

DATA SHEET

74LVC1GU04 Inverter

Product specification
Supersedes data of 2004 Jun 28

2004 Sep 21

Inverter

74LVC1GU04

FEATURES

- 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 consumption
- Latch-up performance exceeds 250 mA
- Input accepts voltages up to 5 V
- Multiple package options
- ESD protection:
 - HBM EIA/JESD22-A114-B exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C.

DESCRIPTION

The 74LVC1GU04 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

The input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device 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.

The 74LVC1GU04 provides the inverting single state unbuffered function.

QUICK REFERENCE DATA

Ground = 0 V; $T_{amb} = 25$ °C; $t_r = t_f \leq 2.5$ ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay A to Y	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k Ω	1.7	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ Ω	1.3	ns
		$V_{CC} = 2.7$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.7	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.6	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.3	ns
C_I	input capacitance		6	pF
C_{PD}	power dissipation capacitance	$V_{CC} = 3.3$ V; notes 1 and 2	14.9	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts;

N = total load switching outputs;

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

2. The condition is $V_I = \text{GND}$ to V_{CC} .

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FUNCTION TABLE

See note 1.

INPUT	OUTPUT
A	Y
L	H
H	L

Note

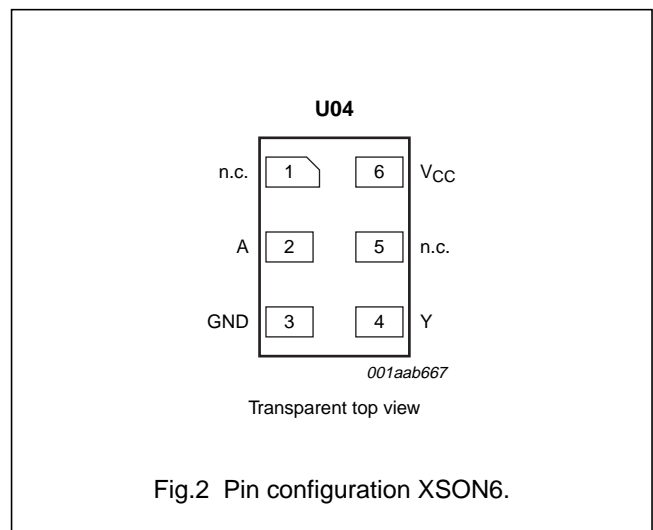
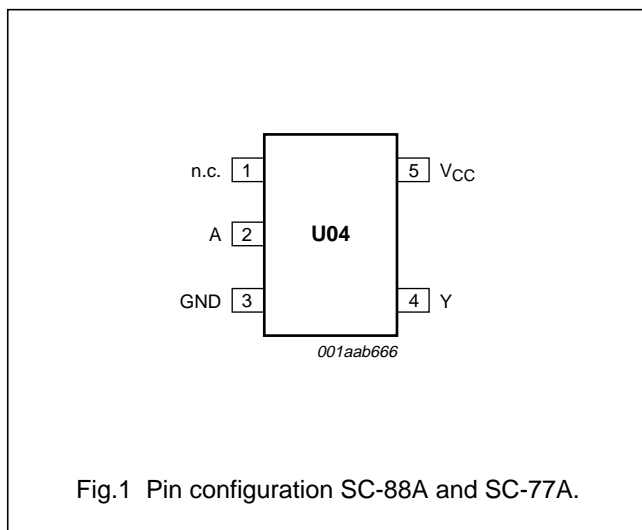
- 1. H = HIGH voltage level;
- L = LOW voltage level.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC1GU04GW	-40 °C to +125 °C	5	SC-88A	plastic	SOT353	VD
74LVC1GU04GV	-40 °C to +125 °C	5	SC-74A	plastic	SOT753	VU4
74LVC1GU04GM	-40 °C to +125 °C	6	XSON6	plastic	SOT886	VD

PINNING

PIN SC-88A; SC-74A	PIN XSON6	SYMBOL	DESCRIPTION
1	1	n.c.	not connected
2	2	A	data input A
3	3	GND	ground (0 V)
4	4	Y	data output Y
-	5	n.c.	not connected
5	6	V _{CC}	supply voltage



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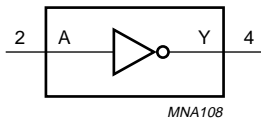


Fig.3 Logic symbol.

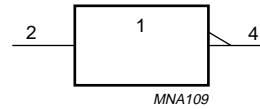


Fig.4 IEEE logic symbol.

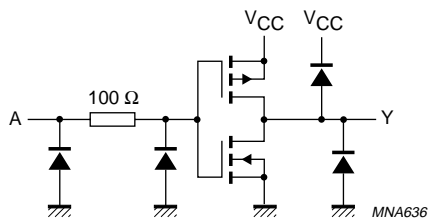


Fig.5 Logic diagram.

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		1.65	5.5	V
V_I	input voltage		0	5.5	V
V_O	output voltage		0	V_{CC}	V
T_{amb}	operating ambient temperature		-40	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	0	20	ns/V
		$V_{CC} = 2.7 \text{ V to } 5.5 \text{ V}$	0	10	ns/V

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 diode current	$V_I < 0 \text{ V}$	-	-50	mA
V_I	input voltage	note 1	-0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0 \text{ V}$	-	±50	mA
V_O	output voltage	active mode; note 1	-0.5	$V_{CC} + 0.5$	V
I_O	output source or sink current	$V_O = 0 \text{ V to } V_{CC}$	-	±50	mA
I_{CC}, I_{GND}	V_{CC} or GND current		-	±100	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	power dissipation	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$; note 2	-	200	mW

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. Above 55 °C the value of P_{tot} derates linearly with 4.5 mW/K.

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DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T_{amb} = -40 °C to +85 °C							
V _{IH}	HIGH-level input voltage		1.65 to 5.5	0.75 × V _{CC}	–	–	V
V _{IL}	LOW-level input voltage		1.65 to 5.5	–	–	0.25 × V _{CC}	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = 100 μA	1.65 to 5.5	–	–	0.1	V
		I _O = 4 mA	1.65	–	–	0.45	V
		I _O = 8 mA	2.3	–	–	0.3	V
		I _O = 12 mA	2.7	–	–	0.4	V
		I _O = 24 mA	3.0	–	–	0.55	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = -100 μA	1.65 to 5.5	V _{CC} - 0.1	–	–	V
		I _O = -4 mA	1.65	1.2	–	–	V
		I _O = -8 mA	2.3	1.9	–	–	V
		I _O = -12 mA	2.7	2.2	–	–	V
		I _O = -24 mA	3.0	2.3	–	–	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	3.6	–	±0.1	±5	μA
		I _O = 0 A					
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	–	0.1	10	μA

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SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T_{amb} = -40 °C to +125 °C							
V _{IH}	HIGH-level input voltage		1.65 to 5.5	0.8 × V _{CC}	–	–	V
V _{IL}	LOW-level input voltage		1.65 to 5.5	–	–	0.2 × V _{CC}	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = 100 μA	1.65 to 5.5	–	–	0.1	V
		I _O = 4 mA	1.65	–	–	0.70	V
		I _O = 8 mA	2.3	–	–	0.45	V
		I _O = 12 mA	2.7	–	–	0.60	V
		I _O = 24 mA	3.0	–	–	0.80	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = -100 μA	1.65 to 5.5	V _{CC} - 0.1	–	–	V
		I _O = -4 mA	1.65	0.95	–	–	V
		I _O = -8 mA	2.3	1.7	–	–	V
		I _O = -12 mA	2.7	1.9	–	–	V
		I _O = -24 mA	3.0	2.0	–	–	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	3.6	–	±0.1	±5	μA
		I _O = 0 A					
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	–	–	200	μA

Note

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

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AC CHARACTERISTICS

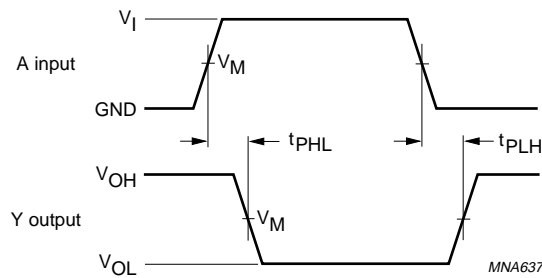
GND = 0 V; $t_r = t_f \leq 2.0$ ns.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T_{amb} = -40 °C to +85 °C							
t _{PHL} /t _{PLH}	propagation delay A to Y	see Figs 6 and 9	1.65 to 1.95	0.3	1.7	5.0	ns
			2.3 to 2.7	0.3	1.3	4.0	ns
			2.7	0.5	1.7	5.0	ns
			3.0 to 3.6	0.5	1.6	3.7	ns
			4.5 to 5.5	0.5	1.3	3.0	ns
T_{amb} = -40 °C to +125 °C							
t _{PHL} /t _{PLH}	propagation delay A to Y	see Figs 6 and 9	1.65 to 1.95	0.3	–	6.5	ns
			2.3 to 2.7	0.3	–	5.5	ns
			2.7	0.5	–	6.5	ns
			3.0 to 3.6	0.5	–	5.0	ns
			4.5 to 5.5	0.5	–	4.0	ns

Note

1. All typical values are measured at T_{amb} = 25 °C.

AC WAVEFORMS



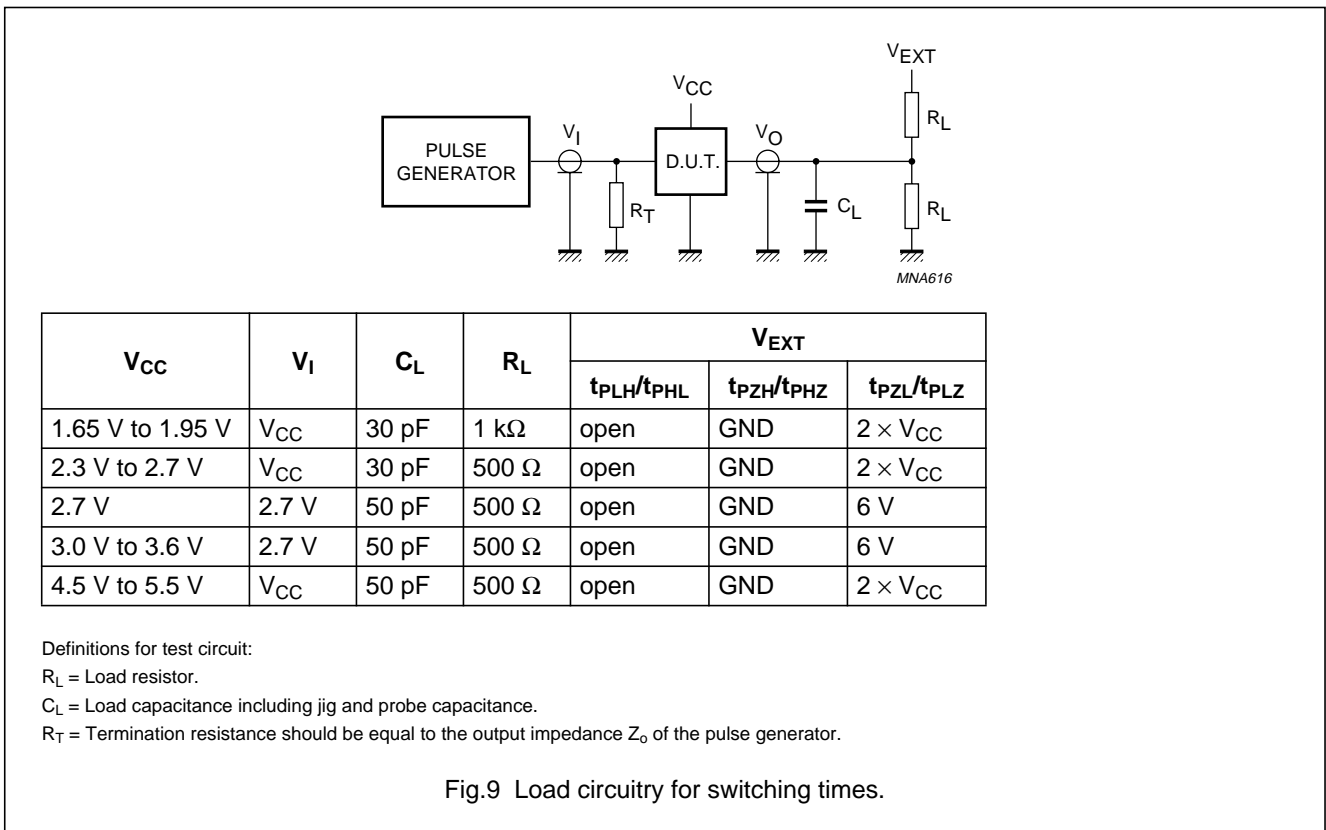
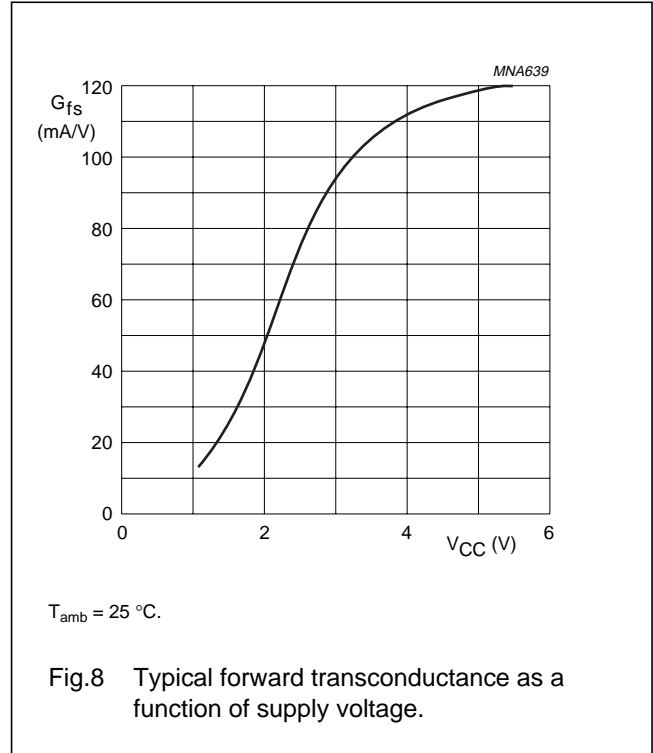
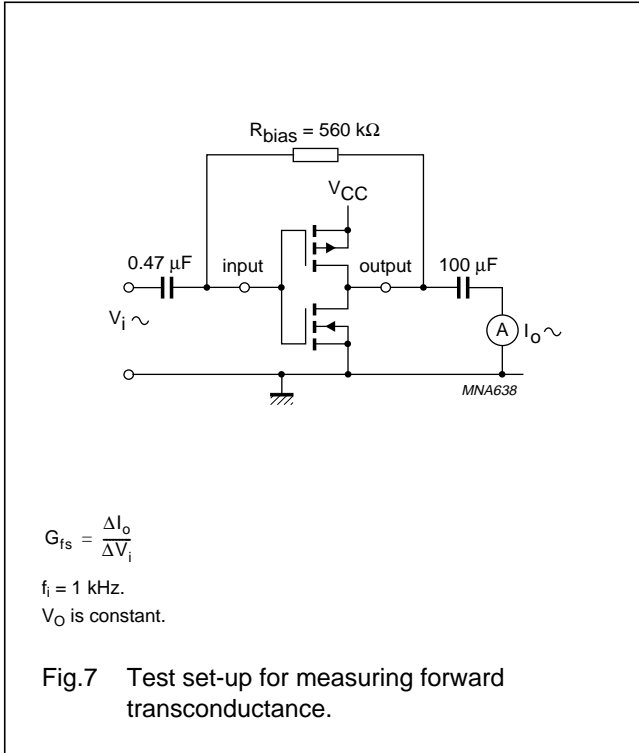
V _{CC}	V _M	INPUT	
		V _I	t _r = t _f
1.65 V to 1.95 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.3 V to 2.7 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 V to 5.5 V	0.5 × V _{CC}	V _{CC}	≤ 2.5 ns

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

Fig.6 Input A to output Y propagation delay times.

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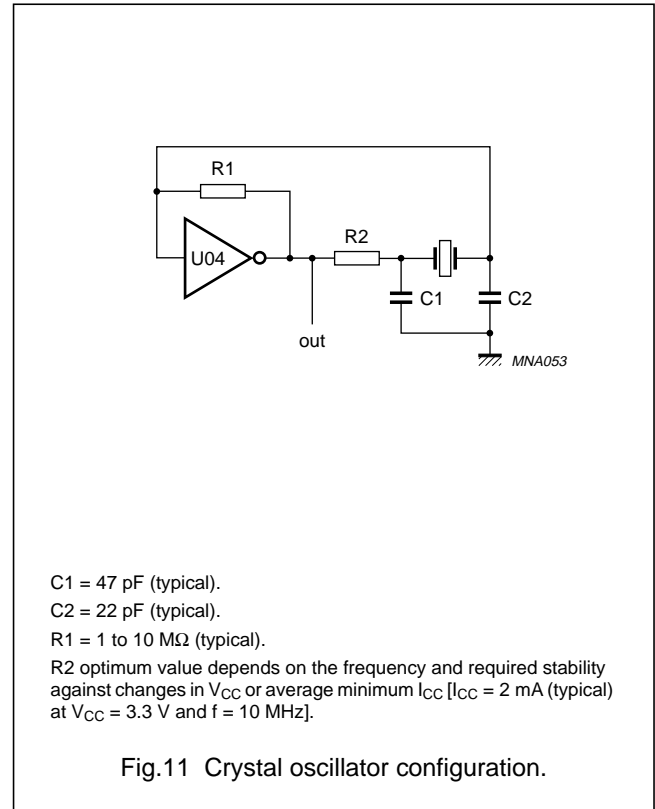
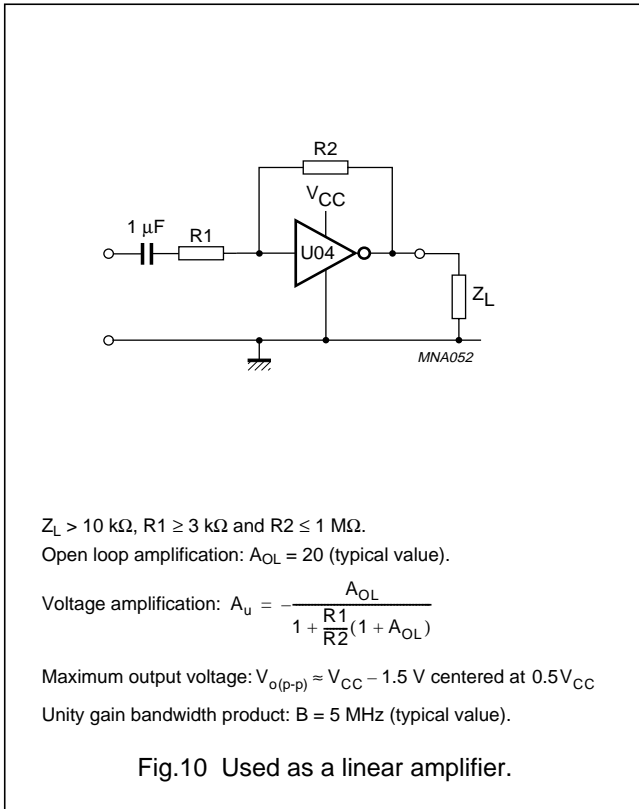
APPLICATION INFORMATION

Some applications for the 74LVC1GU04 are:

- Linear amplifier (see Fig.10)
- Crystal oscillator (see Fig.11).

Remark to the application information

All values given are typical values unless otherwise specified.



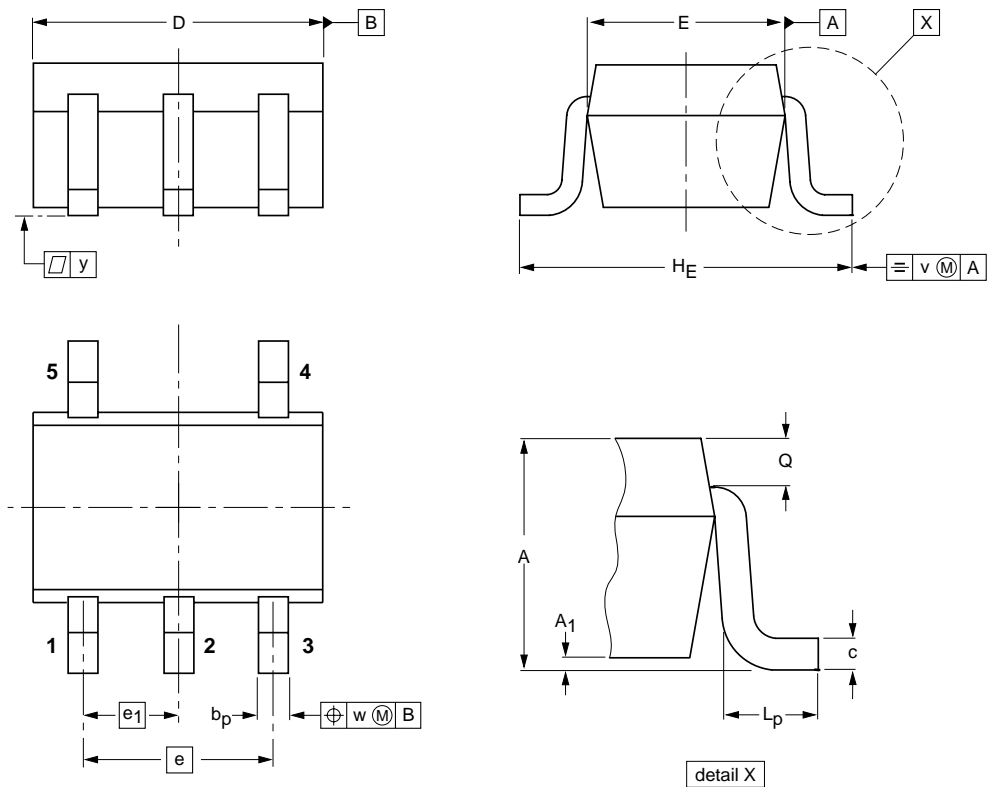
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PACKAGE OUTLINES

Plastic surface mounted package; 5 leads

SOT353



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	c	D	E ⁽²⁾	e	e ₁	H _E	L _p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

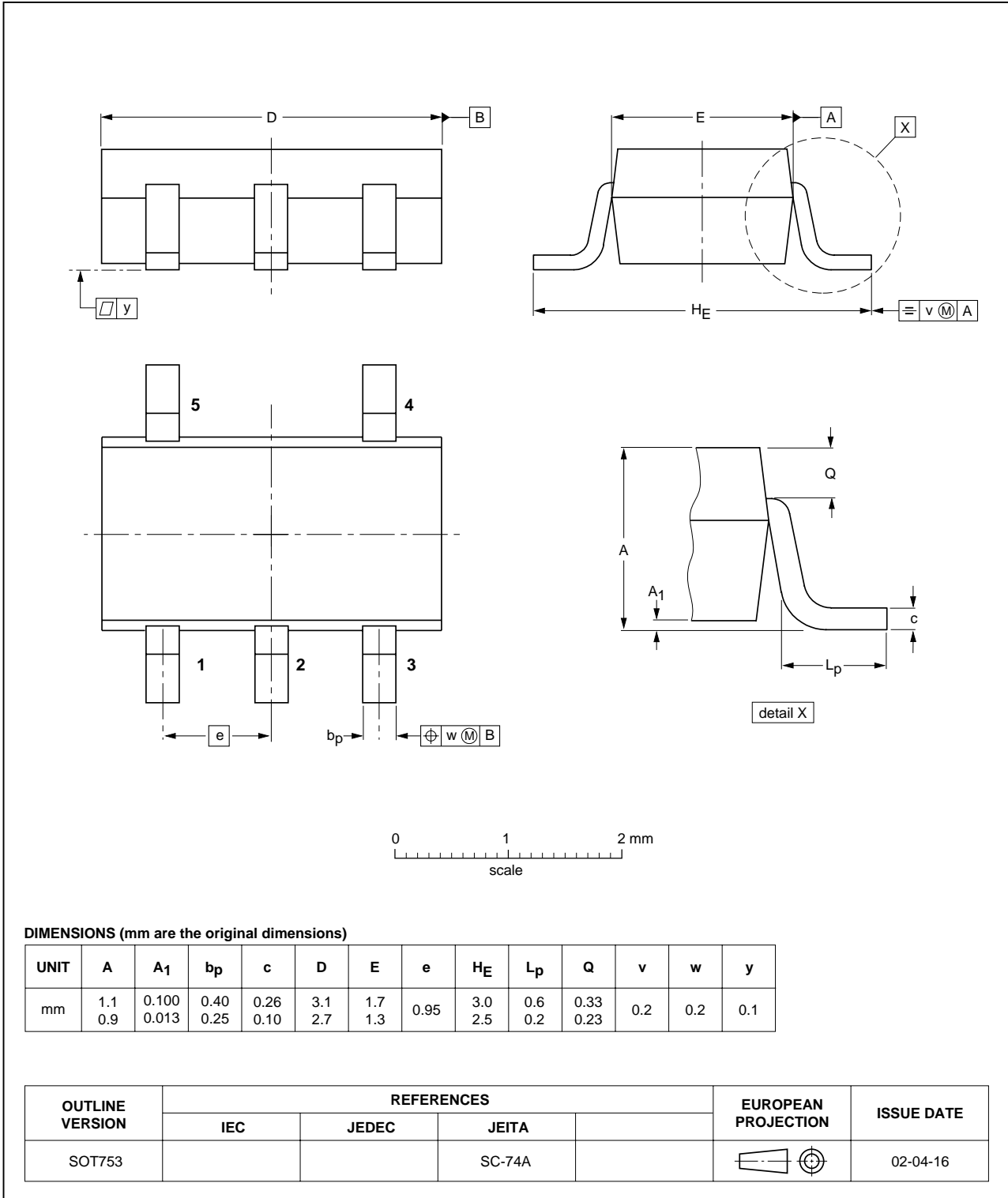
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT353			SC-88A			97-02-28

Inverter

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Plastic surface mounted package; 5 leads

SOT753

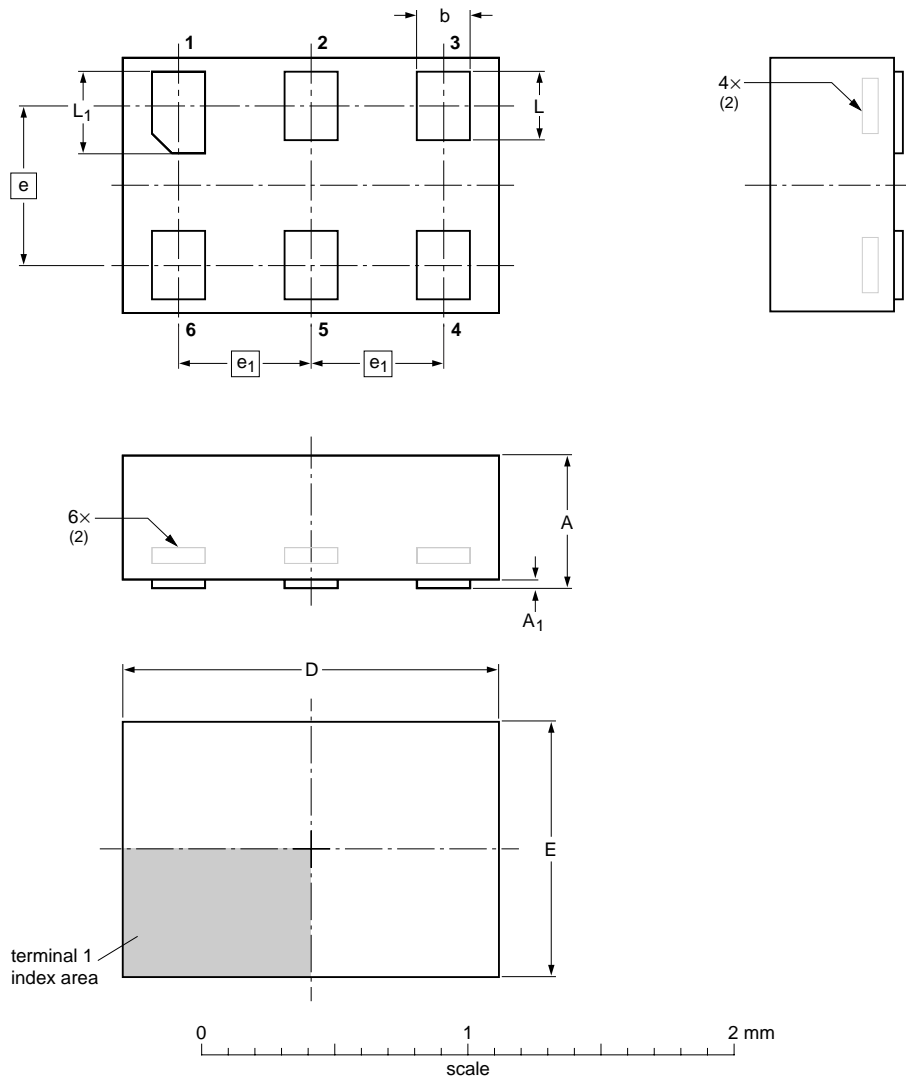


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XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



DIMENSIONS (mm are the original dimensions)

UNIT	A ⁽¹⁾ max	A ₁ max	b	D	E	e	e ₁	L	L ₁
mm	0.5	0.04	0.25 0.17	1.5 1.4	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT886		MO-252			04-07-15 04-07-22

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