

# SN74LS122, SN74LS123

## 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

### GUARANTEED OPERATING RANGES

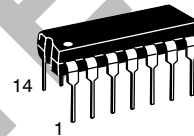
Symbol	Parameter	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage	4.75	5.0	5.25	V
$T_A$	Operating Ambient Temperature Range	0	25	70	°C
$I_{OH}$	Output Current - High			-0.4	mA
$I_{OL}$	Output Current - Low			8.0	mA
$R_{ext}$	External Timing Resistance	5.0		260	k $\Omega$
$C_{ext}$	External Capacitance	No Restriction			
$R_{ext}/C_{ext}$	Wiring Capacitance at $R_{ext}/C_{ext}$ Terminal			50	pF



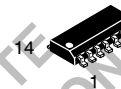
ON Semiconductor™

<http://onsemi.com>

### LOW POWER SCHOTTKY



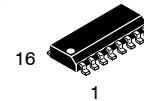
PLASTIC  
N SUFFIX  
CASE 646



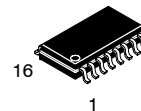
SOIC  
D SUFFIX  
CASE 751A



PLASTIC  
N SUFFIX  
CASE 648



SOIC  
D SUFFIX  
CASE 751B



SOEIAJ  
M SUFFIX  
CASE 966

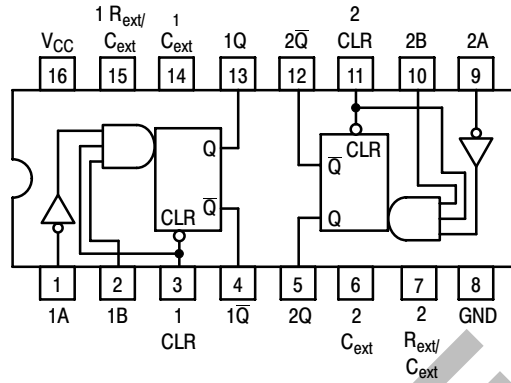
### ORDERING INFORMATION

Device	Package	Shipping
SN74LS122N	14 Pin DIP	2000 Units/Box
SN74LS122D	SOIC-14	55 Units/Rail
SN74LS122DR2	SOIC-14	2500/Tape & Reel
SN74LS123N	16 Pin DIP	2000 Units/Box
SN74LS123D	SOIC-16	38 Units/Rail
SN74LS123DR2	SOIC-16	2500/Tape & Reel
SN74LS123M	SOEIAJ-16	See Note 1
SN74LS123MEL	SOEIAJ-16	See Note 1

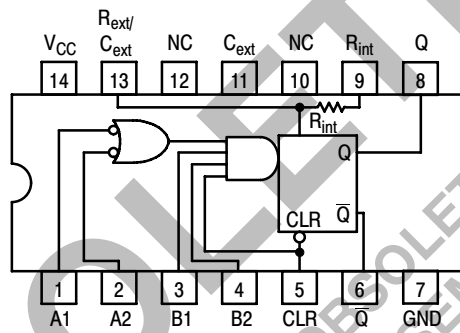
1. For ordering information on the EIAJ version of the SOIC package, please contact your local ON Semiconductor representative.

## SN74LS122, SN74LS123

**SN74LS123 (TOP VIEW)**  
(SEE NOTES 1 THRU 4)



**SN74LS122 (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  $V_{CC}$ .

## SN74LS122, SN74LS123

**LS122 FUNCTIONAL TABLE**

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
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	$\bar{Q}$
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 ensure 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  $5K \leq R_{ext} \leq 260K$ , 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

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

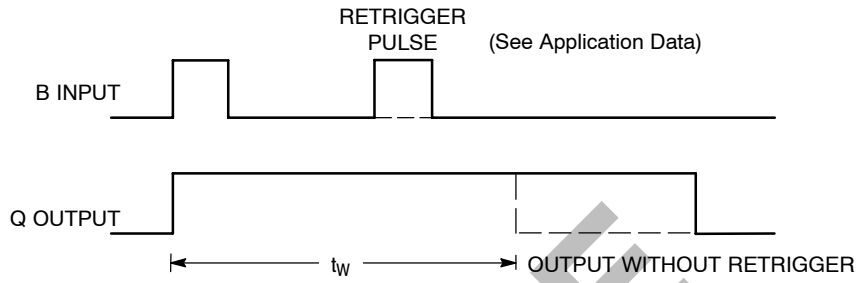
In order to trim the output pulse width, it is necessary to include a variable resistor between  $V_{CC}$  and the  $R_{ext}/C_{ext}$  pin or between  $V_{CC}$  and the  $R_{ext}$  pin of the LS122. Figure 10, 11, and 12 show how this can be done.  $R_{ext}$  remote should be kept as close to the monostable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

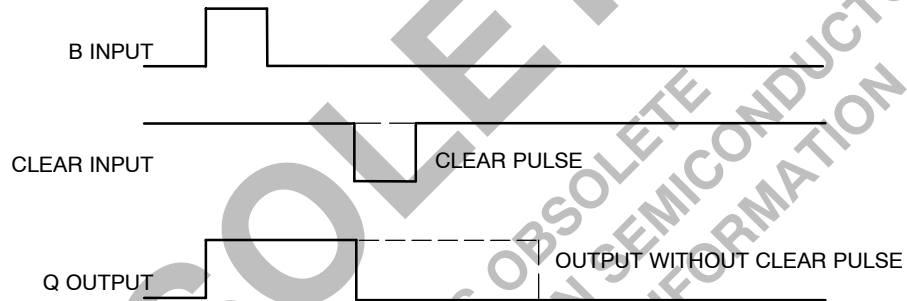
For the smallest possible deviation in output pulse widths from various devices, it is suggested that  $C_{ext}$  be kept  $\geq 1000$  pF.

# SN74LS122, SN74LS123

## WAVEFORMS



## EXTENDING PULSE WIDTH



## OVERRIDING THE OUTPUT PULSE

**OBSOLETE**  
THIS DEVICE IS OBSOLETE  
PLEASE CONTACT YOUR ON SEMICONDUCTOR  
REPRESENTATIVE FOR INFORMATION

# SN74LS122, SN74LS123

## 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			0.8	V	Guaranteed Input LOW Voltage for All Inputs
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	2.7	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
V <sub>OL</sub>	Output LOW Voltage		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
			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 2)	-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		

2. 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 $\bar{Q}$		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 $\bar{Q}$		23 34	44 56	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, Clear to $\bar{Q}$ Propagation Delay, Clear to Q		28 20	45 27	ns	
t <sub>W min</sub>	A or B to Q		116	200	ns	C <sub>ext</sub> = 1000 pF, R <sub>ext</sub> = 10 kΩ, C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2.0 kΩ
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	

# SN74LS122, SN74LS123

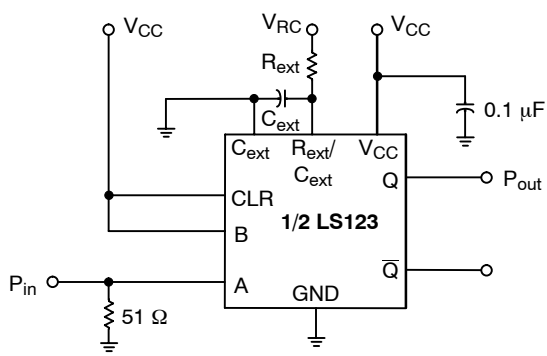


Figure 1.

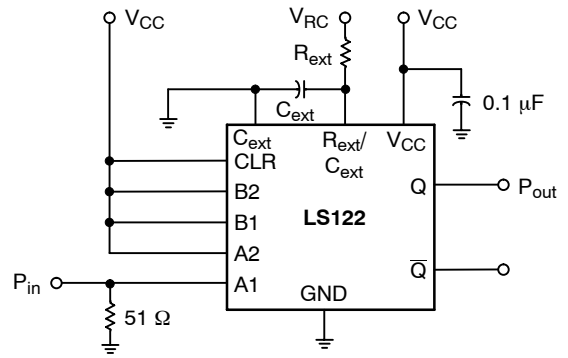


Figure 2.

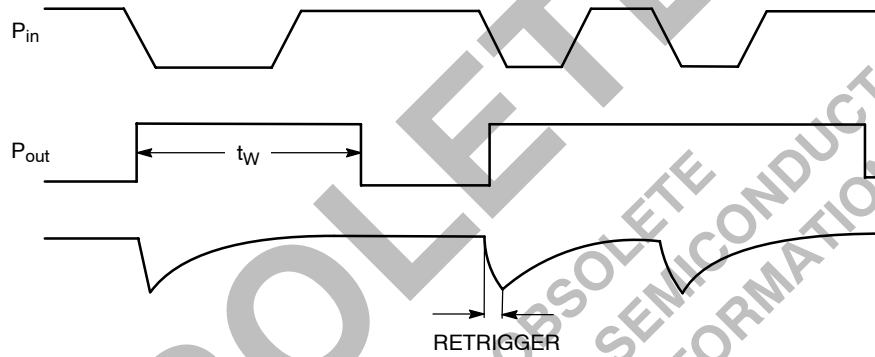


Figure 3.

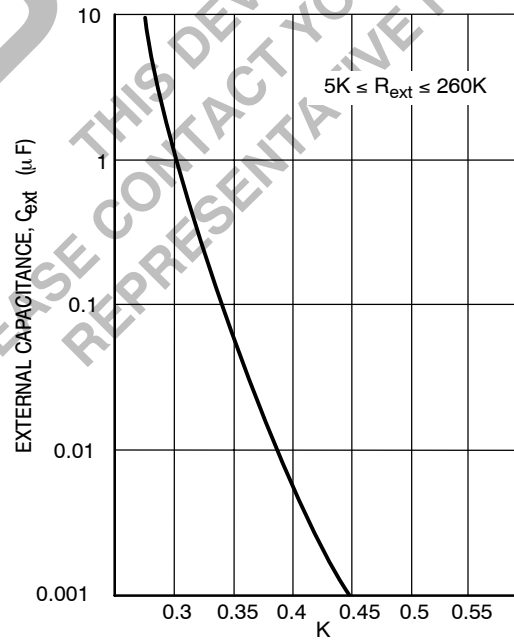


Figure 4.

# SN74LS122, SN74LS123

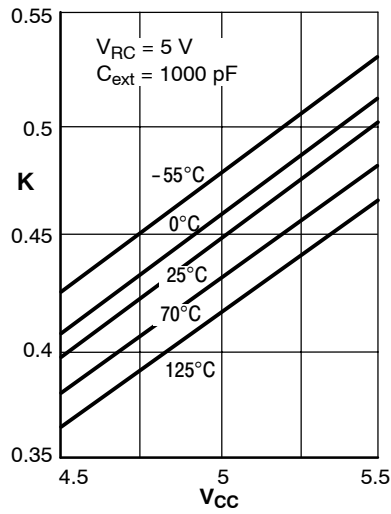


Figure 5. K versus  $V_{CC}$

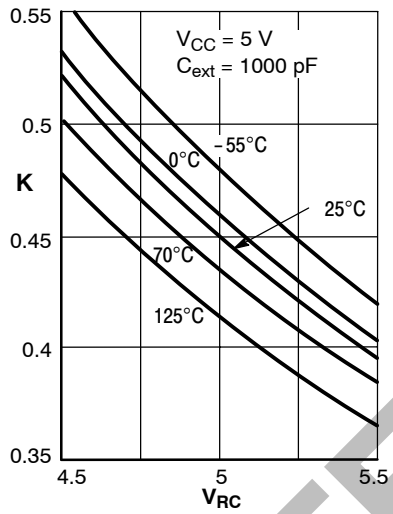


Figure 6. K versus  $V_{RC}$

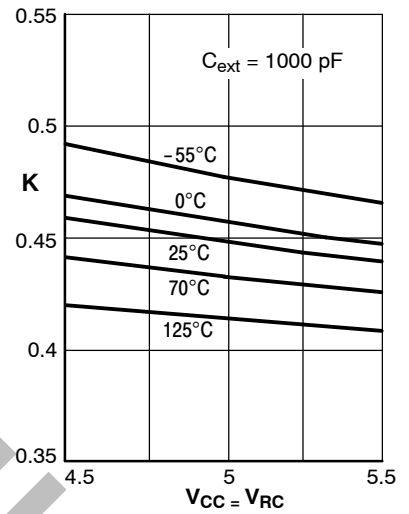


Figure 7. K versus  $V_{CC}$  and  $V_{RC}$

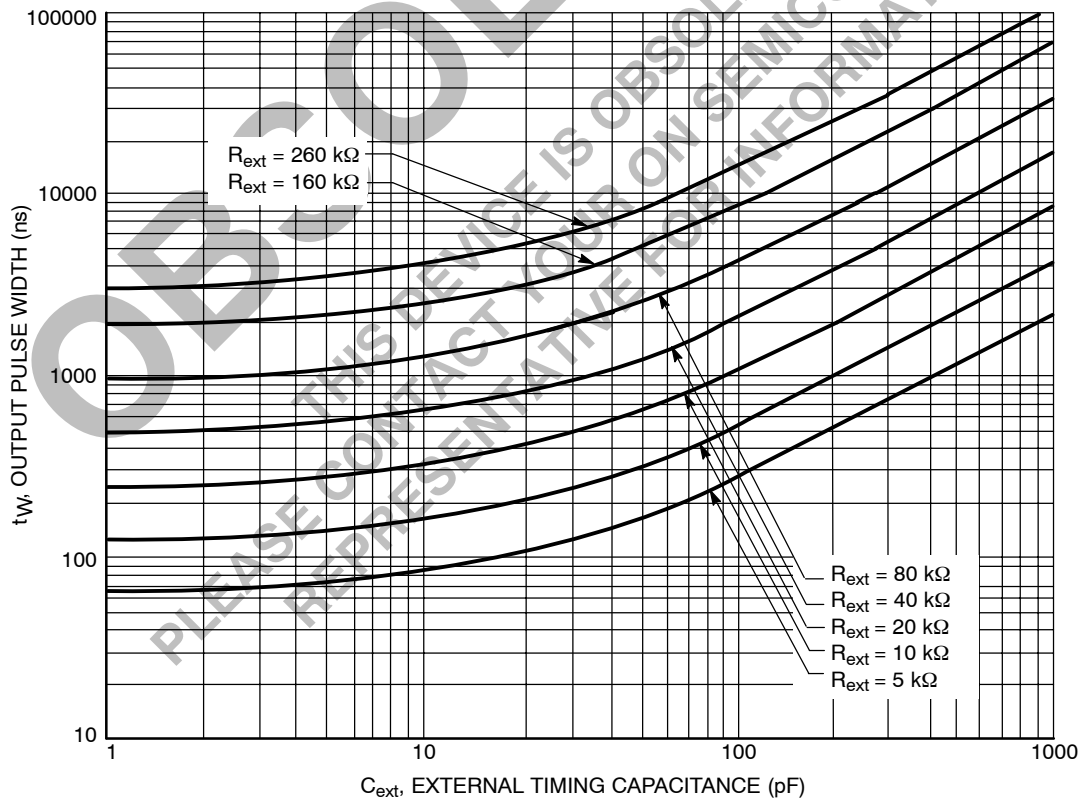


Figure 8.

# SN74LS122, SN74LS123

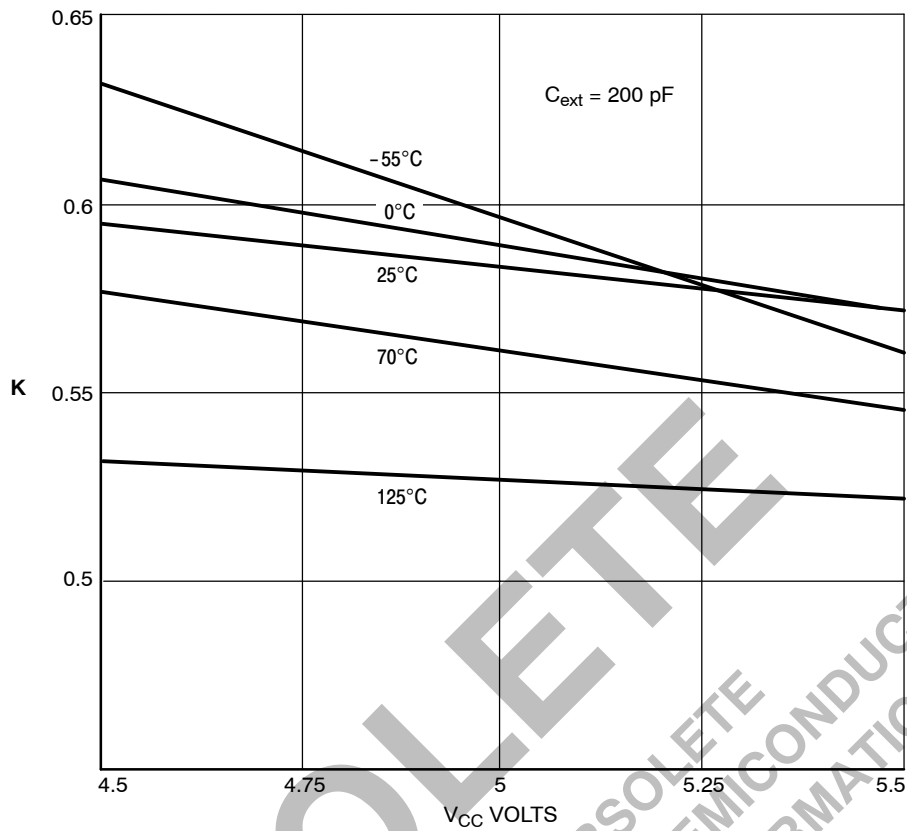


Figure 9.

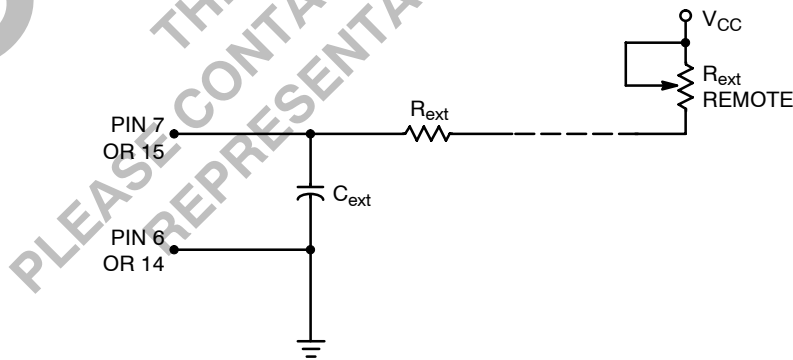


Figure 10. LS123 Remote Trimming Circuit



# SN74LS122, SN74LS123

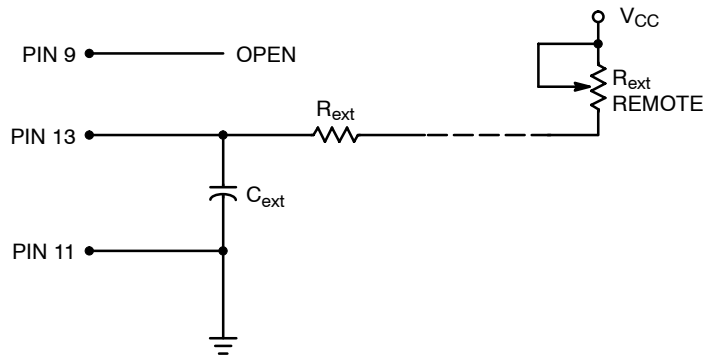


Figure 11. LS122 Remote Trimming Circuit Without  $R_{ext}$

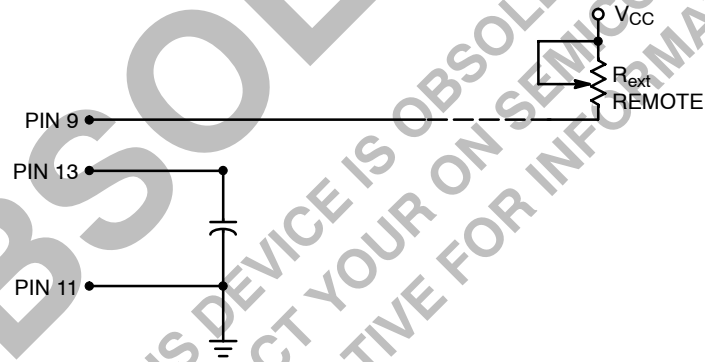
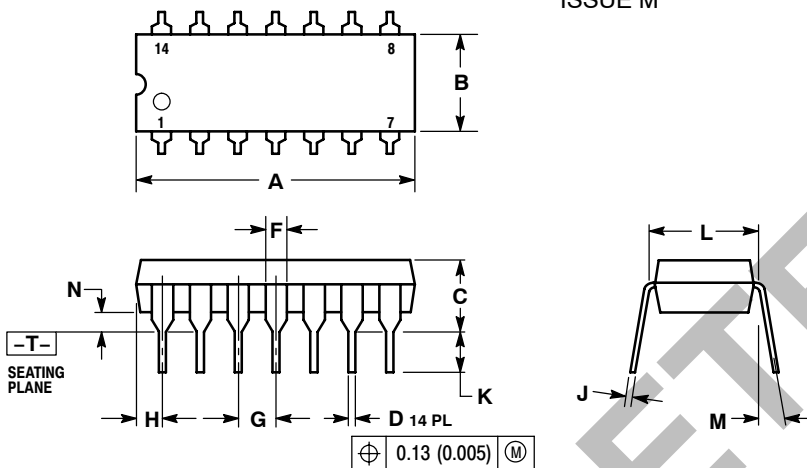


Figure 12. LS122 Remote Trimming Circuit with  $R_{int}$

# SN74LS122, SN74LS123

## PACKAGE DIMENSIONS

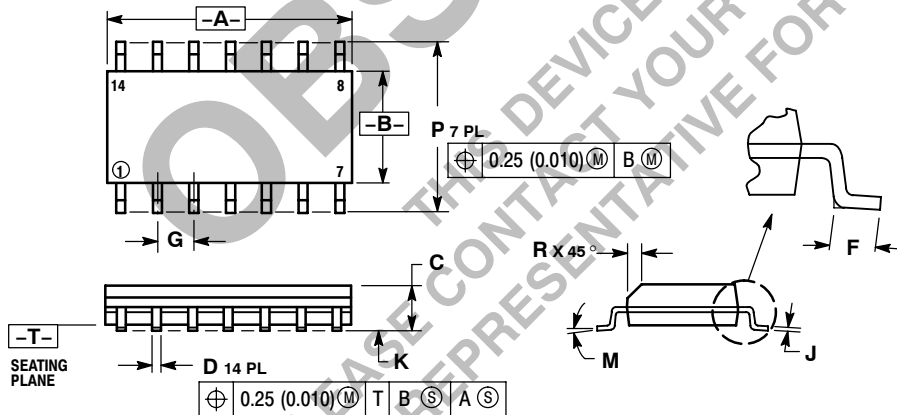
### N SUFFIX PLASTIC PACKAGE CASE 646-06 ISSUE M



- 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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	---	10°	---	10°
N	0.015	0.039	0.38	1.01

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F



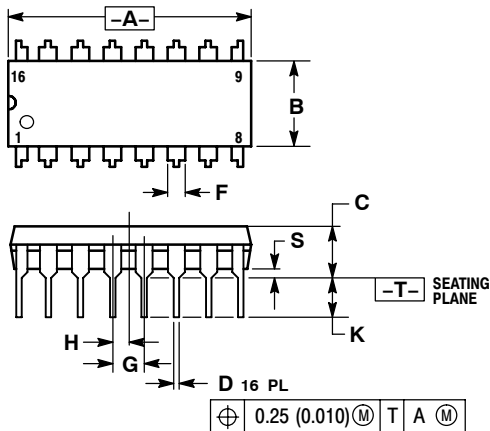
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
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	0.228	0.244
R	0.25	0.50	0.010	0.019

# SN74LS122, SN74LS123

## PACKAGE DIMENSIONS

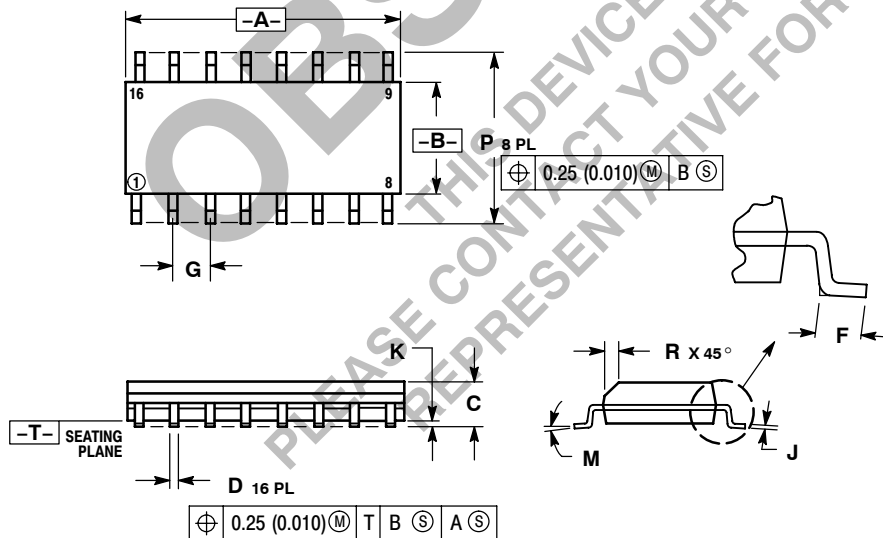
### N SUFFIX PLASTIC PACKAGE CASE 648-08 ISSUE R



- 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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



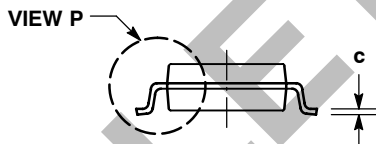
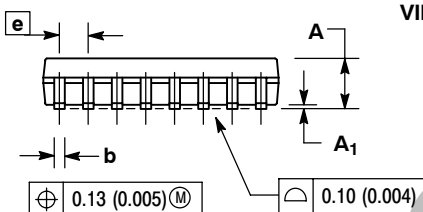
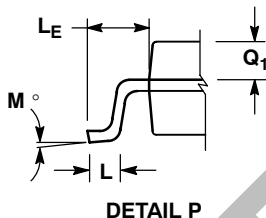
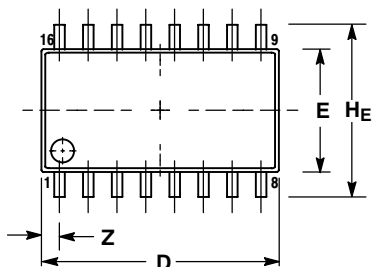
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

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

# SN74LS122, SN74LS123

## PACKAGE DIMENSIONS

M SUFFIX  
SOEIAJ PACKAGE  
CASE 966-01  
ISSUE O



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A <sub>1</sub>	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
HE	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
LE	1.10	1.50	0.043	0.059
M	0° 10°		0° 10°	
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

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