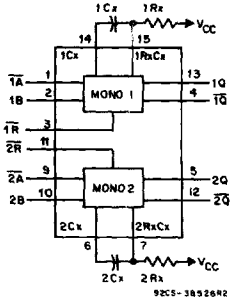
File Number **1708**

Advance Information/
Preliminary Data

CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423

High-Speed CMOS Logic



FUNCTIONAL DIAGRAM

Dual Retriggerable Monostable Multivibrators with Resets

Type Features:

- *Overriding RESET Terminates Output Pulse*
- *Triggering From the Leading or Trailing Edge*
- *Q and $\overline{Q}$ Buffered Outputs*
- *Separate Resets*
- *Wide Range of Output-Pulse Widths*
- *Schmitt Trigger on both $\overline{A}$ and B inputs*

The RCA-CD54/74HCT123,423 and CD54/74HCT123,423 are dual monostable multivibrators with resets. They are all retriggerable and differ only in that the 123 types can be triggered by a negative-to-positive reset pulse; whereas the 423 types do not have this feature. An external resistor (R_x) and an external capacitor (C_x) control the timing and the accuracy for the circuit. Adjustment of R_x and C_x provides a wide range of output pulse widths from the Q and $\overline{Q}$ terminals. Pulse triggering on the $\overline{A}$ and B inputs occur at a particular voltage level and is not related to the rise and fall times of the trigger pulses.

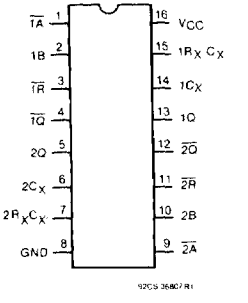
Once triggered, the output pulse width may be extended by retriggering inputs $\overline{A}$ and B. The output pulse can be terminated by a LOW level on the Reset (R) pin. Trailing-edge triggering ($\overline{A}$) and leading-edge triggering (B) inputs are provided for triggering from either edge of the input pulse. If either Mono is not used each input on the unused device ($\overline{A}$, B, and $\overline{R}$) must be terminated high or low.

The minimum value of external resistance, R_x is typically 5kΩ. The minimum value external capacitance, C_x, is 0 pF. The calculation for the pulse width is $t_w = 0.45\ R_xC_x$ at V_{cc} = 5 V.

The CD54HC123,423 and CD54HCT123,423 are supplied in 16-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC123,423 and CD74HCT123,423 are supplied in 16-lead dual-in-line plastic packages (E suffix) and in 16-lead dual-in-line surface mount plastic packages (M suffix). All types are also available in chip form (H suffix).

Family Features:

- *Fanout (Over Temperature Range):*
  Standard Outputs - 10 LSTTL Loads
  Bus Driver Outputs - 15 LSTTL Loads
- *Wide Operating Temperature Range:*
  CD74HC/HCT: -40 to +85° C
- *Balanced Propagation Delay and Transition Times*
- *Significant Power Reduction Compared to LSTTL Logic ICs*
- *Alternate Source is Philips/Signetics*
- *CD54HC/CD74HC Types:*
  2 to 6 V Operation
  High Noise Immunity:
  N_{IL} = 30%, N_{IH} = 30% of V_{CC}; @ V_{CC} = 5 V
- *CD54HCT/CD74HCT Types:*
  4.5 to 5.5 V Operation
  Direct LSTTL Input Logic Compatibility
  V_{IL} = 0.8 V Max., V_{IH} = 2 V Min.
  CMOS Input Compatibility
  $I_I \leq 1\ \mu A$ @ V_{OL}, V_{OH}



TERMINAL ASSIGNMENT

CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CD74HC123/CD54HC123 CD74HC423/CD54HC423										CD74HCT123/CD54HCT123 CD74HCT423/CD54HCT423									UNITS
	TEST CONDITIONS			74HC/54HC TYPES			74HC TYPES		54HC TYPES		TEST CONDITIONS		74HCT/54HCT TYPES			74HCT TYPES		54HCT TYPES		
				+25°C			-40/ +85°C		-55/ +125°C				+25°C			-40/ +85°C		-55/ +125°C		
	V_I V	I_O mA	V_{CC} V	Min	Typ	Max	Min	Max	Min	Max	V_I V	V_{CC} V	Min	Typ	Max	Min	Max	Min	Max	
High-Level Input Voltage V_{IH}			2	1.5	—	—	1.5	—	1.5	—	—	4.5 to 5.5	2	—	—	2	—	2	—	V
			4.5	3.15	—	—	3.15	—	3.15	—										
			6	4.2	—	—	4.2	—	4.2	—										
Low-Level Input Voltage V_{IL}			2	—	—	0.5	—	0.5	—	0.5	—	4.5 to 5.5	—	—	0.8	—	0.8	—	0.8	V
			4.5	—	—	1.35	—	1.35	—	1.35										
			6	—	—	1.8	—	1.8	—	1.8										
High-Level Output Voltage V_{OH} CMOS Loads	V_{IL} or V_{IH}	-0.02	2	1.9	—	—	1.9	—	1.9	—	V_{IL} or V_{IH}	4.5	4.4	—	—	4.4	—	4.4	—	V
			4.5	4.4	—	—	4.4	—	4.4	—										
			6	5.9	—	—	5.9	—	5.9	—										
TTL Loads	V_{IL} or V_{IH}	-4	4.5	3.98	—	—	3.84	—	3.7	—	V_{IL} or V_{IH}	4.5	3.98	—	—	3.84	—	3.7	—	V
		-5.2	6	5.48	—	—	5.34	—	5.2	—										
Low-Level Output Voltage V_{OL} CMOS Loads	V_{IL} or V_{IH}	0.02	2	—	—	0.1	—	0.1	—	0.1	V_{IL} or V_{IH}	4.5	—	—	0.1	—	0.1	—	0.1	V
			4.5	—	—	0.1	—	0.1	—	0.1										
			6	—	—	0.1	—	0.1	—	0.1										
TTL Loads	V_{IL} or V_{IH}	4	4.5	—	—	0.26	—	0.33	—	0.4	V_{IL} or V_{IH}	4.5	—	—	0.26	—	0.33	—	0.4	V
		5.2	6	—	—	0.26	—	0.33	—	0.4										
Input Leakage Current I_I	V_{CC} or Gnd		6	—	—	±0.1	—	±1	—	±1	Any Voltage Between V_{CC} & Gnd	5.5	—	—	±0.1	—	±1	—	±1	μA
Quiescent Device Current I_{CC}	V_{CC} or Gnd	0	6	—	—	8	—	80	—	160	V_{CC} or Gnd	5.5	—	—	8	—	80	—	160	μA
Additional Quiescent Device Current per input pin: 1 unit load ΔI_{CC}*											V_{CC} -2.1	4.5 to 5.5	—	100	360	—	450	—	490	μA

*For dual-supply systems theoretical worst case (V_I = 2.4 V, V_{CC} = 5.5 V) specification is 1.8 mA.

HCT INPUT LOADING TABLE

INPUT	UNIT LOADS *
All Inputs	0.35

* Unit Load is ΔI_{CC} limit specified in Static Characteristic Chart, e.g., 360 μA max. @ 25°C.

CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423

HC/HCT123 TRUTH TABLE

INPUTS			OUTPUTS	
$\overline{A}$	B	$\overline{R}$	Q	$\overline{Q}$
H	X	H	L	H
X	L	H	L	H
L	↗	H	⎍	⎎
↘	H	H	⎍	⎎
X	X	L	L	H
L	H	↗	⎍	⎎

HC/HCT423 TRUTH TABLE

INPUTS			OUTPUTS	
$\overline{A}$	B	$\overline{R}$	Q	$\overline{Q}$
H	X	H	L	H
X	L	H	L	H
L	↗	H	⎍	⎎
↘	H	H	⎍	⎎
X	X	L	L	H

H = High Level
L = Low Level
X = Irrelevant
↗ = Transition from Low to High
↘ = Transition from High to Low
⎍ = One High Level Pulse
⎎ = One Low Level Pulse

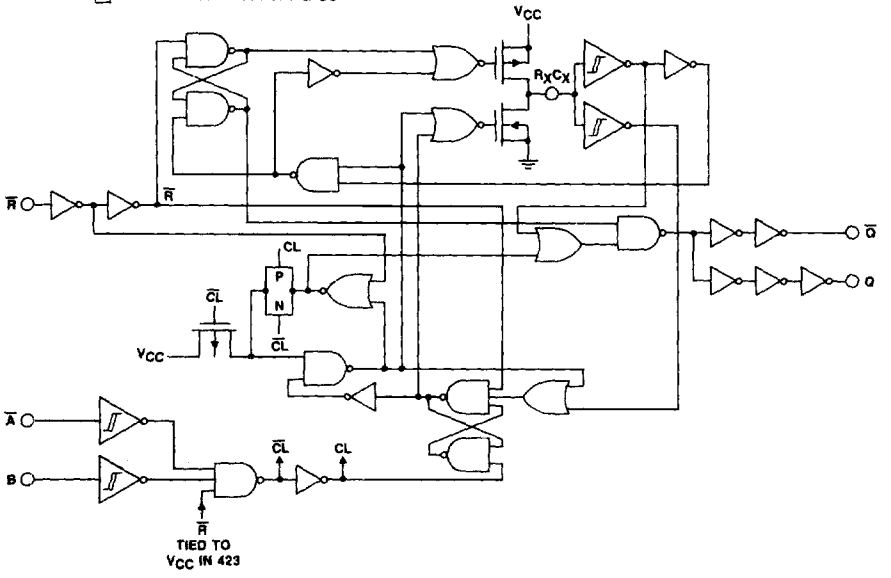


Fig. 1 - Logic diagram for HC/HCT123 and 423.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE, (V_{CC}):
(Voltages referenced to ground) ..... -0.5 to +7 V
DC INPUT DIODE CURRENT, I_{IK} (FOR $V_I < -0.5$ V OR $V_I > V_{CC}$ +0.5 V) ..... ±20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (FOR $V_O < -0.5$ V OR $V_O > V_{CC}$ +0.5 V) ..... ±20 mA
DC DRAIN CURRENT, PER OUTPUT (I_O) (FOR -0.5 V < V_O < V_{CC} +0.5 V) ..... ±25 mA
DC V_{CC} OR GROUND CURRENT, (I_{CC}): ..... ±50 mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -40 to +60° C (PACKAGE TYPE E) ..... 500 mW
For T_A = +60 to +85° C (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/° C to 300 mW
For T_A = -55 to +100° C (PACKAGE TYPE F, H) ..... 500 mW
For T_A = +100 to +125° C (PACKAGE TYPE F, H) ..... Derate Linearly at 8 mW/° C to 300 mW
For T_A = -40 to +70° C (PACKAGE TYPE M) ..... 400 mW
For T_A = +70 to +125° C (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/° C to 70 mW
OPERATING-TEMPERATURE RANGE (T_A):
PACKAGE TYPE F, H ..... -55 to +125° C
PACKAGE TYPE E, M ..... -40 to +85° C
STORAGE TEMPERATURE (T_{stg}) ..... -65 to +150° C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max. ..... +265° C
Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm)
with solder contacting lead tips only ..... +300° C

CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423

RECOMMENDED OPERATING CONDITIONS:
For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC		LIMITS MIN.	LIMITS MAX.	UNITS
Supply-Voltage Range (For T_A = Full Package-Temperature Range) V_{CC}:*				
	CD54/74HC Types	2	6	V
	CD54/74HCT Types	4.5	5.5	V
DC Input or Output Voltage V_I, V_O		0	V_{CC}	V
Operating Temperature T_A:	CD74 Types	-40	+85	°C
	CD54 Types	-55	+125	°C
Input Rise and Fall Times t_r, t_f on Input $\overline{R}$	at 2 V	0	1000	ns
	at 4.5 V	0	500	ns
	at 6 V	0	400	ns
Input Rise and Fall Times t_r, t_f on Input B and $\overline{A}$	at 2 V	0	Unlimited	ns
	at 4.5	0	Unlimited	ns
	at 6 V	0	Unlimited	ns

*Unless otherwise specified, all voltages are referenced to Ground.

PREREQUISITE FOR SWITCHING FUNCTION

CHARACTERISTIC		Vcc	LIMITS 25°C HC Min.	HC Max.	HCT Min.	HCT Max.	-40°C to +85°C 74HC Min.	74HC Max.	74HCT Min.	74HCT Max.	-55°CC to +125°C 54HC Min.	54HC Max.	54HCT Min.	54HCT Max.	UNITS
Minimum Input Pulse Width $\overline{A}$	t_{WL}	2	100	—	—	—	125	—	—	—	150	—	—	—	ns
		4.5	20	—	20	—	25	—	25	—	30	—	30	—	
		6	17	—	—	—	21	—	—	—	26	—	—	—	
B	t_{WH}	2	100	—	—	—	125	—	—	—	150	—	—	—	ns
		4.5	20	—	20	—	25	—	25	—	30	—	30	—	
		6	17	—	—	—	21	—	—	—	26	—	—	—	
$\overline{R}$	t_{WL}	2	100	—	—	—	125	—	—	—	150	—	—	—	ns
		4.5	20	—	20	—	25	—	25	—	30	—	30	—	
		6	17	—	—	—	21	—	—	—	26	—	—	—	
$\overline{A}$ & B Hold Time	t_H	2	50	—	—	—	65	—	—	—	75	—	—	—	ns
		4.5	10	—	10	—	13	—	13	—	15	—	15	—	
		6	9	—	—	—	11	—	—	—	13	—	—	—	
Reset Removal Time	t_{REM}	2	50	—	—	—	65	—	—	—	75	—	—	—	ns
		4.5	10	—	10	—	13	—	13	—	15	—	15	—	
		6	9	—	—	—	11	—	—	—	13	—	—	—	
Retrigger Time # R_x = 10 KΩ	t_{rT}	5	50 Typ.		50 Typ.		63 Typ.		63 Typ.		76 Typ.		76 Typ.		ns
Output Pulse Width Q or $\overline{Q}$ R_x = 10 KΩ, C_x = 10 nF	tw	5	40	50	40	50	38.7	51.3	38.7	51.3	38.2	51.8	38.2	51.8	us

#Time to trigger depends on the values of R_x and C_x. The output pulse width can only be extended when the time between the active-going edges of the trigger input pulses meet the minimum retrigger time requirement.

CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423

SWITCHING CHARACTERISTICS (V_{CC} = 5 V, T_A = 25° C, Input t_r, t_f = 6 ns)

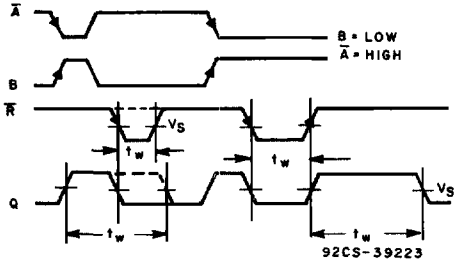
CHARACTERISTIC		C_L (pF)	TYPICAL VALUES 54/74HC	TYPICAL VALUES 54/74HCT	UNITS
Propagation Delay					
$\overline{A}$, B, $\overline{R}$ to Q	t_{PLH}	15	25	25	ns
$\overline{A}$, B, $\overline{R}$ to $\overline{Q}$	t_{PHL}	15	26	27	ns
Output Pulse Width					
R_x = 10 KΩ, C_x = 10 nF		—	45	45	μs
Pulse Width Match Between Circuits in the same Package					
R_x = 10 KΩ, C_x = 10 nF		—	±2	±2	%
Power Dissipation Capacitance *	C_{PD}	—	—	—	pF

* CPD is used to determine the dynamic power consumption, per multivibrator.
$P_D = (C_{PD} + C_x) V_{CC}^2 f_i + \Sigma (C_L V_{CC}^2 f_o)$ where:
f_i = input frequency.
f_o = output frequency.
C_L = output load capacitance.
C_x = external capacitance.
V_{CC} = supply voltage.
assuming $f_i \ll \frac{1}{t_w}$

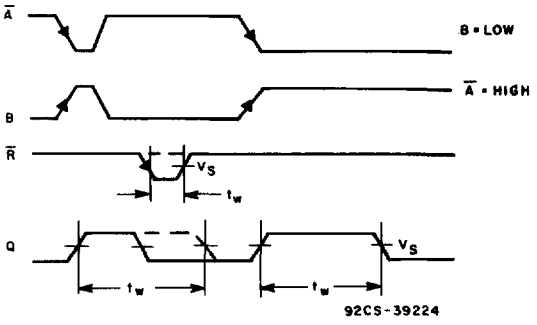
SWITCHING CHARACTERISTICS (C_L = 50 pF, Input t_r, t_f = 6 ns, R_x = 10 KΩ, C_x = 0)

CHARACTERISTIC	SYMBOL	V_{CC}	LIMITS 25° C HC Min.	25° C HC Max.	25° C HCT Min.	25° C HCT Max.	-40° C to +85° C 74HC Min.	-40° C to +85° C 74HC Max.	-40° C to +85° C 74HCT Min.	-40° C to +85° C 74HCT Max.	-55° C to +125° C 54HC Min.	-55° C to +125° C 54HC Max.	-55° C to +125° C 54HCT Min.	-55° C to +125° C 54HCT Max.	UNITS
Trigger Propagation Delay, $\overline{A}$, B, $\overline{R}$ to Q	t_{PLH}	2	—	300	—	—	—	375	—	—	—	450	—	—	ns
		4.5	—	60	—	60	—	75	—	75	—	90	—	90	
		6	—	51	—	—	—	64	—	—	—	76	—	—	
$\overline{A}$, B, $\overline{R}$ to $\overline{Q}$	t_{PHL}	2	—	320	—	—	—	400	—	—	—	480	—	—	ns
		4.5	—	64	—	68	—	80	—	85	—	96	—	102	
		6	—	54	—	—	—	68	—	—	—	82	—	—	
Reset Propagation Delay, $\overline{R}$ to Q or $\overline{Q}$	t_{PHL}	2	—	215	—	—	—	270	—	—	—	325	—	—	ns
	t_{PLH}	4.5	—	43	—	48	—	54	—	60	—	65	—	72	
		6	—	37	—	—	—	46	—	—	—	55	—	—	
Output Transition Time	t_{TLH}	2	—	75	—	—	—	95	—	—	—	110	—	—	ns
	t_{THL}	4.5	—	15	—	15	—	19	—	19	—	22	—	22	
		6	—	13	—	—	—	16	—	—	—	19	—	—	
Input Capacitance	C_I		—	10	—	10	—	10	—	10	—	10	—	10	pF

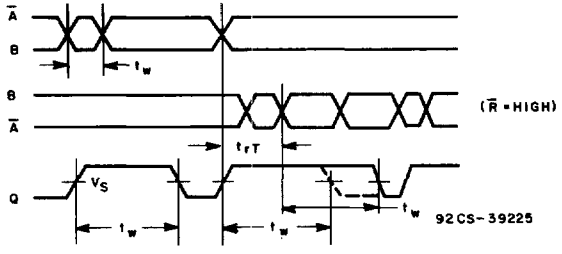
CD54/74HC123, CD54/74HCT123
CD54/74HC423, CD54/74HCT423



Output pulse control using reset input ($\overline{R}$) for 123.



Output pulse control using reset input ($\overline{R}$) for 423.



Output pulse control using retrigger pulse for 123 and 423.

Fig. 2 - Triggering of One Shot by input $\overline{A}$ or input B for a period t_w.

	54/74HC	54/74HCT
Input Level	V_{CC}	3 V
Switching Voltage, V_S	50% V_{CC}	1.3 V

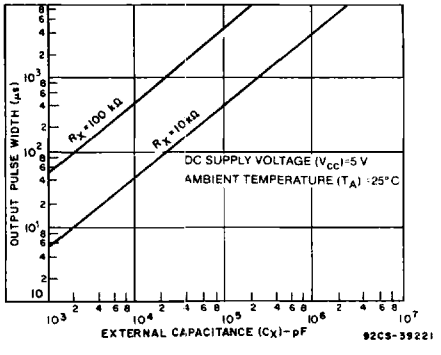


Fig. 3 - Typical output pulse width as a function of C_x for R_x = 10 kΩ and 100 kΩ.

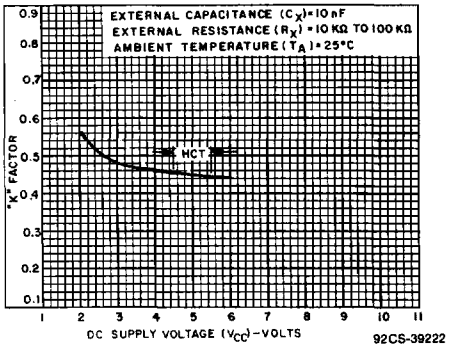


Fig. 4 - Typical "K" Factor as a function of V_{CC}.