Inverter with open-drain output Rev. 10 — 29 June 2012

Product data sheet

1. **General description**

The 74LVC1G06 provides the inverting buffer.

Input 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.

Schmitt-trigger action at all inputs makes the circuit tolerant for slower input rise and fall time.

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.

The output of the device is an open drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 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)
- ± 24 mA output drive (V_{CC} = 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
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from –40 °C to +125 °C



Inverter with open-drain output

Ordering information 3.

Table 1. Ordering	information								
Type number	Package	Package							
	Temperature range	Name	Description	Version					
74LVC1G06GW	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1					
74LVC1G06GV	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753					
74LVC1G06GM	–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					
74LVC1G06GF	–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					
74LVC1G06GN	–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					
74LVC1G06GS	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $1.0\times1.0\times0.35$ mm	SOT1202					
74LVC1G06GX	–40 °C to +125 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body $0.8 \times 0.8 \times 0.35$ mm	SOT1226					

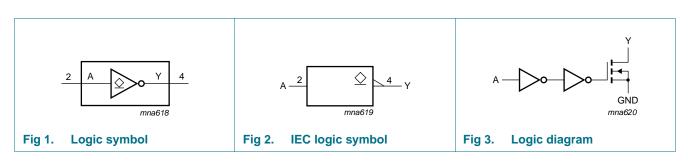
Marking 4.

Table 2. Marking codes

Type number	Marking ^[1]
74LVC1G06GW	VR
74LVC1G06GV	V06
74LVC1G06GM	VR
74LVC1G06GF	VR
74LVC1G06GN	VR
74LVC1G06GS	VR
74LVC1G06GX	VR

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

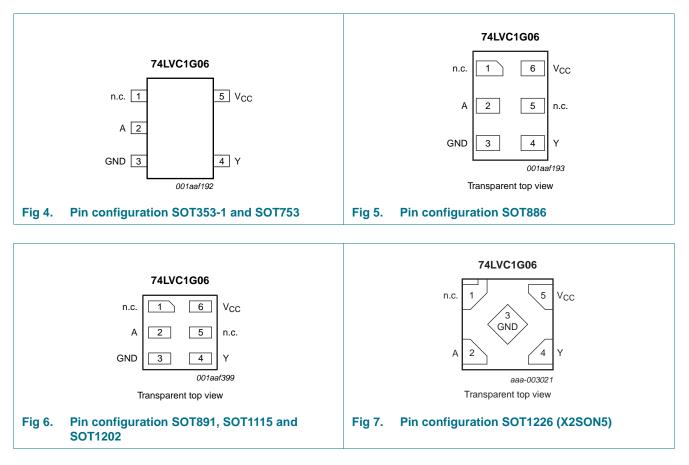
Functional diagram 5.



Inverter with open-drain output

6. Pinning information

6.1 Pinning



6.2 Pin description

Symbol	Pin		Description
	TSSOP5 and X2SON5	XSON6	
n.c.	1	1	not connected
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	•	5	not connected
V _{CC}	5	6	supply voltage

7. Functional description

Table 4.	Function table ^[1]	
Input		Output
Α		Y
L		Z
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).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+6.5	V
I _{IK}	input clamping current	V ₁ < 0 V	-50	-	mA
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
Ι _{ΟΚ}	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 0 V	-	±50	mA
Vo	output voltage	Active mode and Power-down mode	[1][2] -0.5	+6.5	V
I _{O(sink/source)}	output sink or source current	$V_{O} = 0 V$ to V_{CC}	-	±50	mA
I _{CC}	supply current		-	+100	mA
I _{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 \ ^{\circ}C$ to +125 $^{\circ}C$	<u>[3]</u>	250	mW

[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.

[3] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K. For XSON6 and X2SON5 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{CC}	supply voltage		1.65	-	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	Active mode	0	-	5.5	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	meter Conditions		°C to +8	5 °C	–40 °C to	Unit	
			Min	Typ <mark>[1]</mark>	Max	Min	Max	
V _{IH}	HIGH-level	$V_{CC} = 1.65 \text{ V}$ to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	V
	input voltage	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	V_{CC} = 1.65 V to 1.95 V	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
	input voltage	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 _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$						
	output voltage	I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.10	-	0.10	V
		$I_0 = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.70	V
		$I_0 = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.30	-	0.45	V
		$I_0 = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.40	-	0.60	V
		$I_0 = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.80	V
		$I_0 = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.55	-	0.80	V
I _I	input leakage current	$V_I = 5.5 V \text{ or GND};$ $V_{CC} = 0 V \text{ to } 5.5 V$	-	±0.1	±5	-	±100	μA
I _{OFF}	power-off leakage current	$V_{I} \text{ or } V_{O} = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	±0.1	±10	-	±200	μΑ
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I} = 5.5 \; V \; \text{or GND}; \; I_{O} = 0 \; A; \\ V_{CC} = 1.65 \; V \; \text{to} \; 5.5 \; V \end{array}$	-	0.1	10	-	200	μΑ
ΔI_{CC}	additional supply current		-	5	500	-	5000	μΑ
CI	input capacitance	V_{CC} = 3.3 V; V_{I} = GND to V_{CC}	-	5	-	-	-	pF

[1] All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

11. Dynamic characteristics

Dynamic characteristics Table 8.

Voltages are referenced to GND (ground = 0 V); for load circuit see Figure 9.

Symbol	Parameter	Conditions		-40	0 °C to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	A to Y; see Figure 8	[2]						
	V_{CC} = 1.65 V to 1.95 V		1.0	3	6.5	1.0	8.5	ns	
		V_{CC} = 2.3 V to 2.7 V		0.5	1.9	4	0.5	5.5	ns
		V _{CC} = 2.7 V		0.5	2.5	4.5	0.5	6	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		0.5	2.3	4	0.5	5.5	ns
		$V_{CC} = 4.5 V \text{ to } 5.5 V$		0.5	1.7	3	0.5	4	ns
C _{PD}	power dissipation capacitance	$V_{\rm I}$ = GND to $V_{CC};V_{CC}$ = 3.3 V	<u>[3]</u>	-	14	-	-	-	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_{PLZ} and t_{PZL} .

[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;

 $f_o = output frequency in MHz;$

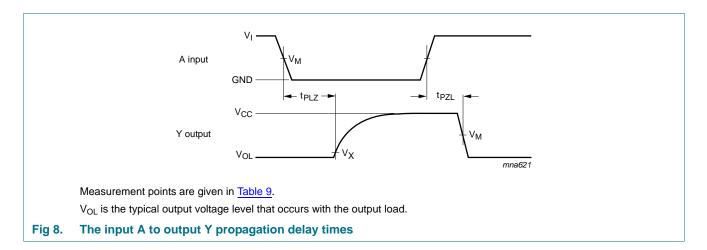
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

12. Waveforms



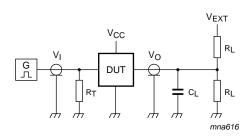
74LVC1G06 Product data sheet

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74LVC1G06

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Table 9. Measurement points						
Supply voltage	Input	Output				
V _{CC}	V _M	V _M	V _X			
1.65 V to 1.95 V	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.15 V			
2.3 V to 2.7 V	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.15 V			
2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V			
3.0 V to 3.6 V	1.5 V	1.5 V	V _{OL} + 0.3 V			
4.5 V to 5.5 V	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.3 V			



Test data is given in Table 10.

Definitions test circuit:

R_L = Load resistance.

 C_L = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to output impedance Z_0 of the pulse generator.

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

Fig 9. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V _{EXT}
V _{CC}	VI	t _r = t _f	CL	RL	t _{PZL} , t _{PLZ}
1.65 V to 1.95 V	V _{CC}	\leq 2.0 ns	30 pF	1 kΩ	2V _{CC}
2.3 V to 2.7 V	V _{CC}	\leq 2.0 ns	30 pF	500 Ω	2V _{CC}
2.7 V	2.7 V	\leq 2.5 ns	50 pF	500 Ω	6 V
3.0 V to 3.6 V	2.7 V	\leq 2.5 ns	50 pF	500 Ω	6 V
4.5 V to 5.5 V	V _{CC}	≤ 2.5 ns	50 pF	500 Ω	2V _{CC}

Inverter with open-drain output

13. Package outline

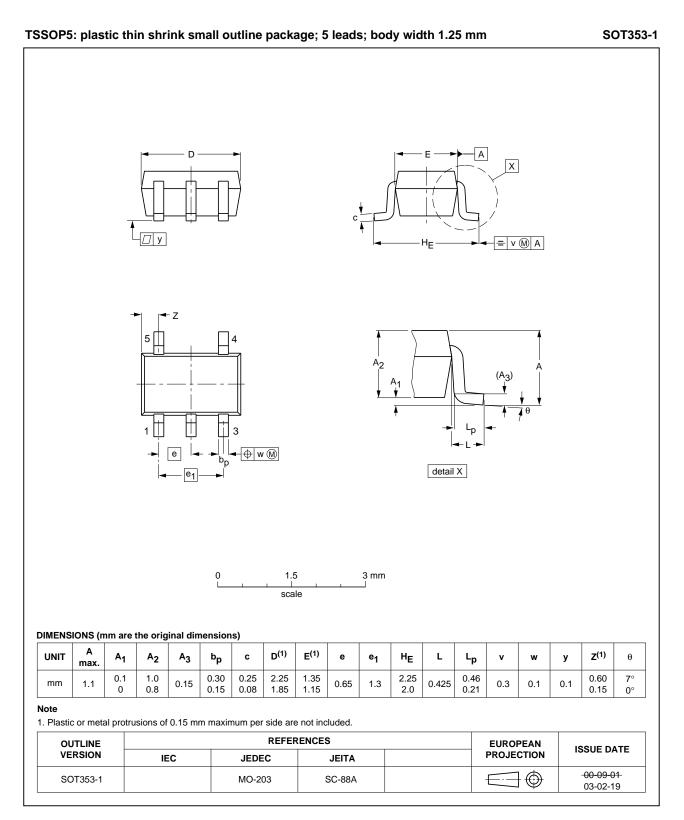


Fig 10. Package outline SOT353-1 (TSSOP5)

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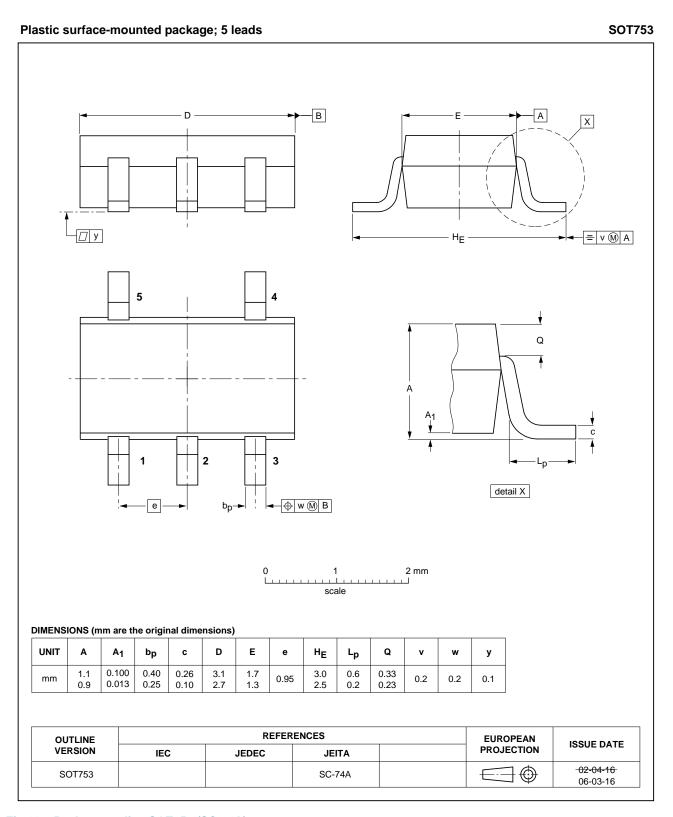


Fig 11. Package outline SOT753 (SC-74A)

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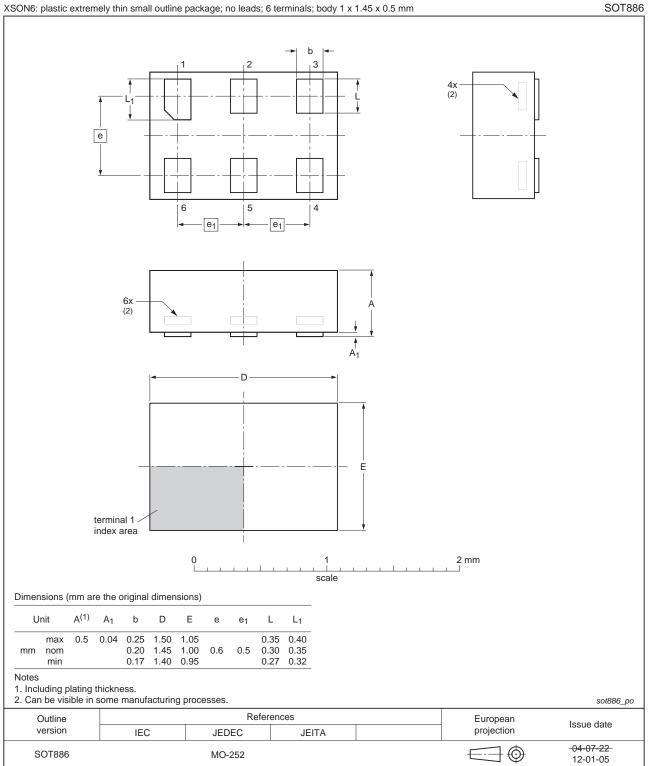


Fig 12. Package outline SOT886 (XSON6)

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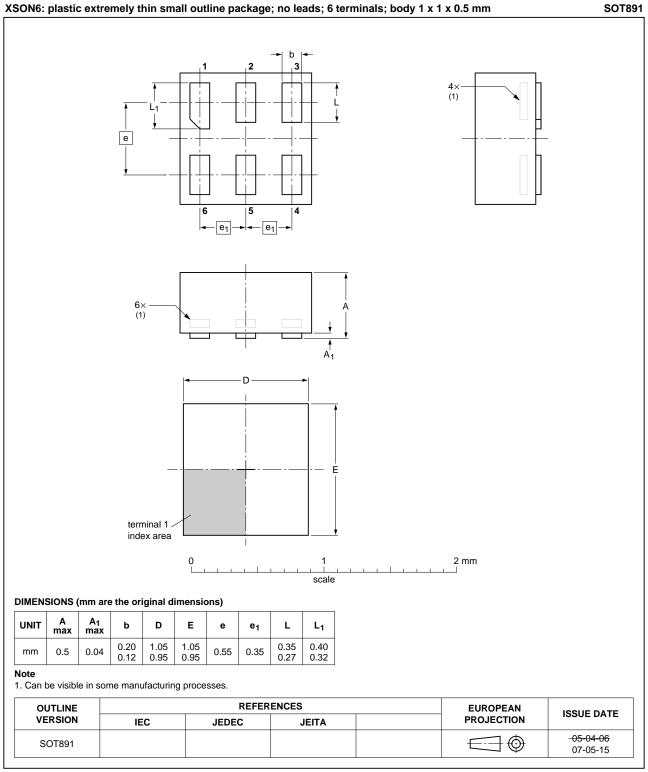
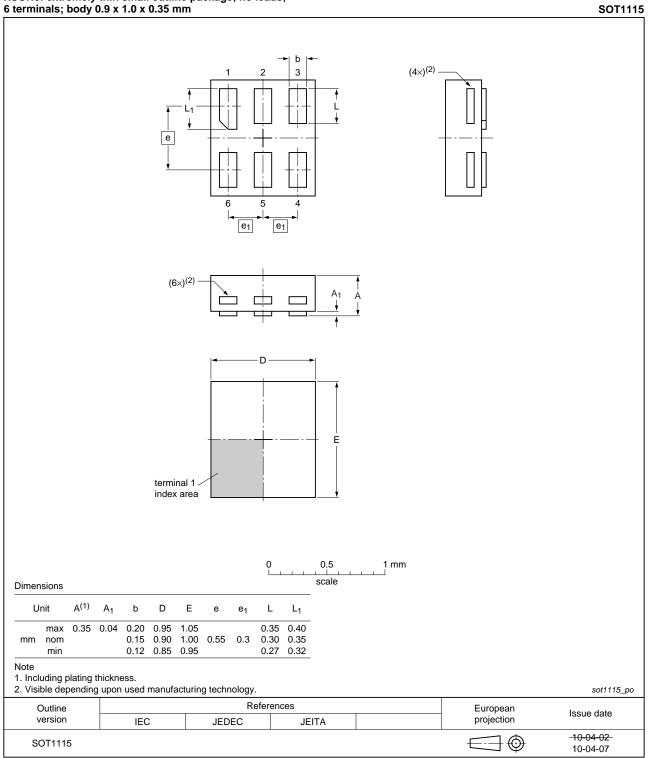


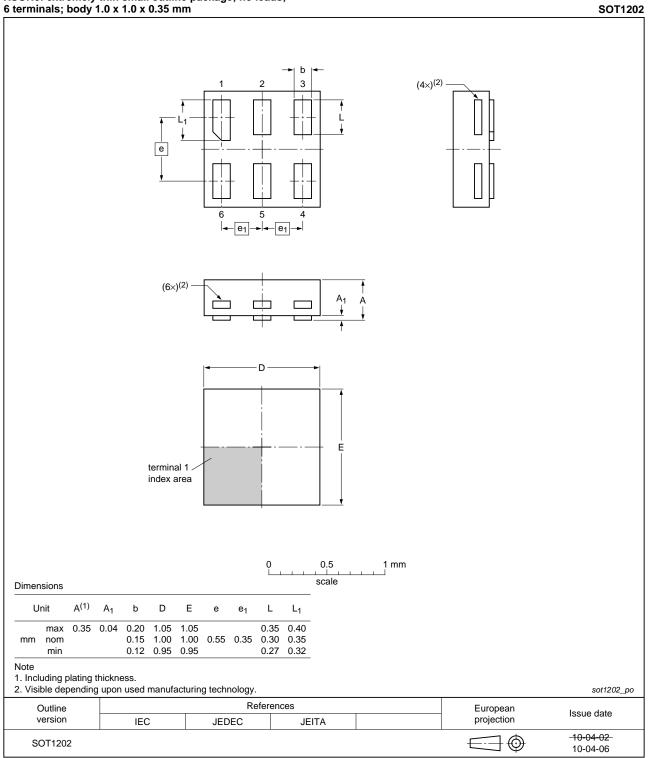
Fig 13. Package outline SOT891 (XSON6)

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

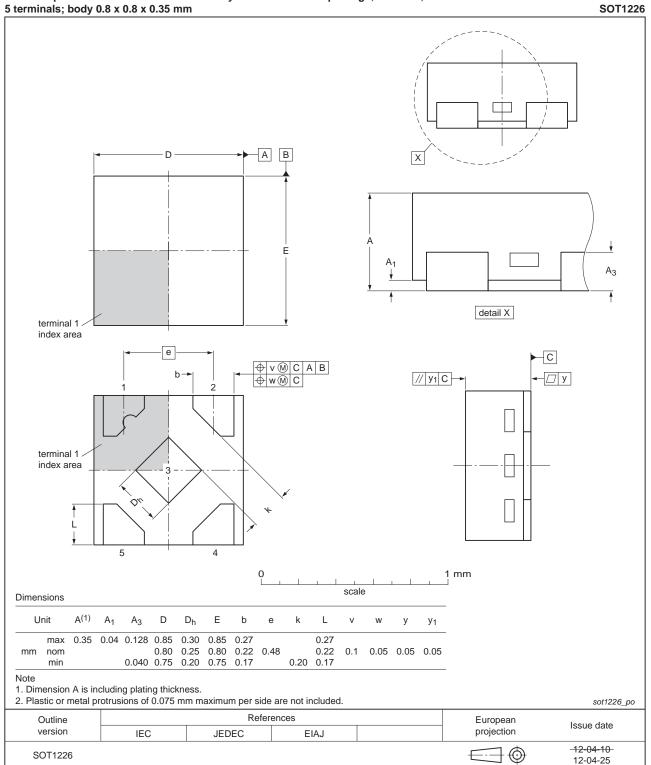
Fig 14. Package outline SOT1115 (XSON6)



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

Fig 15. Package outline SOT1202 (XSON6)

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X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm

Fig 16. Package outline SOT1226 (X2SON5)

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14. Abbreviations

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

15. Revision history

Table 12.	Revision	history
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	-			
Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G06 v.10	20120629	Product data sheet	-	74LVC1G06 v.9
Modifications:	 Added type 	number 74LVC1G06GX (S	OT1226)	
	 Package or 	utline drawing of SOT886 (F	igure 12) modified.	
74LVC1G06 v.9	20111207	Product data sheet	-	74LVC1G06 v.8
Modifications:	 Legal pages updated. 			
74LVC1G06 v.8	20101026	Product data sheet	-	74LVC1G06 v.7
74LVC1G06 v.7	20070712	Product data sheet	-	74LVC1G06 v.6
74LVC1G06 v.6	20060912	Product data sheet	-	74LVC1G06 v.5
74LVC1G06 v.5	20040907	Product specification	-	74LVC1G06 v.4
74LVC1G06 v.4	20030303	Product specification	-	74LVC1G06 v.3
74LVC1G06 v.3	20020529	Product specification	-	74LVC1G06 v.2
74LVC1G06 v.2	20010405	Product specification	-	74LVC1G06 v.1
74LVC1G06 v.1	20001121	Product specification	-	-

16. Legal information

16.1 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.
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