

DATA SHEET

74LVC2G38 Dual 2-input NAND gate (open drain)

Product specification
Supersedes data of 2003 Oct 27

2004 Oct 18

Dual 2-input NAND gate (open drain)

74LVC2G38

FEATURES

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant outputs 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 EIA/JESD22-A114-B exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- Open drain outputs
- 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.

DESCRIPTION

The 74LVC2G38 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3 V or 5 V devices. These feature allows the use of these devices as translators 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 74LVC2G38 provides the 2-input NAND function.

The outputs of the 74LVC2G38 devices are open drain and can be connected to other open-drain outputs to implement active-LOW, wired-OR or active-HIGH wired-AND functions.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25$ °C.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PZL}/t_{PLZ}	propagation delay inputs nA and nB to output nY	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k Ω	3.0	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ Ω	1.8	ns
		$V_{CC} = 2.7$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.5	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.1	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.5	ns
C_I	input capacitance		2.5	pF
C_{PD}	power dissipation capacitance per gate	$V_{CC} = 3.3$ V; notes 1 and 2	5	pF

Notes

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

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

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 = number of inputs switching;

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

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

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FUNCTION TABLE

See note 1.

INPUT		OUTPUT
nA	nB	nY
L	L	Z
L	H	Z
H	L	Z
H	H	L

Note

1. H = HIGH voltage level;
L = LOW voltage level;
Z = high-impedance OFF-state.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC2G38DP	-40 °C to +125 °C	8	TSSOP8	plastic	SOT505-2	Y38
74LVC2G38DC	-40 °C to +125 °C	8	VSSOP8	plastic	SOT765-1	Y38
74LVC2G38GM	-40 °C to +125 °C	8	XSON8	plastic	SOT833-1	Y38

PINNING

PIN	SYMBOL	DESCRIPTION
1	1A	data input
2	1B	data input
3	2Y	data output
4	GND	ground (0 V)
5	2A	data input
6	2B	data input
7	1Y	data output
8	V _{CC}	supply voltage

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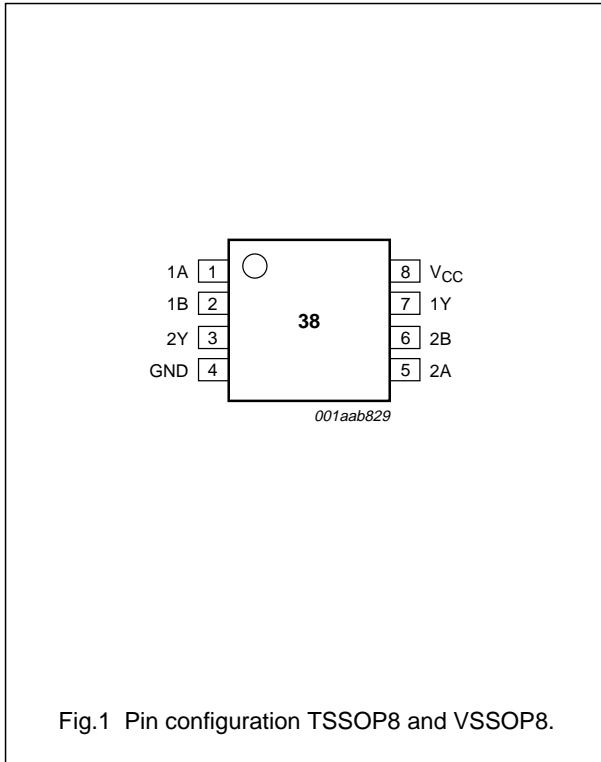


Fig.1 Pin configuration TSSOP8 and VSSOP8.

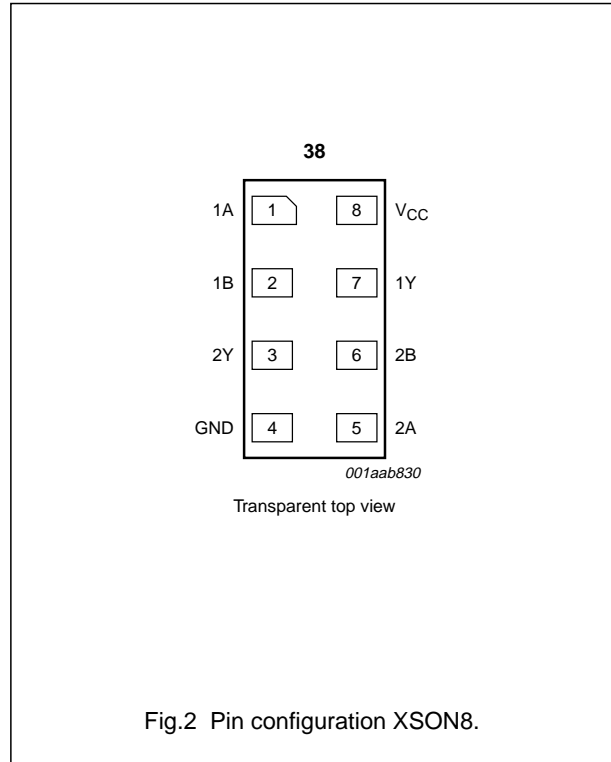


Fig.2 Pin configuration XSON8.

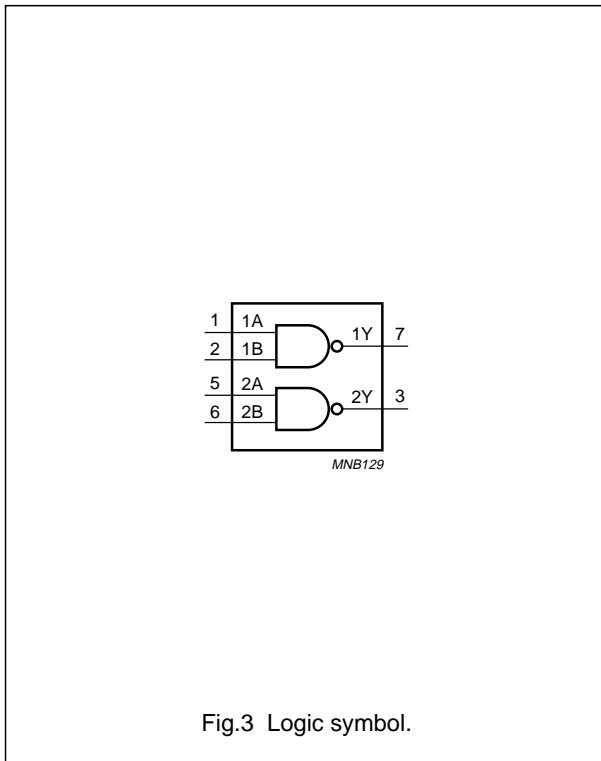


Fig.3 Logic symbol.

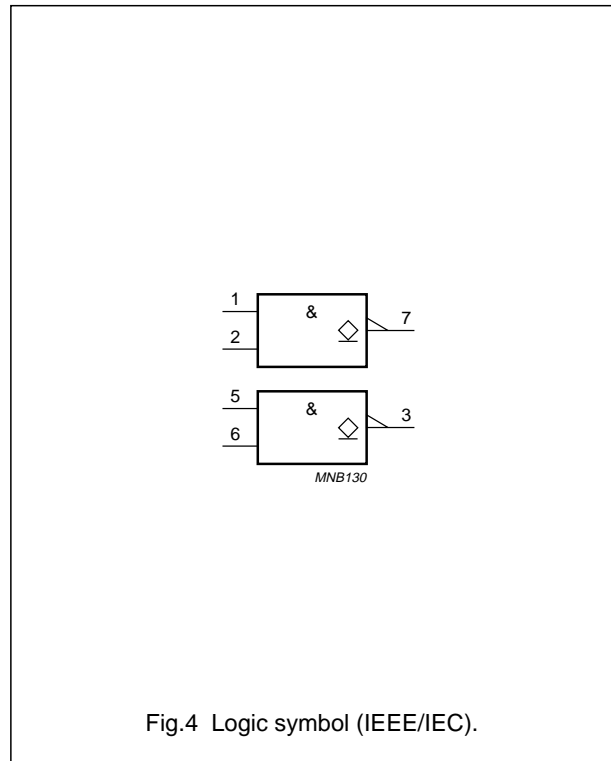
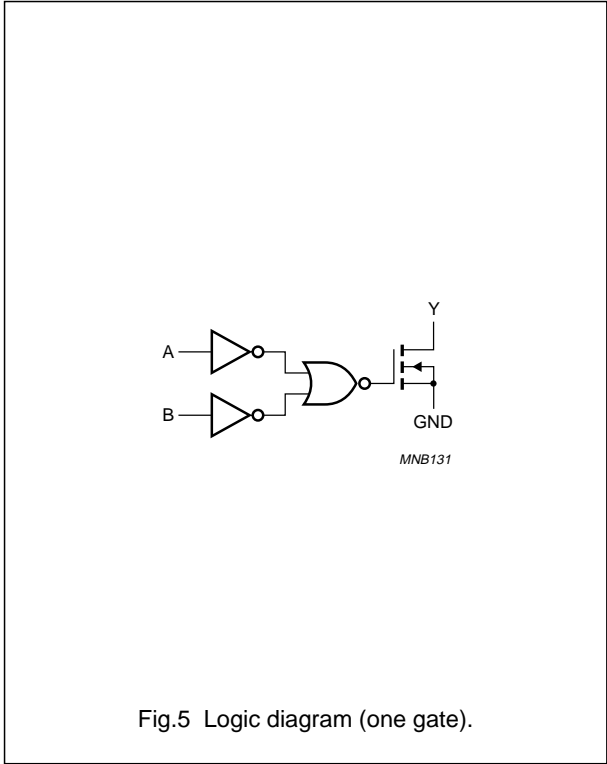


Fig.4 Logic symbol (IEEE/IEC).

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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
		$V_{CC} = 1.65\text{ V to }5.5\text{ V}$; disable mode	0	5.5	V
		$V_{CC} = 0\text{ V}$; Power-down mode	0	5.5	V
T_{amb}	operating ambient temperature		-40	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 1.65\text{ V to }2.7\text{ V}$	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; notes 1 and 2	-0.5	+6.5	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	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_D	power dissipation	$T_{amb} = -40\text{ °C to }+125\text{ °C}$	-	300	mW

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. When $V_{CC} = 0\text{ V}$ (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.	MAX.	UNIT
		OTHER	V _{CC} (V)				
T_{amb} = -40 °C to +85 °C; note 1							
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	1.65 to 5.5	–	–	0.1	V
		I _O = 4 mA	1.65	–	0.08	0.45	V
		I _O = 8 mA	2.3	–	0.14	0.3	V
		I _O = 12 mA	2.7	–	0.19	0.4	V
		I _O = 24 mA	3.0	–	0.37	0.55	V
	I _O = 32 mA	4.5	–	0.43	0.55	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.	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} 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	–	–	0.70	V
			2.3	–	–	0.45	V
			2.7	–	–	0.60	V
			3.0	–	–	0.80	V
			4.5	–	–	0.80	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	5.5	–	–	±20	μA
I _{off}	power OFF leakage current	V _I or V _O = 5.5 V	0	–	–	±20	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	–	–	40	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 T_{amb} = 25 °C.

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AC CHARACTERISTICS

GND = 0 V.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T_{amb} = -40 °C to +85 °C; note 1							
t _{PZL} /t _{PLZ}	propagation delay inputs nA and nB to output nY	see Figs 6 and 7	1.65 to 1.95	1.2	3.0	8.6	ns
			2.3 to 2.7	0.7	1.8	4.8	ns
			2.7	0.7	2.5	4.4	ns
			3.0 to 3.6	0.7	2.1	4.1	ns
			4.5 to 5.5	0.5	1.5	3.3	ns
T_{amb} = -40 °C to +125 °C							
t _{PZL} /t _{PLZ}	propagation delay inputs nA and nB to output nY	see Figs 6 and 7	1.65 to 1.95	1.2	–	10.8	ns
			2.3 to 2.7	0.7	–	6.0	ns
			2.7	0.7	–	5.5	ns
			3.0 to 3.6	0.7	–	5.2	ns
			4.5 to 5.5	0.5	–	4.2	ns

Note

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

AC WAVEFORMS

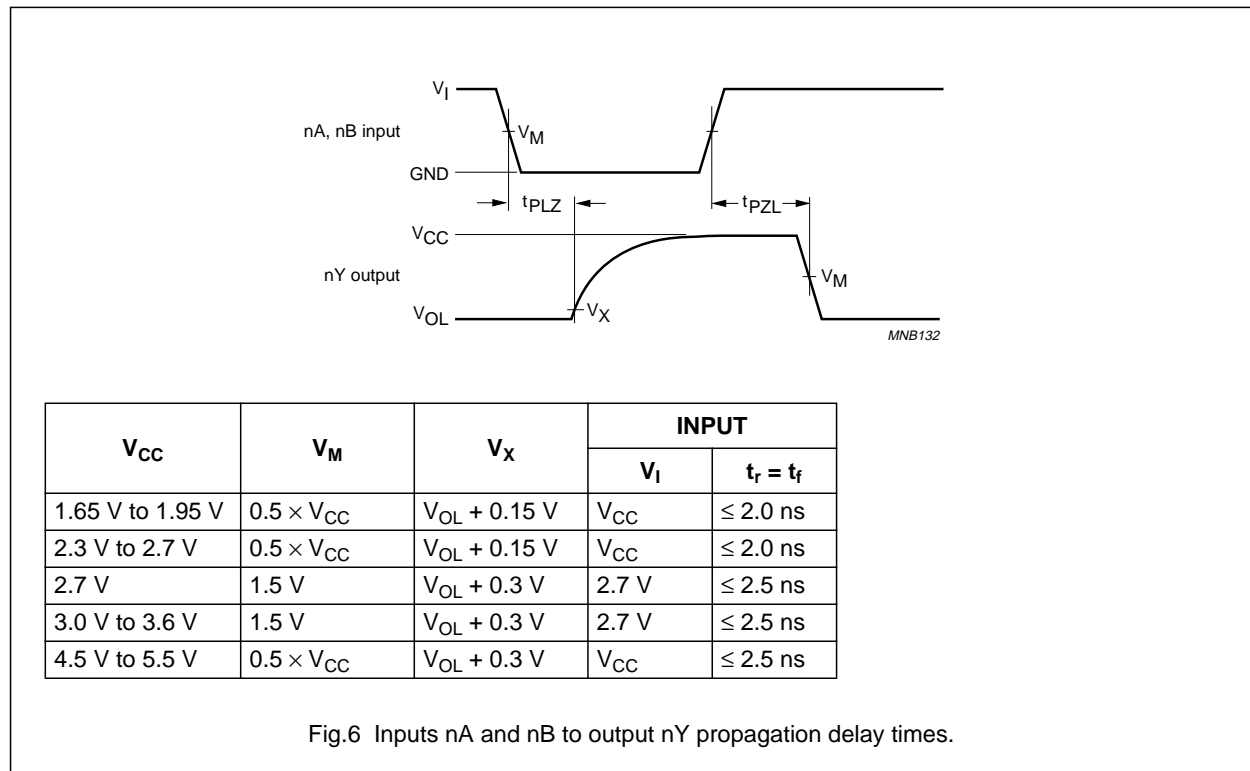
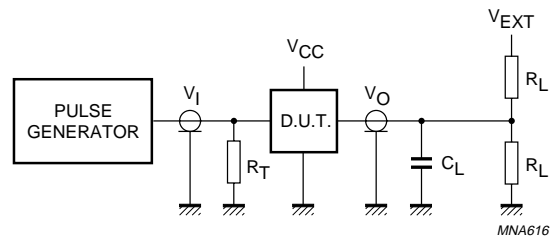


Fig.6 Inputs nA and nB to output nY propagation delay times.

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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 k Ω	open	GND	$2 \times V_{CC}$
2.3 V to 2.7 V	V_{CC}	30 pF	500 Ω	open	GND	$2 \times V_{CC}$
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	$2 \times V_{CC}$

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.

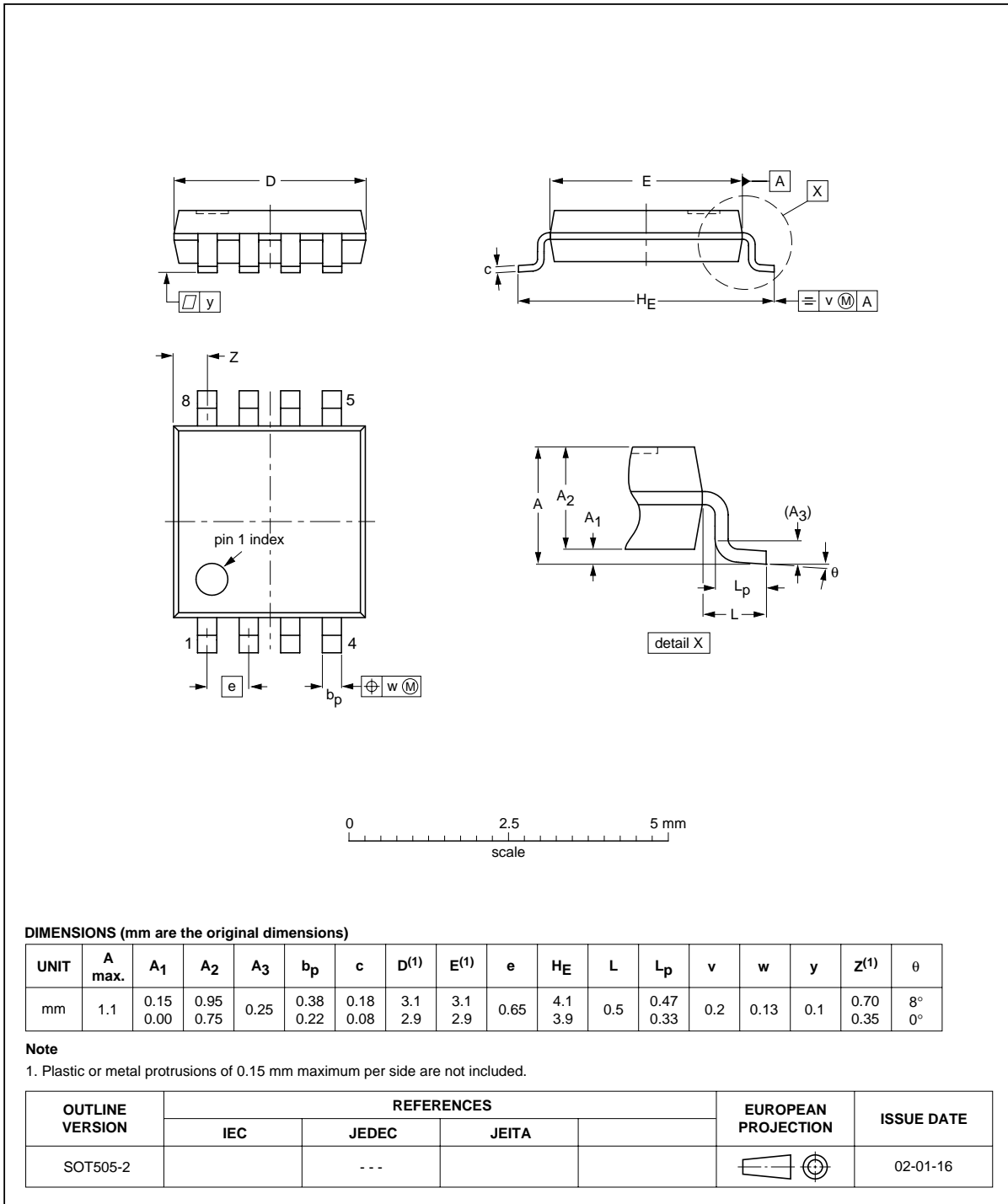
Fig.7 Load circuitry for switching times.

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PACKAGE OUTLINES

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

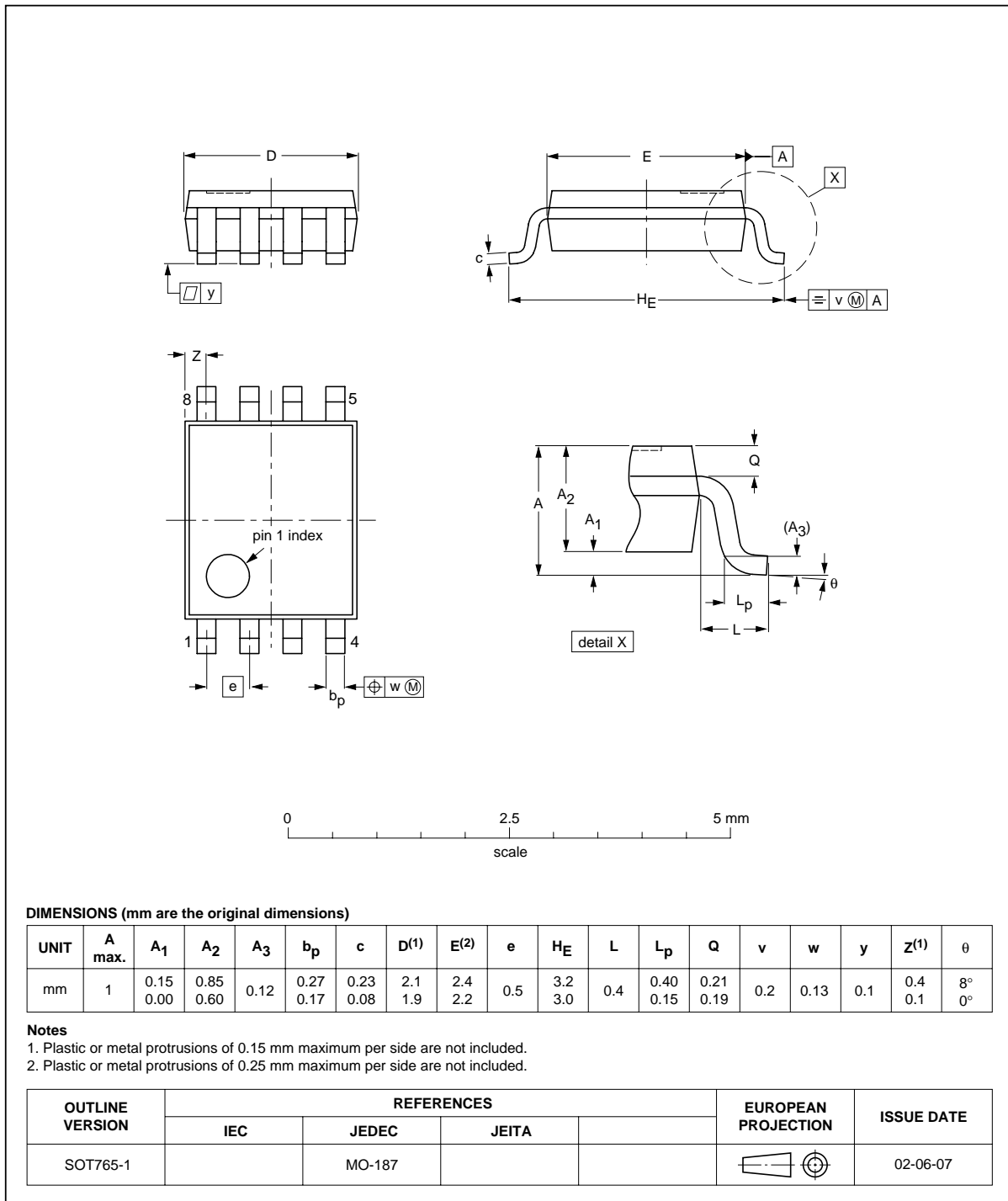


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VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

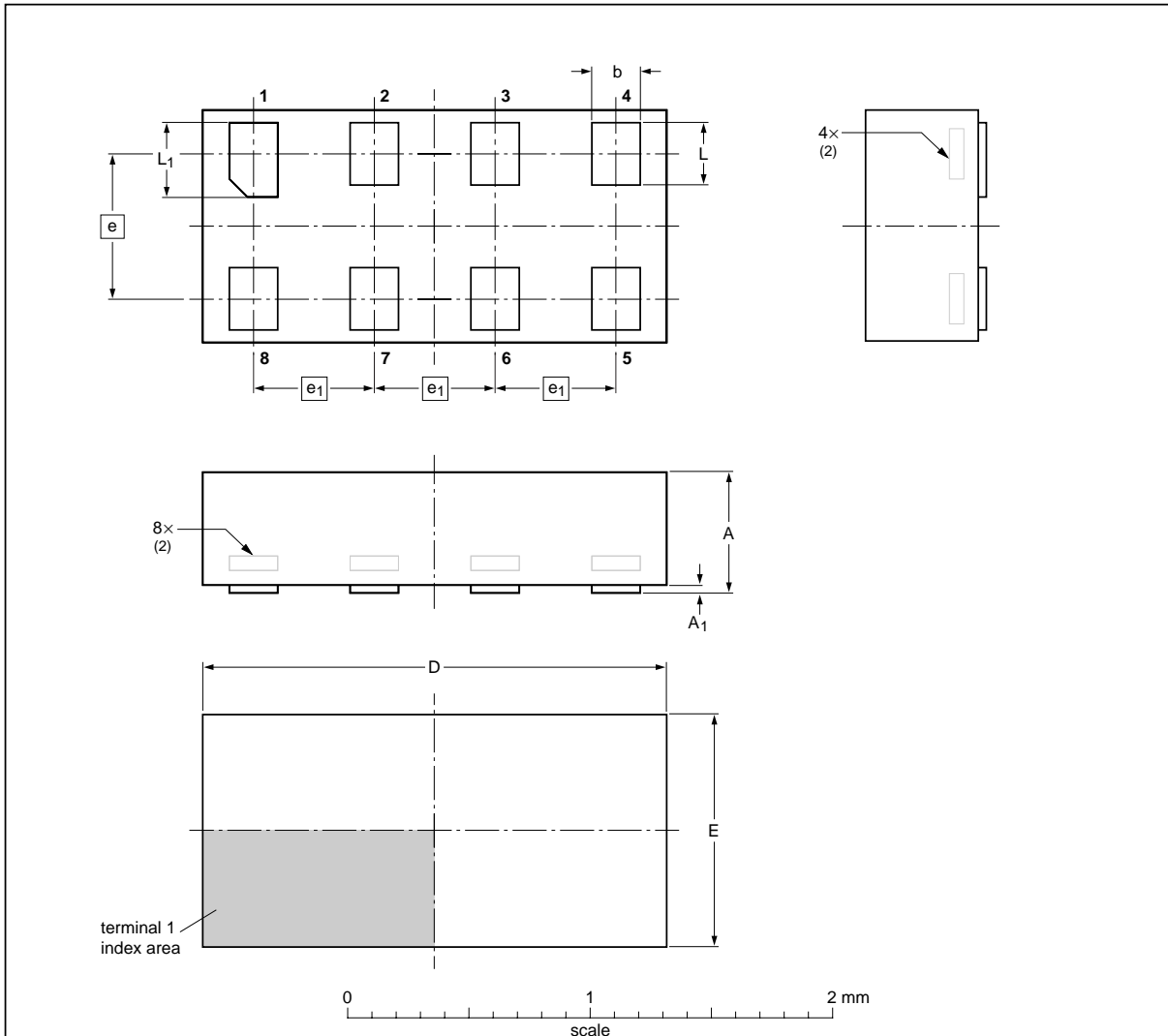


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XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 0.95 x 1.95 x 0.5 mm

SOT833-1



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	2.0 1.9	1.0 0.9	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			
SOT833-1	---	MO-252	---			04-07-15 04-07-22

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