.3 V	0.28	0.4	0.57	0.22	0.57	V
		V <sub>CC</sub> = 3.0 V	0.31	0.5	0.64	0.25	0.64	V
		V <sub>CC</sub> = 4.5 V	0.40	0.6	0.77	0.34	0.77	V
		V <sub>CC</sub> = 5.5 V	0.47	0.6	0.88	0.41	0.88	V

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

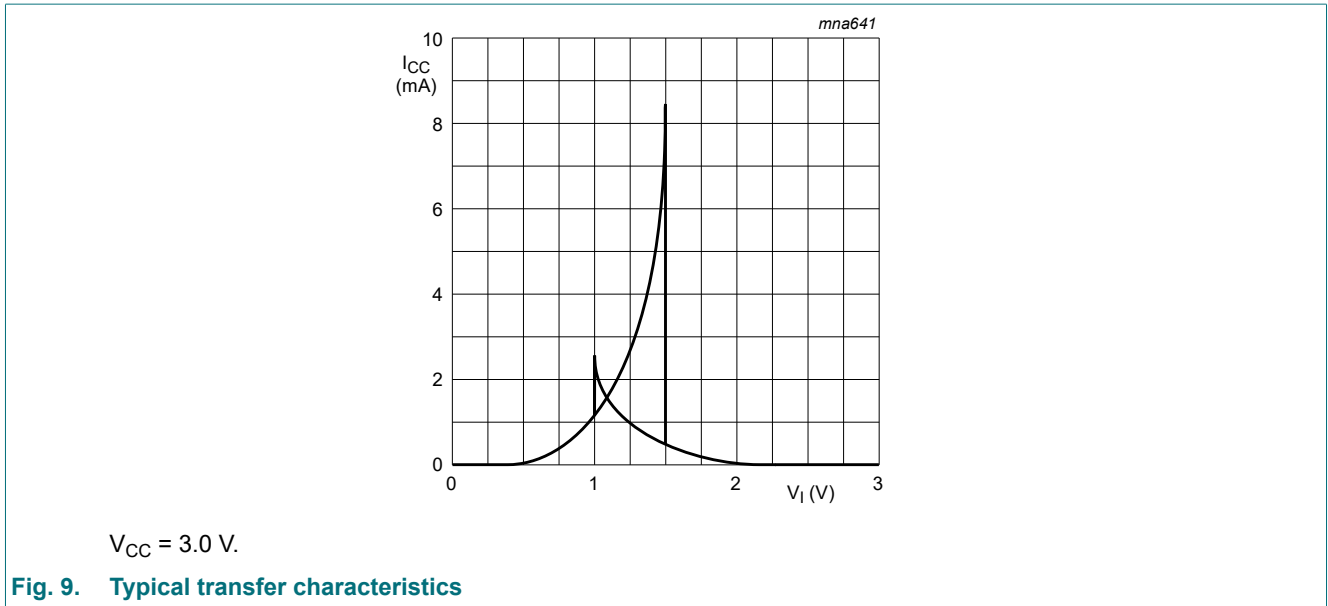
### 11.2. Waveforms transfer characteristics



**Fig. 7. Transfer characteristic**



**Fig. 8. Definition of V<sub>T+</sub>, V<sub>T-</sub> and V<sub>H</sub>**



## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 11.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Fig. 10 [2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	4.1	11.0	1.0	14.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7	2.8	6.5	0.7	8.5	ns
		V <sub>CC</sub> = 2.7 V	0.7	3.2	6.5	0.7	8.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.7	3.0	5.5	0.7	7.0	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7	2.2	5.0	0.7	6.5	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = GND to V <sub>CC</sub> [3]	-	15.4	-	-	-	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] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

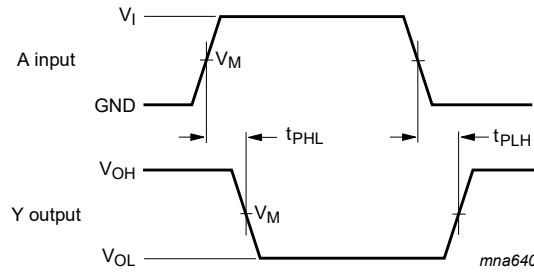
f<sub>i</sub> = input frequency in MHz;

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.

12.1. Waveform and test circuit



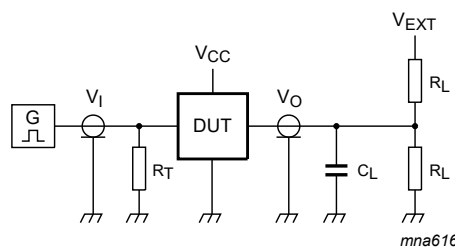
Measurement points are given in [Table 10](#).

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

Fig. 10. The data input (A) to output (Y) propagation delays

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



Test data is given in [Table 11](#).

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. 11. Test circuit for measuring switching times

Table 11. 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. Application information

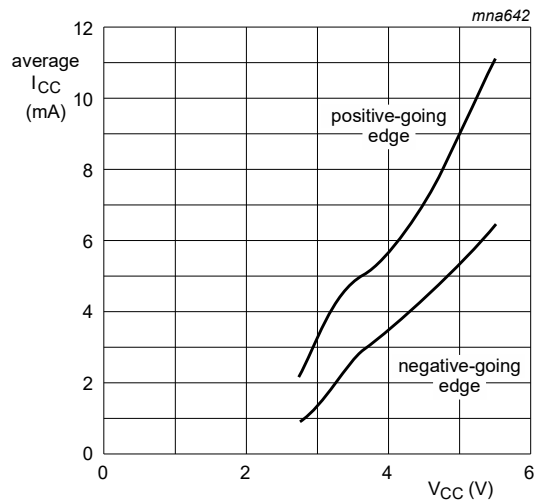
The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC} \text{ where:}$$

- $P_{add}$  = additional power dissipation ( $\mu\text{W}$ );
- $f_i$  = input frequency (MHz);
- $t_r$  = input rise time (ns); 10 % to 90 %;
- $t_f$  = input fall time (ns); 90 % to 10 %;
- $\Delta I_{CC(AV)}$  = average additional supply current ( $\mu\text{A}$ ).

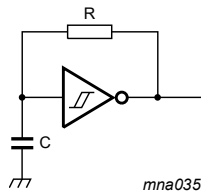
Average  $\Delta I_{CC(AV)}$  differs with positive or negative input transitions, as shown in Fig. 12.

An example of a relaxation circuit using the 74LVC1G14-Q100 is shown in Fig. 13.



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

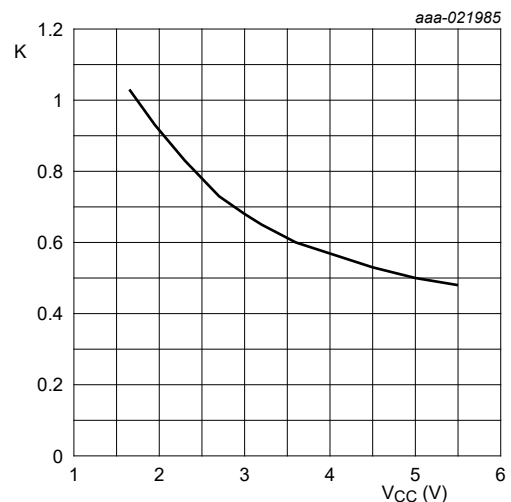
**Fig. 12. Average additional supply current as a function of supply voltage**



$$f = \frac{1}{T} \approx \frac{1}{K \times RC}$$

For K-factor, see Fig. 14

**Fig. 13. Relaxation oscillator**



**Fig. 14. Typical K-factor for relaxation oscillator**



14. Package outline

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

SOT353-1

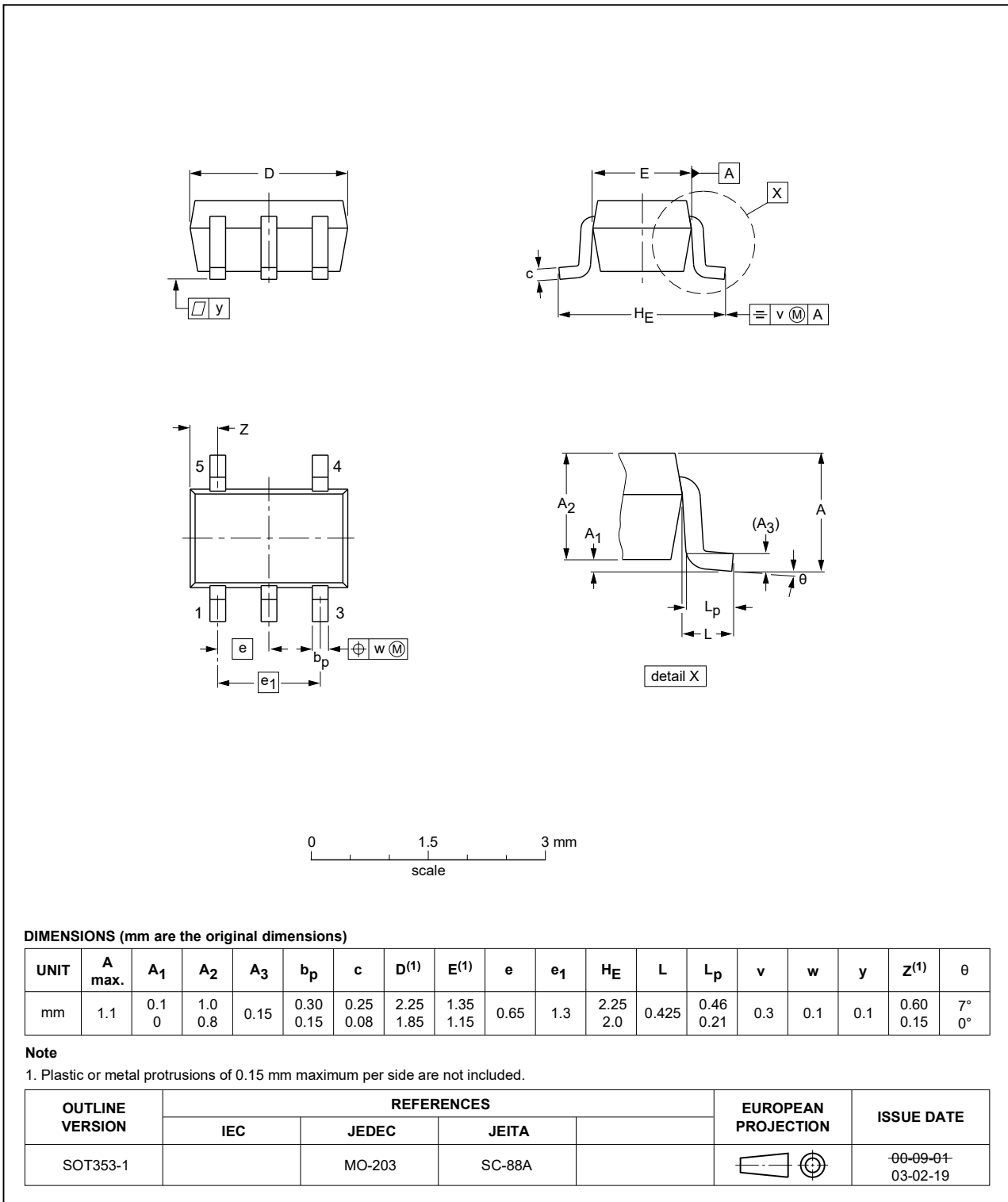


Fig. 15. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

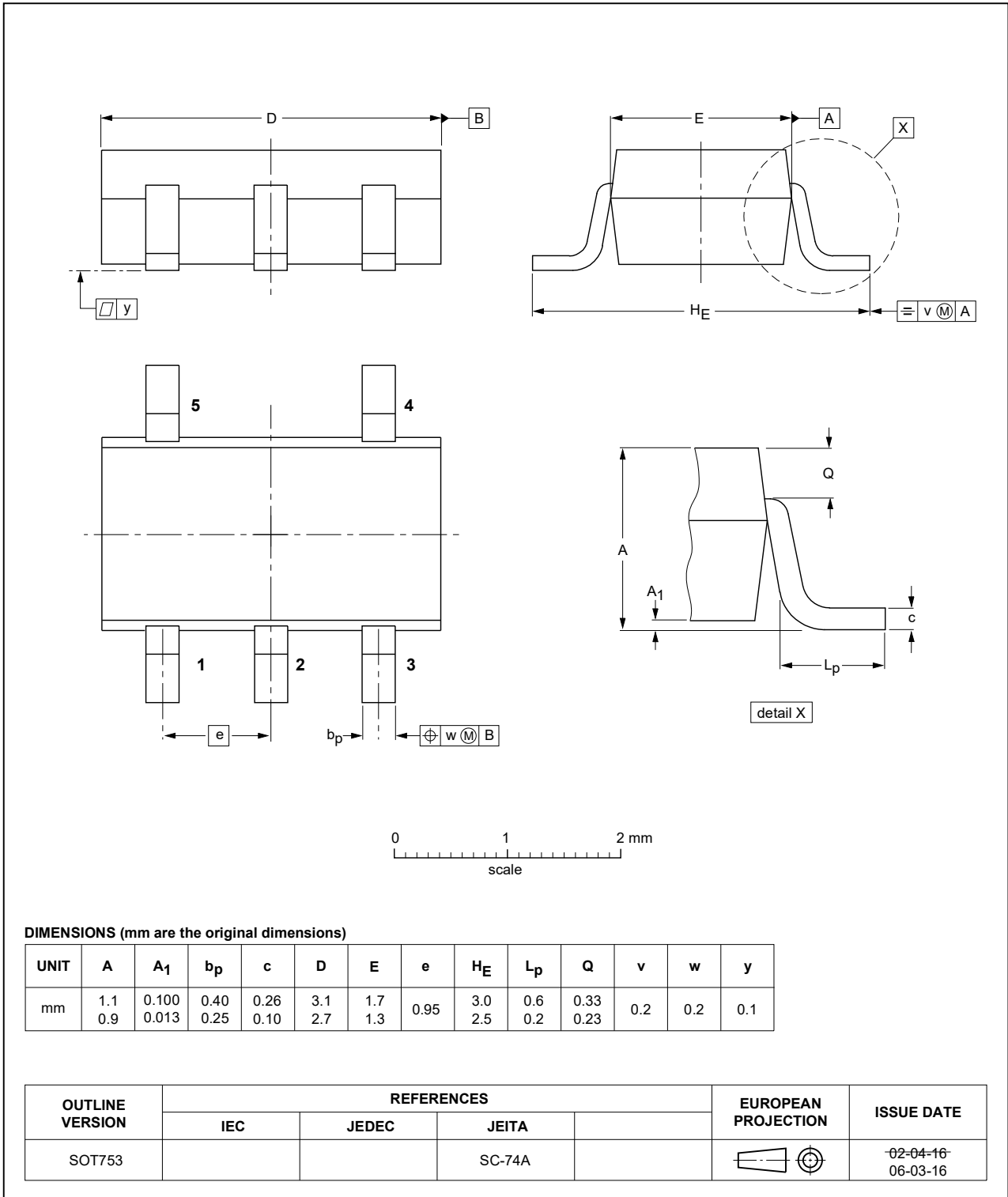


Fig. 16. Package outline SOT753 (SC-74A)

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

SOT886

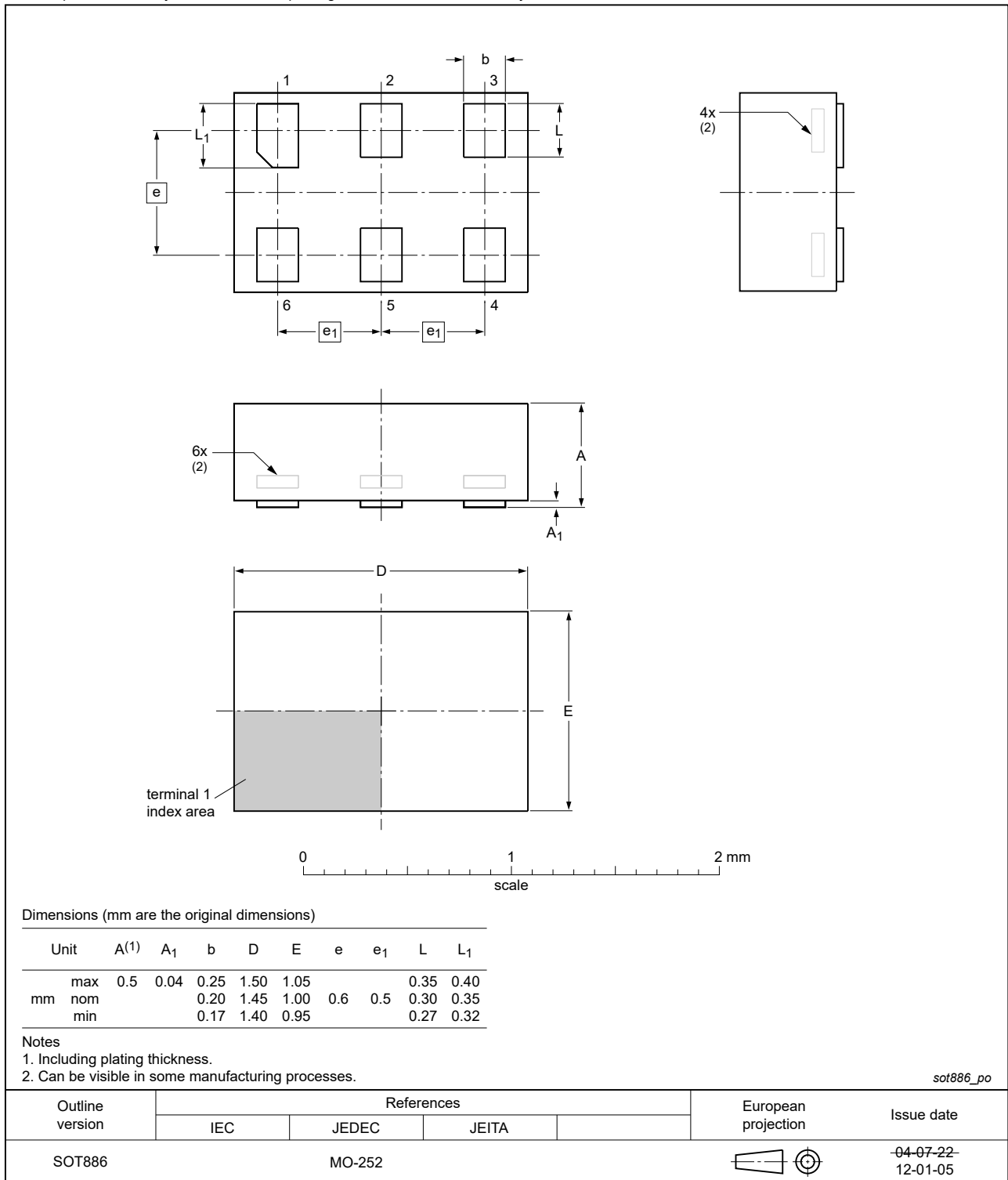


Fig. 17. Package outline SOT886 (XSON6)

X2SON4: plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 x 0.6 x 0.32 mm

SOT1269-2

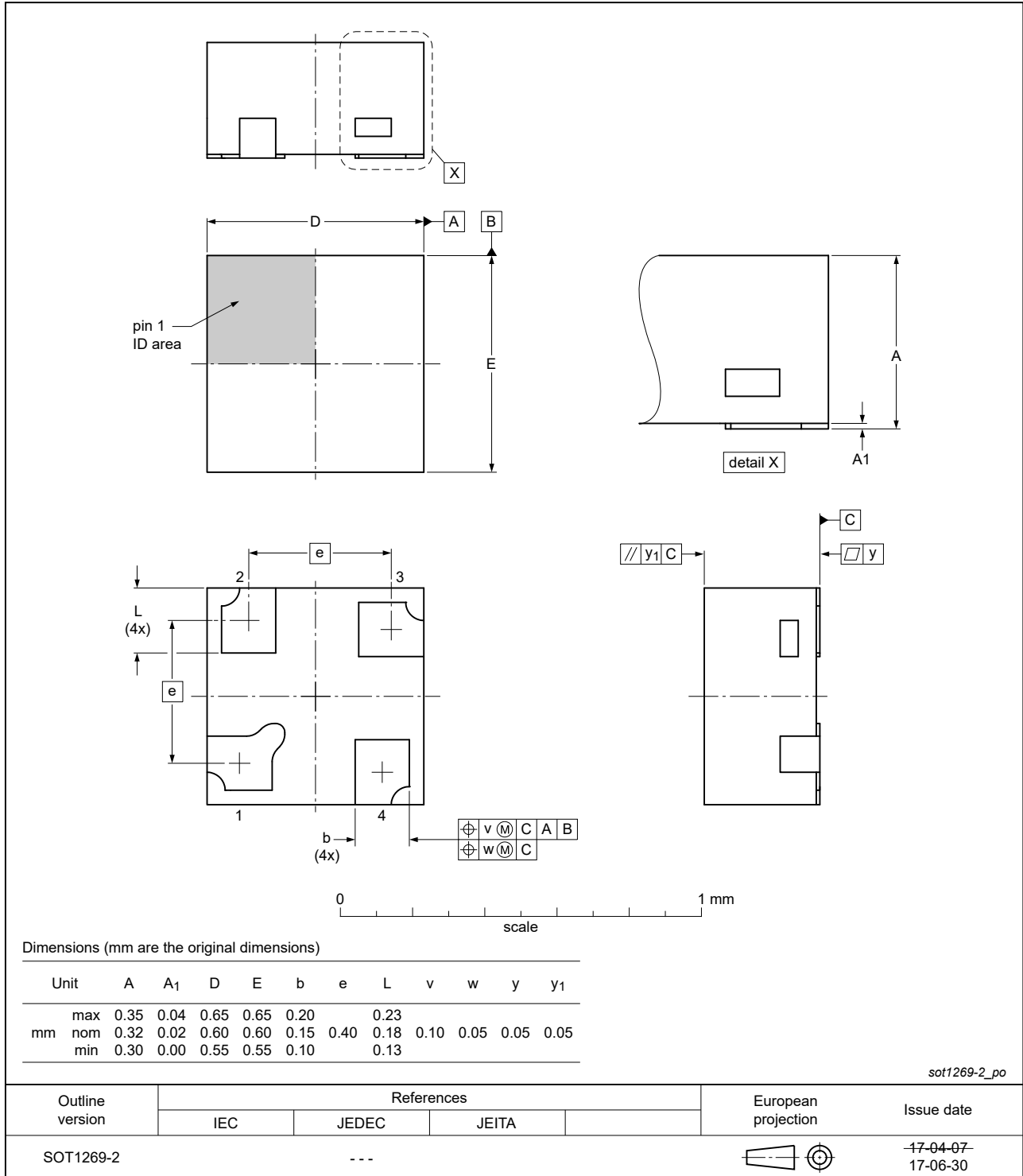


Fig. 18. Package outline SOT1269-2 (X2SON4)

## 15. Abbreviations

Table 12. Abbreviations

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

## 16. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G14_Q100 v.6	20210504	Product data sheet	-	74LVC1G14_Q100 v.5
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> </ul>			
74LVC1G14_Q100 v.5	20210127	Product data sheet	-	74LVC1G14_Q100 v.4
Modifications:	<ul style="list-style-type: none"> <li>• Added type number 74LVC1G14GX4-Q100 (SOT1269-2).</li> <li>• <a href="#">Table 5</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74LVC1G14_Q100 v.4	20190125	Product data sheet	-	74LVC1G14_Q100 v.3
Modifications:	<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• Added type number 74LVC1G14GM-Q100 (SOT886)</li> </ul>			
74LVC1G14_Q100 v.3	20161208	Product data sheet	-	74LVC1G14_Q100 v.2
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 7</a>: The maximum limits for leakage current and supply current have changed.</li> </ul>			
74LVC1G14_Q100 v.2	20160315	Product data sheet	-	74LVC1G14_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Fig. 14</a> added (typical K-factor for relaxation oscillator).</li> </ul>			
74LVC1G14_Q100 v.1	20120709	Product data sheet	-	-

## 17. 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.
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