

74LVC2G14

Dual inverting Schmitt trigger with 5 V tolerant input

Rev. 14 — 18 August 2023

Product data sheet

1. General description

The 74LVC2G14 is a dual 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.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power dissipation
- Direct interface with TTL levels
- Unlimited rise and fall times
- Overvoltage tolerant inputs to 5.5 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: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C.

3. Applications

- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC2G14GW	-40 °C to +125 °C	TSSOP6	plastic thin shrink small outline package; 6 leads; body width 1.25 mm	SOT363-2
74LVC2G14GV	-40 °C to +125 °C	SC-74; TSOP6	plastic surface-mounted package; 6 leads	SOT457
74LVC2G14GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC2G14GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC2G14GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202

5. Marking

Table 2. Marking codes

Type number	Marking code [1]
74LVC2G14GW	VK
74LVC2G14GV	V14
74LVC2G14GM	VK
74LVC2G14GN	VK
74LVC2G14GS	VK

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

6. Functional diagram

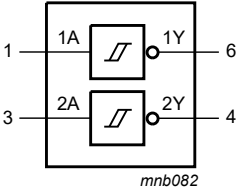


Fig. 1. Logic symbol

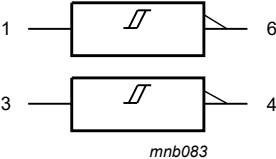


Fig. 2. IEC logic symbol

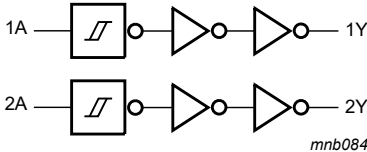
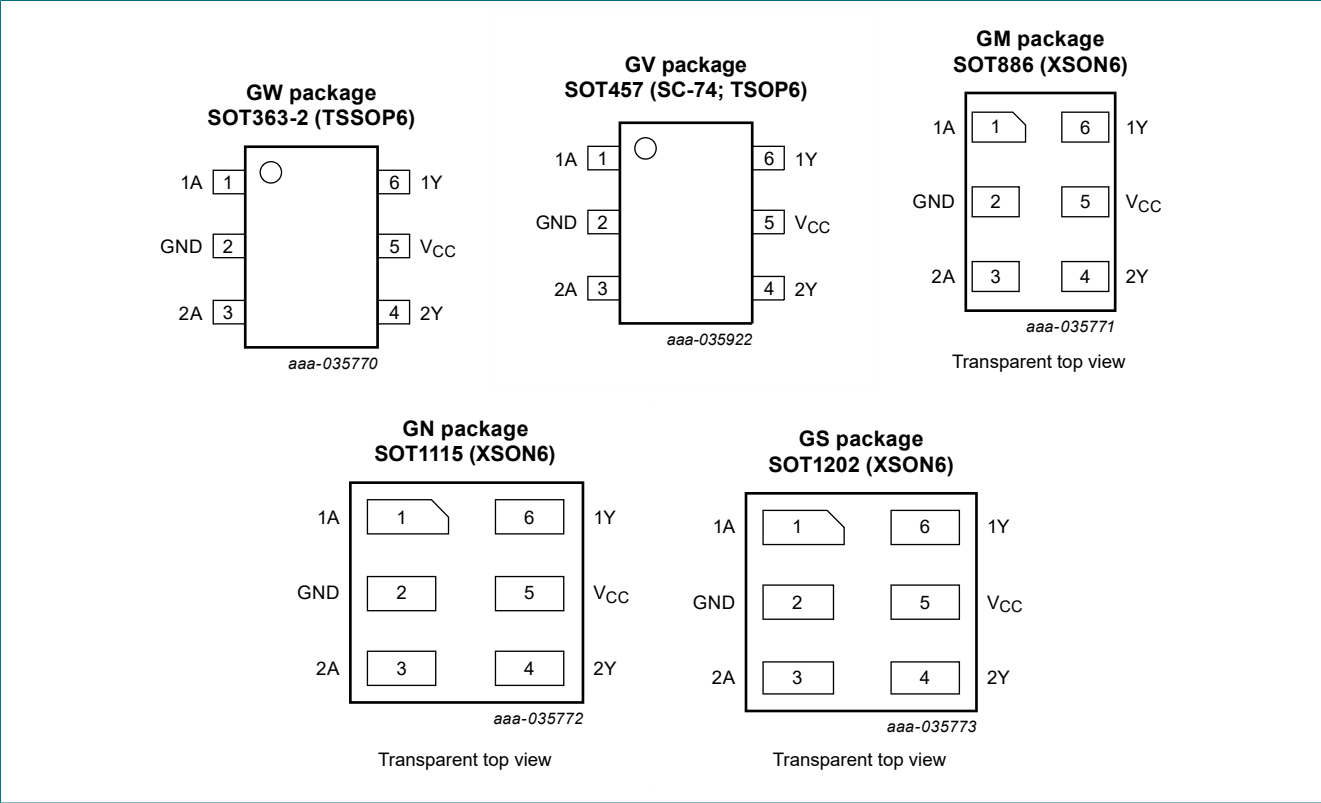


Fig. 3. Logic diagram

7. Pinning information

7.1. Pinning



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 output

8. Functional description

Table 4. Function table

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

Input	Output
nA	nY
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_{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.

For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °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	Min	Typ[1]	Max	Unit
$T_{amb} = -40$ °C to $+85$ °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = -100$ 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
		$I_O = -32$ mA; $V_{CC} = 4.5$ V	3.8	-	-	V

Dual inverting Schmitt trigger with 5 V tolerant input

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
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
I_I	input leakage current	$V_I = 5.5\ \text{V}$ or GND; $V_{CC} = 0\ \text{V}$ to $5.5\ \text{V}$	-	± 0.1	± 1	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5\ \text{V}$; $V_{CC} = 0\ \text{V}$	-	± 0.1	± 2	μA
I_{CC}	supply current	$V_I = 5.5\ \text{V}$ or GND; $V_{CC} = 1.65\ \text{V}$ to $5.5\ \text{V}$; $I_O = 0\ \text{A}$	-	0.1	4	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	$V_{CC} = 3.3\ \text{V}$; $V_I = \text{GND}$ to V_{CC}	-	3.5	-	pF
$T_{\text{amb}} = -40\ ^\circ\text{C}$ to $+125\ ^\circ\text{C}$						
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
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
		$I_O = 4\ \text{mA}$; $V_{CC} = 1.65\ \text{V}$	-	-	0.7	V
		$I_O = 8\ \text{mA}$; $V_{CC} = 2.3\ \text{V}$	-	-	0.45	V
		$I_O = 12\ \text{mA}$; $V_{CC} = 2.7\ \text{V}$	-	-	0.6	V
		$I_O = 24\ \text{mA}$; $V_{CC} = 3.0\ \text{V}$	-	-	0.8	V
		$I_O = 32\ \text{mA}$; $V_{CC} = 4.5\ \text{V}$	-	-	0.8	V
I_I	input leakage current	$V_I = 5.5\ \text{V}$ or GND; $V_{CC} = 0\ \text{V}$ to $5.5\ \text{V}$	-	-	± 1	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5\ \text{V}$; $V_{CC} = 0\ \text{V}$	-	-	± 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	$V_I = V_{CC} - 0.6\ \text{V}$; $I_O = 0\ \text{A}$; $V_{CC} = 2.3\ \text{V}$ to $5.5\ \text{V}$	-	-	500	μA

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

12. Transfer characteristics

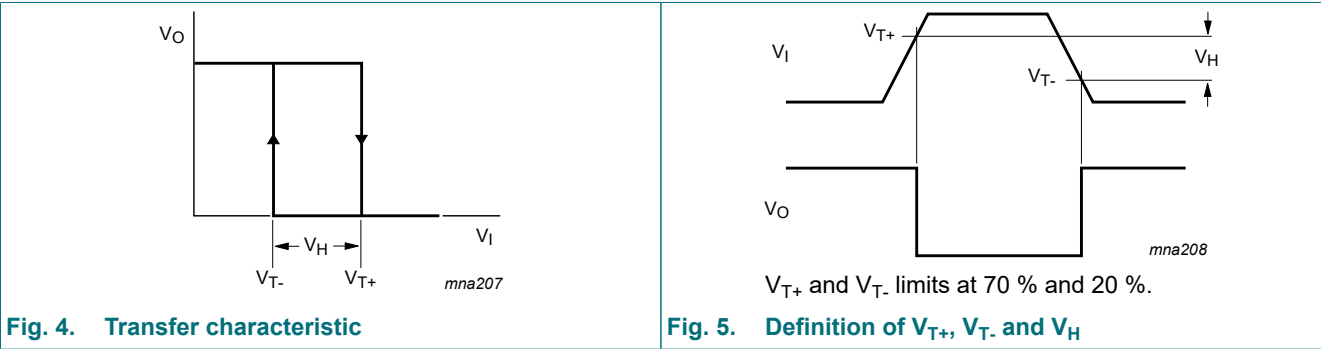
Table 8. Transfer characteristics

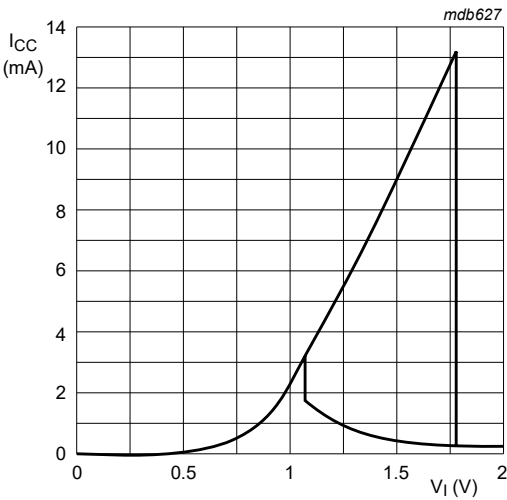
Voltages are referenced to GND (ground = 0 V; for test circuit see Fig. 8

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 Fig. 4 and Fig. 5						
		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; see Fig. 6	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 _{CC} = 5.5 V	2.20	2.91	3.60	2.20	3.80	V
V _{T-}	negative-going threshold voltage	see Fig. 4 and Fig. 5						
		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; see Fig. 6	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 _{CC} = 5.5 V	1.20	1.86	2.30	1.20	2.50	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see Fig. 4 and Fig. 5						
		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; see Fig. 6	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

12.1. Waveforms transfer characteristics





V_{CC} = 3.0 V

Fig. 6. Typical transfer characteristics

13. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 8.

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 Fig. 7 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	5.6	11.0	1.0	12.0	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	3.7	6.5	0.5	7.2	ns
		V _{CC} = 2.7 V	0.5	4.1	7.0	0.5	7.7	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	3.9	6.0	0.5	6.7	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.7	4.3	0.5	4.7	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; V _{CC} = 3.3 V [3]	-	18.1	-	-	-	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).

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

13.1. Waveforms and test circuit

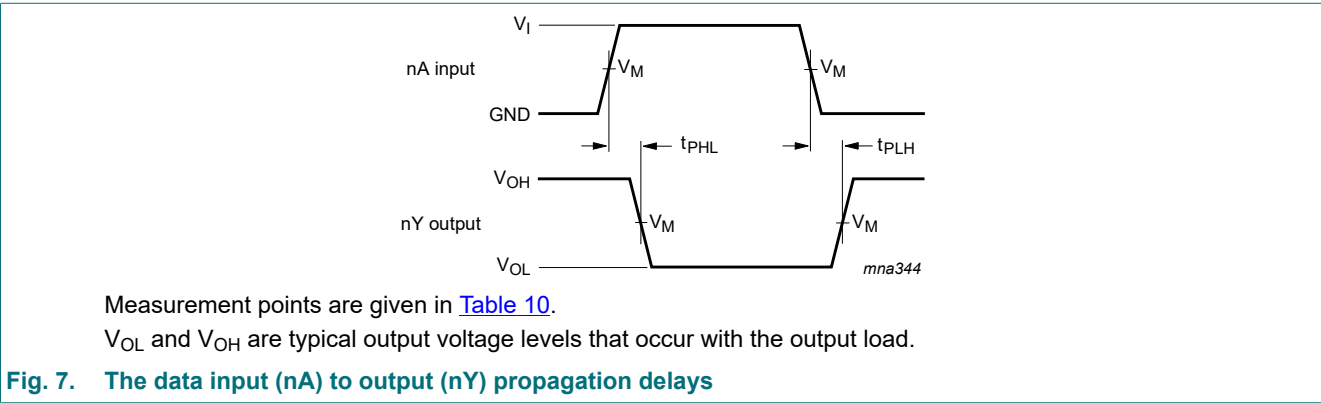


Table 10. Measurement points

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

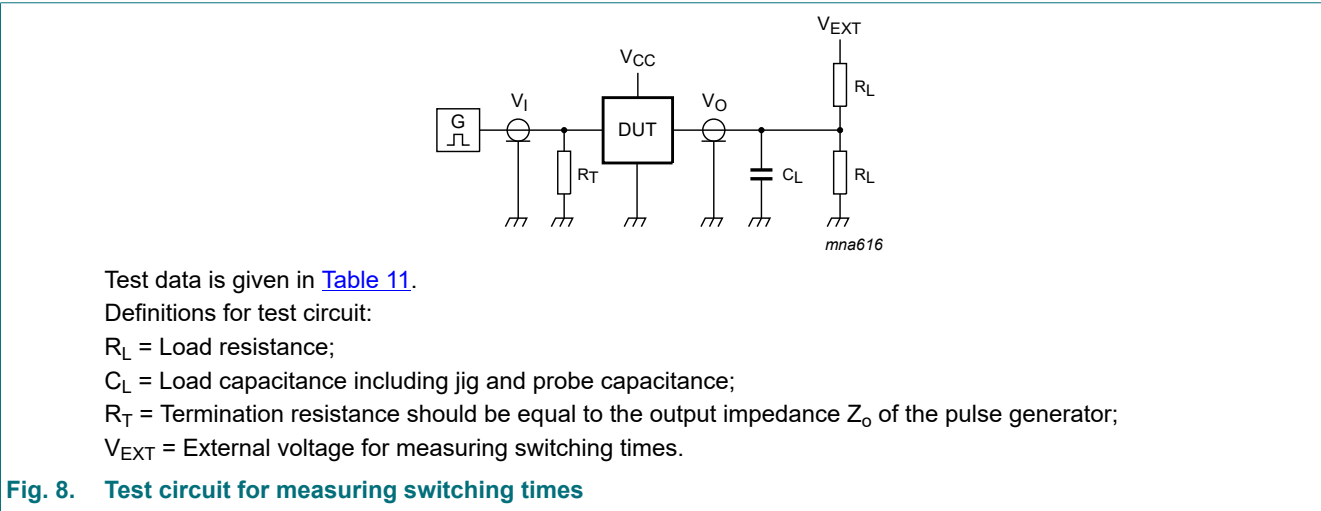


Table 11. Test data

Supply voltage	Input		Load		V_{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}	$\leq 2.0 \text{ ns}$	30 pF	1 k Ω	open
2.3 V to 2.7 V	V_{CC}	$\leq 2.0 \text{ ns}$	30 pF	500 Ω	open
2.7 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open
4.5 V to 5.5 V	V_{CC}	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open

14. Application information

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

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

P_{add} = additional power dissipation (μW);

f_i = input frequency (MHz);

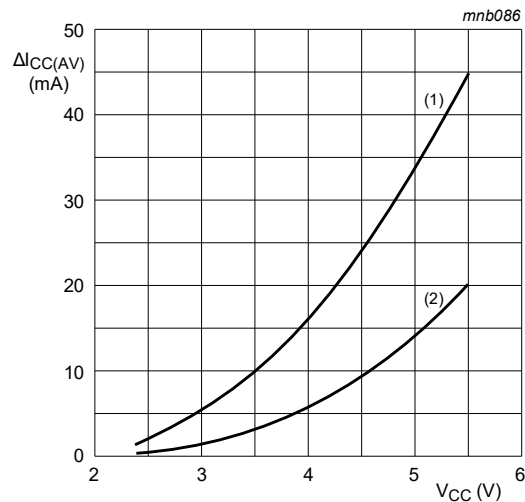
t_r = input rise time (ns); 10 % to 90 %;

t_f = input fall time (ns); 90 % to 10 %;

$\Delta I_{\text{CC(AV)}}$ = average additional supply current (μA).

$\Delta I_{\text{CC(AV)}}$ differs with positive or negative input transitions, as shown in Fig. 9.

An example of a relaxation circuit using the 74LVC2G14 is shown in Fig. 10.

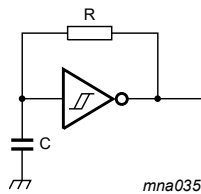


Linear change of V_i between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.

(1) Positive-going edge.

(2) Negative-going edge.

Fig. 9. Average I_{CC} as a function of V_{CC}



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

For K-factor, see Fig. 11

Fig. 10. Relaxation oscillator

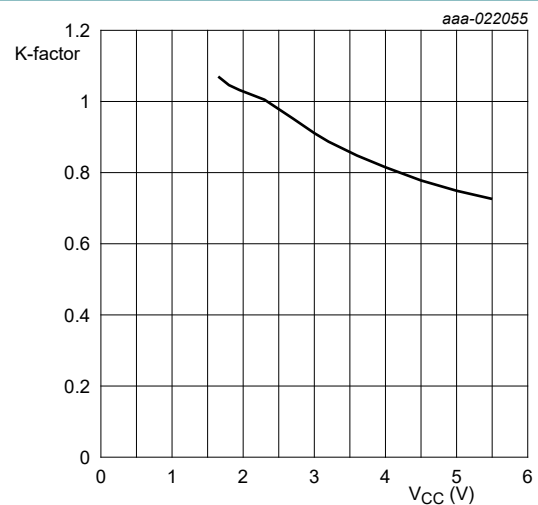


Fig. 11. Typical K-factor for relaxation oscillator

15. Package outline

TSSOP6: plastic thin shrink small outline package; 6 leads; body width 1.25 mm SOT363-2

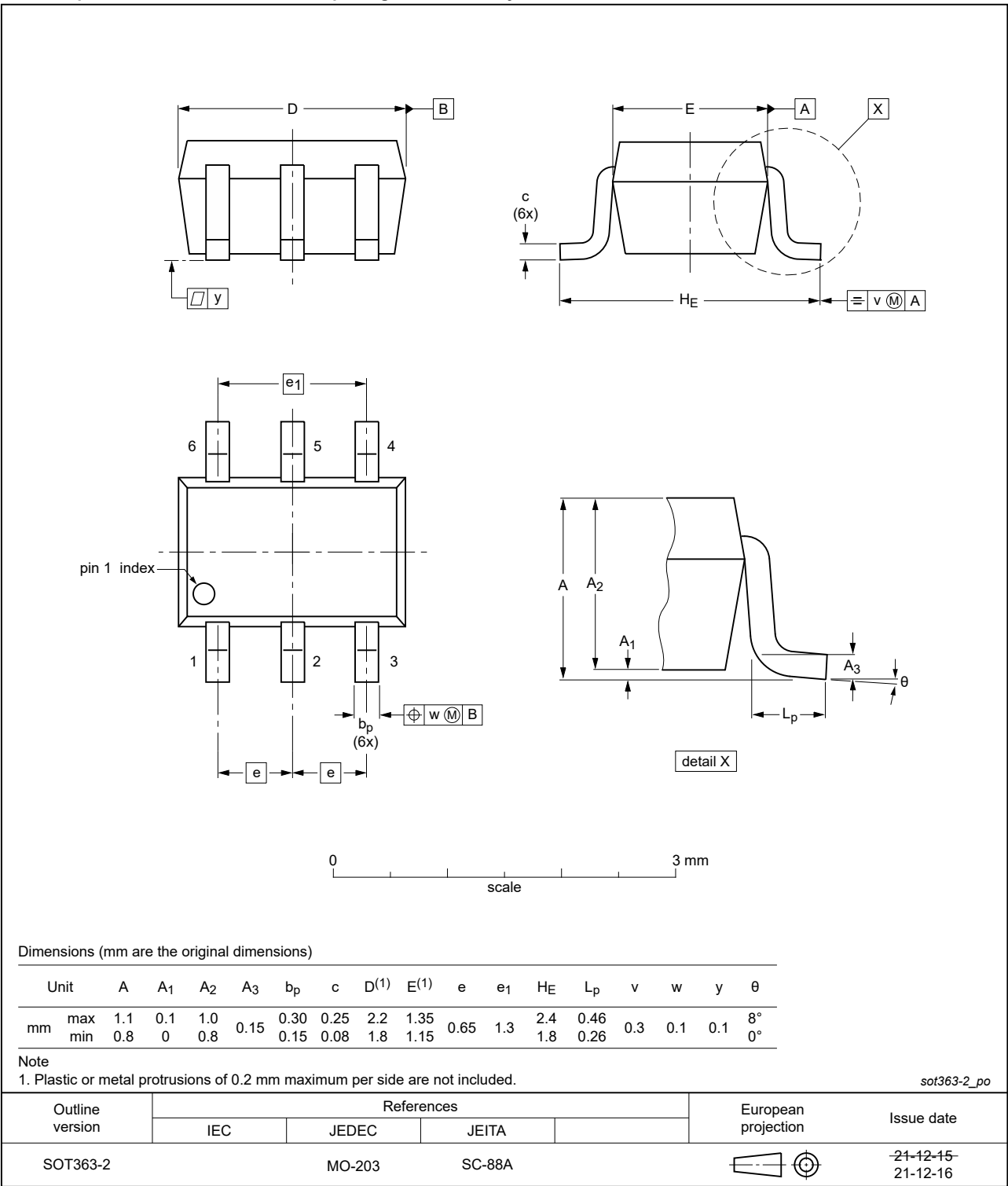


Fig. 12. Package outline SOT363-2 (TSSOP6)

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

SOT457

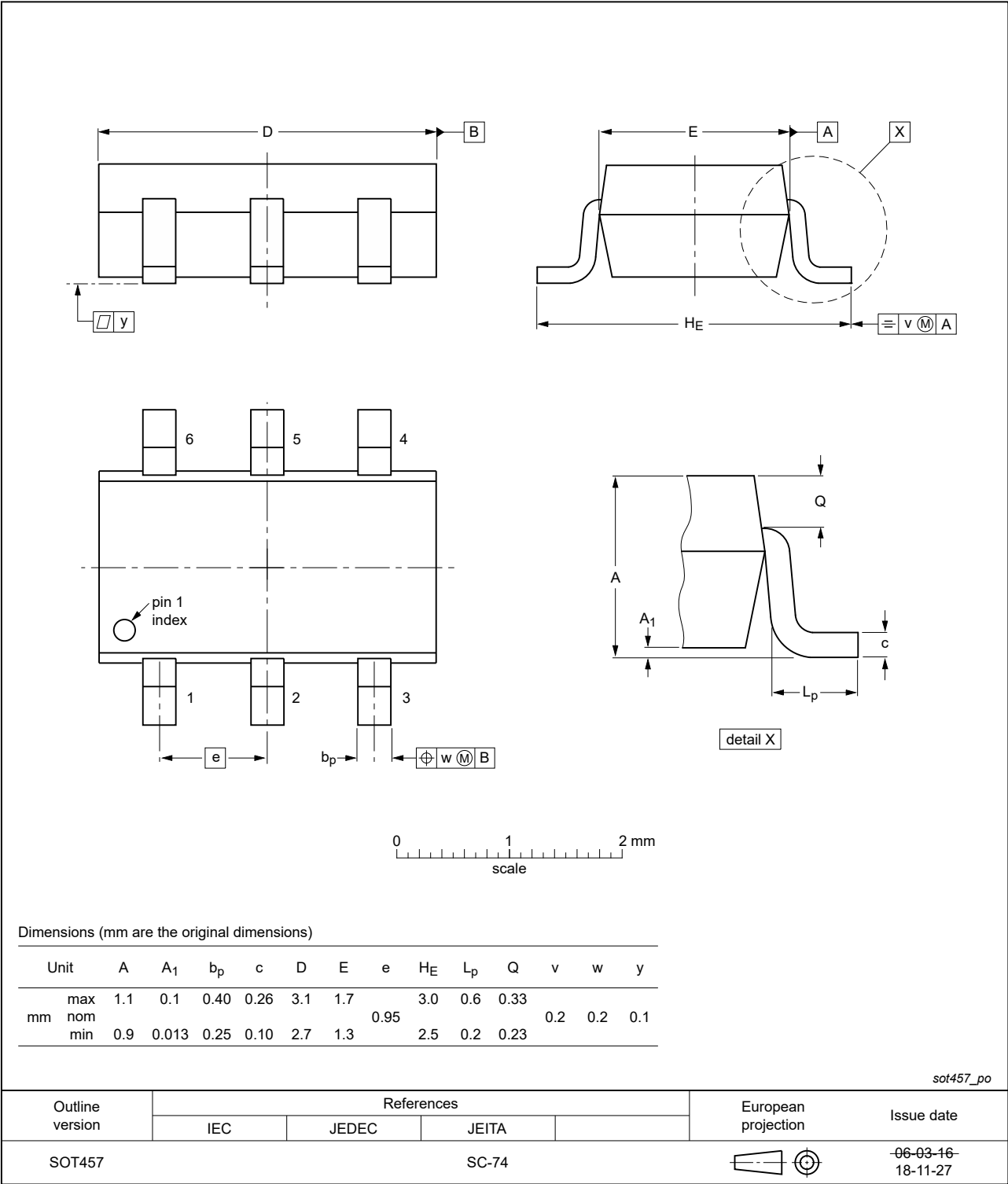


Fig. 13. Package outline SOT457 (SC-74; TSOP6)

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

SOT886

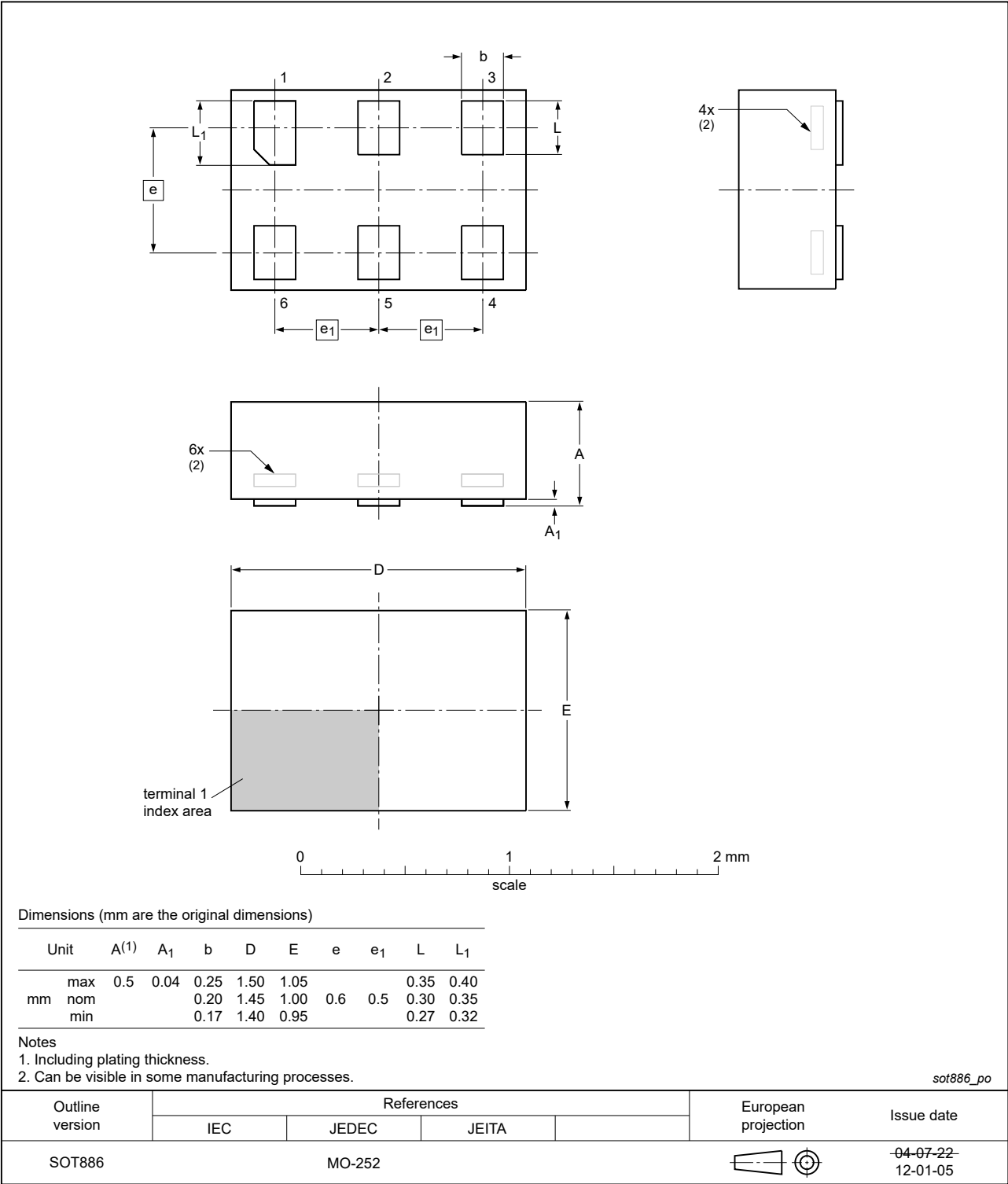


Fig. 14. Package outline SOT886 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 0.9 x 1.0 x 0.35 mm

SOT1115



Fig. 15. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 1.0 x 1.0 x 0.35 mm

SOT1202

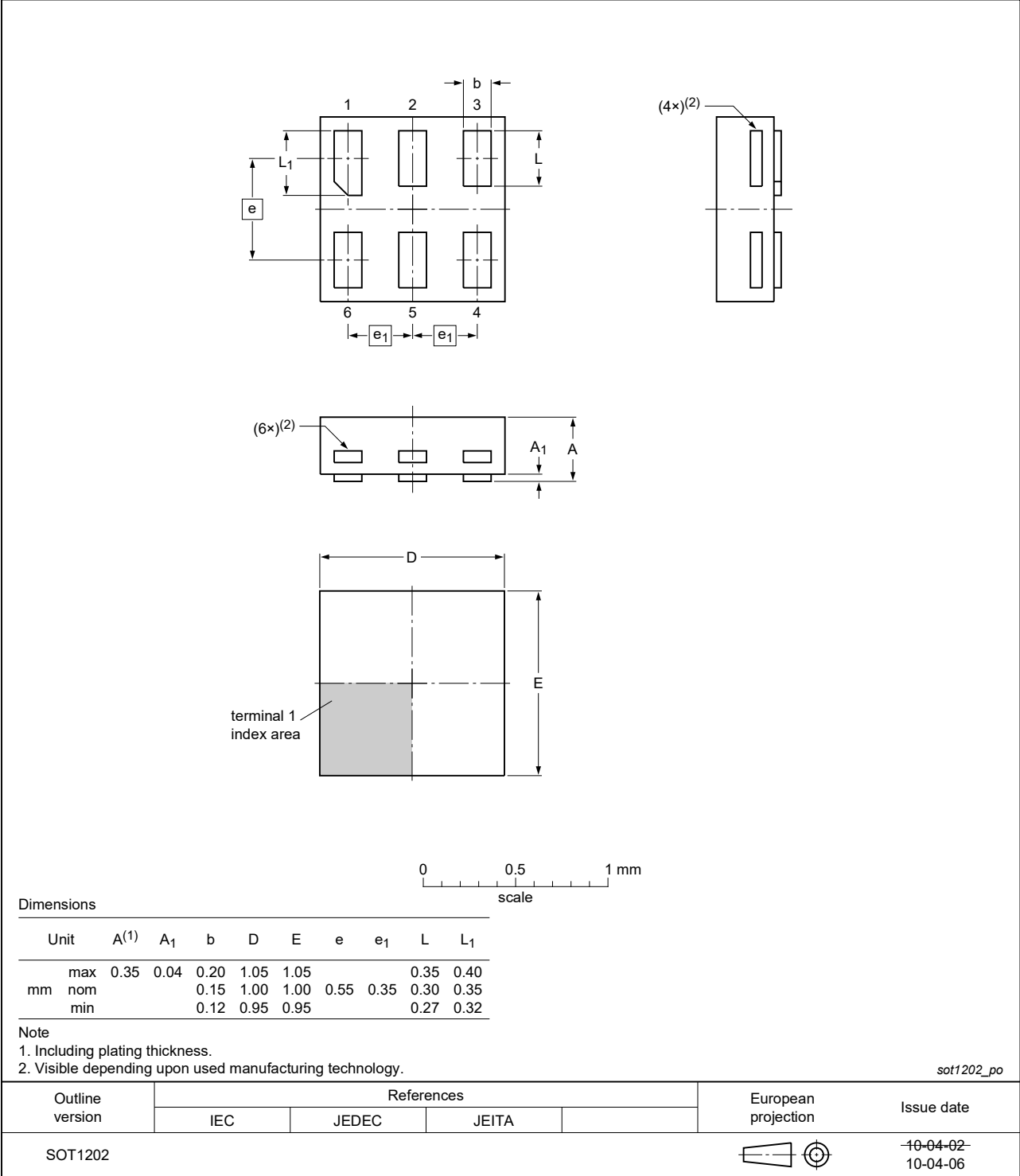


Fig. 16. Package outline SOT1202 (XSON6)

16. Abbreviations

Table 12. Abbreviations

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

17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G14 v.14	20230818	Product data sheet	-	74LVC2G14 v.13
Modifications:	Section 2: ESD specification updated according to the latest JEDEC standard.			
74LVC2G14 v.13	20220124	Product data sheet	-	74LVC2G14 v.12
Modifications:	Package SOT363 (SC-88) changed to SOT363-2 (TSSOP6).			
74LVC2G14 v.12	20210611	Product data sheet	-	74LVC2G14 v.11
Modifications:	- Type number 74LVC2G14GF (SOT891 / XSON6) removed. Section 1 updated. Section 7.2: pin 6 description corrected (Errata). Section 9: Derating values for P_{tot} total power dissipation updated. Fig. 13: Package outline drawing SOT457 (SC-74) updated.			
74LVC2G14 v.11	20180810	Product data sheet	-	74LVC2G14 v.10
Modifications:	- 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.			
74LVC2G14 v.10	20161215	Product data sheet	-	74LVC2G14 v.9
Modifications:	Table 7: The maximum limits for leakage current and supply current have changed.			
74LVC2G14 v.9	20160315	Product data sheet	-	74LVC2G14 v.8
Modifications:	Fig. 11 added (typical K-factor for relaxation oscillator).			
74LVC2G14 v.8	20140910	Product data sheet	-	74LVC2G14 v.7
Modifications:	Package outline drawing of SOT886 (Fig. 14) modified.			
74LVC2G14 v.7	20111130	Product data sheet	-	74LVC2G14 v.6
74LVC2G14 v.6	20110923	Product data sheet	-	74LVC2G14 v.5
74LVC2G14 v.5	20101029	Product data sheet	-	74LVC2G14 v.4
74LVC2G14 v.4	20070904	Product data sheet	-	74LVC2G14 v.3
74LVC2G14 v.3	20070220	Product data sheet	-	74LVC2G14 v.2
74LVC2G14 v.2	20040908	Product specification	-	74LVC2G14 v.1
74LVC2G14 v.1	20030731	Product specification	-	-

18. 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.

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