

DATA SHEET

74LV423

Dual retriggerable monostable
multivibrator with reset

Product specification

1997 Feb 04

IC24 Data Handbook

Dual retriggerable monostable multivibrator with reset

74LV423

FEATURES

- Optimized for Low Voltage applications: 1.0 to 5.5V
- 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) $> 2V$ @ $V_{CC} = 3.3V$, $T_{amb} = 25^{\circ}C$
- DC triggered from active HIGH or active LOW inputs
- Retriggerable for very long pulses up to 100% duty factor
- Direct reset terminates output pulses
- Schmitt-trigger action on all inputs except for the reset input
- Output capability: standard (except for nR_{EXT}/C_{EXT})
- I_{CC} category: MSI

DESCRIPTION

The 74LV423 is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC/HCT423.

The 74LV423 is a dual retriggerable monostable multivibrator with output pulse width control by three methods. The basic pulse time is programmed by selection of an external resistor (R_{EXT}) and capacitor (C_{EXT}). They are normally connected as shown in Figure 1. Once triggered, the basic output pulse width may be extended by retriggering the gated active LOW-going edge input ($n\bar{A}$) or the active HIGH-going edge input (nB). By repeating this process, the output pulse period ($nQ = HIGH$, $n\bar{Q} = LOW$) can be made as long as desired. Alternatively, an output delay can be terminated at any time by a LOW-going edge on input $n\bar{R}_D$, which also inhibits the triggering. Figures 2 and 3 illustrate pulse control by retriggering and early reset. The basic output pulse width is essentially determined by the values of the external timing components R_{EXT} and C_{EXT} . For pulse width when $C_{EXT} < 10000pF$, see Figure 6. When $C_{EXT} > 10,000pF$, the typical output pulse width is defined as: $t_W = 0.45 \times R_{EXT} \times C_{EXT}$ (typ.), where t_W = pulse width in ns; R_{EXT} = external resistor in $K\Omega$; and C_{EXT} = external capacitor in pF. Schmitt-trigger action in the $n\bar{A}$ and nB inputs makes the circuit highly tolerant of slower input rise and fall times.

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 nQ , $n\bar{Q}$ $n\bar{R}_D$ to nQ , $n\bar{Q}$	$C_L = 15pF$ $V_{CC} = 3.3V$ $R_{EXT} = 5K\Omega$ $C_{EXT} = 0pF$	16 13	ns ns
C_I	Input capacitance		3.5	pF
C_{PD}	Power dissipation capacitance per flip-flop	$V_{CC} = 3.3V$, $V_I = GND$ to V_{CC}^1	17	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.

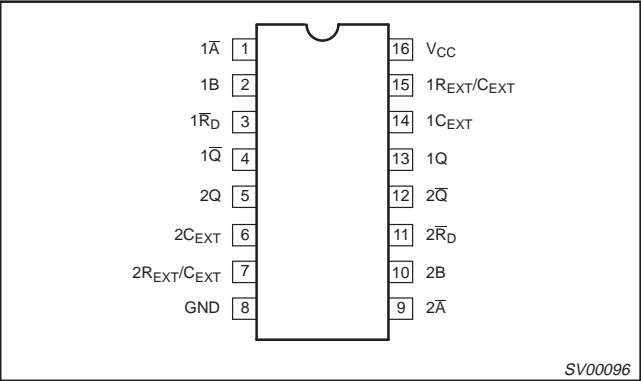
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
16-Pin Plastic DIL	$-40^{\circ}C$ to $+125^{\circ}C$	74LV423 N	74LV423 N	SOT38-1
16-Pin Plastic SO	$-40^{\circ}C$ to $+125^{\circ}C$	74LV423 D	74LV423 D	SOT109-1
16-Pin Plastic SSOP Type II	$-40^{\circ}C$ to $+125^{\circ}C$	74LV423 DB	74LV423 DB	SOT338-1
16-Pin Plastic TSSOP Type I	$-40^{\circ}C$ to $+125^{\circ}C$	74LV423 PW	74LV423PW DH	SOT403-1

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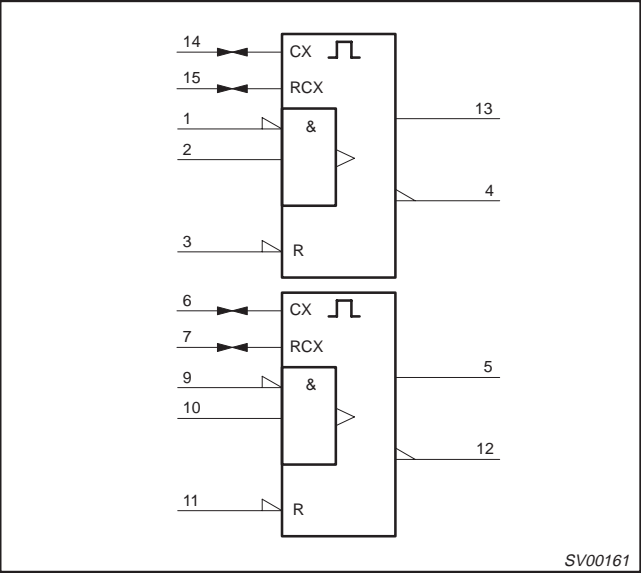
PIN CONFIGURATION



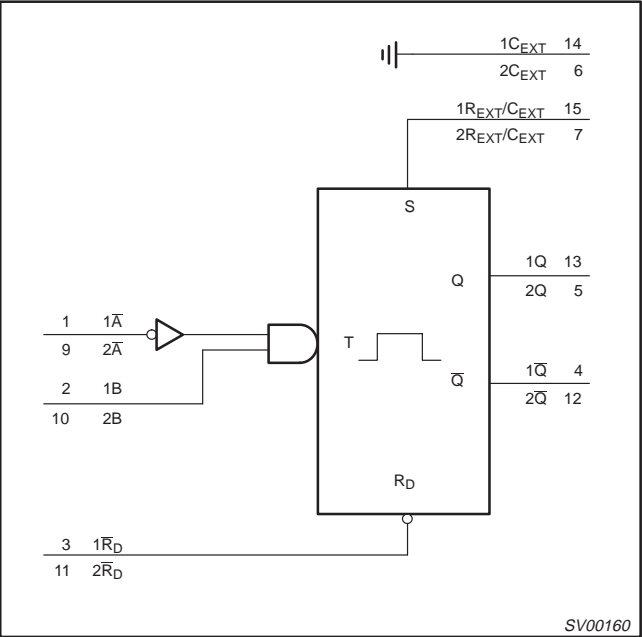
PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1,9	1A, 2A	Trigger inputs (negative-edge triggered)
2,10	1B, 2B	Trigger inputs (positive-edge triggered)
3,11	1RD, 2RD	Direct reset LOW
4, 12	1Q, 2Q	Outputs (active LOW)
7	2REXT/CEXT	External resistor/capacitor connection
8	GND	Ground (0V)
13, 5	1Q, 2Q	Outputs (active HIGH)
14, 6	1CEXT, 2CEXT	External capacitor connection
15	1REXT/CEXT	External resistor/capacitor connection
16	VCC	Positive supply voltage

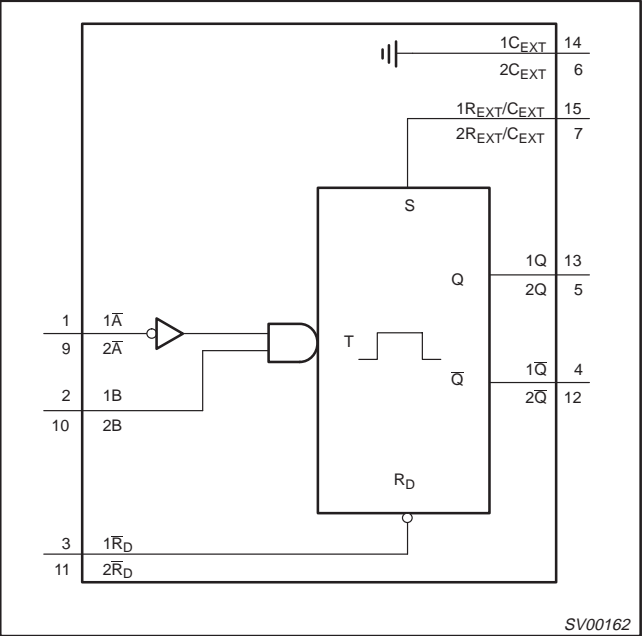
LOGIC SYMBOL (IEEE/IEC)



LOGIC SYMBOL



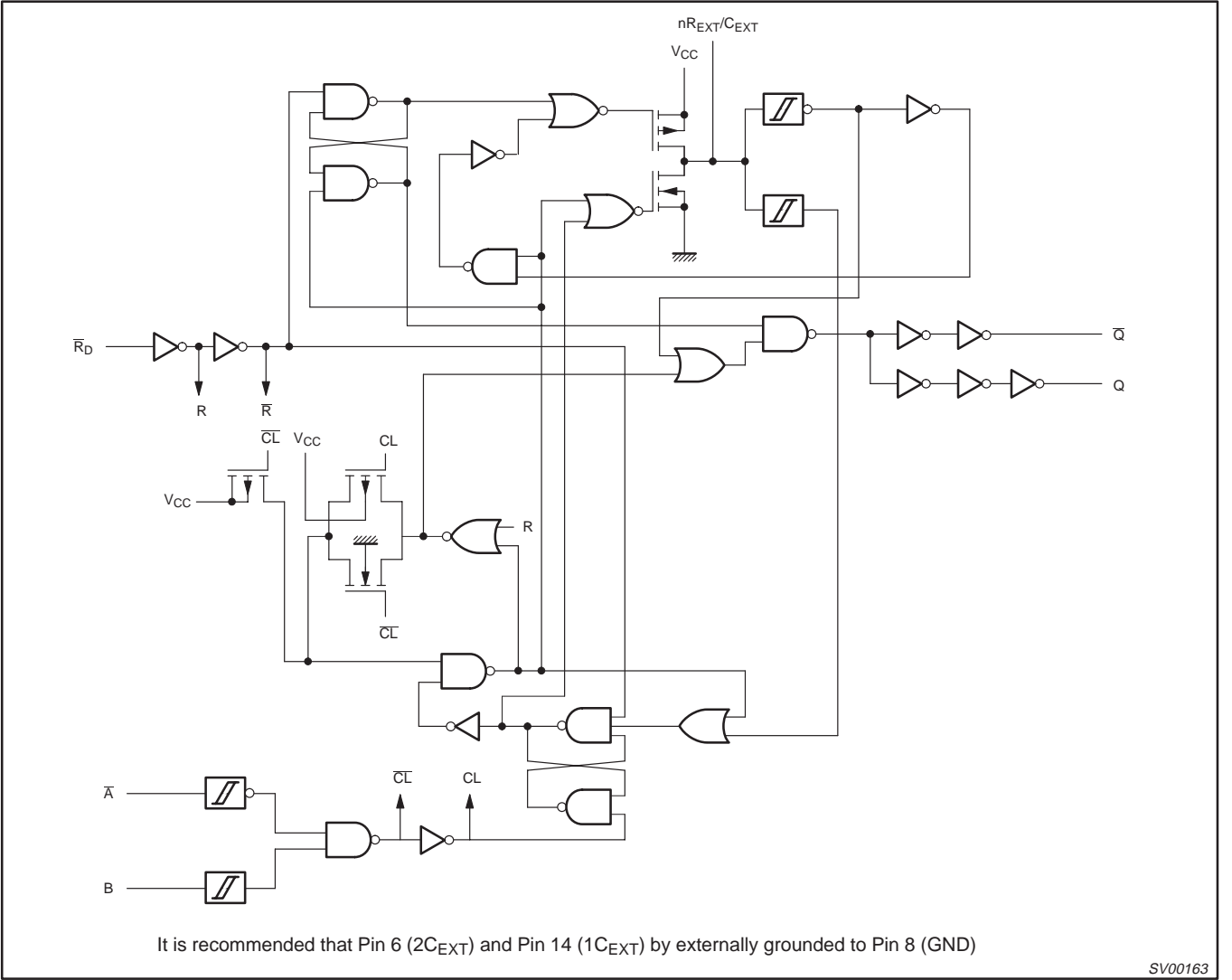
FUNCTIONAL DIAGRAM



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LOGIC DIAGRAM

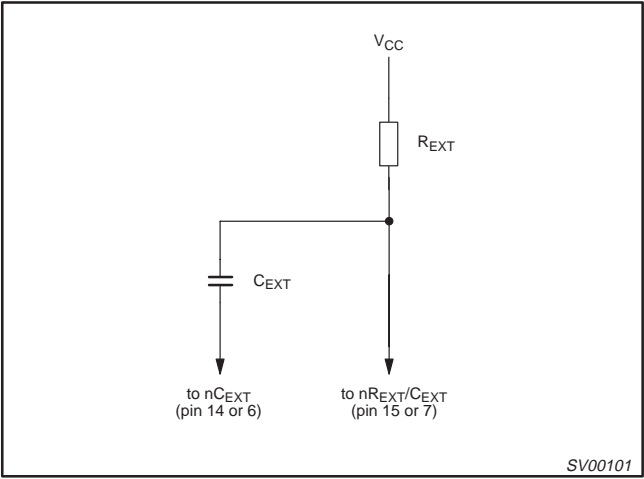


FUNCTION TABLE

INPUTS			OUTPUTS	
nRD	nA	nB	nQ	nQ
L	X	X	L	H
X	H	X	L *	H *
X	X	L	L *	H *
H	L	↑	⬆	⬆
H	↓	H	⬆	⬆

NOTES:

- * If the monostable was triggered before this condition was established, the pulse will continue as programmed.
- H = HIGH voltage level
- L = LOW voltage level
- X = don't care
- ↑ = LOW-to-HIGH transition
- ↓ = HIGH-to-LOW transition
- ⬆ = one HIGH level output pulse
- ⬆ = one LOW level output pulse



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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	750 500 500	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	1.2	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 ELECTRICAL CHARACTERISTICS

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	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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AC CHARACTERISTICS

GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 1\text{k}\Omega$

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}	Propagation delay nR _D , nA, nB, to nQ	Figure 4 C _{EXT} = 0pF R _{EXT} = 5kΩ	1.2		150				ns
			2.0		51	95		116	
			2.7		38	70		85	
			3.0 to 3.6		30 ²	56		68	
			4.5 to 5.5		20 ³	38		45	
t _{PLH}	Propagation delay nR _D , nA, nB, to nQ	Figure 4 C _{EXT} = 0pF R _{EXT} = 5kΩ	1.2		150				ns
			2.0		51	95		116	
			2.7		38	70		85	
			3.0 to 3.6		30 ²	56		68	
			4.5 to 5.5		20 ³	38		45	
t _{PHL}	Propagation delay nR _D to nQ (reset)	Figure 4 C _{EXT} = 0pF R _{EXT} = 5kΩ	1.2		120				ns
			2.0		41	77		92	
			2.7		30	56		68	
			3.0 to 3.6		24 ²	45		54	
			4.5 to 5.5		18 ³	34		41	
t _{PLH}	Propagation delay nR _D to nQ (reset)	Figure 4 C _{EXT} = 0pF R _{EXT} = 5kΩ	1.2		120				ns
			2.0		41	77		92	
			2.7		30	56		68	
			3.0 to 3.6		24 ²	45		54	
			4.5 to 5.5		18 ³	34		41	
t _W	Trigger pulse width nA = LOW	Figure 4	2.0	30			40		ns
			2.7	25			30		
			3.0 to 3.6	20			25		
			4.5 to 5.5	15			20		
t _W	Trigger pulse width nB = HIGH	Figure 4	2.0	30			40		ns
			2.7	25			30		
			3.0 to 3.6	20	6 ²		25		
			4.5 to 5.5	15			20		
t _W	Reset pulse width nR _D = LOW	Figure 3	2.0	36					ns
			2.7	30			40		
			3.0 to 3.6	25			30		
			4.5 to 5.5	20			25		
t _W	Output pulse width nQ = HIGH nQ = LOW	Figures 2, 3	2.0						μs
			2.7						
			3.0 to 3.6		450 ²				
			4.5 to 5.5						
t _W	Output pulse width nQ = HIGH nQ = LOW	Figures 2, 3	2.0						ns
			2.7						
			3.0 to 3.6		75 ²				
			4.5 to 5.5						
t _{rt}	Retrigger time nA, nB	Figure 2	2.0						ns
			2.7						
			3.0 to 3.6		30 ²				
			4.5 to 5.5						

NOTES ON FOLLOWING PAGE

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AC CHARACTERISTICS (Continued)

GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 1\text{k}\Omega$

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				−40 to +85 °C			−40 to +125 °C		
			V _{CC} (V)	MIN	TYP ¹	MAX	MIN	MAX	
R _{EXT}	External timing resistor	Figure 6	1.2	20		1000			kΩ
			2.0	5		1000			
			2.7	5		1000			
			3.0 to 3.6	2		1000			
			4.5 to 5.5	2		1000			
C _{EXT}	External timing capacitor	Figure 6 ³	2.0	No limits					pF
			2.7						
			3.0 to 3.6						
			4.5 to 5.5						

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.
4. For other R_{EXT} and C_{EXT} combinations see Figure 6.
if C_{EXT} > 10 nF, the next formula is valid:
 $t_W = K \times R_{EXT} \times C_{EXT}$ (typ.)
where, t_W = output pulse width in ns;
R_{EXT} = external resistor in kΩ; C_{EXT} = external capacitor in pF;
K = constant = 0.45 for V_{CC} = 5.0V and 0.48 for V_{CC} = 2.0V.
The inherent test jig and pin capacitance at pins 15 and 7 (nR_{EXT}/C_{EXT}) is approximately 7 pF.
5. The time to retrigger the monostable multivibrator depends on the values of R_{EXT} and C_{EXT}.
The output pulse width will only be extended when the time between the active-going edges of the trigger pulses meets the minimum retrigger time.
If C_{EXT} > 10 pF, the next formula (at V_{CC} = 5.0V) for the set-up time of a retrigger pulse is valid:
 $t_{rt} = 30 + 0.19R \times C^{-9} + 13 \times R^{1.05}$ (typ.)
where, t_{rt} = retrigger time in ns;
C_{EXT} = external capacitor in pF;
R_{EXT} = external resistor in kΩ.
The inherent test jig and pin capacitance at pins 15 and 7 (nR_{EXT}/C_{EXT}) is approximately 7 pF.
6. When the device is powered up, initiate the device via a reset pulse, when C_{EXT} < 50pF.

AC WAVEFORMS

V_M = 1.5V at V_{CC} ≥ 2.7V; V_M = 0.5 V_{CC} at V_{CC} < 2.7V.
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

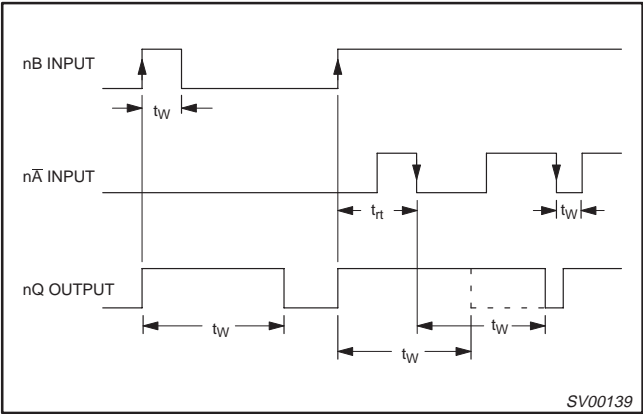


Figure 2. Output pulse control using retrigger pulse;
nR_D = HIGH.

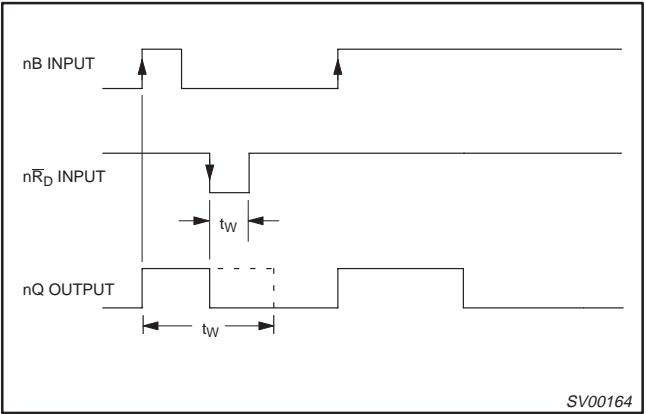
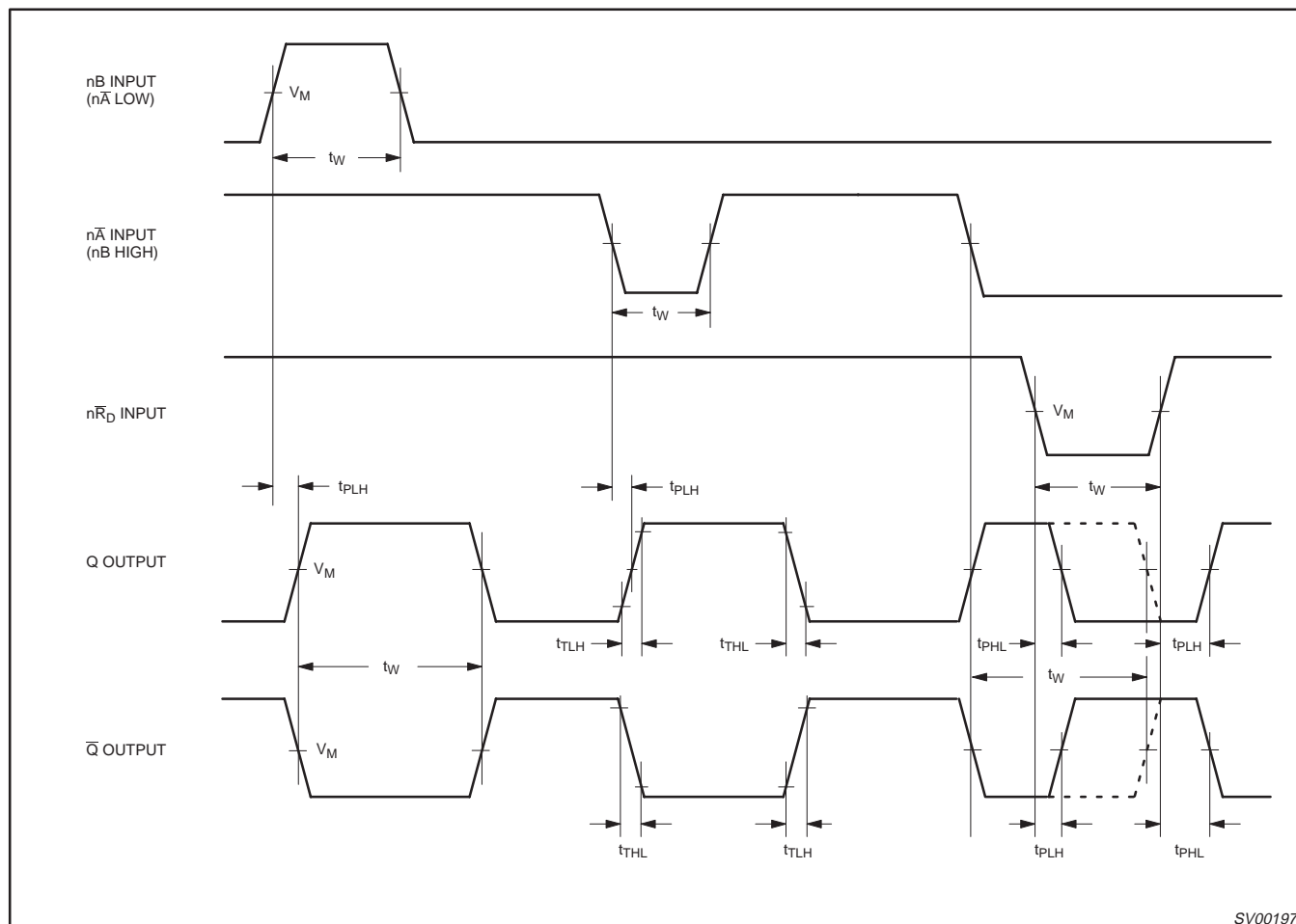


Figure 3. Output pulse control using reset input nR_D;
nA = LOW.

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SV00197

Figure 4. Waveforms showing the input ($n\bar{A}$, nB , $n\bar{R}_D$) to output (nQ , $n\bar{Q}$) propagation delays, the output transition times, and the input and output pulse widths.

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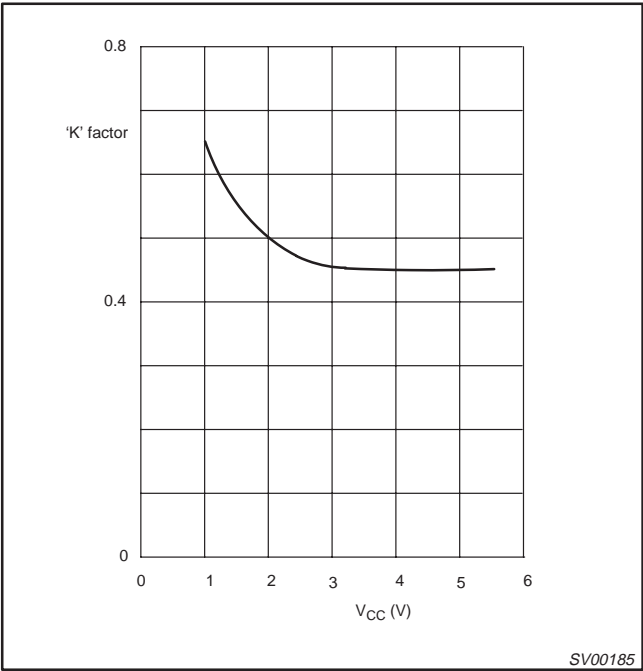


Figure 5. HCT typical "k" factor as a function of V_{CC};
C_X = 10 nF; R_X = 10 kΩ to 100 kΩ.

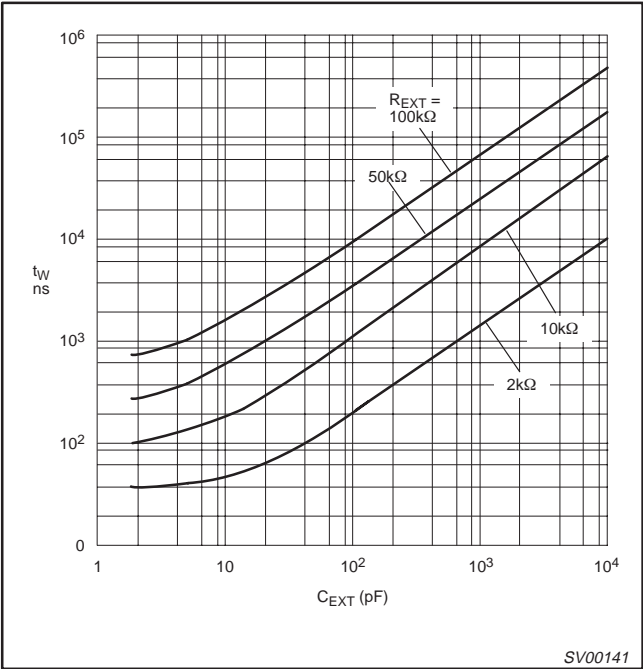


Figure 6. Typical output pulse width as a function of the
external capacitor values at V_{CC} = 3.3V and T_{amb} = 25°C.

APPLICATION INFORMATION

Power-up considerations

When the monostable is powered-up it may produce an output pulse, with a pulse width defined by the values of R_X and C_X, this output pulse can be eliminated using the circuit shown in Figure 7.

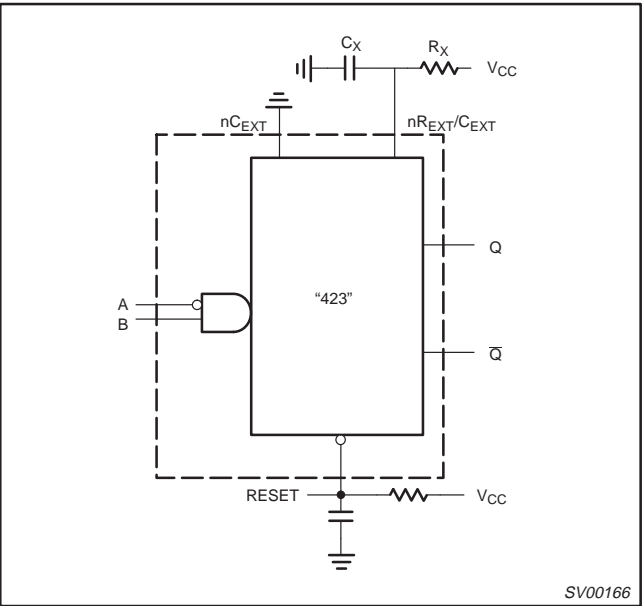


Figure 7. Power-up output pulse elimination circuit

Power-down considerations

A large capacitor (C_X) may cause problems when powering-down the monostable due to the energy stored in this capacitor. When a system containing this device is power-down or a rapid decrease of V_{CC} to zero occurs, the monostable may sustain damage, due to the capacitor discharging through the input protection diodes. To avoid this possibility, use a damping diode (D_X) preferably a germanium or Schottky type diode able to withstand large current surges and connect as shown in Figure 8.

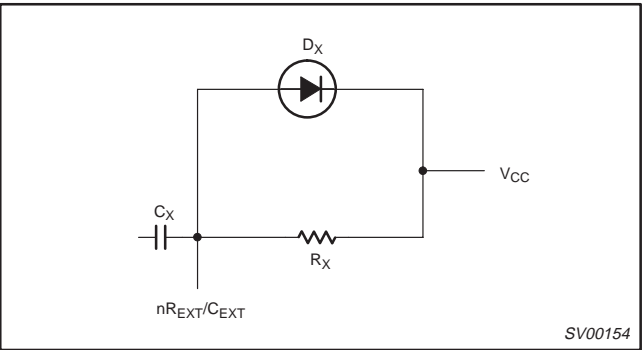


Figure 8. Power-down protection circuit

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TEST CIRCUIT

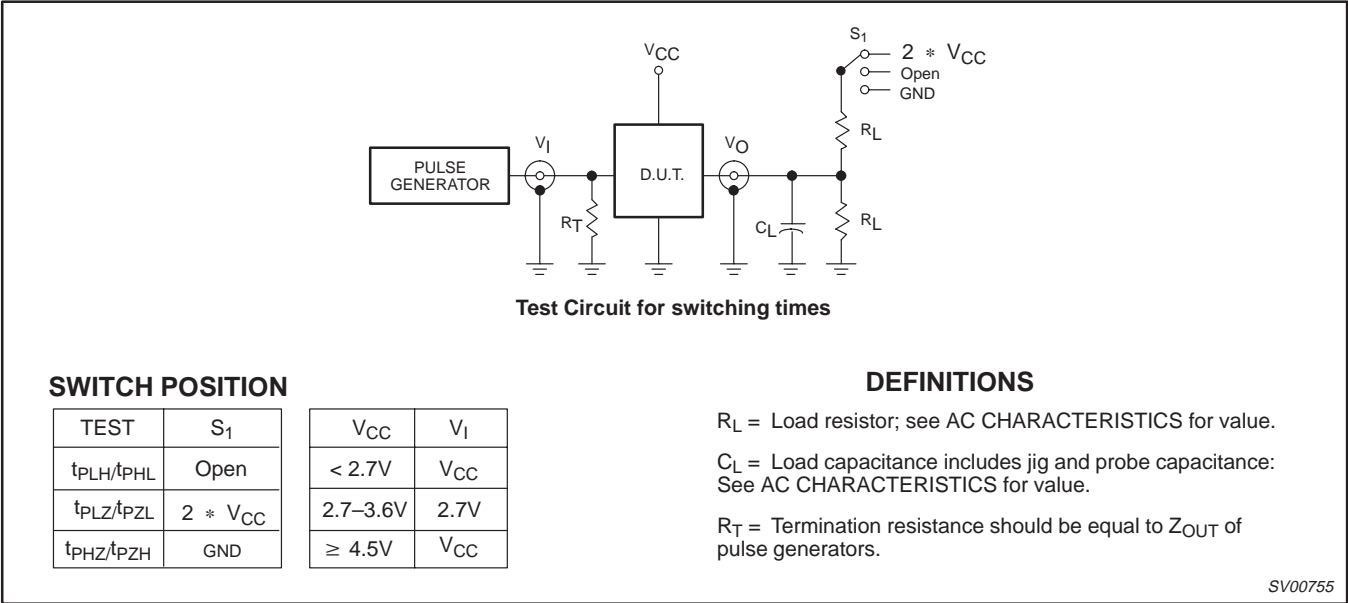


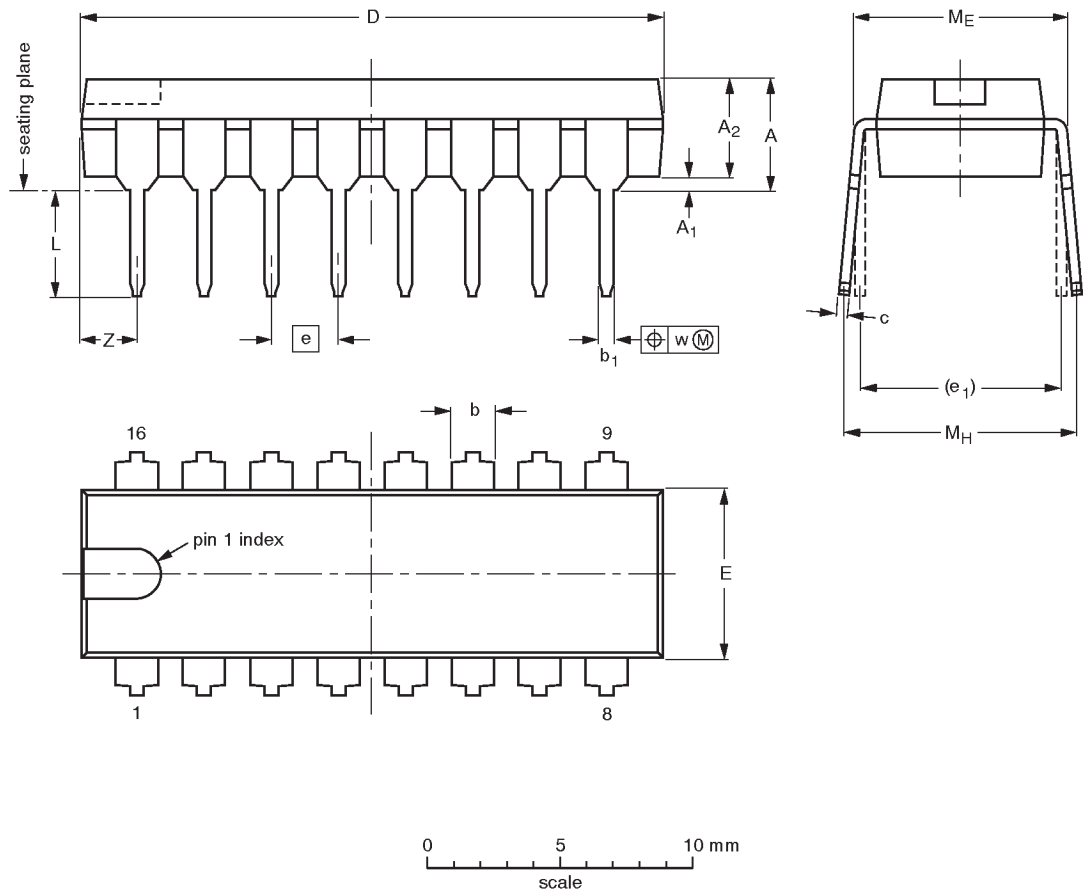
Figure 9. Load circuitry for switching times

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DIP16: plastic dual in-line package; 16 leads (300 mil); long body

SOT38-1




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	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.020	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

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

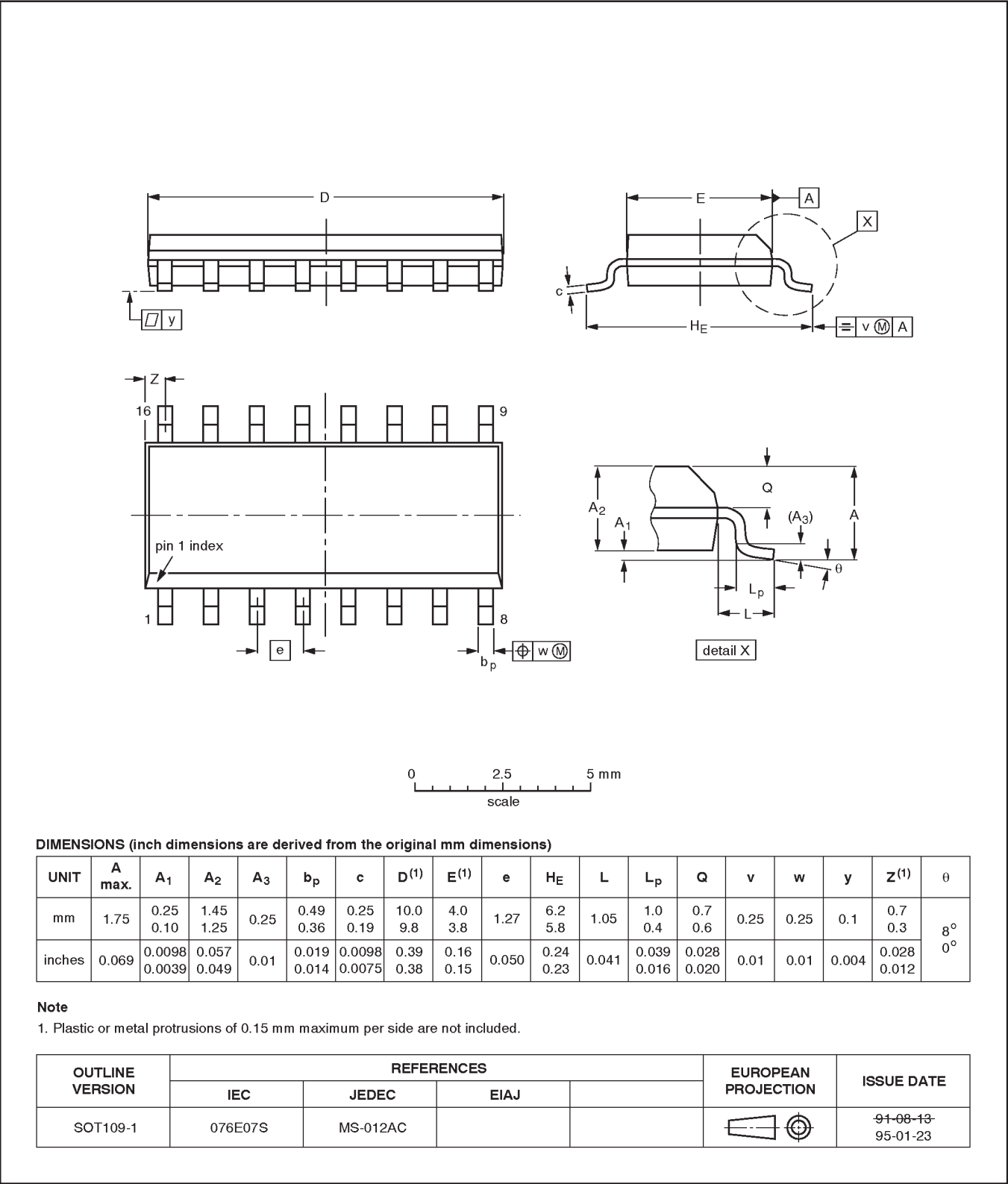
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				92-10-02 95-01-19

Dual retriggerable monostable multivibrator
with reset

74LV423

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

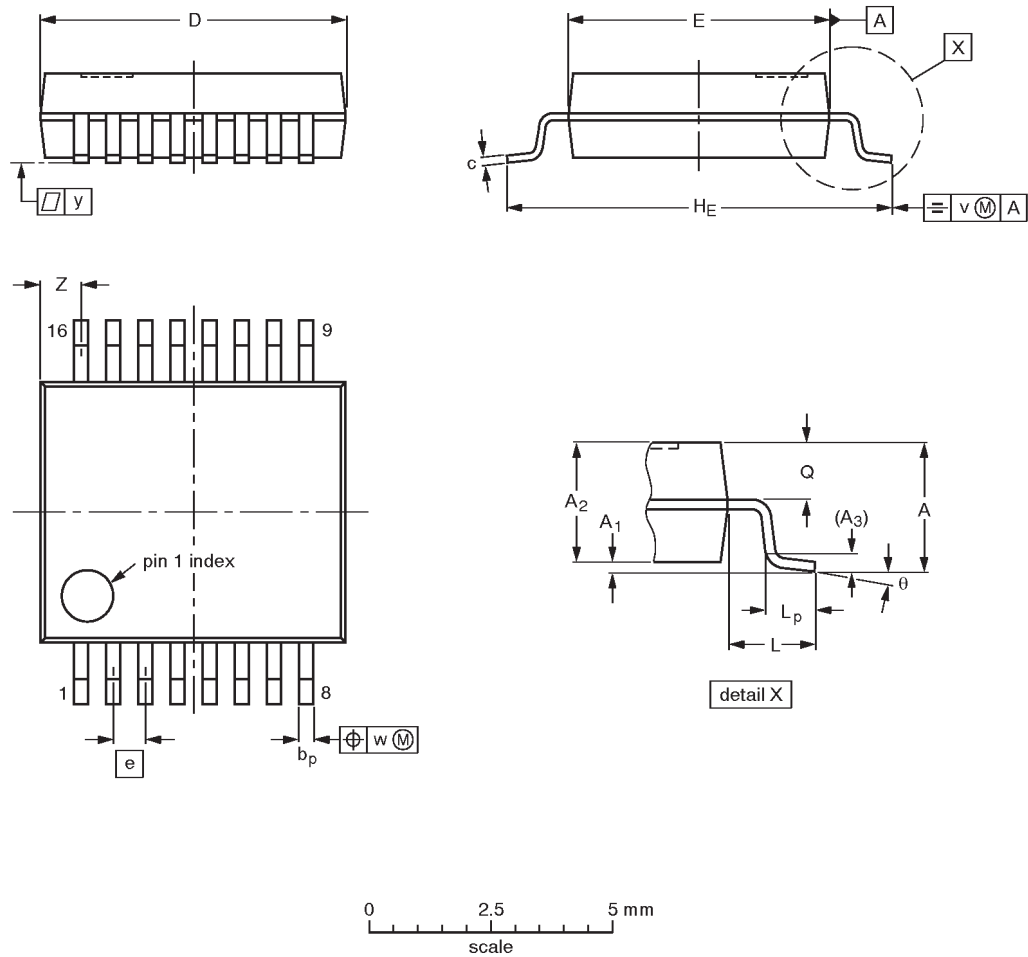


Dual retriggerable monostable multivibrator
with reset

74LV423

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1



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	1.00 0.55	8° 0°

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

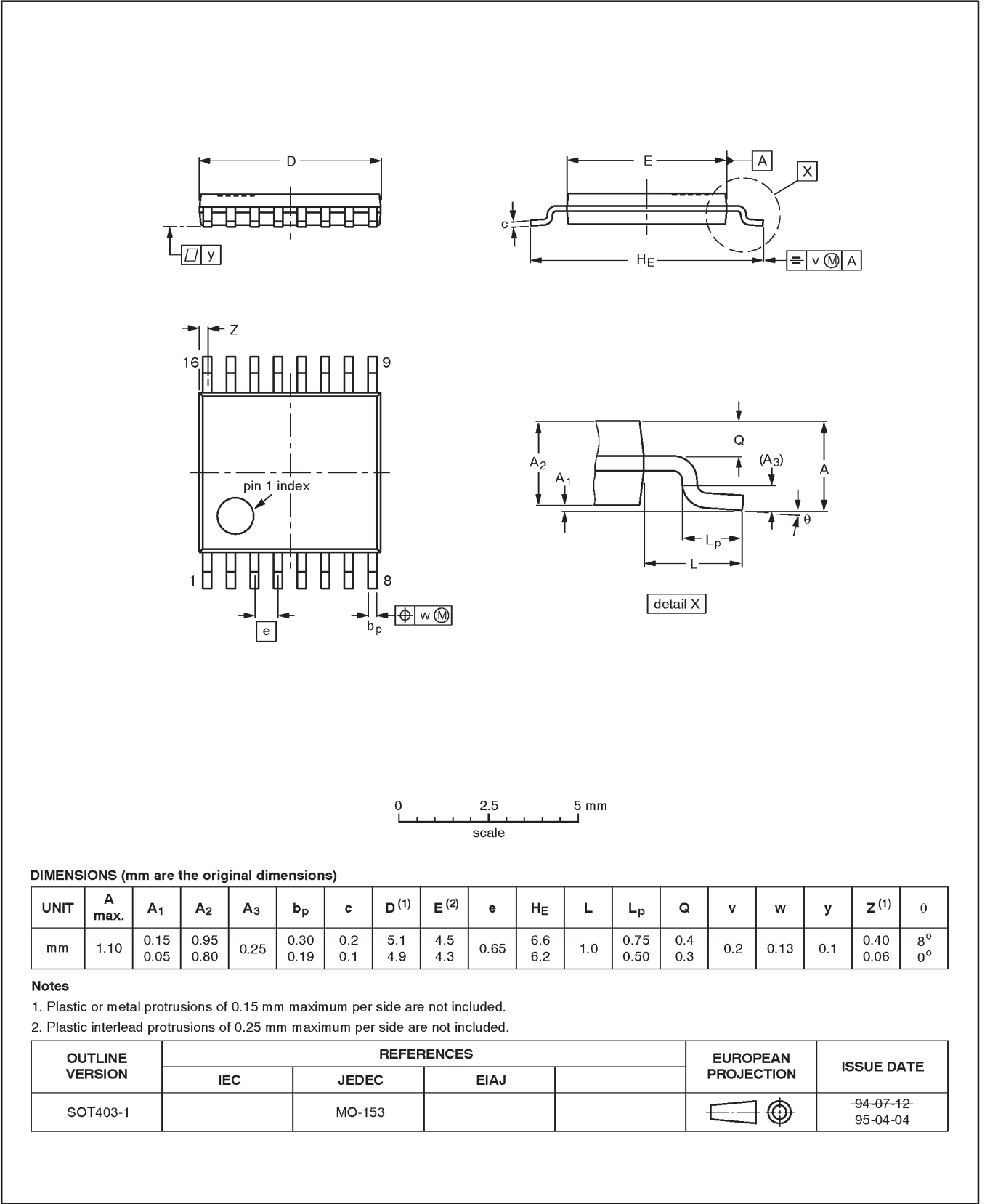
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT338-1		MO-150AC				94-01-14 95-02-04

Dual retriggerable monostable multivibrator
with reset

74LV423

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1



Dual retriggerable monostable multivibrator
with reset

74LV423

DEFINITIONS		
Data Sheet Identification	Product Status	Definition
Objective Specification	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
Preliminary Specification	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product Specification	Full Production	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

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