

74LVC2G14-Q100

Dual inverting Schmitt trigger with 5 V tolerant input

Rev. 6 — 11 June 2021

Product data sheet

1. General description

The 74LVC2G14-Q100 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.

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 °C to +85 °C and from -40 °C to +125 °C
- 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)
 - JESD8B/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 ($C = 200$ pF, $R = 0$ Ω)
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- 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

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-Q100	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74LVC2G14GV-Q100	-40 °C to +125 °C	SC-74; TSOP6	plastic surface-mounted package; 6 leads	SOT457
74LVC2G14GM-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

5. Marking

Table 2. Marking codes

Type number	Marking code [1]
74LVC2G14GW-Q100	VK
74LVC2G14GV-Q100	V14
74LVC2G14GM-Q100	VK

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

6. Functional diagram

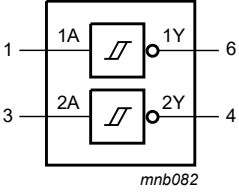


Fig. 1. Logic symbol

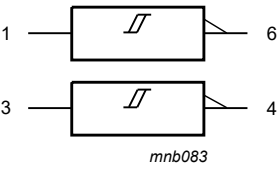


Fig. 2. IEC logic symbol

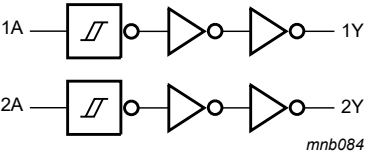


Fig. 3. Logic diagram

7. Pinning information

7.1. Pinning

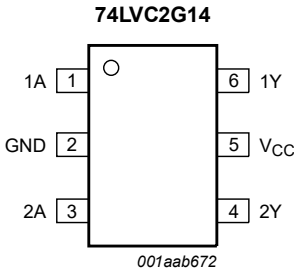


Fig. 4. Pin configuration SOT363 (SC-88) and SOT457 (SC-74; TSOP6)

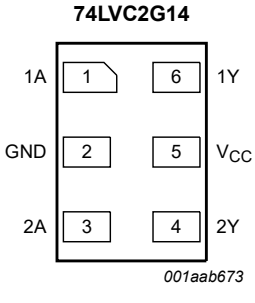


Fig. 5. Pin configuration SOT886 (XSON6)

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 (SC-88) 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.

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
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = -100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$	$V_{CC} - 0.1$	-	-	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
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		$I_O = 100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$	-	-	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

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
T_{amb} = -40 °C to +125 °C						
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}				
		I _O = -100 µA; 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
		I _O = -32 mA; V _{CC} = 4.5 V	3.4	-	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}				
		I _O = 100 µA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.7	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.6	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.8	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.8	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	±1	µA
I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	-	±2	µA
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	-	4	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	-	-	500	µA

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

12. Transfer characteristics

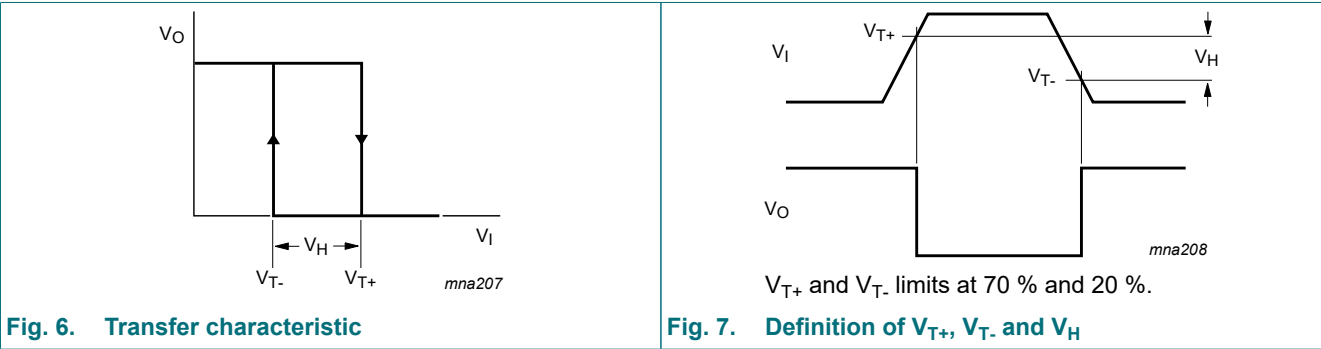
Table 8. Transfer characteristics

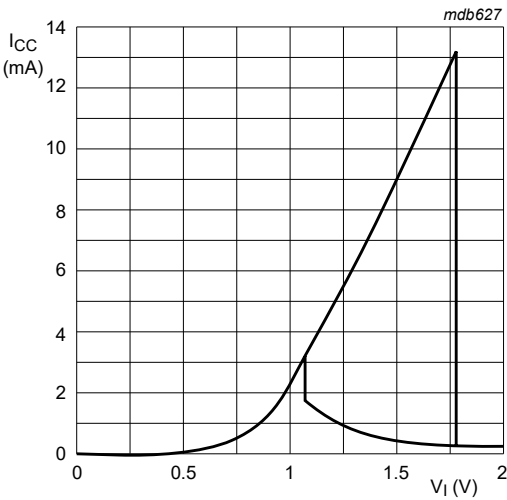
Voltages are referenced to GND (ground = 0 V; for test circuit see Fig. 10

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. 6 and Fig. 7						
		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. 8	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. 6 and Fig. 7						
		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. 8	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. 6 and Fig. 7						
		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. 8	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





$V_{CC} = 3.0\text{ V}$

Fig. 8. Typical transfer characteristics

13. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 10.

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. 9 [2]						
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	1.0	5.6	11.0	1.0	12.0	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.5	3.7	6.5	0.5	7.2	ns
		$V_{CC} = 2.7\text{ V}$	0.5	4.1	7.0	0.5	7.7	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	0.5	3.9	6.0	0.5	6.7	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	0.5	2.7	4.3	0.5	4.7	ns
C_{PD}	power dissipation capacitance	$V_I = \text{GND to }V_{CC}; V_{CC} = 3.3\text{ V}$ [3]	-	18.1	-	-	-	pF

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$ and $V_{CC} = 1.8\text{ V}, 2.5\text{ V}, 2.7\text{ V}, 3.3\text{ V}$ 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;

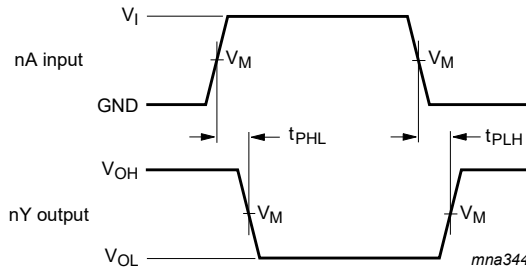
C_L = output load capacitance in pF;

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



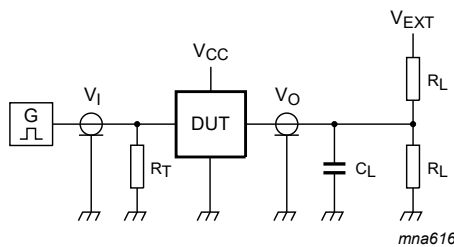
Measurement points are given in [Table 10](#).

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

Fig. 9. The data input (nA) to output (nY) 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. 10. 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}	≤ 2.0 ns	30 pF	1 k Ω	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. 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);

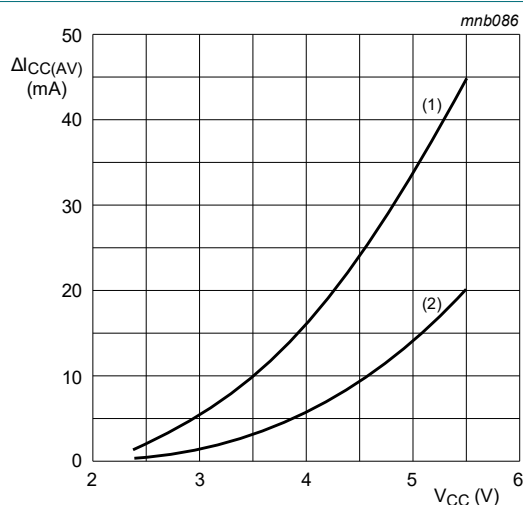
t_r = input rise time (ns); 10 % to 90 %;

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. 11.

An example of a relaxation circuit using the 74LVC2G14-Q100 is shown in Fig. 12.

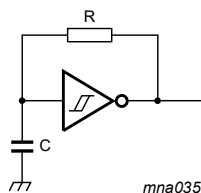


Linear change of V_i between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.

(1) Positive-going edge.

(2) Negative-going edge.

Fig. 11. Average I_{CC} as a function of V_{CC}



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

For K-factor, see Fig. 13

Fig. 12. Relaxation oscillator

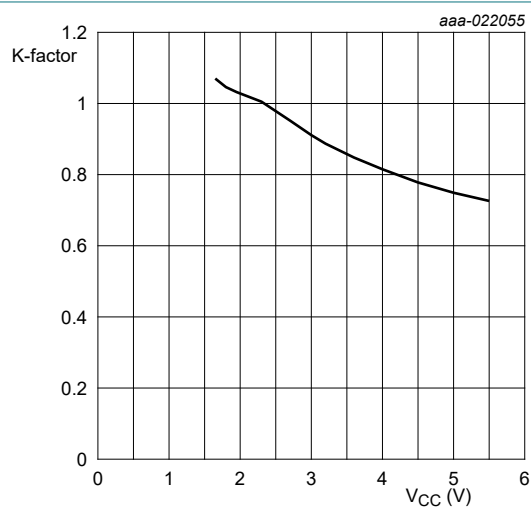


Fig. 13. Typical K-factor for relaxation oscillator

15. Package outline

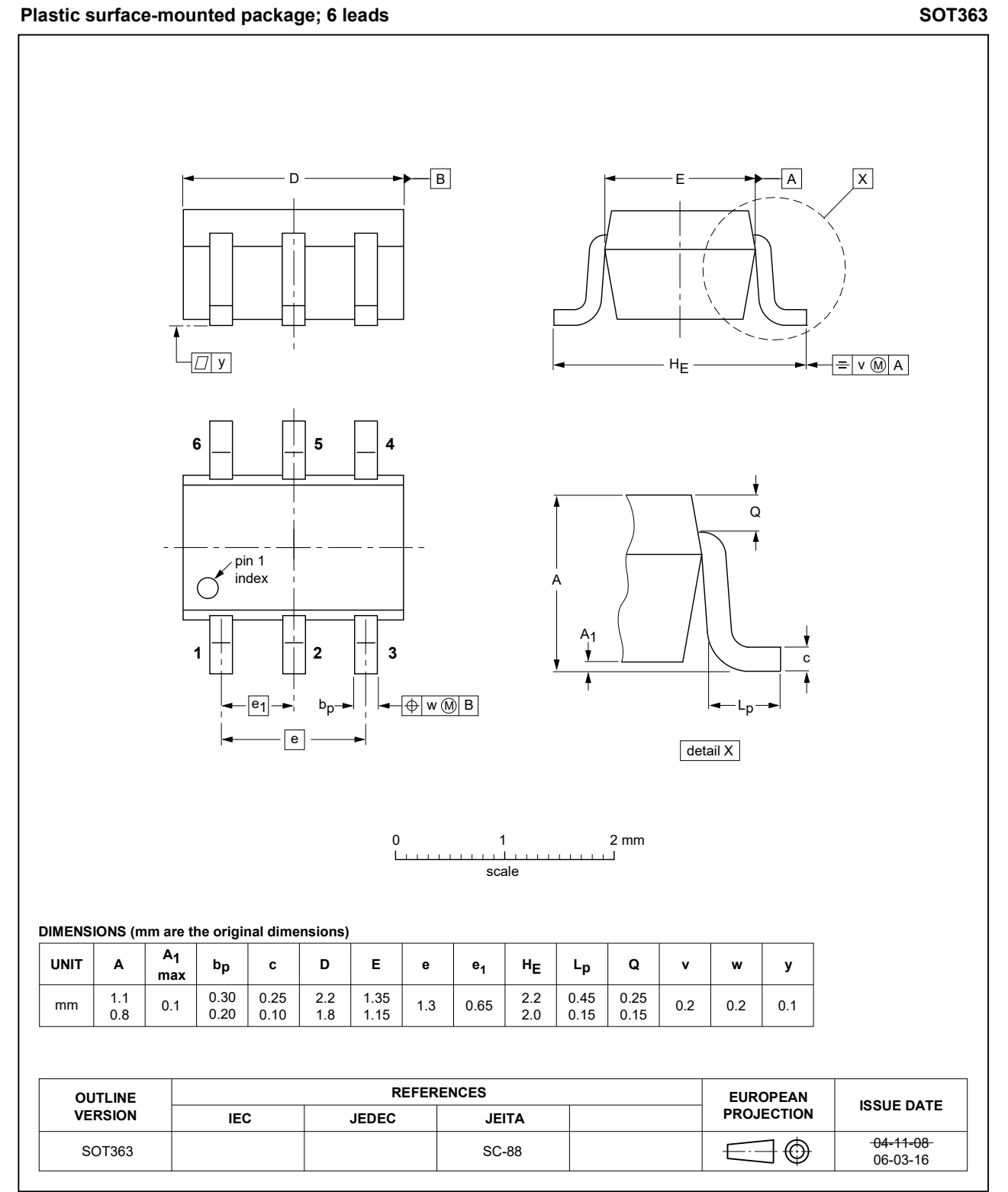


Fig. 14. Package outline SOT363 (SC-88)

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

SOT457

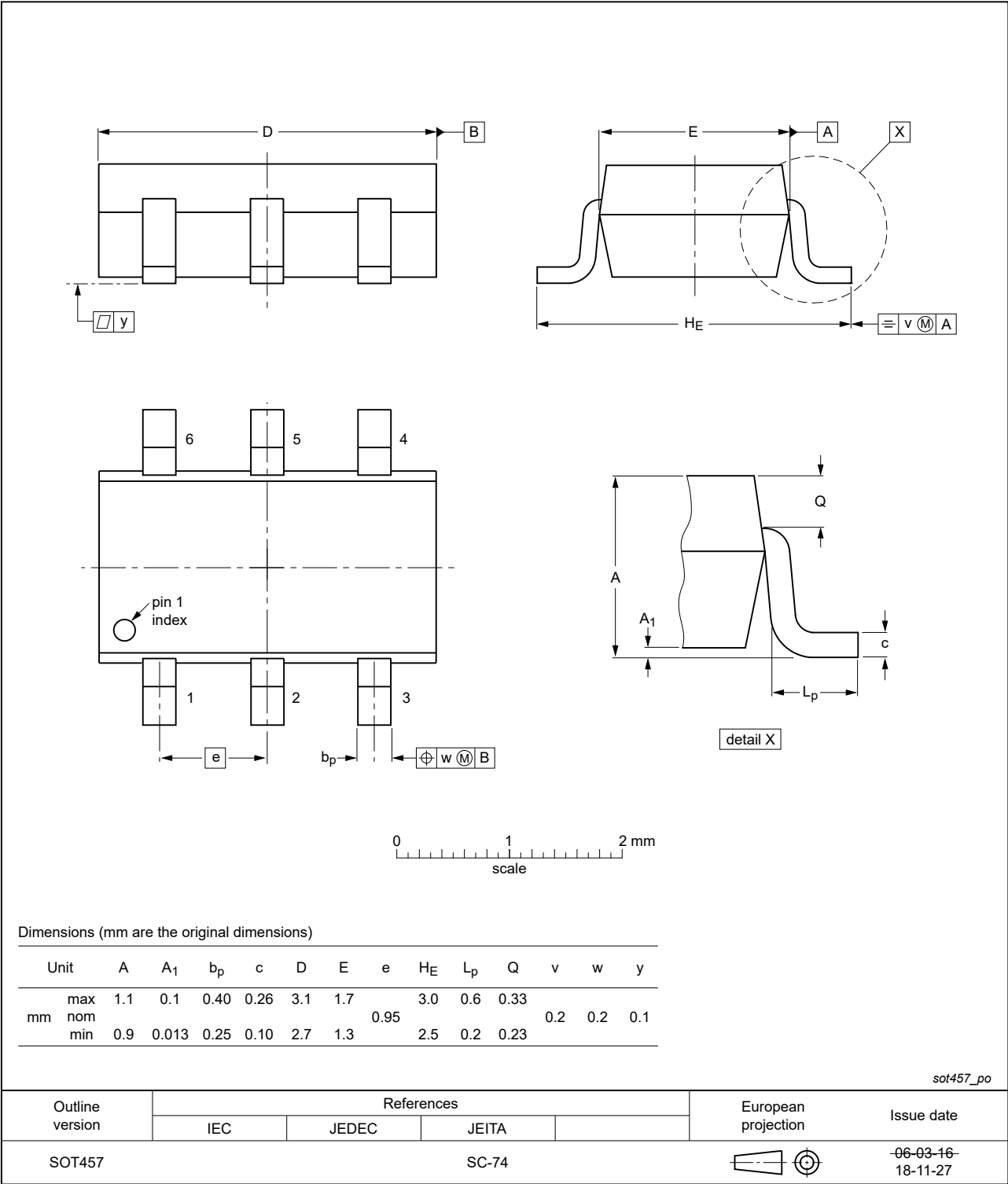


Fig. 15. Package outline SOT457 (SC-74; TSOP6)

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

SOT886

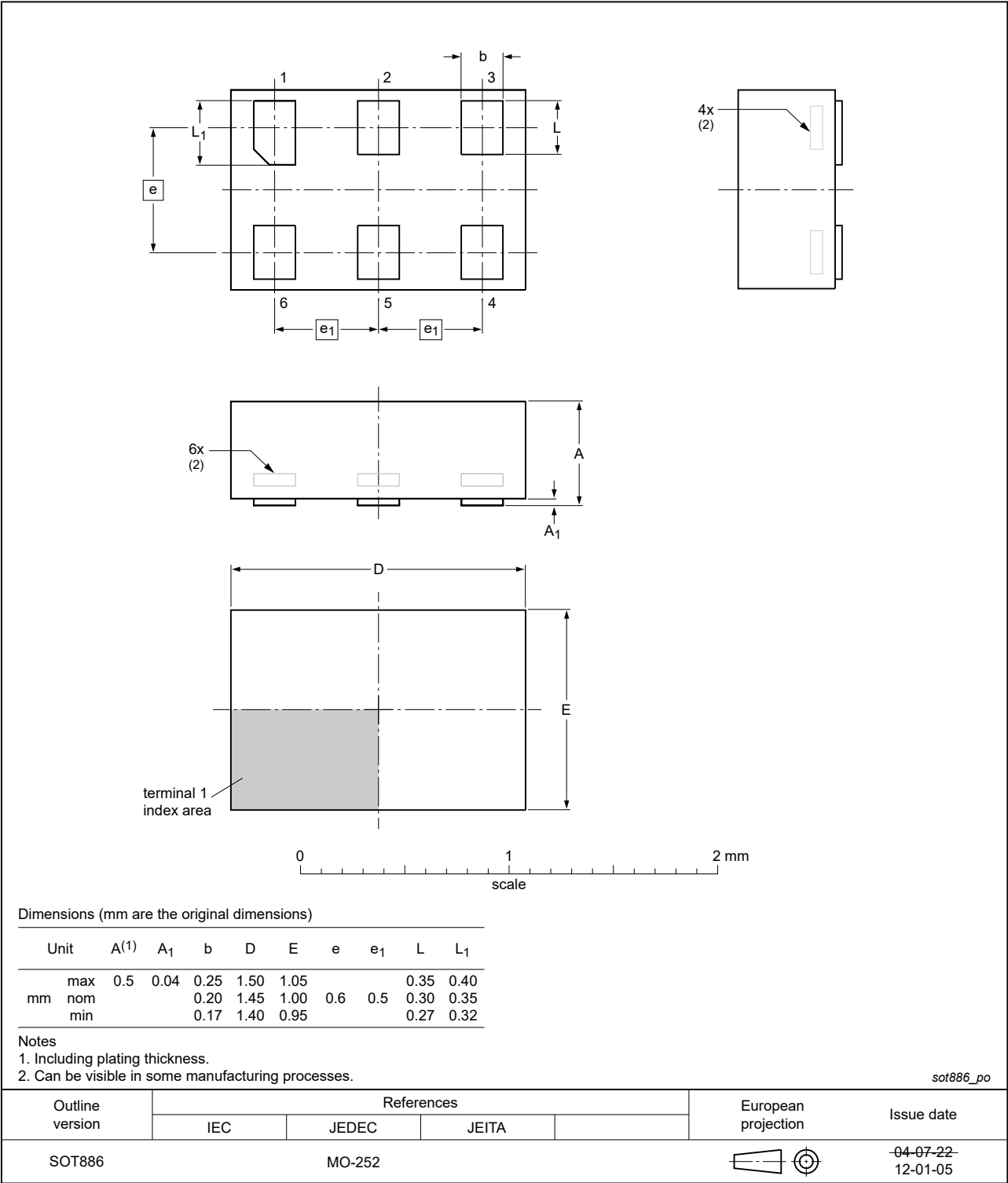


Fig. 16. Package outline SOT886 (XSON6)

16. 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

17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G14_Q100 v.6	20210611	Product data sheet	-	74LVC2G14_Q100 v.5
Modifications:	Section 1 updated. Section 9: Derating values for P_{tot} total power dissipation updated.			
74LVC2G14_Q100 v.5	20190128	Product data sheet	-	74LVC2G14_Q100 v.4
Modifications:	- Type number 74LVC2G14GM-Q100 (SOT886) added. Table 3: pin 6 description corrected (Errata). - Package outline drawing SOT457 (SC-74) updated.			
74LVC2G14_Q100 v.4	20180810	Product data sheet	-	74LVC2G14_Q100 v.3
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_Q100 v.3	20161214	Product data sheet	-	74LVC2G14_Q100 v.2
Modifications:	Table 7: The maximum limits for leakage current and supply current have changed.			
74LVC2G14_Q100 v.2	20160315	Product data sheet	-	74LVC2G14_Q100 v.1
Modifications:	Fig. 13 added (typical K-factor for relaxation oscillator).			
74LVC2G14_Q100 v.1	20131115	Product data sheet	-	-

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.

- [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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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