

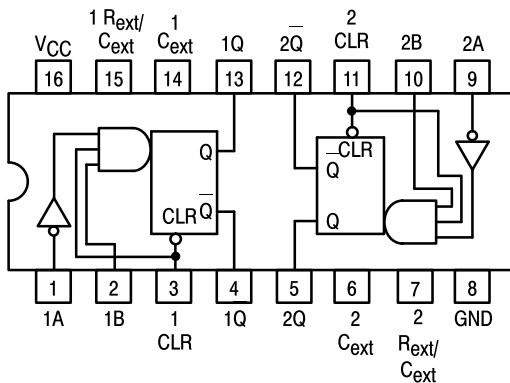


# RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

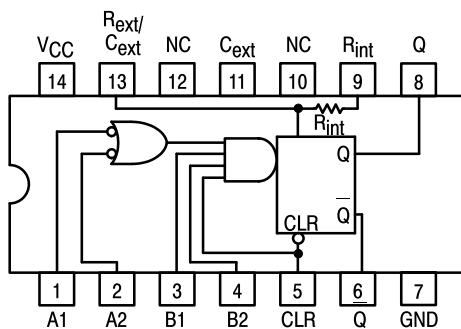
These dc triggered multivibrators feature pulse width control by three methods. The basic pulse width is programmed by selection of external resistance and capacitance values. The LS122 has an internal timing resistor that allows the circuits to be used with only an external capacitor. Once triggered, 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 clear.

- Overriding Clear Terminates Output Pulse
- Compensated for  $V_{CC}$  and Temperature Variations
- DC Triggered from Active-High or Active-Low Gated Logic Inputs
- Retriggerable for Very Long Output Pulses, up to 100% Duty Cycle
- Internal Timing Resistors on LS122

**SN54/74LS123 (TOP VIEW)**  
(SEE NOTES 1 THRU 4)



**SN54/74LS122 (TOP VIEW)**  
(SEE NOTES 1 THRU 4)



NC — NO INTERNAL CONNECTION.

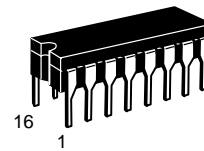
**NOTES:**

1. An external timing capacitor may be connected between  $C_{ext}$  and  $R_{ext}/C_{ext}$  (positive).
2. To use the internal timing resistor of the LS122, connect  $R_{int}$  to  $V_{CC}$ .
3. For improved pulse width accuracy connect an external resistor between  $R_{ext}/C_{ext}$  and  $V_{CC}$  with  $R_{int}$  open-circuited.
4. To obtain variable pulse widths, connect an external variable resistance between  $R_{int}/C_{ext}$  and  $V_{CC}$ .

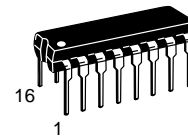
## SN54/74LS122 SN54/74LS123

### RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

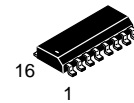
#### LOW POWER SCHOTTKY



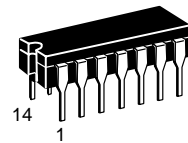
**J SUFFIX**  
CERAMIC  
CASE 620-09



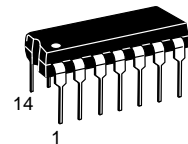
**N SUFFIX**  
PLASTIC  
CASE 648-08



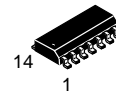
**D SUFFIX**  
SOIC  
CASE 751B-03



**J SUFFIX**  
CERAMIC  
CASE 632-08



**N SUFFIX**  
PLASTIC  
CASE 646-06



**D SUFFIX**  
SOIC  
CASE 751A-02

**ORDERING INFORMATION**

- |            |         |
|------------|---------|
| SN54LSXXXJ | Ceramic |
| SN74LSXXXN | Plastic |
| SN74LSXXXD | SOIC    |

# SN54/74LS122 • SN54/74LS123

**LS122  
FUNCTIONAL TABLE**

INPUTS					OUTPUTS	
CLEAR	A1	A2	B1	B2	Q	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
H	L	X	↑	H		
H	L	X	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  
FUNCTIONAL TABLE**

INPUTS			OUTPUTS	
CLEAR	A	B	Q	Q
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑		
H	↓	H		
↑	L	H		

### TYPICAL APPLICATION DATA

The output pulse  $t_W$  is a function of the external components,  $C_{ext}$  and  $R_{ext}$  or  $C_{ext}$  and  $R_{int}$  on the LS122. For values of  $C_{ext} \geq 1000$  pF, the output pulse at  $V_{CC} = 5.0$  V and  $V_{RC} = 5.0$  V (see Figures 1, 2, and 3) is given by

$$t_W = K R_{ext} C_{ext} \text{ where } K \text{ is nominally } 0.45$$

If  $C_{ext}$  is in pF and  $R_{ext}$  is in k $\Omega$  then  $t_W$  is in nanoseconds.

The  $C_{ext}$  terminal of the LS122 and 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 groundplane and adequate bypassing should be designed into the system for optimum performance to insure that no false triggering occurs.

It should be noted that the  $C_{ext}$  pin is internally connected to ground on the LS122 and LS123, but not on the LS221. Therefore, if  $C_{ext}$  is hard-wired externally to ground, substitution of a LS221 onto a LS123 socket will cause the LS221 to become non-functional.

The switching diode is not needed for electrolytic capacitance application and should not be used on the LS122 and LS123.

To find the value of K for  $C_{ext} \geq 1000$  pF, refer to Figure 4. Variations on  $V_{CC}$  or  $V_{RC}$  can cause the value of K to change, as can the temperature of the LS123, LS122. Figures 5 and 6 show the behavior of the circuit shown in Figures 1 and 2 if

separate power supplies are used for  $V_{CC}$  and  $V_{RC}$ . If  $V_{CC}$  is tied to  $V_{RC}$ , Figure 7 shows how K will vary with  $V_{CC}$  and temperature. Remember, the changes in  $R_{ext}$  and  $C_{ext}$  with temperature are not calculated and included in the graph.

As long as  $C_{ext} \geq 1000$  pF and  $5K \leq R_{ext} \leq 260K$  (SN74LS122/123) or  $5K \leq R_{ext} \leq 160K$  (SN54LS122/123), the change in K with respect to  $R_{ext}$  is negligible.

If  $C_{ext} \leq 1000$  pF the graph shown on Figure 8 can be used to determine the output pulse width. Figure 9 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

$$t_W = 6 + 0.05 C_{ext} (\text{pF}) + 0.45 R_{ext} (\text{k}\Omega) C_{ext} + 11.6 R_{ext}$$

In order to trim the output pulse width, it is necessary to include a variable resistor between  $V_{CC}$  and the  $R_{ext}/C_{ext}$  pin or between  $V_{CC}$  and the  $R_{ext}$  pin of the LS122. Figure 10, 11, and 12 show how this can be done.  $R_{ext}$  remote should be kept as close to the monostable as possible.

Retriggering of the part, as shown in Figure 3, 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).

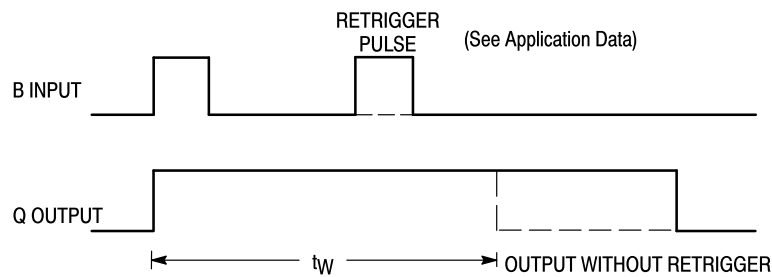
For the smallest possible deviation in output pulse widths from various devices, it is suggested that  $C_{ext}$  be kept  $\geq 1000$  pF.

# SN54/74LS122 • SN54/74LS123

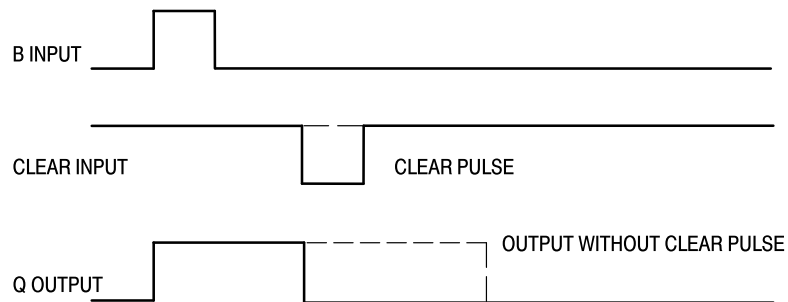
## GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T <sub>A</sub>	Operating Ambient Temperature Range	54 74	-55 0	25 25	125 70	°C
I <sub>OH</sub>	Output Current — High	54, 74			-0.4	mA
I <sub>OL</sub>	Output Current — Low	54 74			4.0 8.0	mA
R <sub>ext</sub>	External Timing Resistance	54 74	5.0 5.0		180 260	kΩ
C <sub>ext</sub>	External Capacitance	54, 74	No Restriction			
R <sub>ext</sub> /C <sub>ext</sub>	Wiring Capacitance at R <sub>ext</sub> /C <sub>ext</sub> Terminal	54, 74			50	pF

## WAVEFORMS



## EXTENDING PULSE WIDTH



## OVERRIDING THE OUTPUT PULSE

# SN54/74LS122 • SN54/74LS123

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter		Limits			Unit	Test Conditions
			Min	Typ	Max		
V <sub>IH</sub>	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V <sub>IL</sub>	Input LOW Voltage	54			0.7	V	Guaranteed Input LOW Voltage for All Inputs
		74			0.8		
V <sub>IK</sub>	Input Clamp Diode Voltage			-0.65	-1.5	V	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54	2.5	3.5		V	V <sub>CC</sub> = MIN, I <sub>OH</sub> = MAX, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table
		74	2.7	3.5		V	
V <sub>OL</sub>	Output LOW Voltage	54, 74		0.25	0.4	V	I <sub>OL</sub> = 4.0 mA V <sub>CC</sub> = V <sub>CC</sub> MIN, V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> per Truth Table
		74		0.35	0.5	V	
I <sub>IH</sub>	Input HIGH Current				20	μA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V
					0.1	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V
I <sub>IL</sub>	Input LOW Current				-0.4	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V
I <sub>OS</sub>	Short Circuit Current (Note 1)		-20		-100	mA	V <sub>CC</sub> = MAX
I <sub>CC</sub>	Power Supply Current	LS122			11	mA	V <sub>CC</sub> = MAX
		LS123			20		

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

## AC CHARACTERISTICS (T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5.0 V)

Symbol	Parameter		Limits			Unit	Test Conditions
			Min	Typ	Max		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, A to Q Propagation Delay, A to Q			23 32	33 45	ns	C <sub>ext</sub> = 0 C <sub>L</sub> = 15 pF  R <sub>ext</sub> = 5.0 kΩ R <sub>L</sub> = 2.0 kΩ
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, B to Q Propagation Delay, B to Q			23 34	44 56		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, Clear to Q Propagation Delay, Clear to Q			28 20	45 27	ns	
t <sub>W min</sub>	A or B to Q			116	200	ns	
t <sub>WQ</sub>	A to B to Q		4.0	4.5	5.0	μs	

## AC SETUP REQUIREMENTS (T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5.0 V)

Symbol	Parameter		Limits			Unit	Test Conditions
			Min	Typ	Max		
t <sub>W</sub>	Pulse Width		40			ns	

# SN54/74LS122 • SN54/74LS123

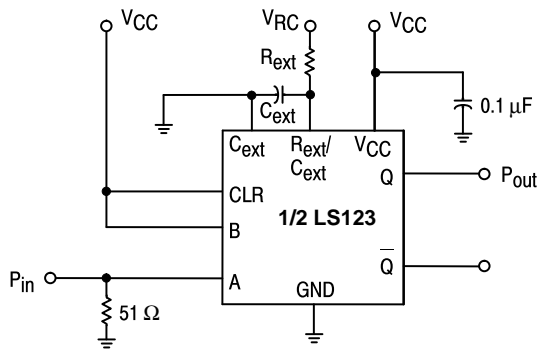


Figure 1

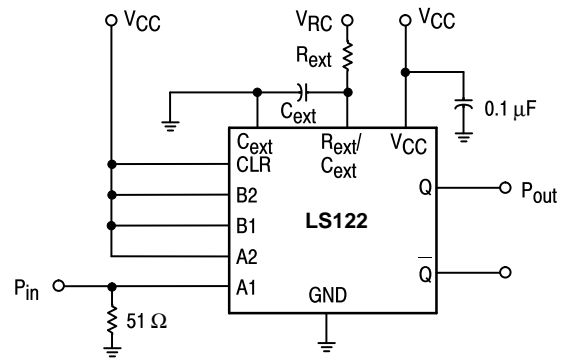


Figure 2

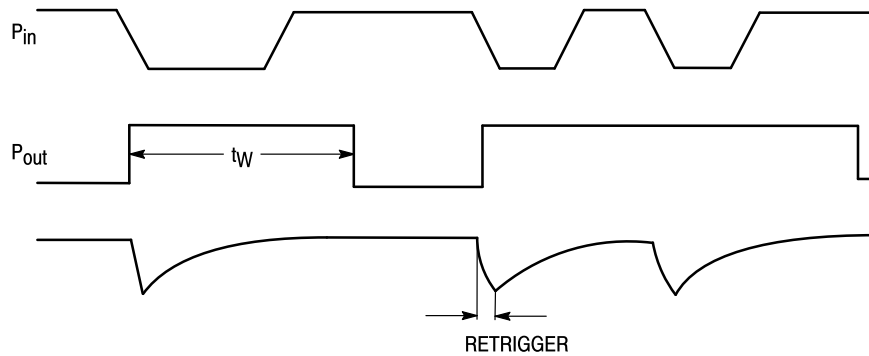


Figure 3

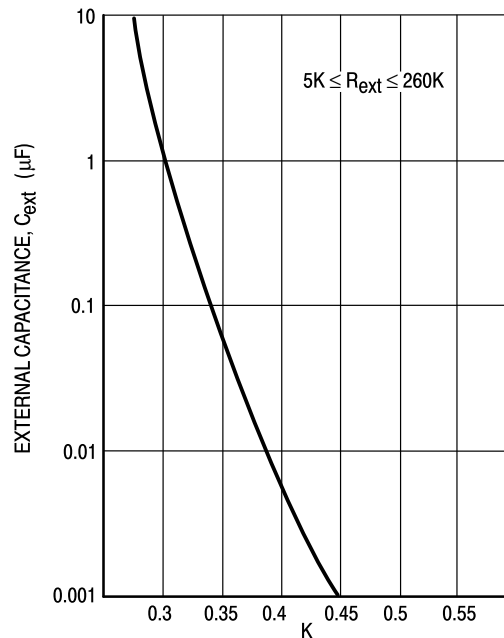


Figure 4

# SN54/74LS122 • SN54/74LS123

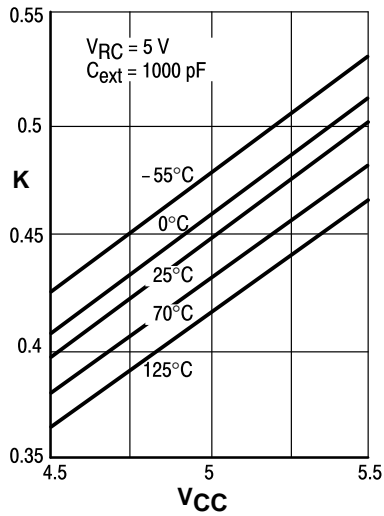


Figure 5. K versus  $V_{CC}$

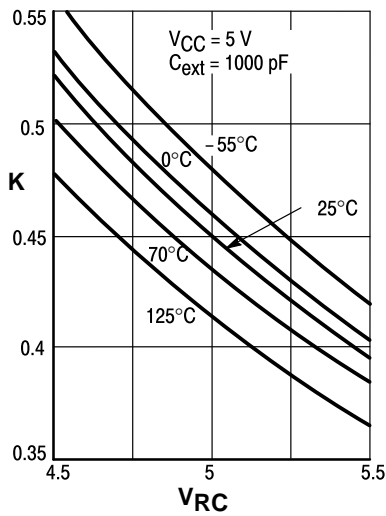


Figure 6. K versus  $V_{RC}$

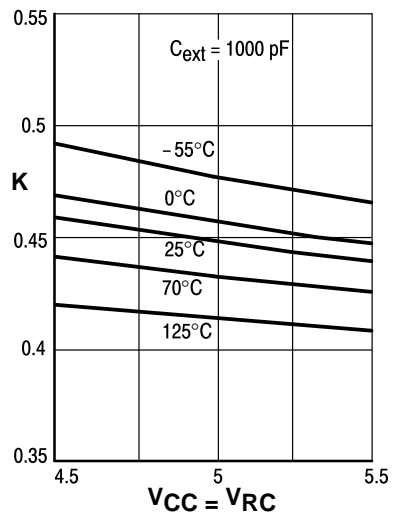


Figure 7. K versus  $V_{CC}$  and  $V_{RC}$

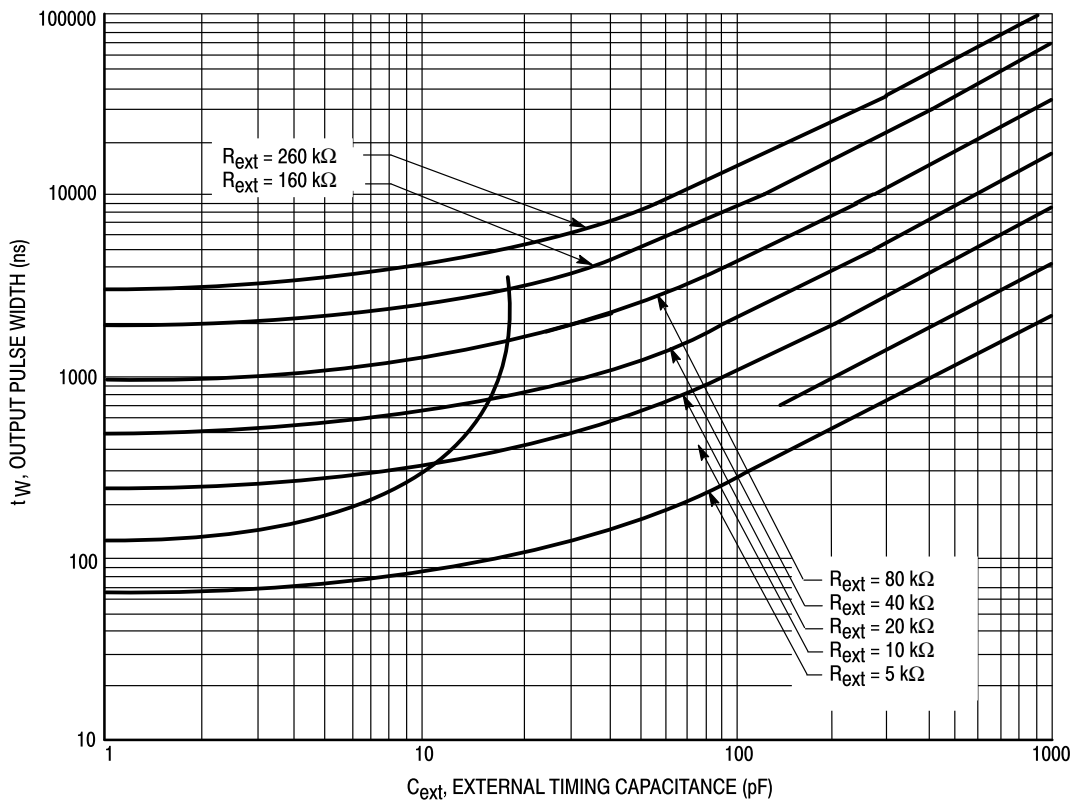


Figure 8

# SN54/74LS122 • SN54/74LS123

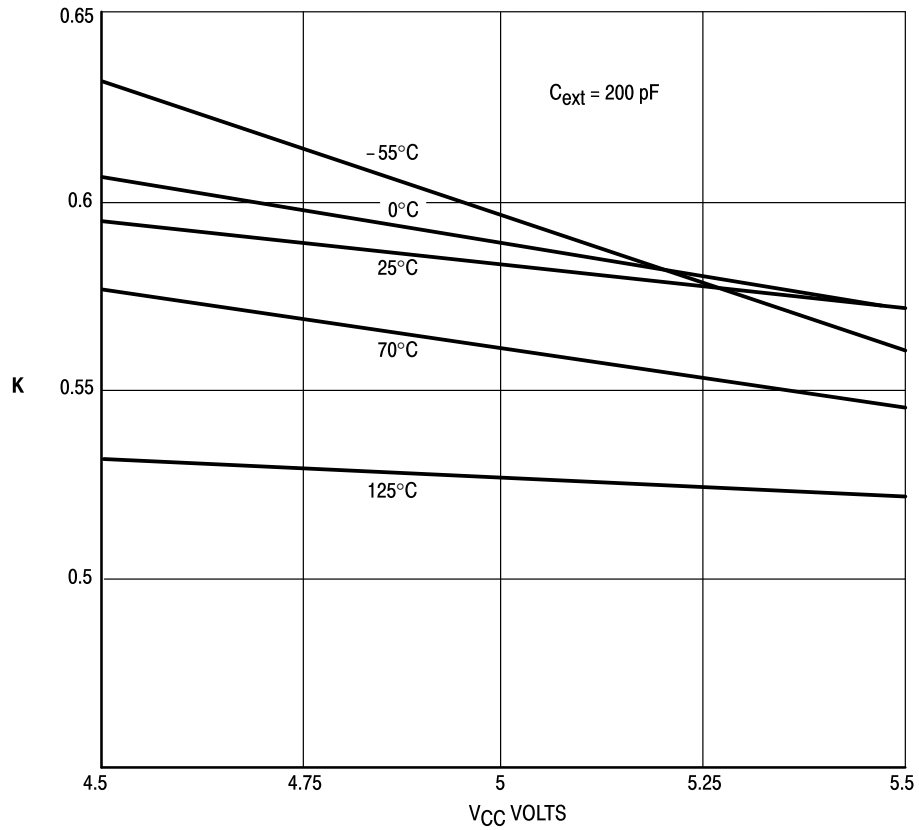


Figure 9

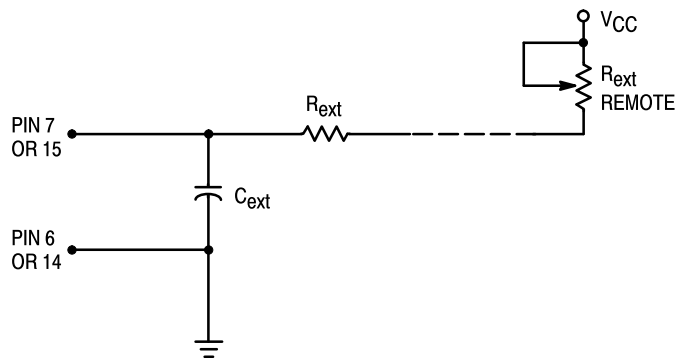


Figure 10. LS123 Remote Trimming Circuit

## SN54/74LS122 • SN54/74LS123

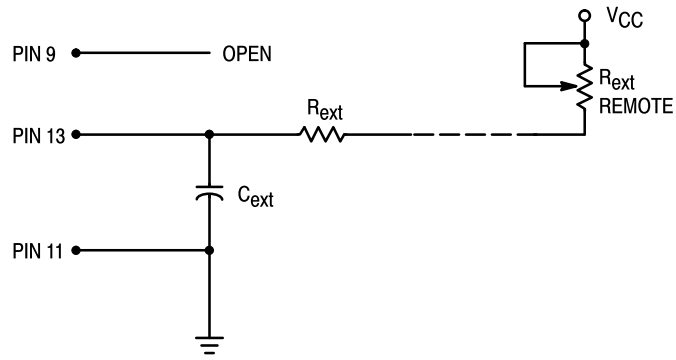


Figure 11. LS122 Remote Trimming Circuit Without  $R_{ext}$

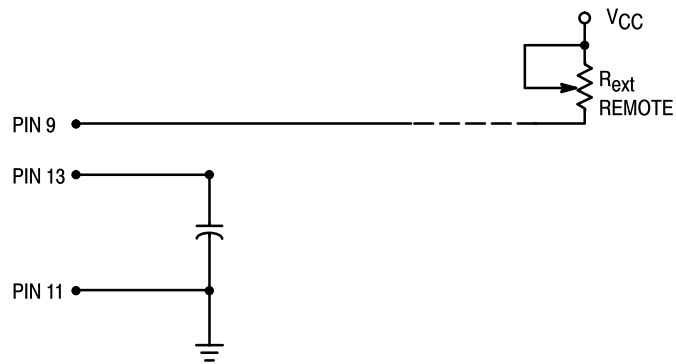
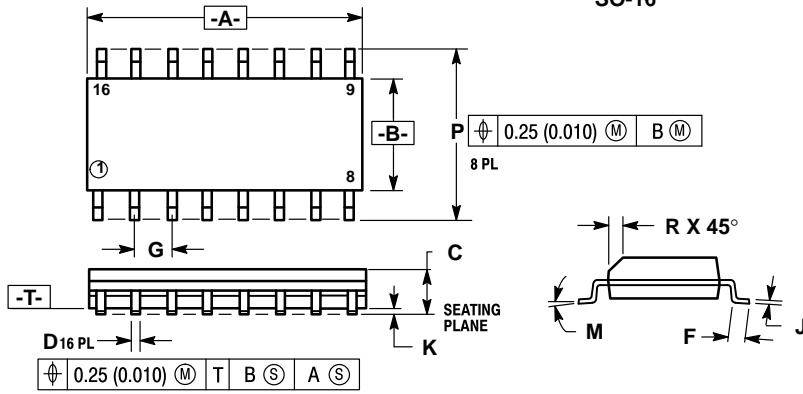


Figure 12. LS122 Remote Trimming Circuit with  $R_{int}$



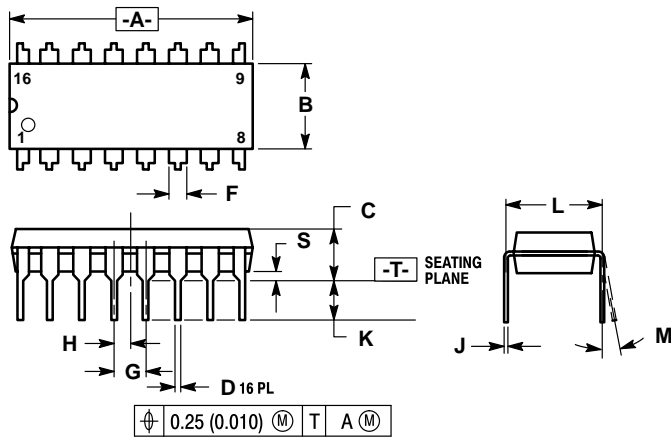
**Case 751B-03 D Suffix  
16-Pin Plastic  
SO-16**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. 751B-01 IS OBSOLETE, NEW STANDARD 751B-03.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

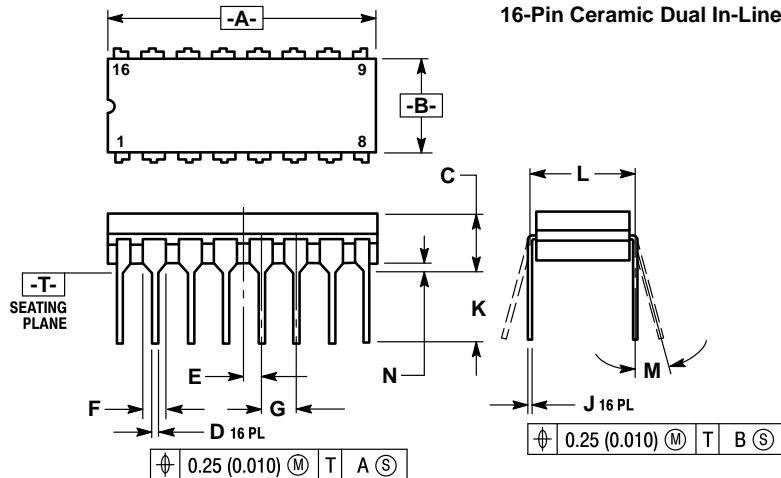
**Case 648-08 N Suffix  
16-Pin Plastic**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
  4. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
  5. ROUNDED CORNERS OPTIONAL.
  6. 648-01 THRU -07 OBSOLETE, NEW STANDARD 648-08.


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	18.80	19.55	0.740	0.770
B	6.35	6.85	0.250	0.270
C	3.69	4.44	0.145	0.175
D	0.39	0.53	0.015	0.021
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.27 BSC		0.050 BSC	
J	0.21	0.38	0.008	0.015
K	2.80	3.30	0.110	0.130
L	7.50	7.74	0.295	0.305
M	0°	10°	0°	10°
S	0.51	1.01	0.020	0.040

**Case 620-09 J Suffix  
16-Pin Ceramic Dual In-Line**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  4. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.
  5. 620-01 THRU -08 OBSOLETE, NEW STANDARD 620-09.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	19.05	19.55	0.750	0.770
B	6.10	7.36	0.240	0.290
C	—	4.19	—	0.165
D	0.39	0.53	0.015	0.021
E	1.27 BSC		0.050 BSC	
F	1.40	1.77	0.055	0.070
G	2.54 BSC		0.100 BSC	
J	0.23	0.27	0.009	0.011
K	—	5.08	—	0.200
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.39	0.88	0.015	0.035

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