Single and Dual Retriggerable Monostable Multivibrators with Clear

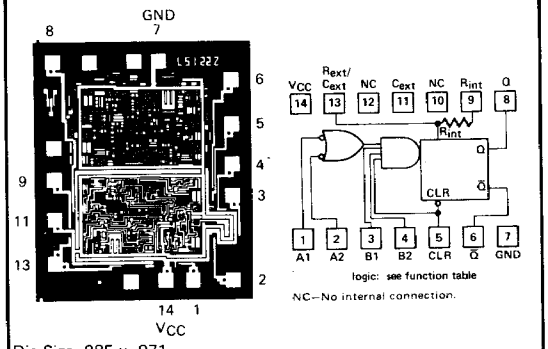
FEATURES

- Functionally and Mechanically Identical to 54122 and 54123
- Retriggerable for Very Long Output Pulses, Up to 100% Duty Cycle
- Overriding Clear Terminates Output Pulse
- Low Power Dissipation:
  - 'LS122 . . . 30 mW Typical
  - 'LS123 . . . 60 mW Typical
- Compensated for V_{CC} and Temperature Variations
- D-C Triggered from Active-High or Active-Low Gated Logic Inputs
- 'LS122 Has Internal 10 kΩ Timing Resistor
- Diode-Clamped Inputs
- Compatible for Use with TTL or DTL

DESCRIPTION

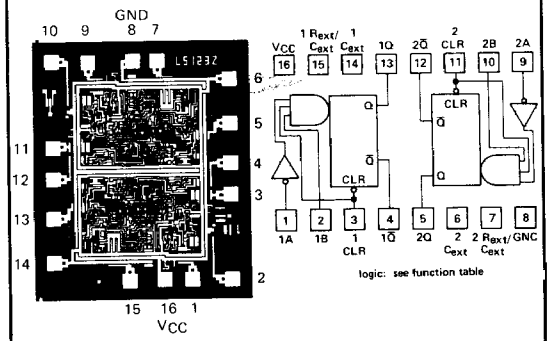
The 'LS122 and 'LS123 multivibrators feature d-c triggering from gated low-level-active (A) and high-level-active (B) inputs, and also provide overriding direct clear inputs. Complementary outputs are provided. The retrigger capability simplifies the generation of output pulses of extremely long duration. By triggering the input before the output pulse is terminated, the output pulse may be extended. The overriding clear capability permits any output pulse to be terminated at a predetermined time independently of the timing components R and C. Enough Schmitt hysteresis is provided to ensure jitter-free triggering from the B inputs with transition rates as slow as 1 volt per second. Figure 1 illustrates triggering the one-shot with the high-level-active (B) inputs.

LS122



Die Size .085 x .071

LS123



Die Size .085 x .071

'LS122 FUNCTION TABLE
(SEE NOTE 1)

INPUTS					OUTPUTS	
CLEAR	A1	A2	B1	B2	Q	$\bar{Q}$
L	X	X	X	X	L	H
X	H	H	X	X	L	H
X	X	X	L	X	L	H
X	X	X	X	L	L	H
X	L	X	H	H	L	H
H	L	X	↑	H	⎍	⎎
H	L	X	H	↑	⎍	⎎
H	X	L	H	H	L	H
H	X	L	↑	H	⎍	⎎
H	X	L	H	↑	⎍	⎎
H	H	↓	H	H	⎍	⎎
H	↓	↓	H	H	⎍	⎎
H	↓	H	H	H	⎍	⎎
↑	L	X	H	H	⎍	⎎
↑	X	L	H	H	⎍	⎎

'LS123 FUNCTION TABLE
(SEE NOTE 1)

INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\bar{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎
↑	L	H	⎍	⎎

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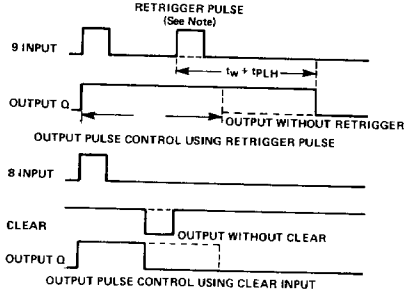
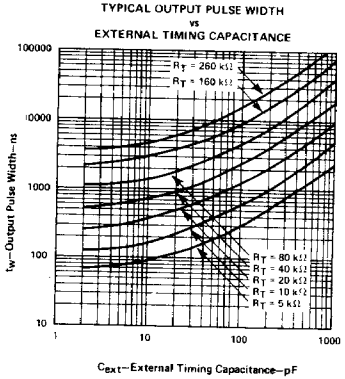
NOTES:
1. H = high level (steady state), L = low level (steady state), ↑ = transition from low to high level, ↓ = transition from high to low level, H = one high-level pulse, L = one low-level pulse, X = irrelevant (any input, including transitions).
2. To use the internal timing resistor of 'LS122, connect R_{int} to V_{CC}.
3. An external timing capacitor may be connected between C_{ext} and R_{ext}/C_{ext} (positive).
4. For accurate repeatable pulse widths, connect an external resistor between R_{ext}/C_{ext} and V_{CC} with R_{int} open circuited.
5. To obtain variable pulse widths, connect external variable resistance between R_{int} or R_{ext}/C_{ext} and V_{CC}.



NOTE: Retrigger pulse must not start before 0.22 C_{ext} (in picofarads) nanoseconds after previous trigger pulse.

FIGURE 1—Typical Input/Output Pulses



†These values of resistance exceed the maximum recommended for use over the full temperature range of the 9LS/54LS' circuits.

FIGURE 2

These monostables are designed to provide the system designer with complete flexibility in controlling the pulse width, either to lengthen the pulse by retriggering, or to shorten by clearing. The 'LS122 has an internal timing resistor which allows the circuit to be operated with only an external capacitor, if so desired.

The output pulse is primarily a function of the external capacitor and resistor. For $C_{ext} > 1000$ pF, the output pulse width (t_w) is defined as:

$$t_w = 0.4 \cdot R_T \cdot C_{ext}$$

where

R_T is in kΩ (either internal or external timing resistor),
C_{ext} is in pF,
t_w is in ns.

For pulse widths when $C_{ext} \leq 1000$ pF, see Figure 2.

Recommended Operating Conditions

		9LS/54LS			9LS/74LS			Unit
		Min.	Nom.	Max.	Min.	Nom.	Max.	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}				−400			−400	μA
Low-level output current, I_{OL}				4			8	mA
Pulse width, t_w	A or B inputs high	40			40			ns
	A or B inputs low	40			40			
	Clear low	40			40			
External timing resistance, R_{ext}		5		225	5		360	kΩ
External capacitance, C_{ext}		No restriction			No restriction			
Wiring capacitance at R_{ext}/C_{ext} terminal				50			50	pF
Operating free-air temperature, T_A		−55		125	0		70	°C

Electrical Characteristics Over Recommended Operating Free-Air Temperature Range (Unless Otherwise Noted)

Parameter		Test Conditions†			9LS/54LS			9LS/74LS			Unit
					Min.	Typ.‡	Max.	Min.	Typ.‡	Max.	
V_{IH}	High-level input voltage				2			2			V
V_{IL}	Low-level input voltage						0.7			0.8	V
V_I	Input clamp voltage	V_{CC} = MIN,	I_I = −18 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IL} = V_{IL} max,	V_{IH} = 2V, I_{OH} = −400 μA		2.5	3.5		2.7	3.5		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IL} = V_{IL} max	V_{IH} = 2V,	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
				I_{OL} = 8 mA					0.35	0.5	
I_I	Input current at maximum input voltage	V_{CC} = MAX,	V_I = 7V				0.1			0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX,	V_I = 2.7V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX,	V_I = 0.4V				−0.4			−0.4	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX			−30		−150	−30		−150	mA
I_{CC}	Supply current (quiescent or triggered)	V_{CC} = MAX,	See Note 2	'LS122		6	11		6	11	mA
				'LS123		12	20		12	20	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡All typical values are at V_{CC} = 5V, T_A = 25°C.
§Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.
NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to clock.

Switching Characteristics V_{CC} = 5.0V Over Recommended Free-Air Temperature Range.

Parameter	From (Input)	To (Output)	−55°C			+25°C			+125°C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Test Conditions: C_L = 15pF, R_L = 2.0k C_{ext} = 0pf, R_{ext} = 5.0kΩ (See Fig. 3, page 2-61 and Fig. A, page 2-174)												
t_{PLH}	A	Q		25	37		22	33		25	37	ns
	B			32	48		29	44		32	48	
t_{PHL}	A	$\bar{Q}$		33	49		30	45		33	49	ns
	B			40	61		37	56		40	61	
t_{PHL}	clear	Q		21	31		18	27		21	31	ns
t_{PLH}		$\bar{Q}$		33	50		30	45		33	50	ns
$t_{WQ(min)}$	A or B	Q		140	250		116	200		140	250	ns
*t_{WQ}	A or B	Q	—	—	—	4.0	4.5	5.0	—	—	—	μs
Test Conditions: C_L = 50pF, R_L = 2.0k, C_{ext} = 0pf, R_{ext} = 5.0kΩ (See Fig. 3, page 2-61 and Fig. A, page 2-174)												
t_{PLH}	A	Q		30	43		26	38		30	43	ns
	B			37	54		33	49		37	54	
t_{PHL}	A	$\bar{Q}$		38	55		34	50		38	55	ns
	B			45	67		41	62		45	67	
t_{PHL}	clear	Q		26	37		22	32		26	37	ns
t_{PLH}		$\bar{Q}$		39	55		35	50		39	55	ns
$t_{WQ(min)}$	A or B	Q		155	270		127	240		155	270	ns

Note: AC specification shown under −55°C and +125°C are for 9LS devices only. All 50pF specifications are for 9LS devices only.

*For this test R_{ext} = 10kΩ, C_{ext} = 1000pF.

TYPICAL APPLICATION DATA

The basic output pulse width is essentially determined by the values of external capacitance and timing resistance. For pulse widths when $C_{ext} \leqslant 1000$ pF.

When $C_{ext} > 1000$ pF, the output pulse width is defined as:

$$t_w = 0.45 \bullet R_T \bullet C_{ext}$$

where

R_T is in kΩ (internal or external timing resistance.)

C_{ext} is in pF

t_w is in nanoseconds

For best results, system ground should be applied to the C_{ext} terminal. The switching diode is not needed for electrolytic capacitance applications.

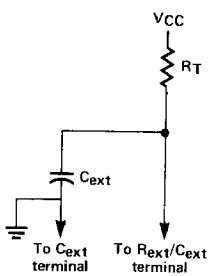


FIGURE 3
TIMING COMPONENT CONNECTIONS