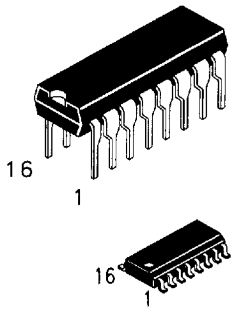
123

DV74LS123
DV74ALS123

Dual Monostable Multivibrators with Clear

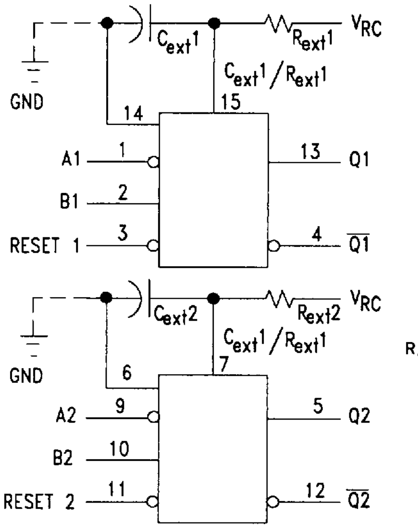
These DC triggered multivibrators feature pulse width control by three methods. The basic pulse width is programmed by selection of external resistance and capacitance values. Once triggered, the basic pulse width may be extended by retriggering the gated low-level -active (A) or high-level-active (B) inputs, or be reduced by use of the overriding low-level clear. The Schmitt trigger inputs ensure jitter-free triggering from the B input with transition rates as slow as 0.1 millivolt per nanosecond.



N Suffix
Plastic DIP
AVG-003 Case

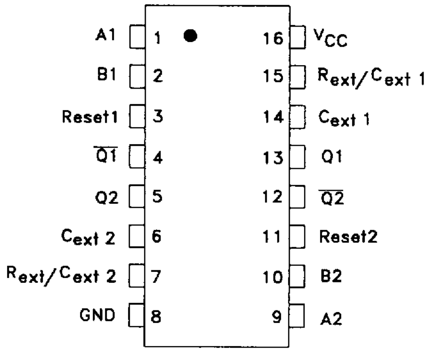
D Suffix
Plastic SOP
AVG-004 Case

- **AVG's LS operates over extended Vcc from 4.5 to 5.5 V**
- **AVG's LS and ALS both have guaranteed DC and AC specification over full temperature and Vcc range**
- **Switching specifications for ALS at 50 pF**
- **AVG's ALS has the lowest speed power product (4pJ per gate typical) of all logic series**



PIN 16 = V_{CC}
PIN 1,8,15 = GND
R_{ext} AND C_{ext} ARE EXTERNAL COMPONENTS

PIN ASSIGNMENT



TRUTH TABLE

INPUTS			OUTPUTS	
Clear	**A**	**B**	**Q**	**Q̄**
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	↑↓	↓↑
H	↓	H	↑↓	↓↑
↑	L	H	↑↓	↓↑

L Low Level
H High Level
X Don't Care
↑ Low to High Transition
↓ High to Low Transition
↑↓ Low to High to Low Transition
↓↑ High to Low to High Transition

NOTES:
1. An external timing capacitor may be connected between C_{EXT} and R_{EXT}/C_{EXT} (positive).
2. For improved pulse width accuracy connect an external resistor between R_{EXT}/C_{EXT} and V_{CC}.
3. To obtain variable pulse widths, connect an external variable resistance between R_{EXT}/C_{EXT} and V_{CC}.
4. C_{EXT} is connected internally to ground, however for best system performance, C_{EXT} should be hard-wired to ground.
5. V_{RC} is normally tied to V_{CC}, but can be connected to separate voltage source.

ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

Symbol	Parameter	LS123	ALS123	Unit
V_{CC}	Supply Voltage	7.0	7.0	V
V_{IN}	Input Voltage	–0.5 to +7.0	–0.5 to +7.0	V
T_{STG}	Storage Temperature Range	–65 to +150	–65 to +150	°C

GUARANTEED OPERATING CONDITIONS

Symbol	Parameter	LS123		ALS123		Unit
		Min	Max	Min	Max	
V_{CC}	Supply Voltage	4.5	5.5	4.5	5.5	V
V_{IH}	High Level Input Voltage	2.0		2.0		V
V_{IL}	Low Level Input Voltage		0.8		0.8	V
I_{OL}	Low Level Output Current		8.0		8.0	mA
I_{OH}	High Level Output Current		-0.4		-0.4	mA
R_{EXT}	External Timing Resistance	5.0	260	5.0	260	kΩ
C_{EXT}	External Capacitance	No Restriction		No Restriction		
R_{EXT}/C_{EXT}	Wiring capacitance at R_{EXT}/C_{EXT} terminal		50		50	pF
R_{EXT}/C_{EXT}	Wiring Capacitance at R_{EXT}/C_{EXT} Terminal		50		50	pF
T_A	Ambient Temperature Range	−10 to +70		−10 to +70		°C

DC ELECTRICAL CHARACTERISTICS over full operating conditions

Symbol	Parameter	Conditions	LS123			ALS123			Units
			Min	Typ	Max	Min	Typ	Max	
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_{IN} = −18 mA			−1.5			−1.5	V
V_{OH}	High Level Output Voltage	V_{CC}=min, I_{OH}=Max	Vcc-2	3.5		Vcc-2			V
V_{OL}	Low Level Output Voltage (V_{IN}=V_{IL} or V_{IH} per truth table)	V_{CC}=min; I_{OL} =4.0mA		0.25	0.4		0.25	0.4	V
		V_{CC}=min; I_{OL} =8.0 mA		0.35	0.5		0.35	0.5	V
I_{IH}	High Level Input Current	V_{CC}=max, V_{IN}=2.7V			20			20	µA
	High Level Input Current	V_{CC}=max, V_{IN}= 7.0V			0.1			0.1	mA
I_{IL}	Low Level Input Current	V_{CC}=max, V_{IN}=0.4V			−0.4			−0.1	mA
I_O	Short Circuit Current One output shorted at a time	V_{CC}=max, V_O=2.25V	−20		−110	−30		−112	mA
I_{CC}	Supply Current	V_{CC}=max			20			10	mA

SWITCHING CHARACTERISTICS

Symbol	Parameter	Conditions	LS123		ALS123		Unit
			Min	Max	Min	Max	
t_{PLH}	Propagation Delay, A to Q	C_{EXT}=0 C_L=15pF R_{EXT}=5.0kΩ R_L=2.0kΩ		33		20	ns
t_{PHL}	Propagation Delay, A to $\overline{Q}$			45		25	ns
t_{PLH}	Propagation Delay, B to Q			44		25	ns
t_{PHL}	Propagation Delay, B to $\overline{Q}$			56		30	ns
t_{PLH}	Propagation Delay, Clear to Q			27		15	ns
t_{PHL}	Propagation Delay, Clear to $\overline{Q}$			45		25	
t_W min	A or B to Q	C_{EXT}= 1000pF, R_L=2.0kΩ R_{EXT}=10kΩ, C_L=15pF,		200		120	ns
t_WQ	A to B to Q		4.0	5.0	4.0	5.0	µs

AC SETUP REQUIREMENTS over full operating conditions

Symbol	Parameter	Conditions	LS123		ALS123		Unit
			Min	Max	Min	Max	
t_W	Pulse Width	V_{CC}=5.0	40		30		ns

TYPICAL APPLICATION DATA

The output pulse t_W is a function of the external components, C_{EXT} and R_{EXT}. For values of $C_{EXT} \geq 1000$ pF, the output pulse at V_{CC} = 5.0 V and V_{RC} = 5.0 V is given by $t_W = K\ R_{EXT}\ C_{EXT}$ where K is nominally 0.45. If C_{EXT} is in pF and R_{EXT} is in kΩ then t_W is in nanoseconds.

The C_{EXT} terminal of the LS123 is an internal connection to ground, however, for the best system performance, C_{EXT} should be hard-wired to ground.

Care should be taken to keep R_{EXT} and C_{EXT} as close to the monostable as possible with a minimum amount of inductance between the R_{EXT}/C_{EXT} junction and the R_{EXT}/C_{EXT} pin. Good ground plane and adequate bypassing should be designed into the system for optimum performance to insure that no false triggering occurs.

To find the value of K for $C_{EXT} \geq 1000$ pF, refer to **Figure 1**. Variations on V_{CC} or V_{RC} can cause the value of K to change, as can the temperature of the LS123. **Figures 2 and 3** show the behavior of the circuit if separate power supplies are used for V_{CC} and V_{RC}. If V_{CC} is tied to V_{RC}, **Figure 4** shows how K will vary with V_{CC} and temperature.

As long as $C_{EXT} \geq 1000$ pF and $5K \leq R_{EXT} \leq 260$ K, the change in K with respect to R_{EXT} is negligible.

If $C_{EXT} \leq 1000$ pF the graph shown on **Figure 5** can be used to determine the output pulse width. **Figure 6** shows how K will change for $C_{EXT} \leq 1000$ pF if V_{CC} and V_{RC} are connected to the same power supply. The pulse width t_W in nanoseconds is approximated by

$$t_W = 6 + 0.05\ C_{EXT}\ (pF) + 0.45\ R_{EXT}\ (K\Omega)\ C_{EXT} + 11.6\ R_{EXT}$$

Retriggering of the part must not occur before C_{EXT} is discharged or the retrigger pulse will not have any effect. The discharge time of C_{EXT} in nanoseconds is guaranteed to be less than 0.22 C_{EXT} (pF) and is typically 0.05 C_{EXT} (pF).

For the smallest possible deviation in output pulse widths from various devices, it is suggested that C_{EXT} be kept ≥ 1000 pF.

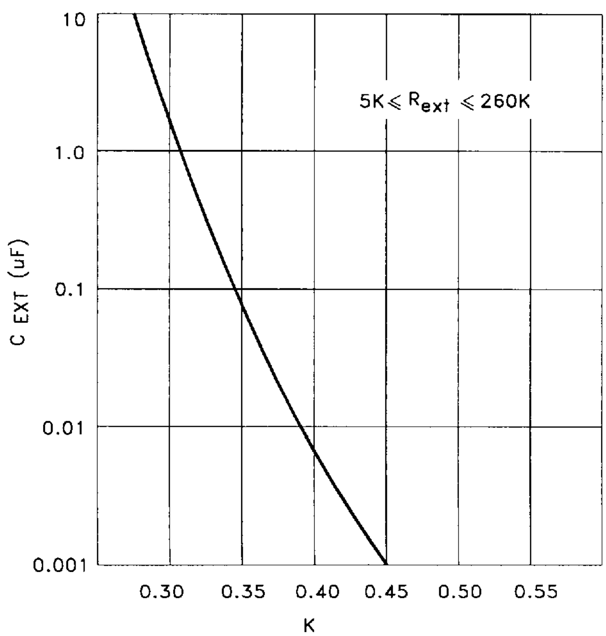


Figure 1

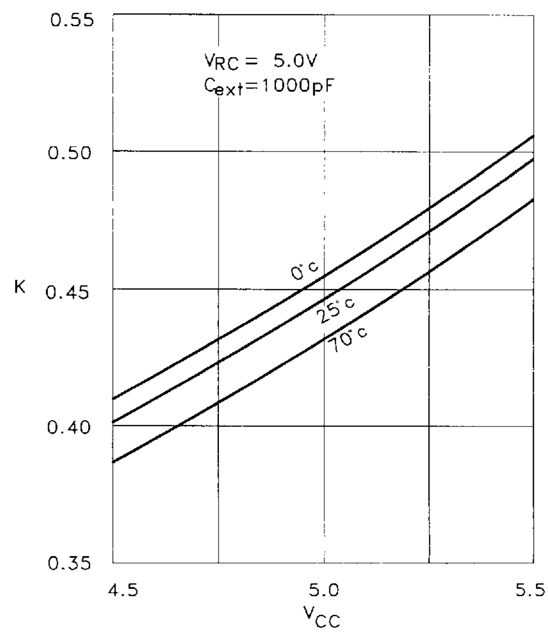


Figure 2

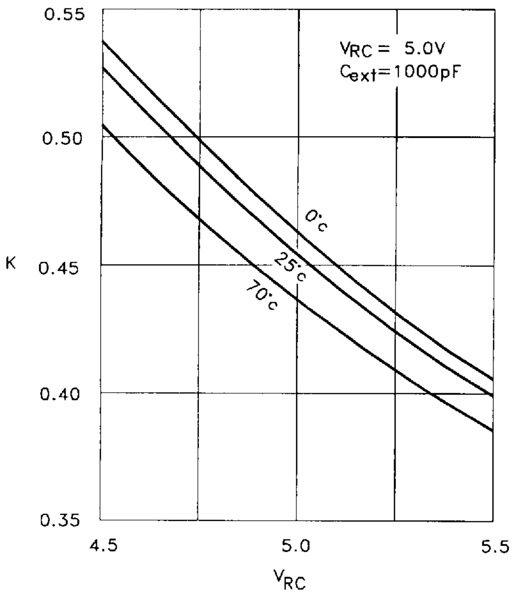


Figure 3

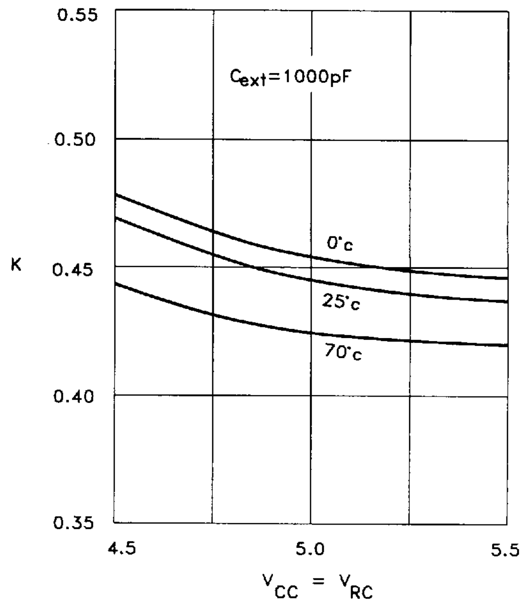


Figure 4

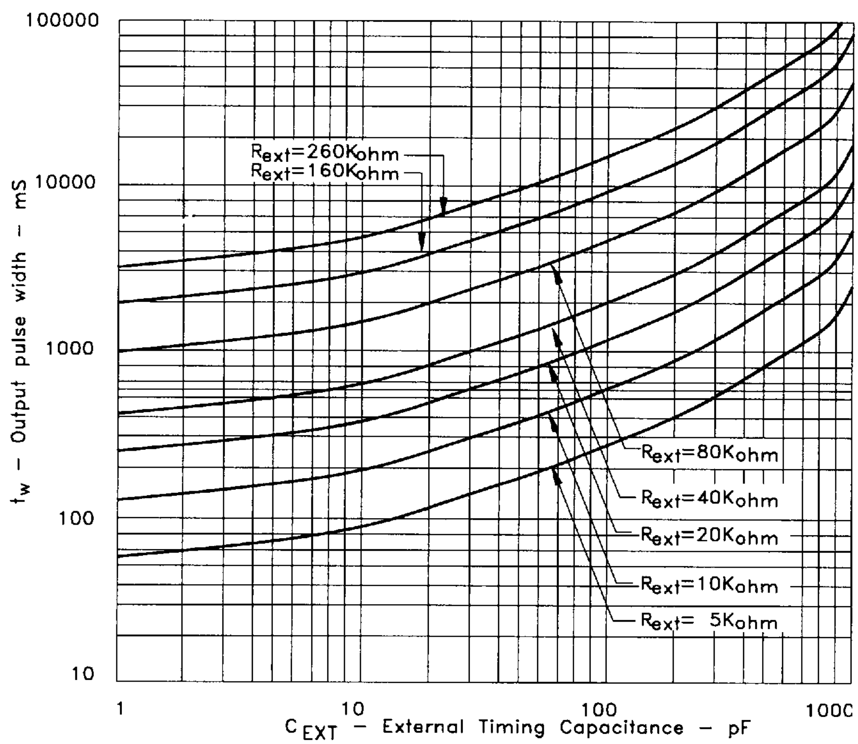


Figure 5

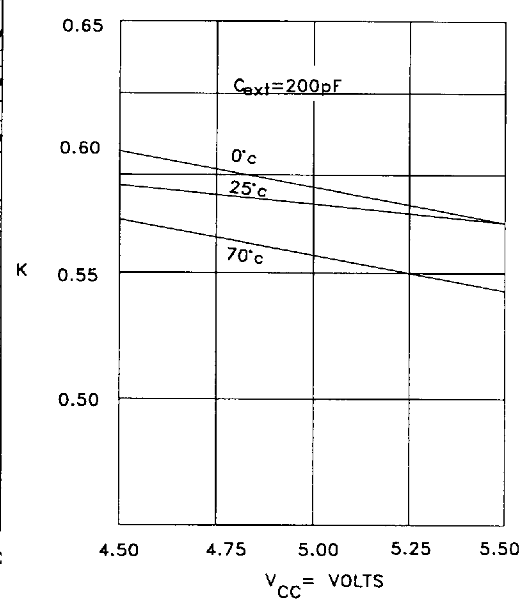


Figure 6