

DATA SHEET

74LVC1G86

2-input EXCLUSIVE-OR gate

Product specification
Supersedes data of 2002 Nov 15

2004 Sep 08

2-input EXCLUSIVE-OR gate

74LVC1G86

FEATURES

- 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 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 74LVC1G86 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

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.

The 74LVC1G86 provides the 2-input EXCLUSIVE-OR function.

QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay inputs A and B to output Y	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k Ω	3.7	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ Ω	2.5	ns
		$V_{CC} = 2.7$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.8	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.3	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.9	ns
C_I	input capacitance		5	pF
C_{PD}	power dissipation capacitance per buffer	$V_{CC} = 3.3$ V; notes 1 and 2	25	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 $V_I = GND$ to V_{CC} .

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FUNCTION TABLE

See note 1.

INPUT		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
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
74LVC1G86GW	-40 °C to +125 °C	5	SC-88A	plastic	SOT353	VH
74LVC1G86GV	-40 °C to +125 °C	5	SC-74A	plastic	SOT753	V86
74LVC1G86GM	-40 °C to +125 °C	6	XSON6	plastic	SOT886	VH

PINNING

PIN SC-88A; SC-74A	PIN XSON6	SYMBOL	DESCRIPTION
1	1	B	data input B
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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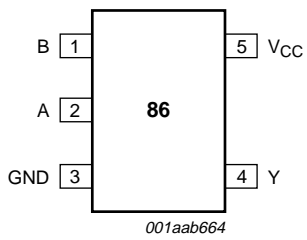


Fig.1 Pin configuration SC-88A and SC-74A.

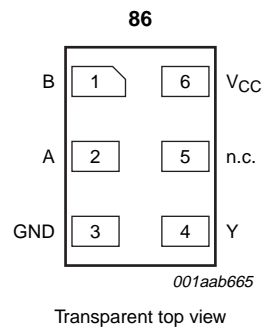


Fig.2 Pin configuration XSON6.

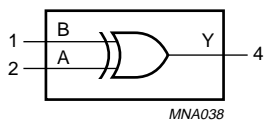


Fig.3 Logic symbol.

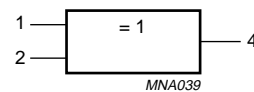
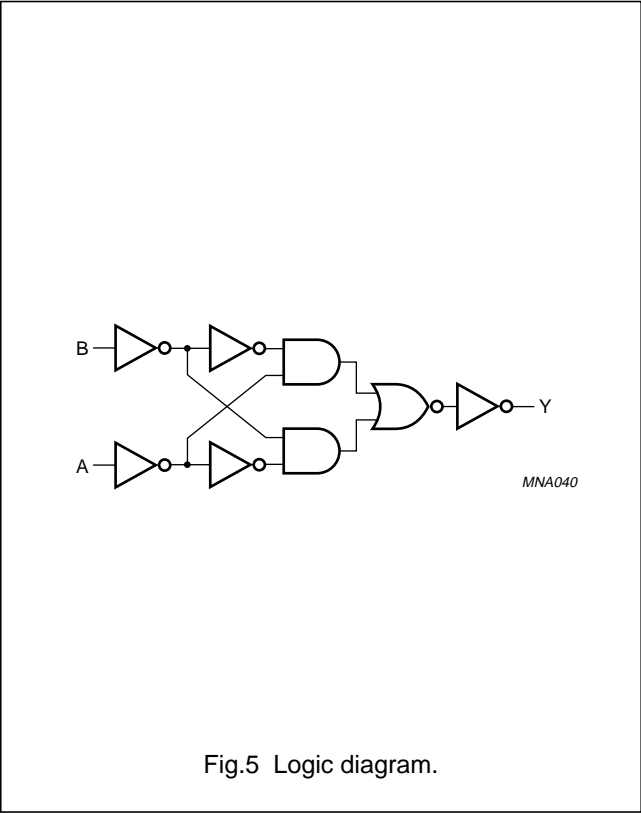


Fig.4 IEE/IEC logic symbol.

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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	active mode	0	V_{CC}	V
		$V_{CC} = 0$ V; Power-down mode	0	5.5	V
T_{amb}	operating ambient temperature		-40	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 1.65$ V to 2.7 V	0	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 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	$V_I < 0$ V	-	-50	mA
V_I	input voltage	note 1	-0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
V_O	output voltage	active mode; notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
I_O	output source or sink current	$V_O = 0$ 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	$T_{amb} = -40$ °C to +125 °C	-	250	mW

Notes

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.

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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 1.95	0.65 × V _{CC}	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2.0	–	–	V
			4.5 to 5.5	0.7 × V _{CC}	–	–	V
V _{IL}	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V _{CC}	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
			4.5 to 5.5	–	–	0.3 × V _{CC}	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 100 μA I _O = 4 mA I _O = 8 mA I _O = 12 mA I _O = 24 mA I _O = 32 mA	1.65 to 5.5	–	–	0.1	V
			1.65	–	–	0.45	V
			2.3	–	–	0.3	V
			2.7	–	–	0.4	V
			3.0	–	–	0.55	V
			4.5	–	–	0.55	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = -100 μA I _O = -4 mA I _O = -8 mA I _O = -12 mA I _O = -24 mA I _O = -32 mA	1.65 to 5.5	V _{CC} - 0.1	–	–	V
			1.65	1.2	–	–	V
			2.3	1.9	–	–	V
			2.7	2.2	–	–	V
			3.0	2.3	–	–	V
			4.5	3.8	–	–	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	5.5	–	±0.1	±5	μA
I _{off}	power OFF leakage current	V _I or V _O = 5.5 V	0	–	±0.1	±10	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	–	0.1	10	μA
ΔI _{CC}	additional quiescent supply current per pin	V _I = V _{CC} - 0.6 V; I _O = 0 A	2.3 to 5.5	–	5	500	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 1.95	0.65 × V _{CC}	–	–	V					
			2.3 to 2.7	1.7	–	–	V					
			2.7 to 3.6	2.0	–	–	V					
			4.5 to 5.5	0.7 × V _{CC}	–	–	V					
V _{IL}	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V _{CC}	V					
			2.3 to 2.7	–	–	0.7	V					
			2.7 to 3.6	–	–	0.8	V					
			4.5 to 5.5	–	–	0.3 × V _{CC}	V					
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}	1.65 to 5.5	–	–	0.1	V					
		I _O = 100 μA										
		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
I _O = 32 mA	4.5	–	–	0.80	V							
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}	1.65 to 5.5	V _{CC} – 0.1	–	–	V					
		I _O = –100 μA										
		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 _O = –32 mA	4.5	3.4	–	–	V							
I _{LI}	input leakage current	V _I = 5.5 V or GND	5.5	–	–	±100	μA					
I _{off}	power OFF leakage current	V _I or V _O = 5.5 V	0	–	–	±200	μA					
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	–	–	200	μA					
ΔI _{CC}	additional quiescent supply current per pin	V _I = V _{CC} – 0.6 V; I _O = 0 A	2.3 to 5.5	–	–	5000	μA					

Note

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

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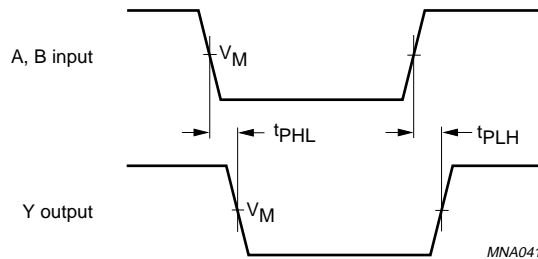
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AC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T_{amb} = -40 °C to +85 °C							
t _{PHL} /t _{PLH}	propagation delay inputs A and B to output Y	see Figs 6 and 7	1.65 to 1.95	1.0	3.7	9.9	V
			2.3 to 2.7	0.5	2.5	5.5	V
			2.7	0.5	2.8	5.8	V
			3.0 to 3.6	0.5	2.3	5.0	V
			4.5 to 5.5	0.5	1.9	4.0	V
T_{amb} = -40 °C to +125 °C							
t _{PHL} /t _{PLH}	propagation delay inputs A and B to output Y	see Figs 6 and 7	1.65 to 1.95	1.0	–	13.0	V
			2.3 to 2.7	0.5	–	7.0	V
			2.7	0.5	–	7.5	V
			3.0 to 3.6	0.5	–	6.5	V
			4.5 to 5.5	0.5	–	5.5	V

AC WAVEFORMS



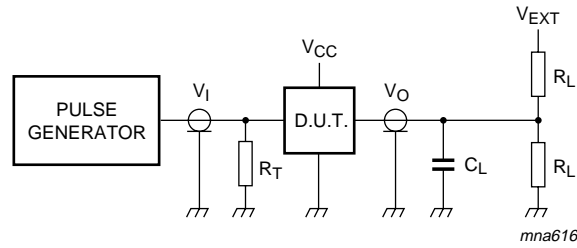
V _{CC}	V _M	INPUT	
		V _I	t _r = t _f
1.65 V to 1.95 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.3 V to 2.7 V	0.5 × V _{CC}	V _{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 V to 5.5 V	0.5 × V _{CC}	V _{CC}	≤ 2.5 ns

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

Fig.6 The inputs A and B to output Y propagation delay times.

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V _{CC}	V _I	C _L	R _L	V _{EXT}		
				t _{PLH} /t _{PHL}	t _{PZH} /t _{PHZ}	t _{PZL} /t _{PLZ}
1.65 V to 1.95 V	V _{CC}	30 pF	1 kΩ	open	GND	2 × V _{CC}
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	2 × V _{CC}
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V
4.5 V to 5.5 V	V _{CC}	50 pF	500 Ω	open	GND	2 × V _{CC}

Definitions for test circuit:

R_L = Load resistor.

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.

Fig.7 Load circuitry for switching times.

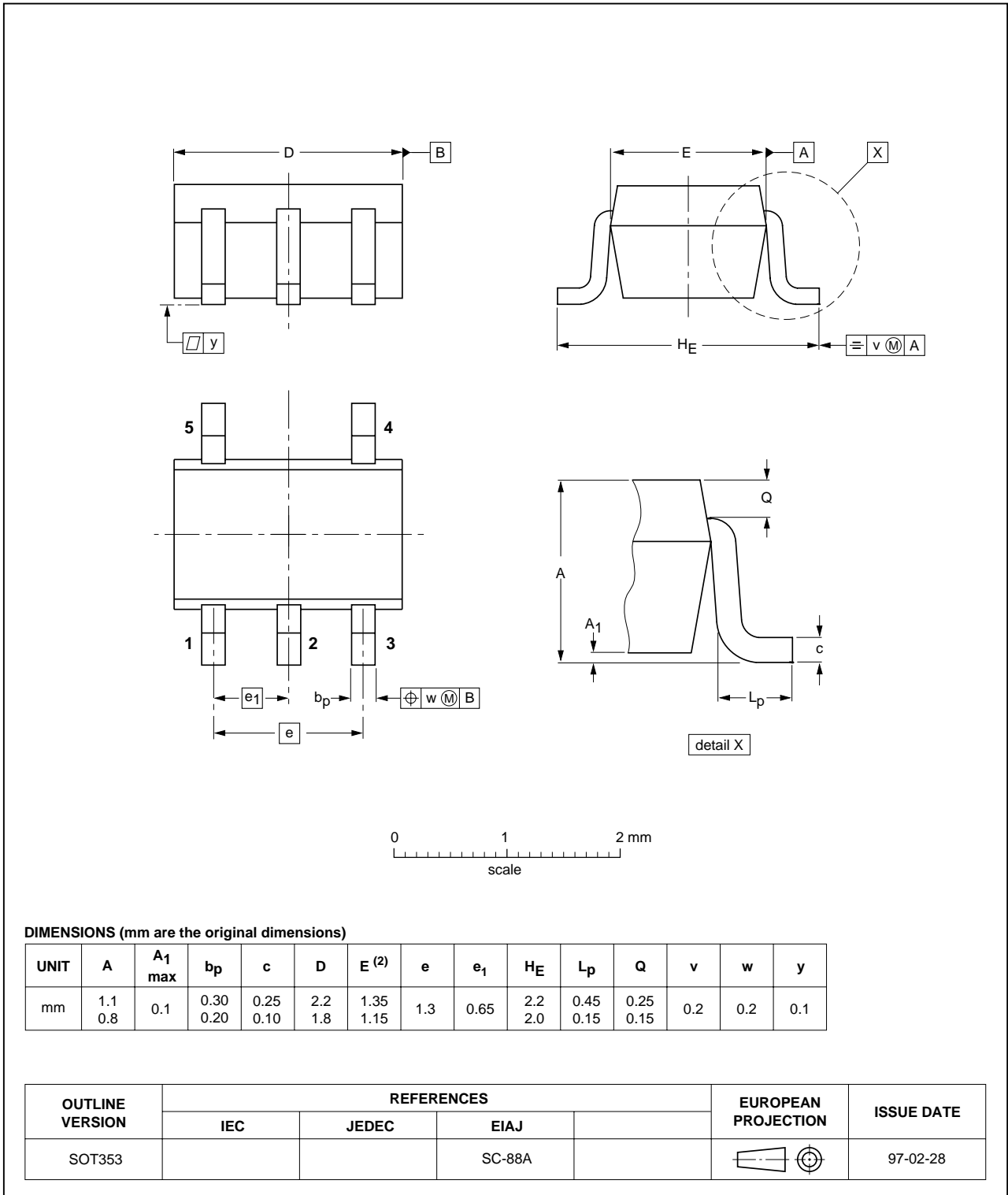
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PACKAGE OUTLINES

Plastic surface mounted package; 5 leads

SOT353

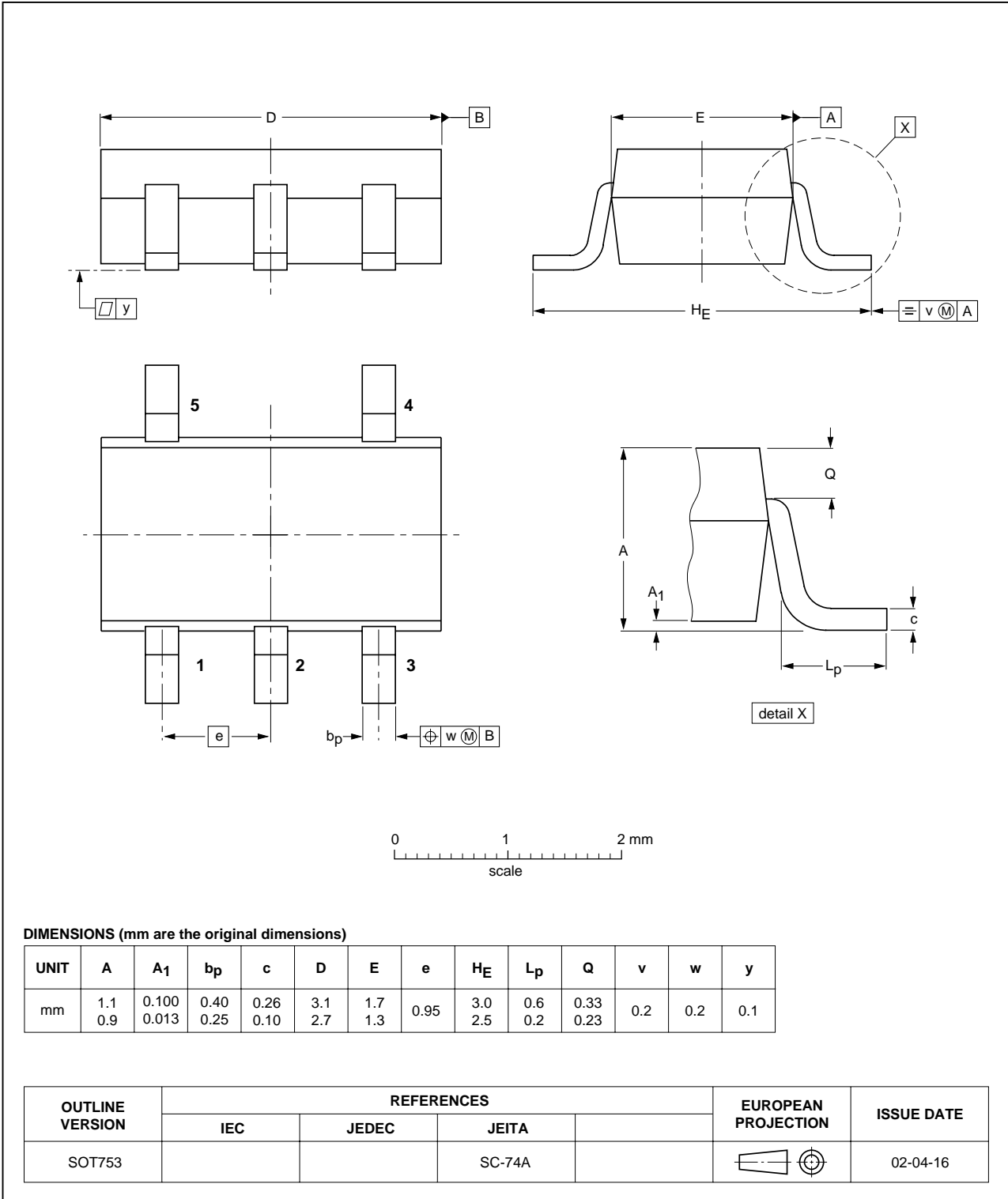


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Plastic surface mounted package; 5 leads

SOT753

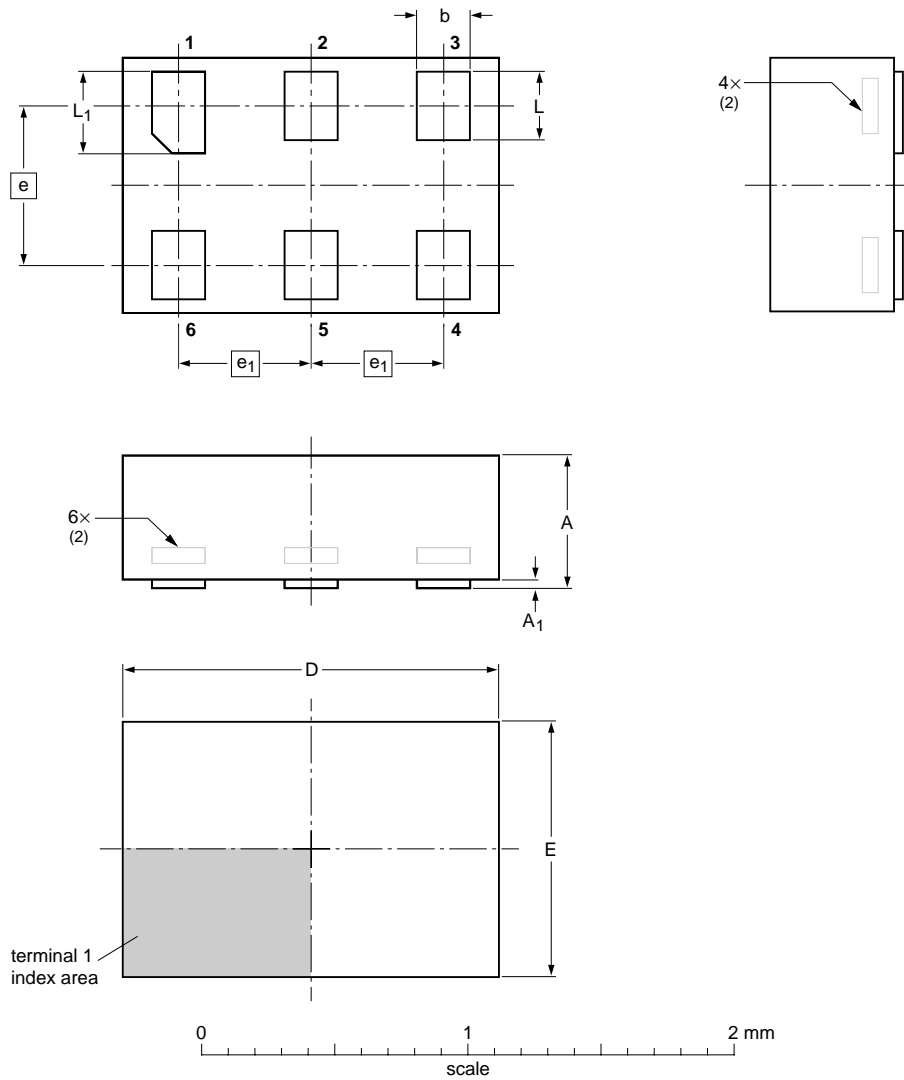


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XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

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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DATA SHEET STATUS

LEVEL	DATA SHEET STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾⁽³⁾	DEFINITION
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Printed in The Netherlands

R20/04/pp15

Date of release: 2004 Sep 08

Document order number: 9397 750 13768

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