

Quad 2-input NAND Schmitt-trigger

74LV132

FEATURES

- Wide operating voltage: 1.0 to 5.5V
- Optimized for Low Voltage applications: 1.0 to 3.6V
- Accepts TTL input levels between $V_{CC} = 2.7V$ and $V_{CC} = 3.6V$
- Typical V_{OLP} (output ground bounce) $< 0.8V$ @ $V_{CC} = 3.3V$, $T_{amb} = 25^{\circ}C$
- Typical V_{OHV} (output V_{OH} undershoot) $> 2V$ @ $V_{CC} = 3.3V$, $T_{amb} = 25^{\circ}C$
- Output capability: standard
- I_{CC} category: SSI

APPLICATIONS

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

DESCRIPTION

The 74LV132 is a low-voltage Si-gate CMOS device and is pin and function compatible with 74HC/HCT132.

The 74LV132 contains four 2-input NAND gates which accept standard input signals. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The gate switches at different points for positive and negative-going signals. The difference between the positive voltage V_{T+} and the negative voltage V_{T-} is defined as the hysteresis voltage V_H .

QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay $n\bar{A}$, nB to nY	$C_L = 15pF$ $V_{CC} = 3.3V$ $R_{EXT} = 5K\Omega$ $C_{EXT} = 0pF$	10	ns
C_I	Input capacitance		3.5	pF
C_{PD}	Power dissipation capacitance per gate	Notes 1 and 2	24	pF

NOTES:

- C_{PD} is used to determine the dynamic power dissipation (P_D in μW)
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
 f_i = input frequency in MHz; C_L = output load capacity in pF;
 f_o = output frequency in MHz; V_{CC} = supply voltage in V;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.
- The condition is $V_i = GND$ to V_{CC}

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
14-Pin Plastic DIL	$-40^{\circ}C$ to $+125^{\circ}C$	74LV132 N	74LV132 N	SOT27-1
14-Pin Plastic SO	$-40^{\circ}C$ to $+125^{\circ}C$	74LV132 D	74LV132 D	SOT108-1
14-Pin Plastic SSOP Type II	$-40^{\circ}C$ to $+125^{\circ}C$	74LV132 DB	74LV132 DB	SOT337-1
14-Pin Plastic TSSOP Type I	$-40^{\circ}C$ to $+125^{\circ}C$	74LV132 PW	74LV132PW DH	SOT402-1

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PIN CONFIGURATION

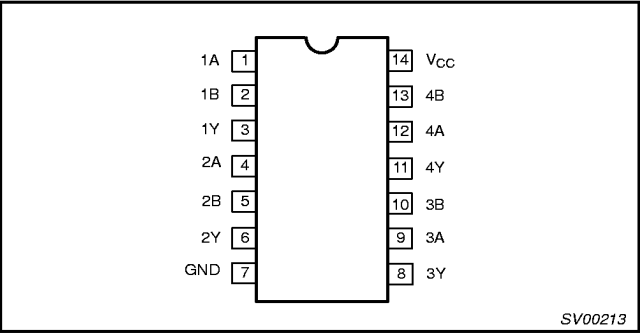


Figure 1. Pin configuration

PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1, 4, 9, 12	1A to 4A	Data inputs
2, 5, 10, 13	1B to 4B	Data inputs
3, 6, 8, 11	1Y to 4Y	Data outputs
7	GND	Ground (0V)
14	V _{CC}	Positive supply voltage

LOGIC SYMBOL (IEEE/IEC)

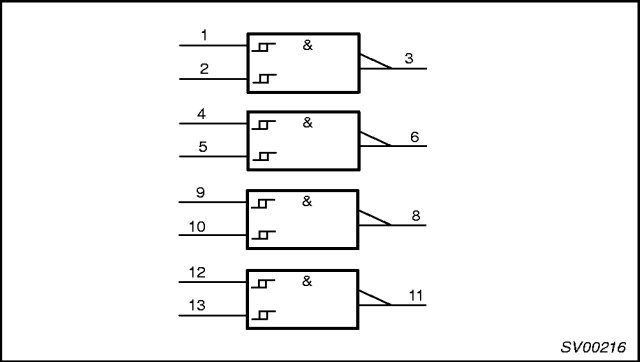


Figure 2. IEC Logic symbol.

LOGIC SYMBOL

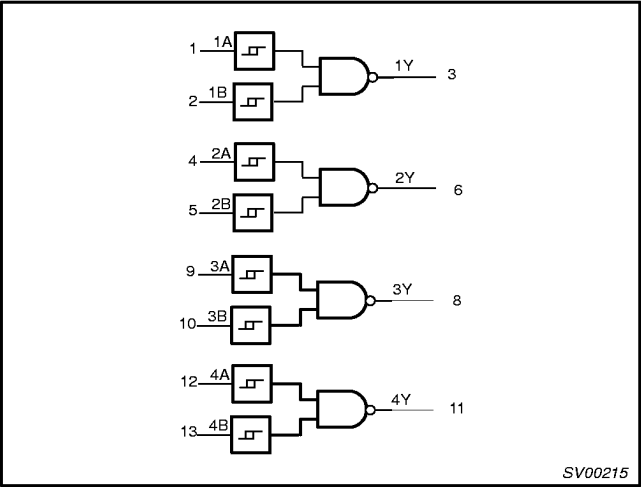


Figure 3. Logic symbol.

LOGIC DIAGRAM

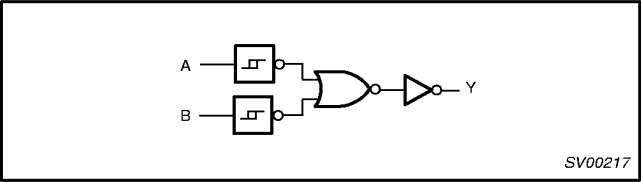


Figure 4. Logic diagram (one Schmitt-trigger)

FUNCTION TABLE

INPUTS		OUTPUT
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

NOTES:
H = HIGH voltage level
L = LOW voltage level

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ABSOLUTE MAXIMUM RATINGS^{1, 2}

In accordance with the Absolute Maximum Rating System (IEC 134).

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

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		−0.5 to +7.0	V
$\pm I_{IK}$	DC input diode current	$V_I < -0.5$ or $V_I > V_{CC} + 0.5V$	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < -0.5$ or $V_O > V_{CC} + 0.5V$	50	mA
$\pm I_O$	DC output source or sink current – standard outputs – bus driver outputs	$-0.5V < V_O < V_{CC} + 0.5V$	25 35	mA
$\pm I_{GND}$, $\pm I_{CC}$	DC V_{CC} or GND current for types with – standard outputs – bus driver outputs		50 70	mA
T_{stg}	Storage temperature range		−65 to +150	°C
P_{TOT}	Power dissipation per package – plastic DIL – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	for temperature range: −40 to +125°C above +70°C derate linearly with 12 mW/K above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	750 500 400	mW

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC}	DC supply voltage	See Note ¹	1.0	3.3	5.5	V
V_I	Input voltage		0	–	V_{CC}	V
V_O	Output voltage		0	–	V_{CC}	V
T_{amb}	Operating ambient temperature range in free air	See DC and AC characteristics per device	−40 −40		+85 +125	°C
t_r, t_f	Input rise and fall times except for Schmitt-trigger inputs	$V_{CC} = 1.0V$ to 2.0V $V_{CC} = 2.0V$ to 2.7V $V_{CC} = 2.7V$ to 3.6V $V_{CC} = 3.6V$ to 5.5V	– – – –	– – – –	500 200 100 50	ns/V

NOTE:

- The LV is guaranteed to function down to $V_{CC} = 1.0V$ (input levels GND or V_{CC}); DC characteristics are guaranteed from $V_{CC} = 1.2V$ to $V_{CC} = 5.5V$.

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DC CHARACTERISTICS FOR THE LV FAMILY

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
			MIN	TYP ¹	MAX	MIN	MAX	
V _{IH}	HIGH level Input voltage	V _{CC} = 1.2V	0.9			0.9		V
		V _{CC} = 2.0V	1.4			1.4		
		V _{CC} = 2.7 to 3.6V	2.0			2.0		
		V _{CC} = 4.5 to 5.5V	0.7 * V _{CC}			0.7 * V _{CC}		
V _{IL}	LOW level Input voltage	V _{CC} = 1.2V			0.3		0.3	V
		V _{CC} = 2.0V			0.6		0.6	
		V _{CC} = 2.7 to 3.6V			0.8		0.8	
		V _{CC} = 4.5 to 5.5			0.3 * V _{CC}		0.3 * V _{CC}	
V _{OH}	HIGH level output voltage; all outputs	V _{CC} = 1.2V; V _I = V _{IH} or V _{IL} ; -I _O = 100µA		1.2				V
		V _{CC} = 2.0V; V _I = V _{IH} or V _{IL} ; -I _O = 100µA	1.8	2.0		1.8		
		V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; -I _O = 100µA	2.5	2.7		2.5		
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; -I _O = 100µA	2.8	3.0		2.8		
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; -I _O = 100µA	4.3	4.5		4.3		
V _{OH}	HIGH level output voltage; STANDARD outputs	V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; -I _O = 6mA	2.40	2.82		2.20		V
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; -I _O = 12mA	3.60	4.20		3.50		
V _{OH}	HIGH level output voltage; BUS driver outputs	V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; -I _O = 8mA	2.40	2.82		2.20		V
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; -I _O = 16mA	3.60	4.20		3.50		
V _{OL}	LOW level output voltage; all outputs	V _{CC} = 1.2V; V _I = V _{IH} or V _{IL} ; I _O = 100µA		0				V
		V _{CC} = 2.0V; V _I = V _{IH} or V _{IL} ; I _O = 100µA		0	0.2		0.2	
		V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = 100µA		0	0.2		0.2	
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 100µA		0	0.2		0.2	
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; I _O = 100µA		0	0.2		0.2	
V _{OL}	LOW level output voltage; STANDARD outputs	V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 6mA		0.25	0.40		0.50	V
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; I _O = 12mA		0.35	0.55		0.65	
V _{OL}	LOW level output voltage; BUS driver outputs	V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 8mA		0.20	0.40		0.50	V
		V _{CC} = 4.5V; V _I = V _{IH} or V _{IL} ; I _O = 16mA		0.35	0.55		0.65	
I _I	Input leakage current	V _{CC} = 5.5V; V _I = V _{CC} or GND			1.0		1.0	µA
I _{OZ}	3-State output OFF-state current	V _{CC} = 5.5V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND			5		10	µA
I _{CC}	Quiescent supply current; SSI	V _{CC} = 5.5V; V _I = V _{CC} or GND; I _O = 0			20.0		40	µA
	Quiescent supply current; flip-flops	V _{CC} = 5.5V; V _I = V _{CC} or GND; I _O = 0			20.0		80	
I _{CC}	Quiescent supply current; MSI	V _{CC} = 5.5V; V _I = V _{CC} or GND; I _O = 0			20.0		160	µA
	Quiescent supply current; LSI	V _{CC} = 5.5V; V _I = V _{CC} or GND; I _O = 0			500		1000	
ΔI _{CC}	Additional quiescent supply current per input	V _{CC} = 2.7V to 3.6V; V _I = V _{CC} - 0.6V			500		850	µA

NOTE:1. All typical values are measured at $T_{amb} = 25^\circ C$.

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TRANSFER CHARACTERISTICS

Voltages are referenced to GND = 0V.

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				−40 to +85°C			−40 to +125°C		
				V _{CC} (V)	MIN	TYP ¹	MAX	MIN	
V _{T+}	Positive going threshold	Figures 5 and 6	1.2	—	0.70	—	—		V
			2.0	0.8	1.10	1.4	0.8	1.4	
			2.7	1.0	1.45	2.0	1.0	2.0	
			3.0	1.2	1.60	2.2	1.2	2.2	
			3.6	1.5	1.95	2.4	1.5	2.4	
			4.5	1.7	2.50	3.2	1.7	3.2	
			5.5	2.1	3.00	3.9	2.1	3.9	
V _{T−}	Negative going threshold	Figures 5 and 6	1.2	—	0.34	—	—	—	V
			2.0	0.3	0.65	0.9	0.3	0.9	
			2.7	0.4	0.90	1.4	0.4	1.4	
			3.0	0.6	1.05	1.5	0.6	1.5	
			3.6	0.8	1.30	1.8	0.8	1.8	
			4.5	0.9	1.60	2.0	0.9	2.0	
			5.5	1.2	2.00	2.6	1.2	2.6	
V _H	Hysteresis (V _{T+} − V _{T−})	Figures 5 and 6	1.2	—	0.30	—	—	—	V
			2.0	0.2	0.55	0.8	0.2	0.8	
			2.7	0.3	0.60	1.1	0.3	1.1	
			3.0	0.4	0.65	1.2	0.4	1.2	
			3.6	0.4	0.70	1.2	0.4	1.2	
			4.5	0.4	0.80	1.4	0.4	1.4	
			5.5	0.6	1.00	1.5	0.6	1.5	

NOTE:

1. Unless otherwise stated, all typical values are at T_{amb} = 25°C.

AC CHARACTERISTICS

GND = 0V; t_r = t_f = 2.5ns; C_L = 50pF; R_L = 1KΩ

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				−40 to +85°C			−40 to +125°C		
			V _{CC} (V)	MIN	TYP ¹	MAX	MIN	MAX	
t _{PHL} /t _{PLH}	Propagation delay nA, nB, to nY	Figure 10	1.2	—	65	—	—	—	ns
			2.0	—	18	34	—	43	
			2.7	—	15	24	—	30	
			3.0 to 3.6	—	12 ²	20	—	25	
			4.5 to 5.5	—	9.0 ³	14	—	17	

NOTES:

1. Unless otherwise stated, all typical values are at T_{amb} = 25°C.2. Typical value measured at V_{CC} = 3.3V.3. Typical value measured at V_{CC} = 5.0V.

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TRANSFER CHARACTERISTIC WAVEFORMS

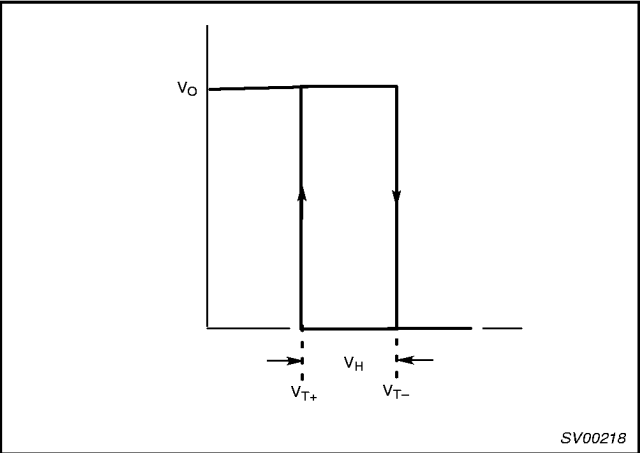


Figure 5. Transfer characteristic.

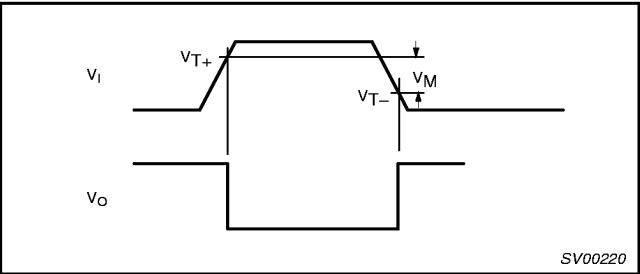


Figure 6. Waveforms showing the definition of V_{T+} , V_{T-} and V_H ; where V_{T+} and V_{T-} are between limits of 20% and 70%.

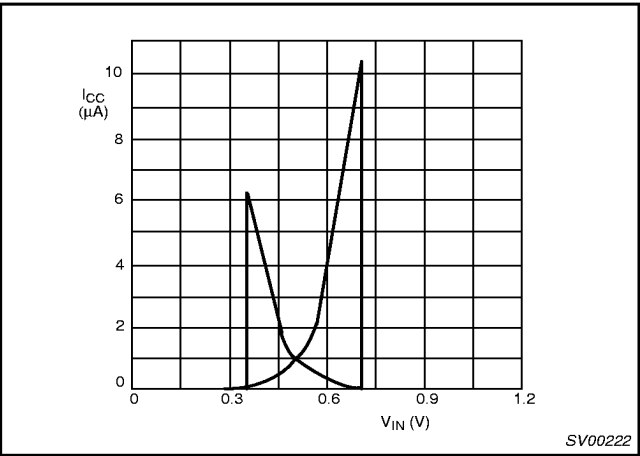


Figure 7. Typical LV132 transfer characteristics; $V_{CC} = 1.2V$.

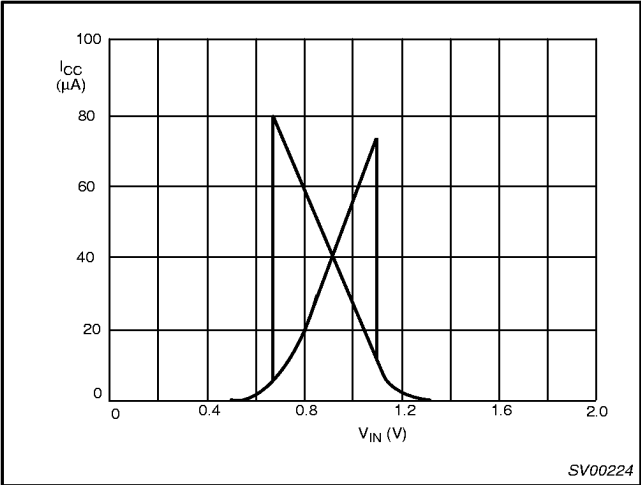


Figure 8. Typical LV132 transfer characteristics; $V_{CC} = 2.0V$.

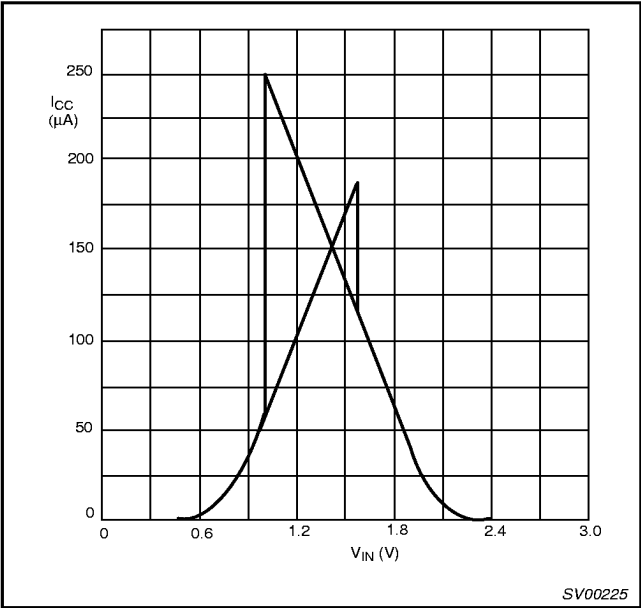


Figure 9. Typical LV132 transfer characteristics; $V_{CC} = 3.0V$.

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AC WAVEFORMS

$V_M = 1.5V$ at $V_{CC} \geq 2.7V \leq 3.6V$
 $V_M = 0.5V * V_{CC}$ at $V_{CC} < 2.7V$ and $\geq 4.5V$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

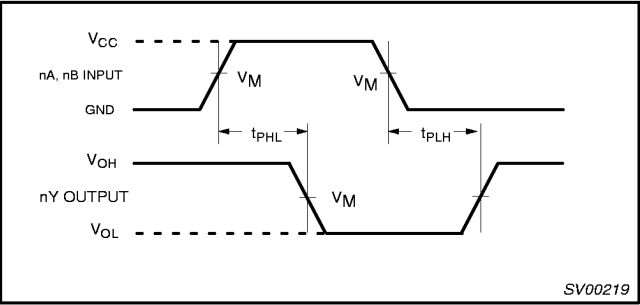


Figure 10. Waveforms showing the input (nA, nB) to output (nY) propagation delays.

TEST CIRCUIT

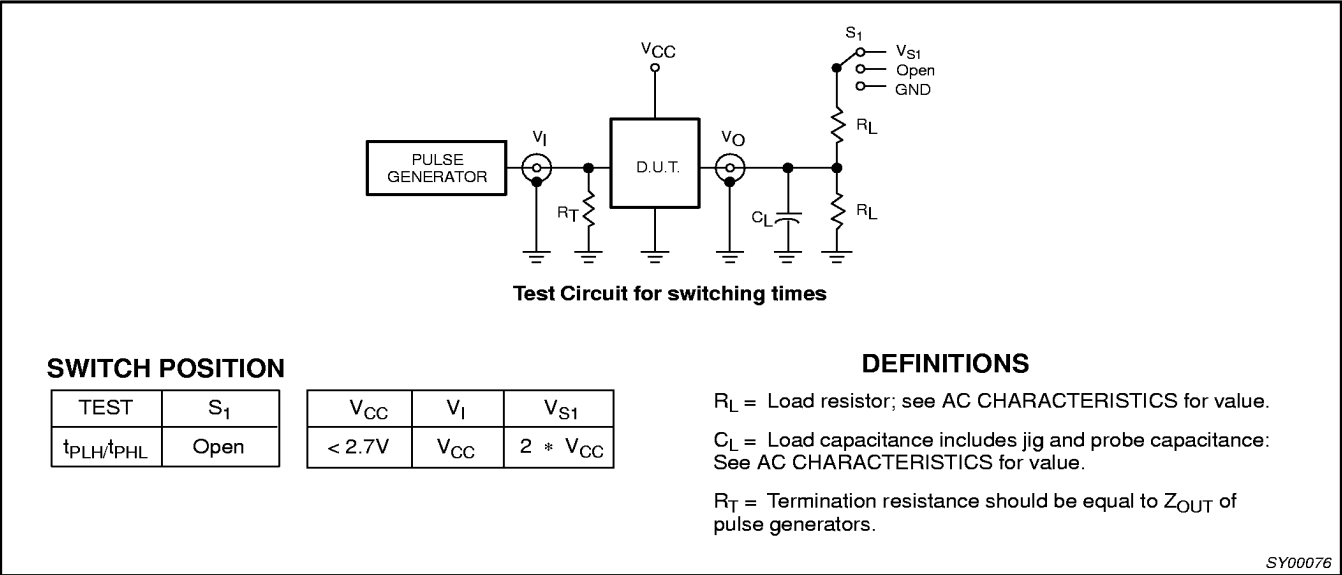


Figure 11. Load circuitry for switching times

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APPLICATION INFORMATION

All values given are typical unless otherwise specified.

The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$$P_{ad} = f_i \times (t_r \times I_{CCa} + t_f \times I_{CCa}) \times V_{CC}$$

WHERE:

P_{ad} = additional power dissipation (μW)

f_i = input frequency (MHz)

t_r = input rise time (ns); 10% – 90%

t_f = input fall time (ns); 10% – 90%

I_{CCa} = average additional supply current (μA)

Average I_{CCa} differs with positive or negative input transitions, as shown in fig.12.

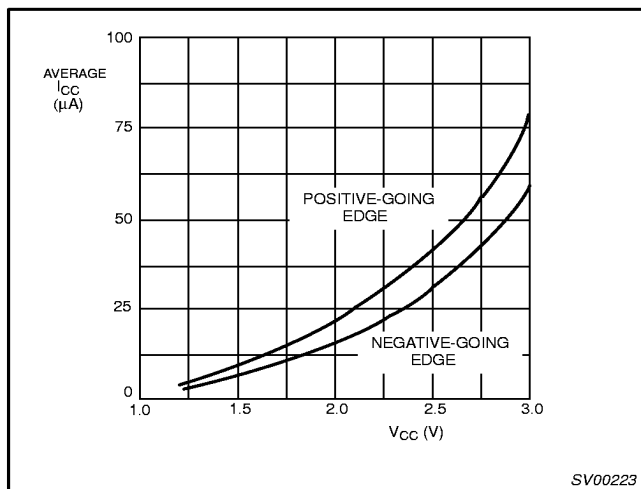


Figure 12. Average I_{CC} for LV Schmitt-trigger devices; linear change of V_i between $0.1 V_{CC}$ to $0.9 V_{CC}$.

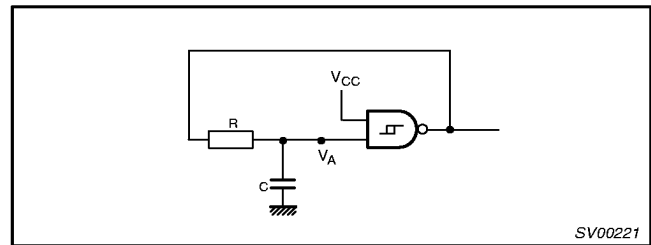


Figure 13. Relaxation oscillator using the LV132

NOTE:

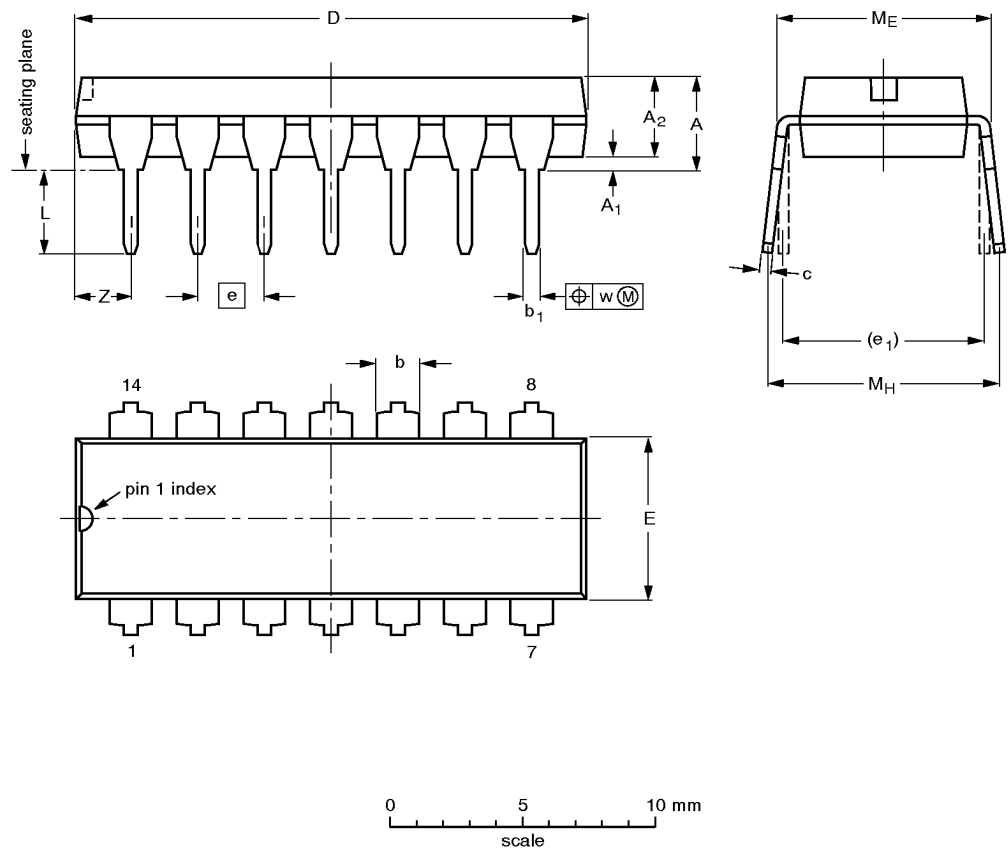
$$f = \frac{1}{T} = \frac{1}{0.8RC}$$

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DIP14: plastic dual in-line package; 14 leads (300 mil)

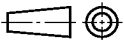
SOT27-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.020	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

Note
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

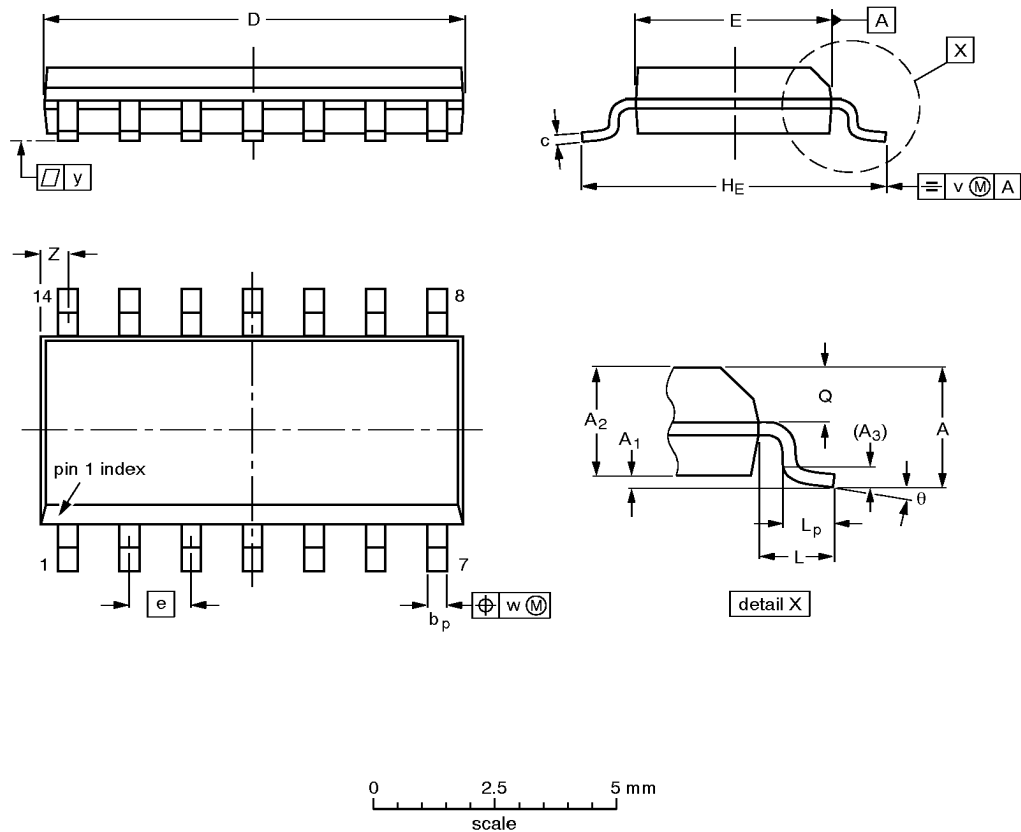
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT27-1	050G04	MO-001AA				92-11-17 95-03-11

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SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A _{max.}	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.35 0.34	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

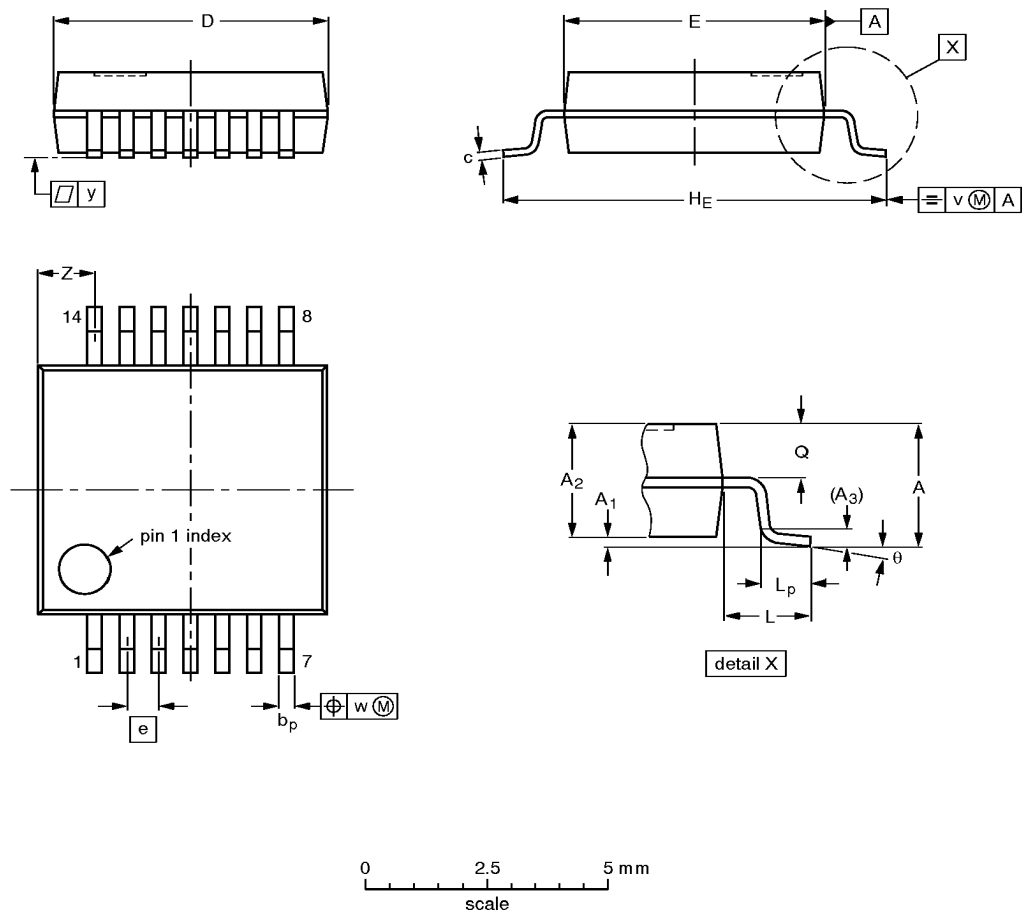
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT108-1	076E06S	MS-012AB				91-08-13 95-01-23

Quad 2-input NAND Schmitt-trigger

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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



DIMENSIONS (mm are the original dimensions)

UNIT	A _{max.}	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

Note
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

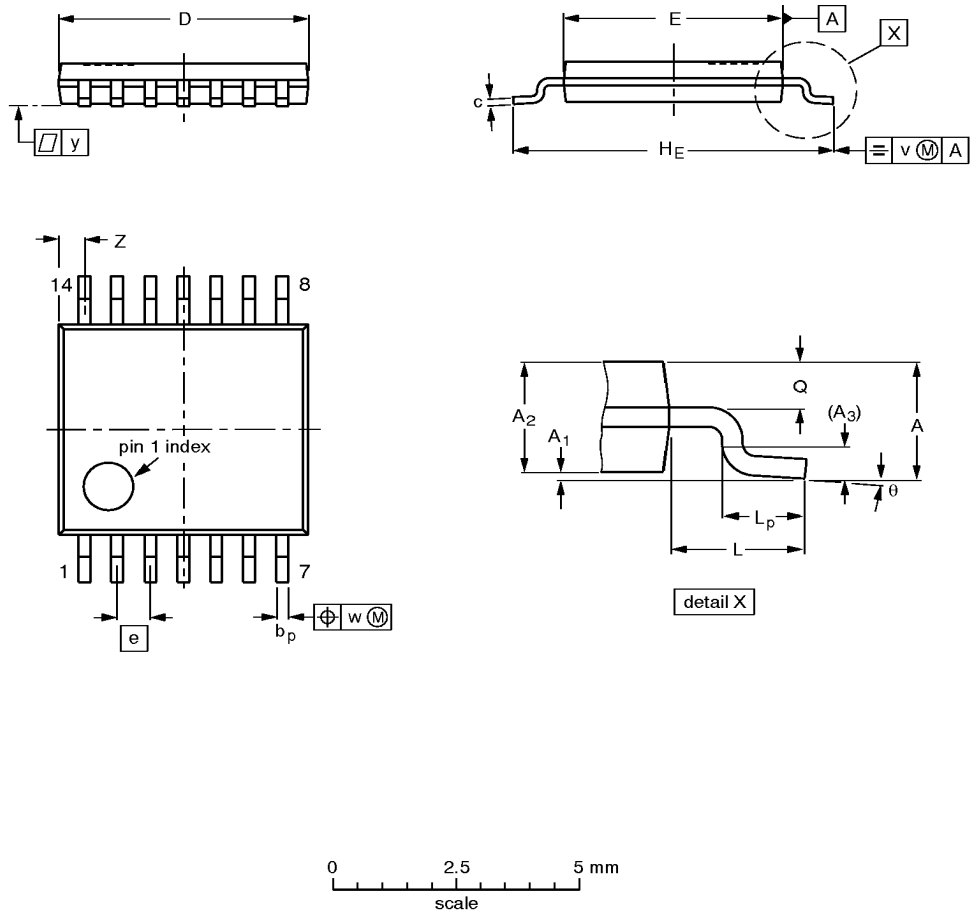
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT337-1		MO-150AB				95-02-04 96-01-18

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TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-153				94-07-12- 95-04-04