

# 74LVC2G04-Q100

## Dual inverter

Rev. 3 — 25 January 2019

Product data sheet

## 1. General description

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The 74LVC2G04-Q100 provides the dual inverting buffer.

Inputs can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> 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

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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
- 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<sub>CC</sub> = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Multiple package options

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC2G04GW-Q100	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74LVC2G04GV-Q100	-40 °C to +125 °C	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457
74LVC2G04GS-Q100	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm	SOT1202

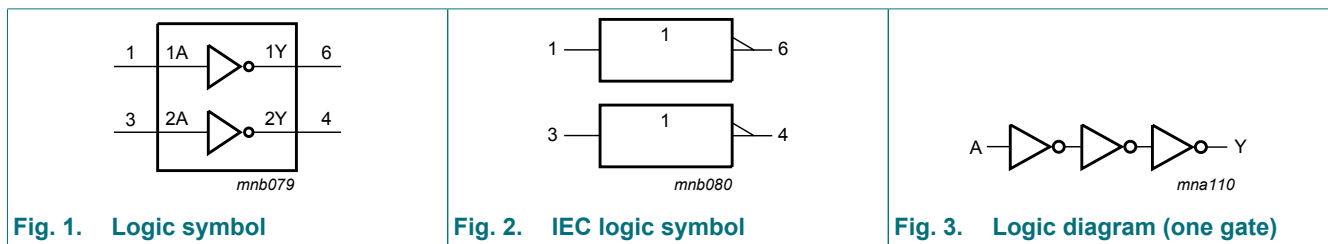
### 4. Marking

Table 2. Marking

Type number	Marking code[1]
74LVC2G04GW-Q100	V4
74LVC2G04GV-Q100	V04
74LVC2G04GS-Q100	V4

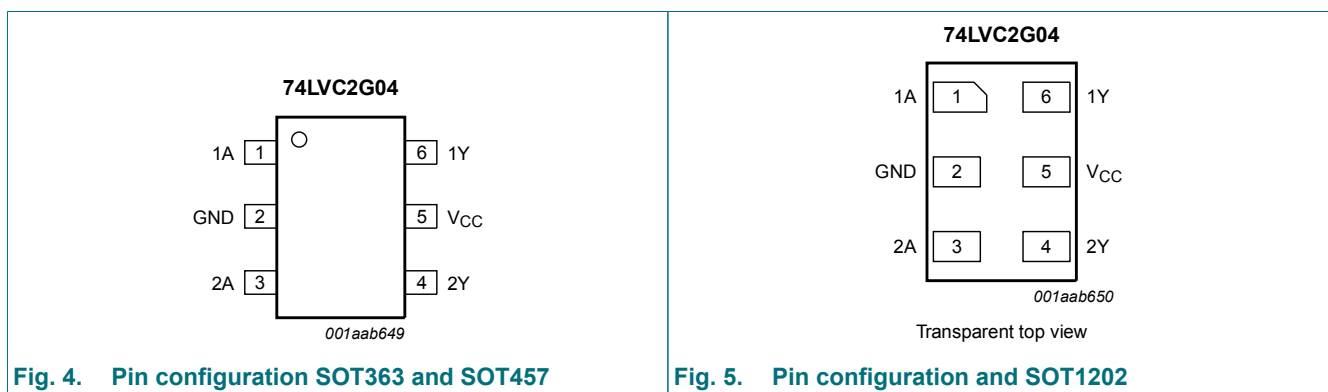
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 5. Functional diagram



### 6. Pinning information

#### 6.1. Pinning



## 6.2. 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 <sub>CC</sub>	5	supply voltage
1Y	6	data output

## 7. Functional description

Table 4. Function table [1]

Input	Output
nA	nY
L	H
H	L

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

## 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 <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
V <sub>I</sub>	input voltage		-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	-	±50	mA
V <sub>O</sub>	output voltage	Active mode	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode	-0.5	+6.5	V
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
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	-	250	mW
T <sub>stg</sub>	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] When V<sub>CC</sub> = 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<sub>tot</sub> derates linearly with 4.0 mW/K.

For XSON6 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 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
		Power-down mode; $V_{CC} = 0$ V	0	-	5.5	V
$T_{amb}$	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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65V_{CC}$	-	-	$0.65V_{CC}$	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	1.7	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	2.0	-	V
		$V_{CC} = 4.5$ V to 5.5 V	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	-	0.8	V
		$V_{CC} = 4.5$ V to 5.5 V	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = -100$ $\mu$ 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	-	-	0.95	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	-	-	1.7	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	-	-	1.9	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	-	-	2.0	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 100$ $\mu$ A; $V_{CC} = 1.65$ V to 5.5 V	-	-	0.10	-	0.10	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	-	0.45	-	0.70	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	-	0.30	-	0.45	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	-	0.40	-	0.60	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	-	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	-	$\pm 0.1$	$\pm 1$	-	$\pm 1$	$\mu$ A
		$V_{CC} = 0$ V; $V_I$ or $V_O = 5.5$ V	-	$\pm 0.1$	$\pm 2$	-	$\pm 2$	$\mu$ A
$I_{OFF}$	power-off leakage current	$V_{CC} = 0$ V; $V_I$ or $V_O = 5.5$ V	-	$\pm 0.1$	$\pm 2$	-	$\pm 2$	$\mu$ A

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.65 V to 5.5 V	-	0.1	4	-	4	µA
ΔI <sub>CC</sub>	additional supply current	per pin; V <sub>CC</sub> = 2.3 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	500	-	500	µA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	2.5	-	-	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

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	nA to nY; see Fig. 6 [2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	3.5	8.0	1.0	9.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.2	4.4	1.0	5.4	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.7	5.2	1.0	7.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	2.7	4.1	0.5	5.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.0	1.9	3.2	1.0	3.8	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V [3]	-	13.5	-	-	-	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).

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

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

f<sub>o</sub> = output frequency in MHz;

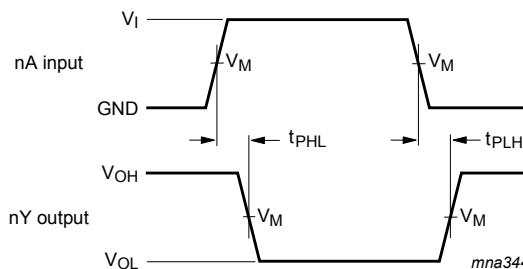
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

### 11.1. Waveforms and test circuit



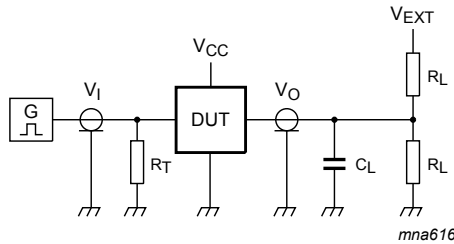
Measurement points are given in Table 9.

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

**Fig. 6. The input nA to output nY propagation delays**

Table 9. Measurement points

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
1.65 V to 1.95 V	$0.5V_{CC}$	$0.5V_{CC}$
2.3 V to 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
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	$0.5V_{CC}$	$0.5V_{CC}$



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. 7. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		$V_{EXT}$
	$V_I$	$t_r = t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$
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

## 12. Package outline

Plastic surface-mounted package; 6 leads

SOT363

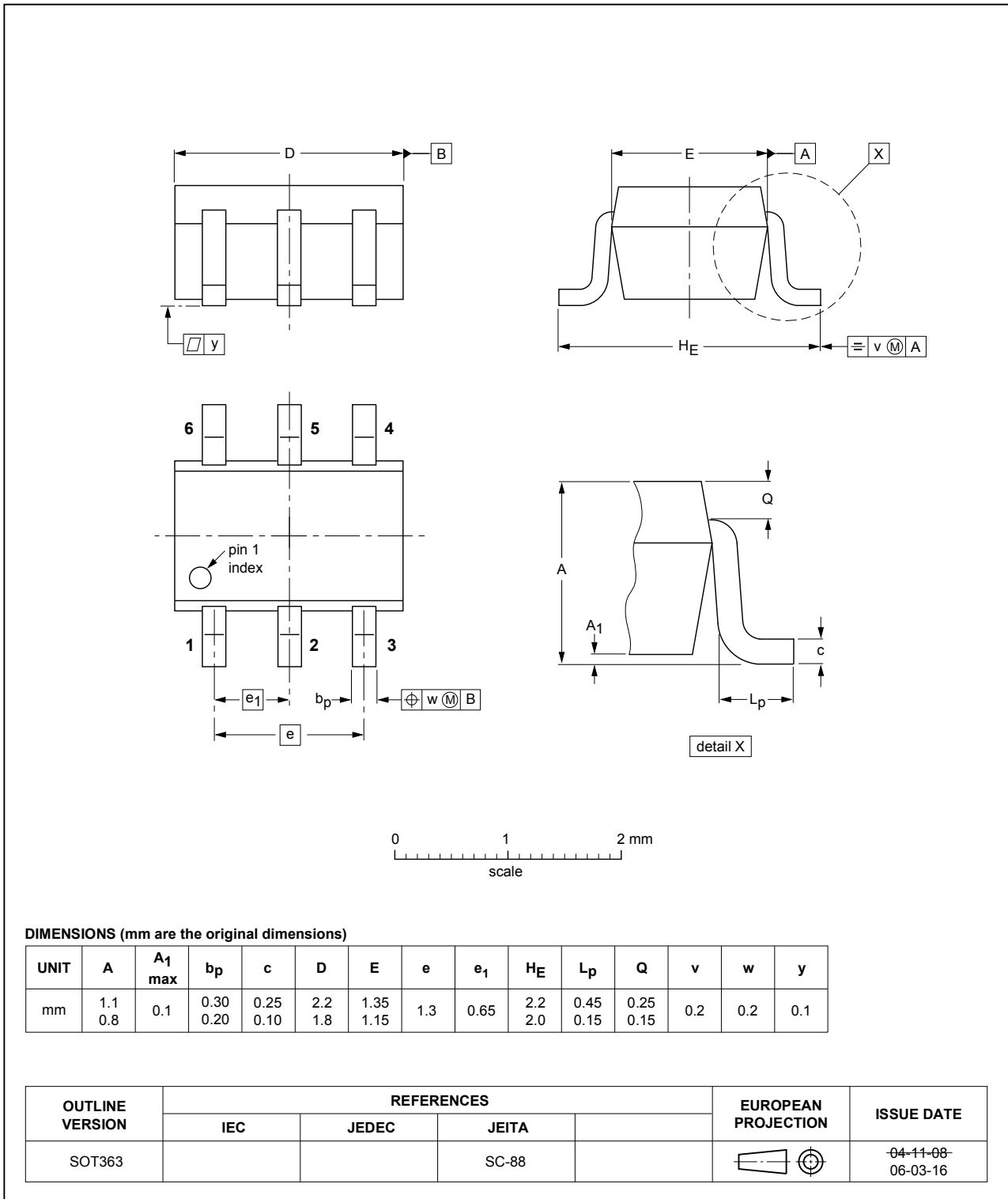


Fig. 8. Package outline SOT363 (SC-88)

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

SOT457

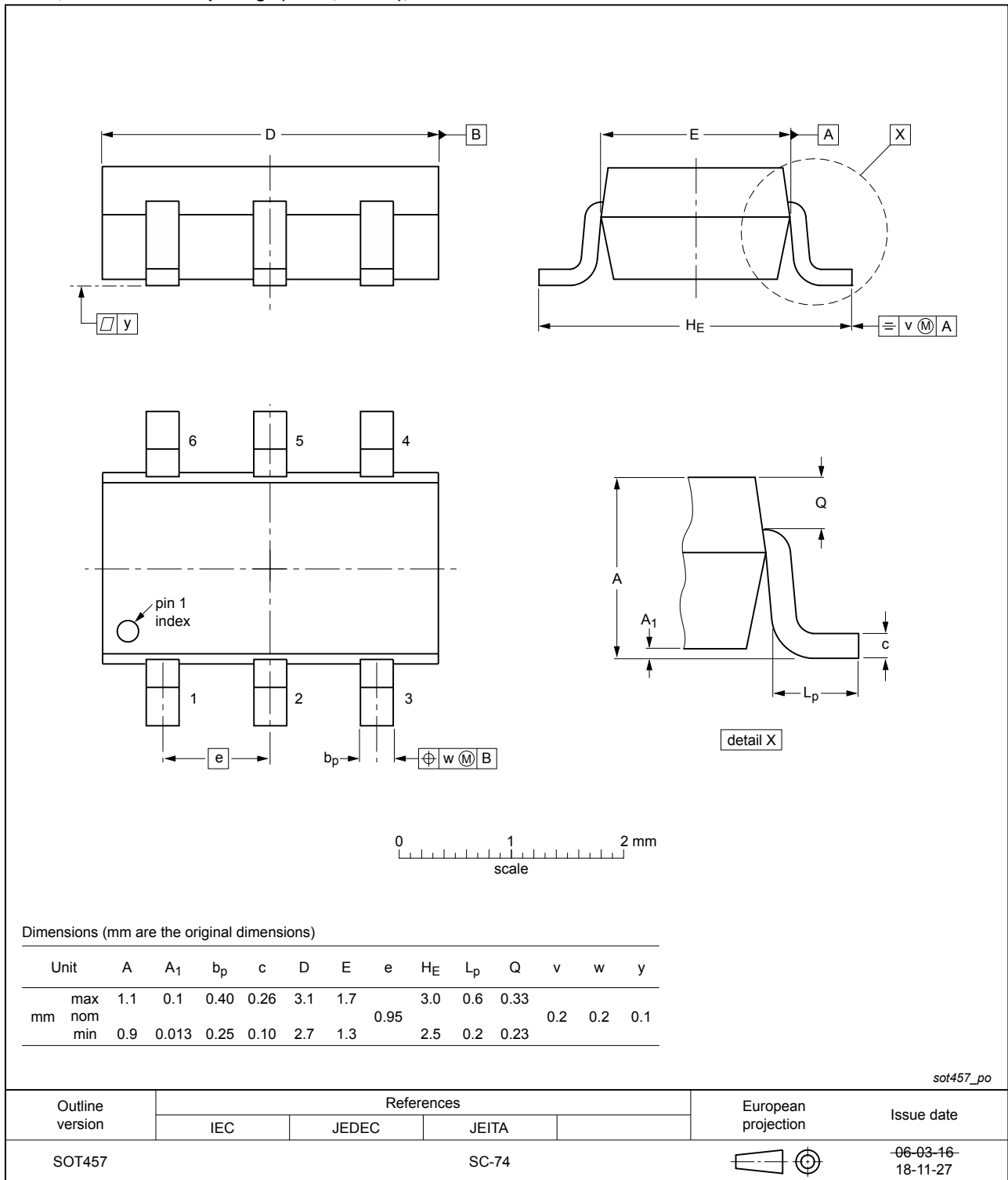
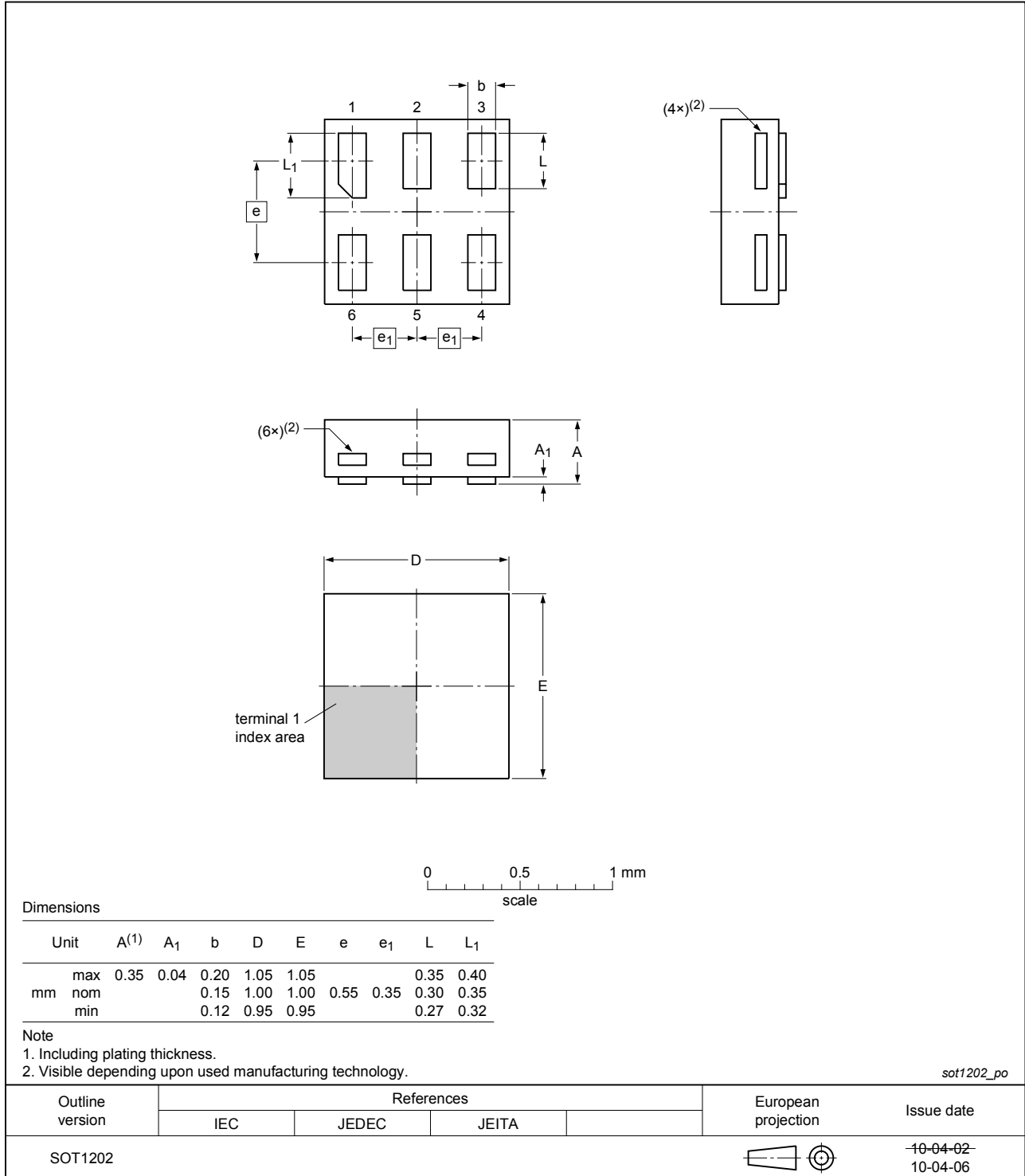


Fig. 9. Package outline SOT457 (SC-74)



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

SOT1202



**Fig. 10. Package outline SOT1202 (XSON6)**

## 13. Abbreviations

Table 11. 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

## 14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G04_Q100 v.3	20190125	Product data sheet	-	74LVC2G04_Q100 v.2
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>Pin 6 description updated. <a href="#">Section 6.2</a></li> <li>Added type number 74LVC2G04GS-Q100 (SOT1202/XSON6).</li> <li>Package outline drawing <a href="#">SOT457</a> (SC-74) updated.</li> </ul>			
74LVC2G04_Q100 v.2	20161213	Product data sheet	-	74LVC2G04_Q100 v.1
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>			
74LVC2G04_Q100 v.1	20140520	Product data sheet	-	-

## 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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