**Product data sheet** 

## 1. General description

The 74LVC2G04 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  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the 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
- 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:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- $\pm 24$  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
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.



#### **Ordering information** 3.

#### Table 1. **Ordering information**

Type number	Package							
	Temperature range	Name	Description	Version				
74LVC2G04GW	–40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363				
74LVC2G04GV	–40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457				
74LVC2G04GM	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 1.45 $\times$ 0.5 mm	SOT886				
74LVC2G04GF	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1 \times 0.5$ mm	SOT891				
74LVC2G04GN	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $0.9 \times 1.0 \times 0.35$ mm	SOT1115				
74LVC2G04GS	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $1.0 \times 1.0 \times 0.35$ mm	SOT1202				

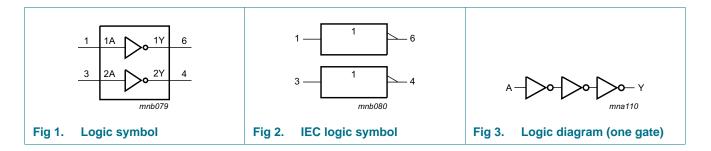
#### Marking 4.

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC2G04GW	V4
74LVC2G04GV	V04
74LVC2G04GM	V4
74LVC2G04GF	V4
74LVC2G04GN	V4
74LVC2G04GS	V4

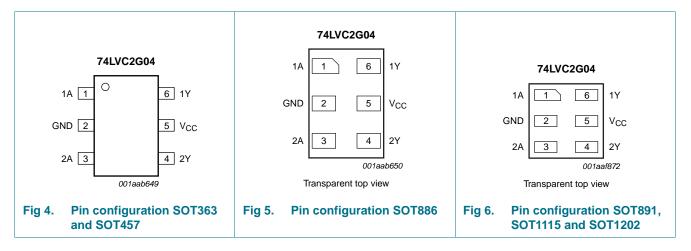
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

#### **Functional diagram** 5.



# 6. Pinning information

## 6.1 Pinning



## 6.2 Pin description

Table 3. Pin descri							
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 input					

## 7. Functional description

### Table 4.Function table

Input	Output
nA	nY
L	Н
Н	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
VI	input voltage		[1]	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 0 V		-	±50	mA
Vo	output voltage	Active mode	[1][2]	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode	[1][2]	-0.5	+6.5	V
lo	output current	$V_{O} = 0 V$ to $V_{CC}$		-	±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	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$	[3]	-	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  $V_{CC}$  = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation.

## 9. Recommended operating conditions

#### Table 6. Recommended operating conditions

Symbol Parameter		arameter Conditions		Тур	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	Active mode	0	-	V <sub>CC</sub>	V
		Power-down mode; $V_{CC} = 0 V$	0	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	-	-	20	ns/V
		$V_{CC} = 2.7 V \text{ to } 5.5 V$	-	-	10	ns/V

**Dual inverter** 

# **10. Static characteristics**

#### Table 7. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °	–40 °C to +85 °C			+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
VIH	HIGH-level	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
	input voltage	$V_{CC} = 2.3 \text{ V} \text{ to } 2.7 \text{ V}$	1.7	-	-	1.7	-	V
	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2.0	-	-	2.0	-	V	
		$V_{CC} = 4.5 \text{ V} \text{ to } 5.5 \text{ V}$	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	V
VIL	LOW-level input	$V_{CC} = 1.65 \text{ V}$ to 1.95 V	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
	voltage	$V_{CC} = 2.3 \text{ V} \text{ to } 2.7 \text{ V}$	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	0.8	-	0.8	V
		$V_{CC} = 4.5 \text{ V} \text{ to } 5.5 \text{ V}$	-	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
V <sub>он</sub>	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$						
	output voltage	I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	0.95	-	V
		$I_{O} = -8$ mA; $V_{CC} = 2.3$ V	1.9	-	-	1.7	-	V
		$I_0 = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	1.9	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	-	-	2.0	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	-	-	3.4	-	V
√ <sub>OL</sub>	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$						
	output voltage	I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.10	-	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.30	-	0.45	V
		$I_{O}$ = 12 mA; $V_{CC}$ = 2.7 V	-	-	0.40	-	0.60	V
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.80	V
		$I_{O}$ = 32 mA; $V_{CC}$ = 4.5 V	-	-	0.55	-	0.80	V
I	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	±0.1	±5	-	±20	μA
OFF	power-off leakage current	$V_{CC} = 0 \text{ V}; \text{ V}_{I} \text{ or } \text{V}_{O} = 5.5 \text{ V}$	-	±0.1	±10	-	±20	μA
СС	supply current	$V_{I} = 5.5 V \text{ or GND}; I_{O} = 0 A;$ $V_{CC} = 1.65 V \text{ to } 5.5 V$	-	0.1	10	-	40	μA
∆l <sub>CC</sub>	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	-	5000	μA
CI	input capacitance	$V_{CC}$ = 3.3 V; $V_{I}$ = GND to $V_{CC}$	-	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 load circuit see <u>Figure 8</u>.

Symbol	Parameter	Conditions	Conditions		°C to +85	°C to +85 °C		–40 °C to +125 °C	
				Min	Typ <mark>[1]</mark>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA to nY; see Figure 7	[2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V		1.0	3.5	8.0	1.0	9.5	ns
		$V_{CC}$ = 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
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		0.5	2.7	4.1	0.5	5.5	ns
		$V_{CC}$ = 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	$V_I = GND$ to $V_{CC}$ ; $V_{CC} = 3.3 V$	<u>[3]</u>	-	13.5	-	-	-	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<sub>D</sub> in  $\mu$ W).

 $\mathsf{P}_{\mathsf{D}} = C_{\mathsf{P}\mathsf{D}} \times \mathsf{V}_{\mathsf{C}\mathsf{C}}{}^2 \times f_i \times \mathsf{N} + \sum (C_L \times \mathsf{V}_{\mathsf{C}\mathsf{C}}{}^2 \times f_o)$  where:

 $f_i$  = input frequency in MHz;

 $f_o = output frequency in MHz;$ 

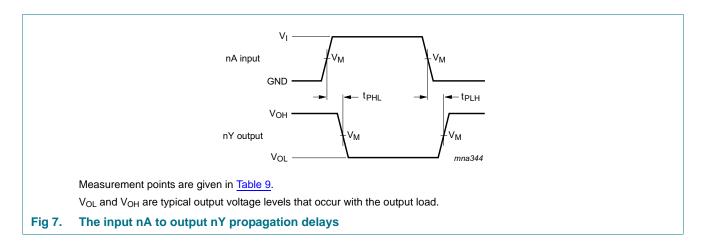
 $C_L$  = output load capacitance in pF;

 $V_{CC}$  = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}{}^2 \times f_o)$  = sum of outputs.

## 12. AC waveforms



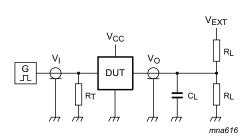
## **NXP Semiconductors**

# 74LVC2G04

**Dual inverter** 

#### Table 9.Measurement points

Supply voltage	Input	Output
V <sub>cc</sub>	V <sub>M</sub>	V <sub>M</sub>
1.65 V to 1.95 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>
2.3 V to 2.7 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>
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 <sub>CC</sub>	0.5V <sub>CC</sub>



Test data is given in <u>Table 10</u>.

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  $Z_0$  of the pulse generator.

 $V_{EXT}$  = External voltage for measuring switching times.

Fig 8. Test circuit for measuring switching times

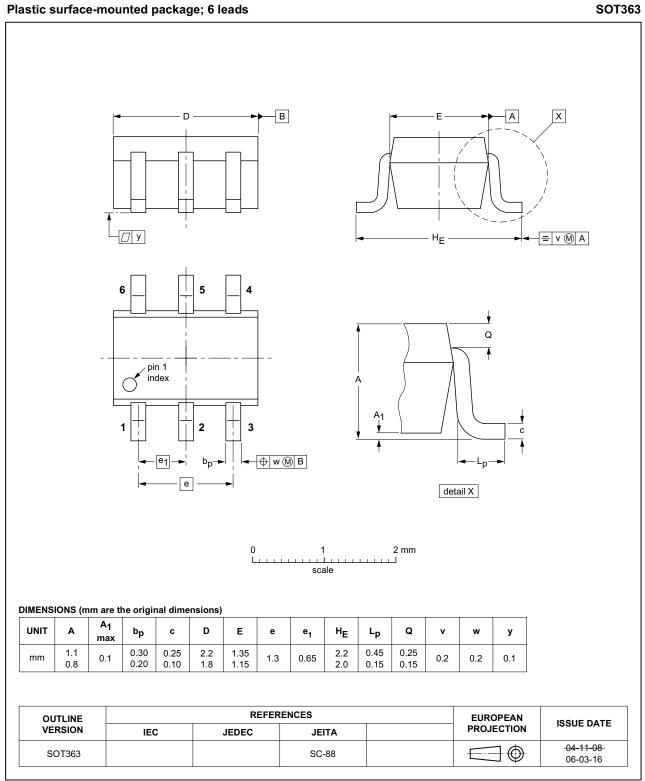
#### Table 10. Test data

Supply voltage	Input	Input		Load		
V <sub>cc</sub>	VI	$t_r = t_f$	C∟	RL	t <sub>PLH</sub> , t <sub>PHL</sub>	
1.65 V to 1.95 V	V <sub>CC</sub>	$\leq$ 2.0 ns	30 pF	1 kΩ	open	
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open	

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74LVC2G04

## 13. Package outline



#### Fig 9. Package outline SOT363 (SC-88)

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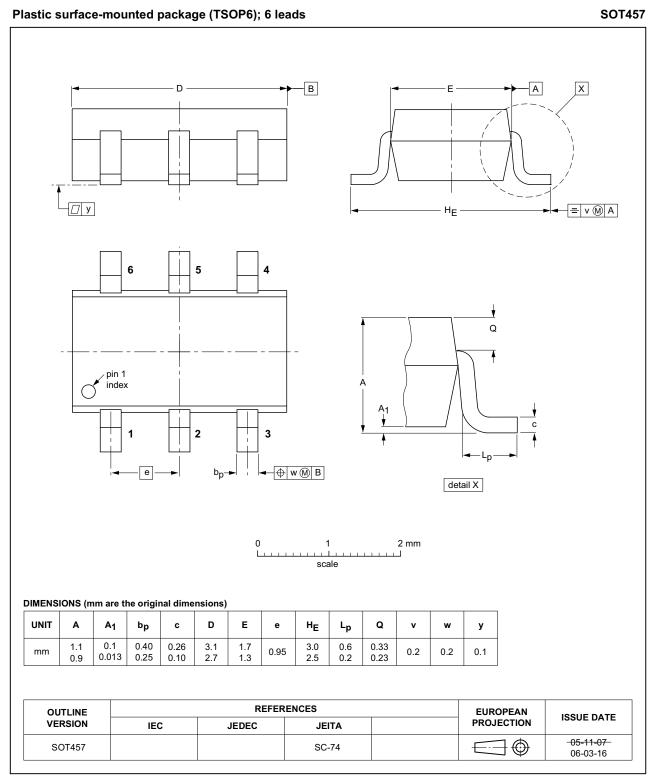
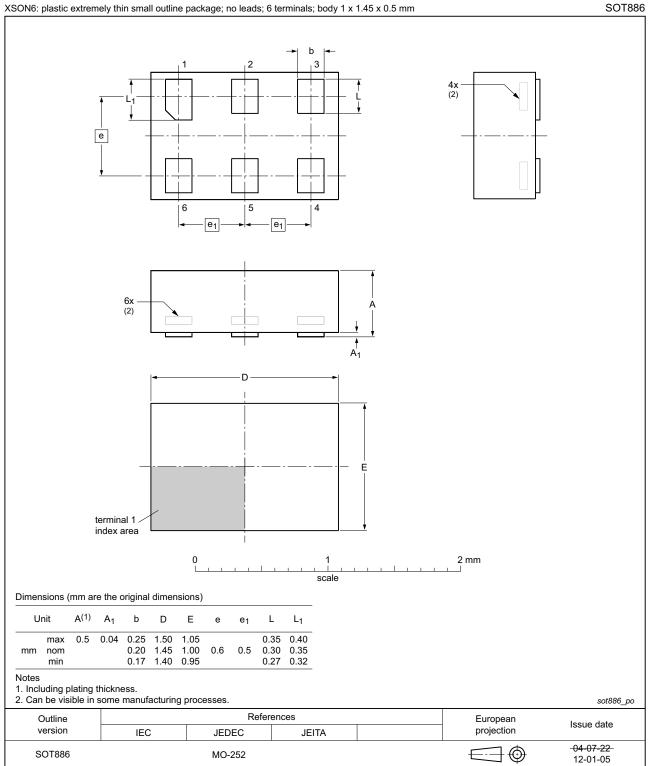


Fig 10. Package outline SOT457 (SC-74)

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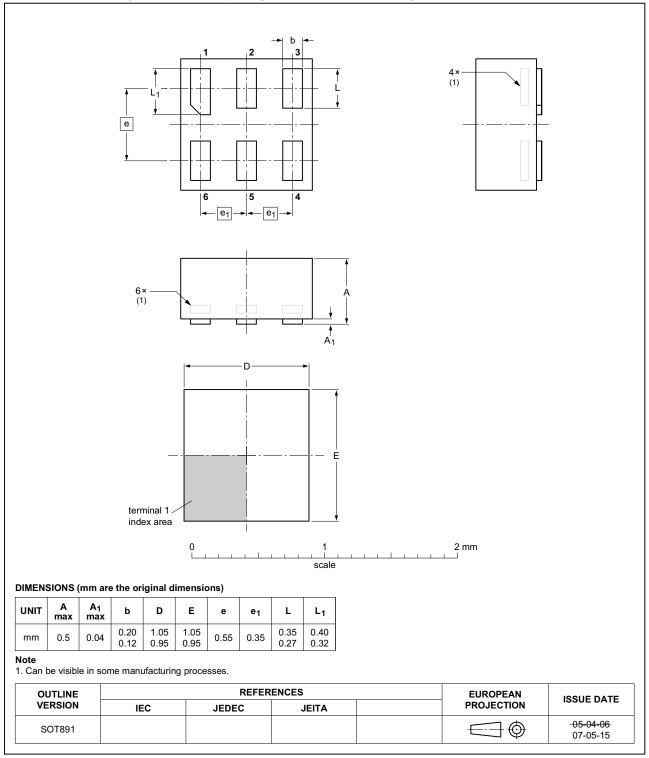


XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

Fig 11. Package outline SOT886 (XSON6)

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SOT891

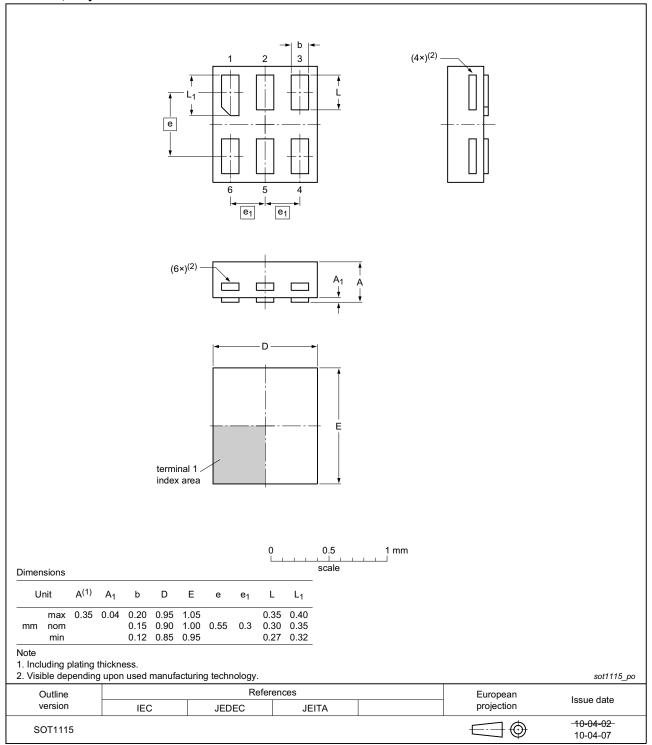


## XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

Fig 12. Package outline SOT891 (XSON6)

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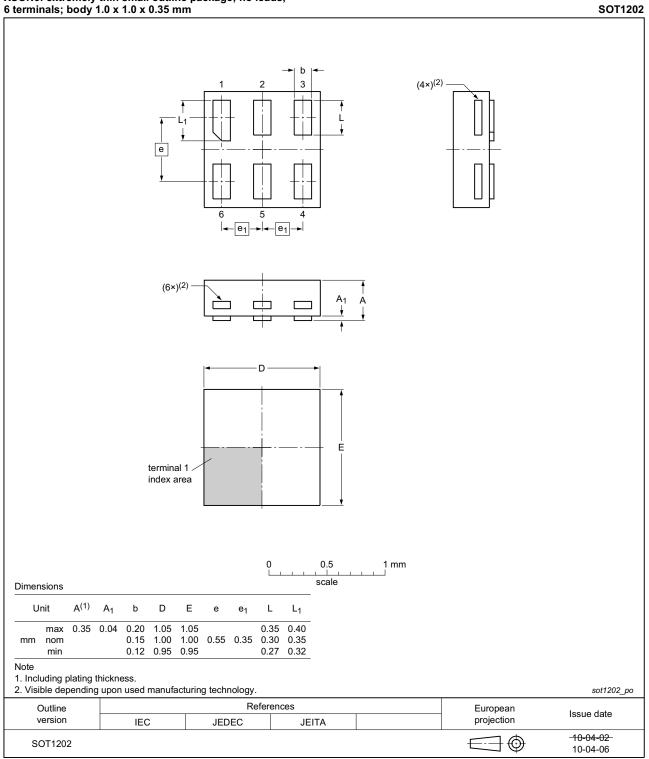
SOT1115



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

Fig 13. Package outline SOT1115 (XSON6)

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

Fig 14. Package outline SOT1202 (XSON6)

**Product data sheet** 



## 14. Abbreviations

Table 11.   Abbreviations				
Acronym	Description			
CMOS	Complementary Metal Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
НВМ	Human Body Model			
MM	Machine Model			
TTL	Transistor-Transistor Logic			

# **15. Revision history**

### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74LVC2G04 v.7	20140910	Product data sheet	-	74LVC2G04 v.6			
Modifications: • Package outline drawing of SOT886 (Figure 11) modified.							
74LVC2G04 v.6	20111206	Product data sheet	-	74LVC2G04 v.5			
74LVC2G04 v.5	20100805	Product data sheet	-	74LVC2G04 v.4			
74LVC2G04 v.4	20070725	Product data sheet	-	74LVC2G04 v.3			
74LVC2G04 v.3	20070216	Product data sheet	-	74LVC2G04 v.2			
74LVC2G04 v.2	20040915	Product specification	-	74LVC2G04 v.1			
74LVC2G04 v.1	20030722	Product specification	-	-			

## 16. Legal information

### 16.1 Data sheet status

Document status[1][2]	Product status <sup>[3]</sup>	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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# 74LVC2G04

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# 74LVC2G04

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