

# SN54122, SN54123, SN54130, SN54LS122, SN54LS123, SN74122, SN74123, SN74130, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

SDLS043 - DECEMBER 1983 - REVISED MARCH 1988

- D-C Triggered from Active-High or Active-Low Gated Logic Inputs
- Retriggerable for Very Long Output Pulses, Up to 100% Duty Cycle
- Overriding Clear Terminates Output Pulse
- '122 and 'LS122 Have Internal Timing Resistors

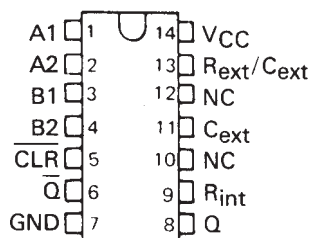
## description

These d-c triggered multivibrators feature output pulse-duration control by three methods. The basic pulse time is programmed by selection of external resistance and capacitance values (see typical application data). The '122 and 'LS122 have internal timing resistors that allow the circuits to be used with only an external capacitor, if so desired. Once triggered, the basic pulse duration 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. Figure 1 illustrates pulse control by retriggering and early clear.

The 'LS122 and 'LS123 are provided enough Schmitt hysteresis to ensure jitter-free triggering from the B input with transition rates as slow as 0.1 millivolt per nanosecond.

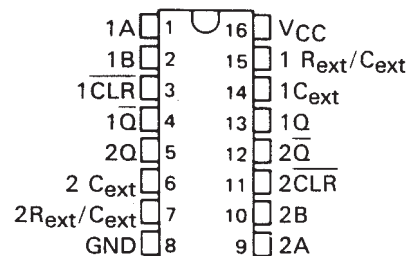
The  $R_{int}$  is nominally 10 k $\Omega$  for '122 and 'LS122.

SN54122, SN54LS122 . . . J OR W PACKAGE  
SN74122 . . . N PACKAGE  
SN74LS122 . . . D OR N PACKAGE  
(TOP VIEW) (SEE NOTES 1 THRU 4)

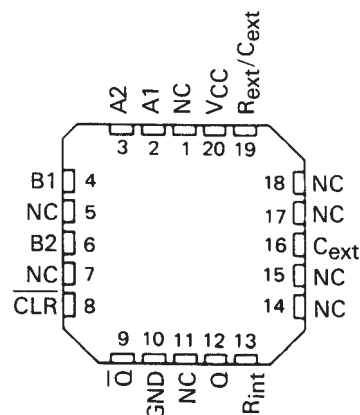


- NOTES: 1. An external timing capacitor may be connected between  $C_{ext}$  and  $R_{ext}/C_{ext}$  (positive).  
2. To use the internal timing resistor of '122 or 'LS122, connect  $R_{int}$  to VCC.  
3. For improved pulse duration accuracy and repeatability, connect an external resistor between  $R_{ext}/C_{ext}$  and VCC with  $R_{int}$  open-circuited.  
4. To obtain variable pulse durations, connect an external variable resistance between  $R_{int}$  or  $R_{ext}/C_{ext}$  and VCC.

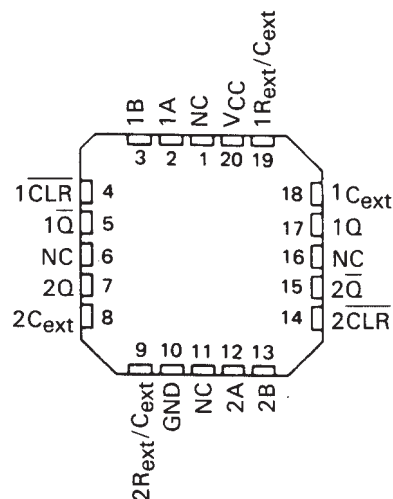
SN54123, SN54130, SN54LS123 . . . J OR W PACKAGE  
SN74123, SN74130 . . . N PACKAGE  
SN74LS123 . . . D OR N PACKAGE  
(TOP VIEW) (SEE NOTES 1 THRU 4)



SN54LS122 . . . FK PACKAGE  
(TOP VIEW) (SEE NOTES 1 THRU 4)



SN54LS123 . . . FK PACKAGE  
(TOP VIEW) (SEE NOTES 1 THRU 4)

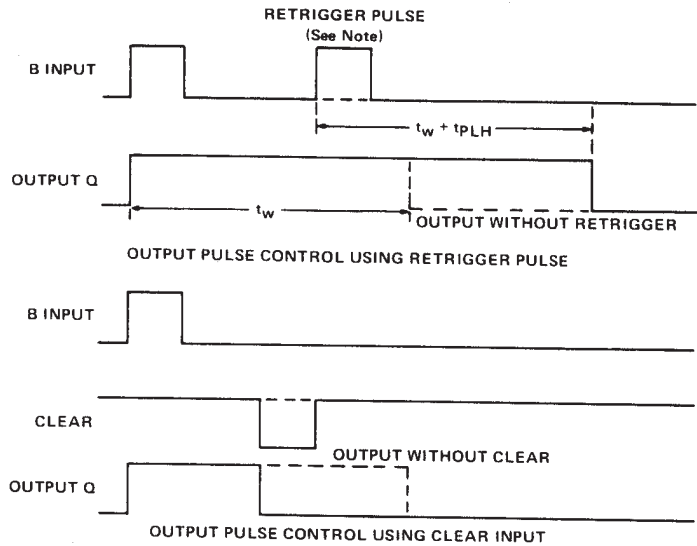


NC - No internal connection

SN54122, SN54123, SN54130, SN54LS122, SN54LS123,  
SN74122, SN74123, SN74130, SN74LS122, SN74LS123  
RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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description (continued)



NOTE: Retrigger pulses starting before 0.22 C<sub>ext</sub> (in picofrads) nanoseconds after the initial trigger pulse will be ignored and the output duration will remain unchanged.

FIGURE 1—TYPICAL INPUT/OUTPUT PULSES

'122, 'LS122  
FUNCTION 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  |         |           |

'123, '130, 'LS123  
FUNCTION 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 |         |           |

See explanation of function tables on page

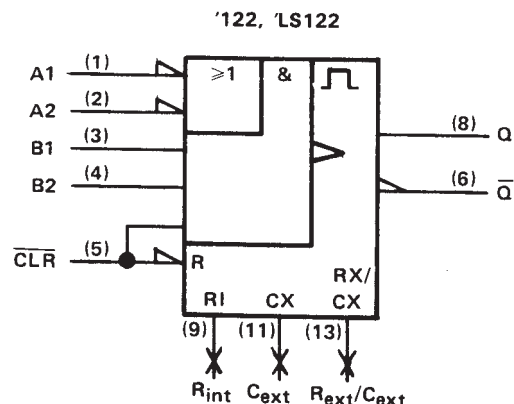
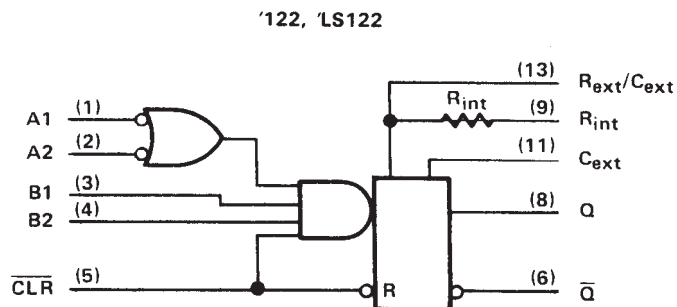
† These lines of the functional tables assume that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the set up.

# SN54122, SN54123, SN54130, SN54LS122, SN54LS123, SN74122, SN74123, SN74130, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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logic diagram (positive logic)

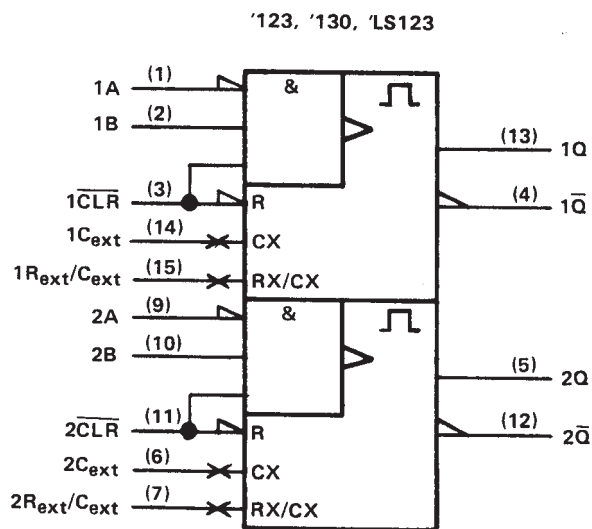
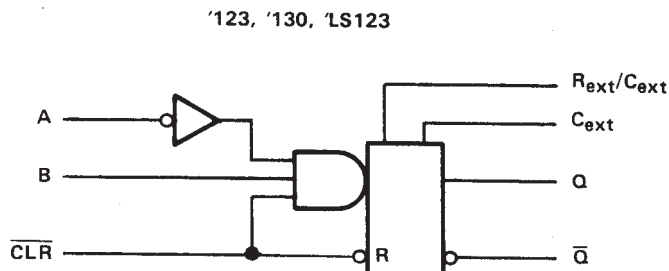
logic symbol†



$R_{int}$  is nominally 10 k $\Omega$  for '122 and 'LS122

logic diagram (positive logic) (each multivibrator)

logic symbol†



Pin numbers shown are for D, J, N, and W packages.

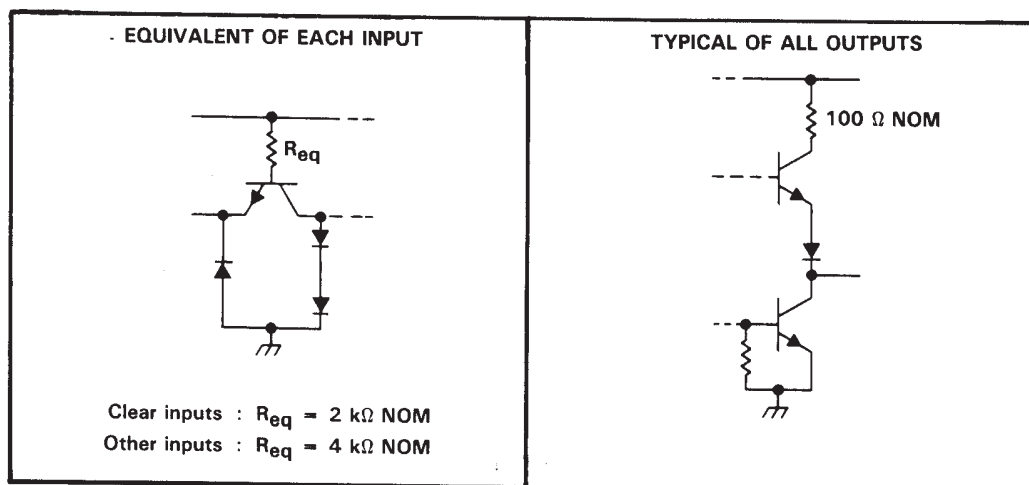
†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

# SN54122, SN54123, SN54130, SN54LS122, SN54LS123, SN74122, SN74123, SN74130, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

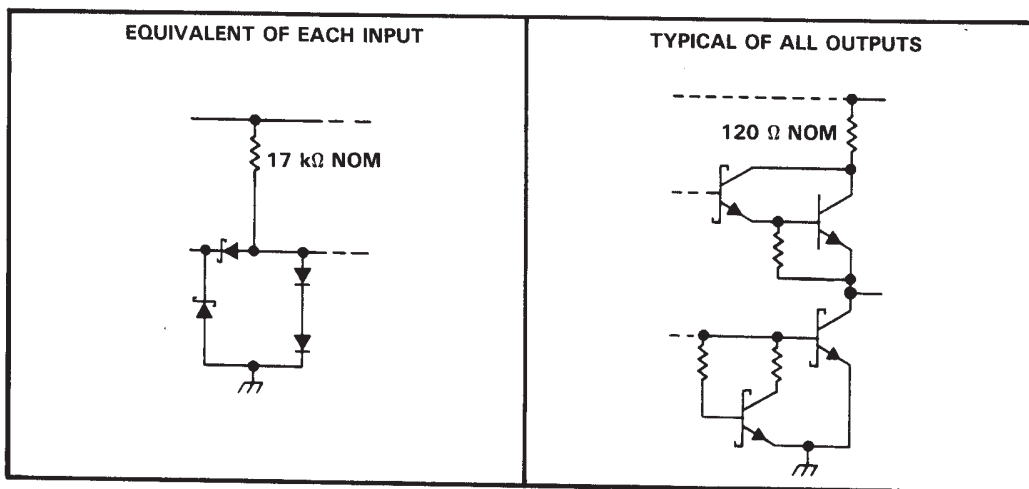
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## schematics of inputs and outputs

### '122, '123, '130 CIRCUITS



### 'LS122, 'LS123 CIRCUITS



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)       | 7 V            |
| Input voltage: '122, '123, '130             | 5.5 V          |
| 'LS122, 'LS123                              | 7 V            |
| Operating free-air temperature range: SN54' | -55°C to 125°C |
| SN74'                                       | 0°C to 70°C    |
| Storage temperature range                   | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

# SN54122, SN54123, SN54130, SN74122, SN74123, SN74130 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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## recommended operating conditions

|  | SN54'          |     |      | SN74'          |     |      | 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, $I_{OH}$              |                |     | -800 |                |     | -800 | $\mu A$     |
| Low-level output current, $I_{OL}$               |                |     | 16   |                |     | 16   | mA          |
| Pulse duration, $t_W$                            | 40             |     |      | 40             |     |      | ns          |
| External timing resistance, $R_{ext}$            | 5              |     | 25   | 5              |     | 50   | k $\Omega$  |
| 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   | $^{\circ}C$ |

## electrical characteristics over recommended free-air operating temperature range (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS†  | '122 |      |      | '123, '130 |      |      | UNIT    |
|-----------|---|---|------|------|------|------------|------|------|---------|
|           |   |   | MIN  | TYP‡ | MAX  | MIN        | TYP‡ | MAX  |         |
| $V_{IH}$  | High-level input voltage                |   | 2    |      |      | 2          |      |      | V       |
| $V_{IL}$  | Low-level input voltage                 |   |      |      | 0.8  |            |      | 0.8  | V       |
| $V_{IK}$  | Input clamp voltage                     | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                   |      |      | -1.5 |            |      | -1.5 | V       |
| $V_{OH}$  | High-level output voltage               | $V_{CC} = \text{MIN}, I_{OH} = -800 \mu A$ ,<br>See Note 5    | 2.4  | 3.4  |      | 2.4        | 3.4  |      | V       |
| $V_{OL}$  | Low-level output voltage                | $V_{CC} = \text{MIN}, I_{OL} = 16 \text{ mA}$ ,<br>See Note 5 |      | 0.2  | 0.4  |            | 0.2  | 0.4  | V       |
| $I_I$     | Input current at maximum input voltage  | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                    |      |      | 1    |            |      | 1    | mA      |
| $I_{IH}$  | High-level input current                | Data inputs   |      |      | 40   |            |      | 40   | $\mu A$ |
|           |   | Clear input   |      |      | 80   |            |      | 80   |         |
| $I_{IL}$  | Low-level input current                 | Data inputs   |      |      | -1.6 |            |      | -1.6 | mA      |
|           |   | Clear input   |      |      | -3.2 |            |      | -3.2 |         |
| $I_{OS}$  | Short-circuit output current§           | $V_{CC} = \text{MAX}$ , See Note 5                            | -10  |      | -40  | -10        |      | -40  | mA      |
| $I_{CC}$  | Supply current (quiescent or triggered) | $V_{CC} = \text{MAX}$ , See Notes 6 and 7                     | 23   | 36   |      | 46         | 66   |      | mA      |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}C$ .

§ Not more than one output should be shorted at a time.

NOTES: 5. Ground  $C_{ext}$  to measure  $V_{OH}$  at Q,  $V_{OL}$  at  $\bar{Q}$ , or  $I_{OS}$  at Q.  $C_{ext}$  is open to measure  $V_{OH}$  at  $\bar{Q}$ ,  $V_{OL}$  at Q, or  $I_{OS}$  at  $\bar{Q}$ .

6. Quiescent  $I_{CC}$  is measured (after clearing) with 4.5 V applied to all clear and A inputs, B inputs grounded, all outputs open and  $R_{ext} = 25 \text{ k}\Omega$ .  $R_{int}$  of '122 is open.

7.  $I_{CC}$  is measured in the triggered state with 2.4 V applied to all clear and B inputs, A inputs grounded, all outputs open,  $C_{ext} = 0.02 \mu F$ , and  $R_{ext} = 25 \text{ k}\Omega$ .  $R_{int}$  of '122 is open.

## switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}C$ , see note 8

| PARAMETER¶           | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS  | '122, '130 |      |      | '123 |      |      | UNIT    |
|----------------------|--------------|-------------|--|------------|------|------|------|------|------|---------|
|                      |              |             |  | MIN        | TYP  | MAX  | MIN  | TYP  | MAX  |         |
| $t_{PLH}$            | A            | Q           | $C_{ext} = 0$ , $R_{ext} = 5 \text{ k}\Omega$ ,<br>$C_L = 15 \text{ pF}$ , $R_L = 400 \Omega$                | 22         | 33   |      | 22   | 33   |      | ns      |
|                      | B            | Q           |  | 19         | 28   |      | 19   | 28   |      |         |
| $t_{PHL}$            | A            | $\bar{Q}$   |  | 30         | 40   |      | 30   | 40   |      | ns      |
|                      | B            | $\bar{Q}$   |  | 27         | 36   |      | 27   | 36   |      |         |
| $t_{PHL}$            | Clear        | Q           |  | 18         | 27   |      | 18   | 27   |      | ns      |
| $t_{PLH}$            | Clear        | $\bar{Q}$   |  | 30         | 40   |      | 30   | 40   |      |         |
| $t_{WQ}(\text{min})$ | A or B       | Q           |  | 45         | 65   |      | 45   | 76   |      | ns      |
| $t_{WQ}$             | A or B       | Q           | $C_{ext} = 1000 \text{ pF}$ , $R_{ext} = 10 \text{ k}\Omega$ ,<br>$C_L = 15 \text{ pF}$ , $R_L = 400 \Omega$ | 3.08       | 3.42 | 3.76 | 2.76 | 3.03 | 3.37 | $\mu s$ |

¶  $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

$t_{WQ}$  = duration of pulse at output Q.

NOTE 8: Load circuits and voltage waveforms are shown in Section 1.



# SN54LS122, SN54LS123, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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## recommended operating conditions

|  | SN54LS'        |     |      | SN74LS'        |     |      | 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 | $\mu A$     |
| Low-level output current, $I_{OL}$               |                |     | 4    |                |     | 8    | mA          |
| Pulse duration, $t_w$                            | 40             |     |      | 40             |     |      | ns          |
| External timing resistance, $R_{ext}$            | 5              |     | 180  | 5              |     | 260  | $k\Omega$   |
| 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   | $^{\circ}C$ |

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS†  | SN54LS' |      |             | SN74LS' |      |             | 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       |
| $V_{IK}$ Input clamp voltage                     | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$   |         |      | -1.5        |         |      | -1.5        | V       |
| $V_{OH}$ High-level output voltage               | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu A$   | 2.5     | 3.5  |             | 2.7     | 3.5  |             | V       |
| $V_{OL}$ Low-level output voltage                | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 4 \text{ mA}$ | 0.25    | 0.4  |             | 0.25    | 0.4  |             | V       |
|  |   |         |      |             |         |      | 0.35 0.5    |         |
| $I_I$ Input current at maximum input voltage     | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$  |         |      | 0.1         |         |      | 0.1         | mA      |
| $I_{IH}$ High-level input current                | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$  |         |      | 20          |         |      | 20          | $\mu A$ |
| $I_{IL}$ Low-level input current                 | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$  |         |      | -0.4        |         |      | -0.4        | mA      |
| $I_{OS}$ Short-circuit output current§           | $V_{CC} = \text{MAX}$   | -20     |      | -100        | -20     |      | -100        | mA      |
| $I_{CC}$ Supply current (quiescent or triggered) | $V_{CC} = \text{MAX}, \text{ See Note 13}$  |         |      | 'LS122 6 11 |         |      | 'LS123 6 11 | mA      |
|  |   |         |      |             |         |      | 12 20       |         |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}C$ .

§Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

NOTES: 12. To measure  $V_{OH}$  at Q,  $V_{OL}$  at Q, or  $I_{OS}$  at Q, ground  $R_{ext}/C_{ext}$ , apply 2 V to B and clear, and pulse A from 2 V to 0 V.

13. 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 A or B inputs.

## switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}C$ (see note 8)

| PARAMETER¶ | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS   | MIN | TYP | MAX | UNIT |
|------------|-----------------|----------------|---|-----|-----|-----|------|
| tPLH       | A               | Q              | Cext = 0,                    Rext = 5 kΩ,<br>CL = 15 pF,                RL = 2 kΩ |     | 23  | 33  | ns   |
|            | B               |                |   |     | 23  | 44  |      |
| tPHL       | A               | Q̅             |   |     | 32  | 45  | ns   |
|            | B               |                |   |     | 34  | 56  |      |
| tPHL       | Clear           | Q              |   |     | 20  | 27  | ns   |
| tPLH       |                 | Q̅             |   |     | 28  | 45  |      |
| tWQ (min)  |                 | A or B         |   | Q   |     | 116 |      |
| tWQ        | A or B          | Q              | Cext = 1000 pF,    Rext = 10 kΩ,<br>CL = 15 pF,            RL = 2 kΩ              | 4   | 4.5 | 5   | μs   |

¶ $t_{PLH}$  = propagation delay time, low-to-high-level output

$t_{PHL}$  = propagation delay time, high-to-low-level output

$t_{wQ}$  = duration of pulse at output Q.

NOTE 8: Load circuits and voltage waveforms are shown in Section 1.



# SN54122, SN54123, SN54130, SN74122, SN74123, SN74130 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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## TYPICAL APPLICATION DATA FOR '122, '123, '130

For pulse durations when  $C_{ext} \leq 1000$  pF, see Figure 4.

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

$$t_W = K \cdot R_T \cdot C_{ext} \left( 1 + \frac{0.7}{R_T} \right)$$

where

$K$  is 0.32 for '122, 0.28 for '123 and '130

$R_T$  is in  $k\Omega$  (internal or external timing resistance.)

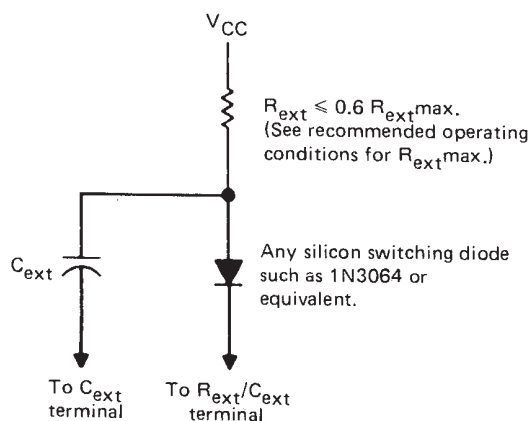
$C_{ext}$  is in pF

$t_W$  is in ns

To prevent reverse voltage across  $C_{ext}$ , it is recommended that the method shown in Figure 2 be employed when using electrolytic capacitors and in applications utilizing the clear function. In all applications using the diode, the pulse duration is:

$$t_W = K_D \cdot R_T \cdot C_{ext} \left( 1 + \frac{0.7}{R_T} \right)$$

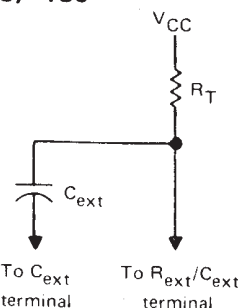
$K_D$  is 0.28 for '122, 0.25 for '123 and '130



TIMING COMPONENT CONNECTIONS WHEN  
 $C_{ext} > 1000$  pF AND CLEAR IS USED

FIGURE 2

Applications requiring more precise pulse durations (up to 28 seconds) and not requiring the clear feature can best be satisfied with the '121.



TIMING COMPONENT CONNECTIONS  
FIGURE 3

## TYPICAL OUTPUT PULSE DURATION vs EXTERNAL TIMING CAPACITANCE

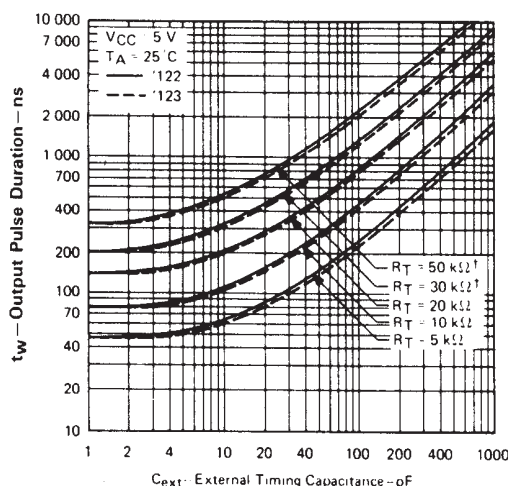


FIGURE 4

†These values of resistance exceed the maximum recommended for use over the full temperature range of the SN54' circuits.



# SN54LS122, SN54LS123, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

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## TYPICAL APPLICATION DATA FOR 'LS122, 'LS123

The basic output pulse duration is essentially determined by the values of external capacitance and timing resistance. For pulse durations when  $C_{ext} \leq 1000$  pF, use Figure 6, or use Figure 7 where the pulse duration may be defined as:

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

When  $C_{ext} \geq 1 \mu F$ , the output pulse width is defined as:

$$t_w = 0.33 \cdot R_T \cdot C_{ext}$$

For the above two equations, as applicable;

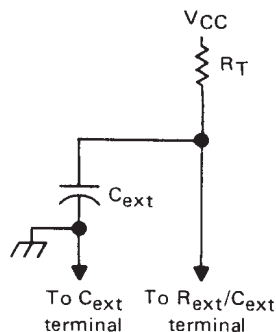
$K$  is multiplier factor, see Figure 7

$R_T$  is in  $k\Omega$  (internal or external timing resistance)

$C_{ext}$  is in pF

$t_w$  is in ns

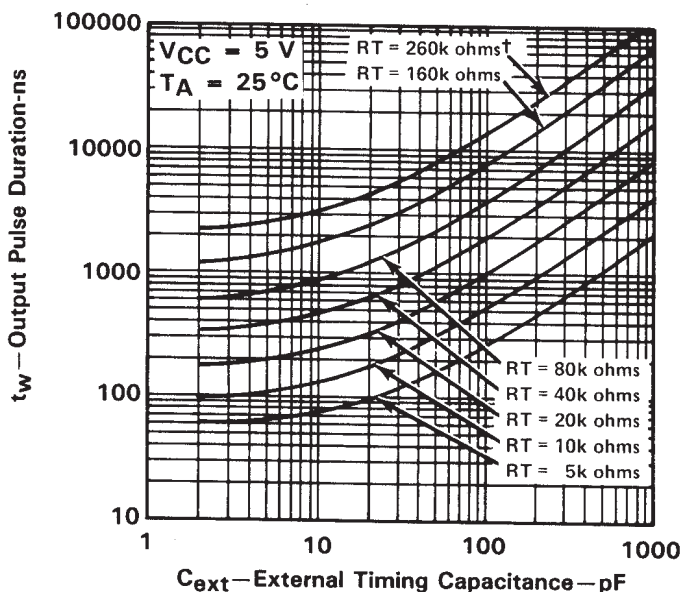
For maximum noise immunity, system ground should be applied to the  $C_{ext}$  node, even though the  $C_{ext}$  node is already tied to the ground lead internally. Due to the timing scheme used by the 'LS122 and 'LS123, a switching diode is not required to prevent reverse biasing when using electrolytic capacitors.



TIMING COMPONENT CONNECTIONS

FIGURE 5

## 'LS122, 'LS123 TYPICAL OUTPUT PULSE DURATION vs EXTERNAL TIMING CAPACITANCE



<sup>†</sup>This value of resistance exceeds the maximum recommended for use over the full temperature range of the SN54LS circuits.

FIGURE 6



# SN54LS122, SN54LS123, SN74LS122, SN74LS123 RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

SDLS043 – DECEMBER 1983 – REVISED MARCH 1988

## TYPICAL APPLICATION DATA FOR 'LS122, 'LS123†

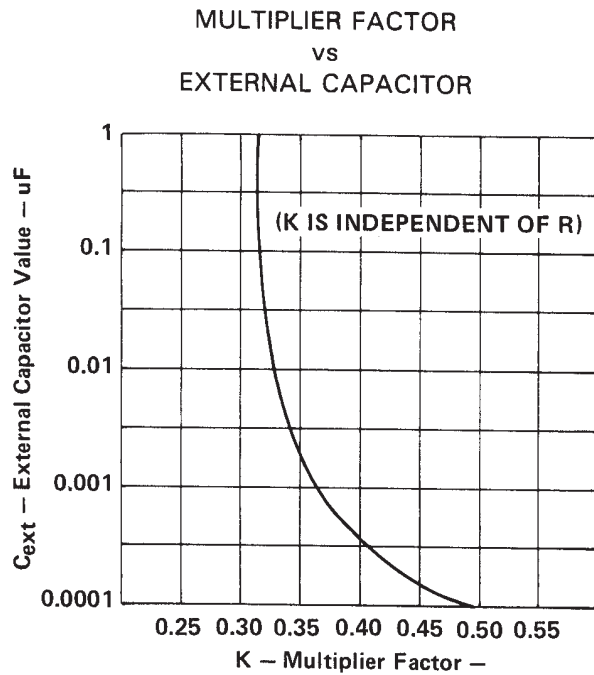


FIGURE 7

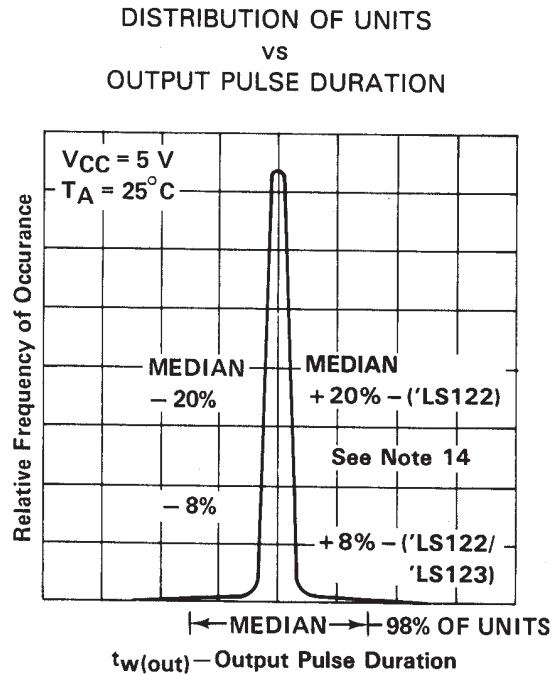


FIGURE 8

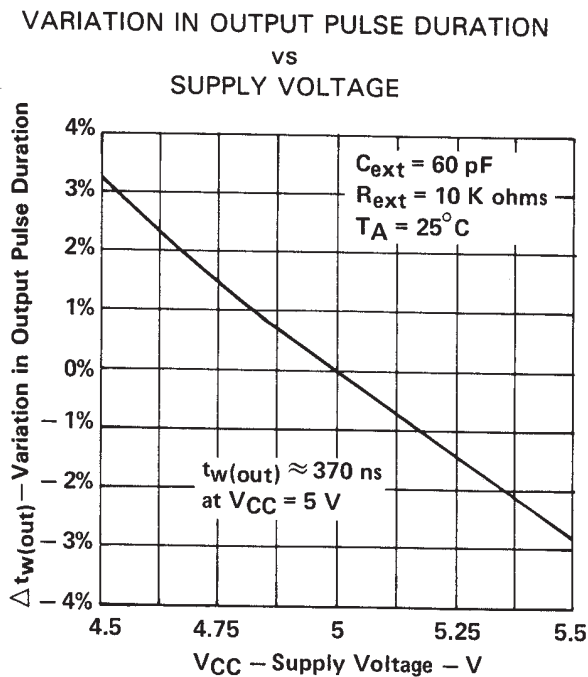


FIGURE 9

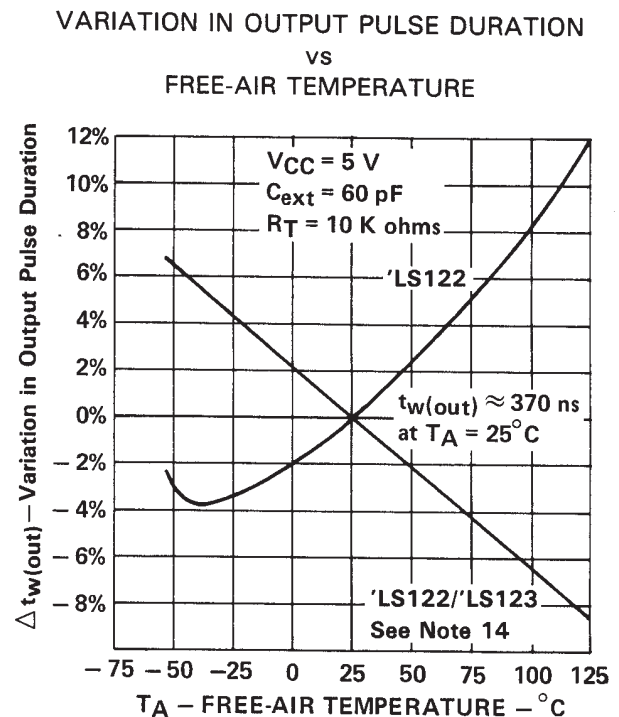


FIGURE 10

NOTE 14: For the 'LS122, the internal timing resistor,  $R_{int}$  was used. For the 'LS122/123, an external timing resistor was used for  $R_T$ .

†Data for temperatures below  $0^\circ C$  and above  $70^\circ C$  and for supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS122 and SN54LS123 only.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)            | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|------------------------------------|-------------------------|
| 5962-7603901VEA  | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-7603901VE<br>A<br>SNV54LS123J | <a href="#">Samples</a> |
| 5962-7603901VFA  | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-7603901VF<br>A<br>SNV54LS123W | <a href="#">Samples</a> |
| 7603901EA        | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 7603901EA<br>SNJ54LS123J           | <a href="#">Samples</a> |
| 7603901FA        | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 7603901FA<br>SNJ54LS123W           | <a href="#">Samples</a> |
| JM38510/01203BEA | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>01203BEA               | <a href="#">Samples</a> |
| JM38510/31401B2A | ACTIVE        | LCCC         | FK                 | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401B2A               | <a href="#">Samples</a> |
| JM38510/31401BEA | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401BEA               | <a href="#">Samples</a> |
| JM38510/31401BFA | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401BFA               | <a href="#">Samples</a> |
| M38510/01203BEA  | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>01203BEA               | <a href="#">Samples</a> |
| M38510/31401B2A  | ACTIVE        | LCCC         | FK                 | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401B2A               | <a href="#">Samples</a> |
| M38510/31401BEA  | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401BEA               | <a href="#">Samples</a> |
| M38510/31401BFA  | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>31401BFA               | <a href="#">Samples</a> |
| SN54123J         | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54123J                           | <a href="#">Samples</a> |
| SN54LS123J       | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54LS123J                         | <a href="#">Samples</a> |
| SN74123N         | ACTIVE        | PDIP         | N                  | 16   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74123N                           | <a href="#">Samples</a> |
| SN74LS122D       | ACTIVE        | SOIC         | D                  | 14   | 50             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS122                              | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)  | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|--------------------------|-------------------------|
| SN74LS122DR      | ACTIVE        | SOIC         | D                  | 14   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS122                    | <a href="#">Samples</a> |
| SN74LS122DRE4    | ACTIVE        | SOIC         | D                  | 14   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS122                    | <a href="#">Samples</a> |
| SN74LS122N       | ACTIVE        | PDIP         | N                  | 14   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS122N               | <a href="#">Samples</a> |
| SN74LS122NE4     | ACTIVE        | PDIP         | N                  | 14   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS122N               | <a href="#">Samples</a> |
| SN74LS122NSR     | ACTIVE        | SO           | NS                 | 14   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS122                  | <a href="#">Samples</a> |
| SN74LS123D       | ACTIVE        | SOIC         | D                  | 16   | 40             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123DBR     | ACTIVE        | SSOP         | DB                 | 16   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   |              | LS123                    | <a href="#">Samples</a> |
| SN74LS123DE4     | ACTIVE        | SOIC         | D                  | 16   | 40             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123DG4     | ACTIVE        | SOIC         | D                  | 16   | 40             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123DR      | ACTIVE        | SOIC         | D                  | 16   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123DRE4    | ACTIVE        | SOIC         | D                  | 16   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123DRG4    | ACTIVE        | SOIC         | D                  | 16   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | LS123                    | <a href="#">Samples</a> |
| SN74LS123N       | ACTIVE        | PDIP         | N                  | 16   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS123N               | <a href="#">Samples</a> |
| SN74LS123NE4     | ACTIVE        | PDIP         | N                  | 16   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74LS123N               | <a href="#">Samples</a> |
| SN74LS123NSR     | ACTIVE        | SO           | NS                 | 16   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS123                  | <a href="#">Samples</a> |
| SN74LS123NSRG4   | ACTIVE        | SO           | NS                 | 16   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 74LS123                  | <a href="#">Samples</a> |
| SNJ54123J        | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54123J                | <a href="#">Samples</a> |
| SNJ54123W        | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54123W                | <a href="#">Samples</a> |
| SNJ54LS123FK     | ACTIVE        | LCCC         | FK                 | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SNJ54LS<br>123FK         | <a href="#">Samples</a> |
| SNJ54LS123J      | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 7603901EA<br>SNJ54LS123J | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)  | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|--------------------------|-------------------------|
| SNJ54LS123W      | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 7603901FA<br>SNJ54LS123W | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54123, SN54LS123, SN54LS123-SP, SN74123, SN74LS123 :**

- Catalog : [SN74123](#), [SN74LS123](#), [SN54LS123](#)
- Military : [SN54123](#), [SN54LS123](#)
- Space : [SN54LS123-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS122DR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS122NSR | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LS123DBR | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| SN74LS123DR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS123NSR | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS122DR  | SOIC         | D               | 14   | 2500 | 853.0       | 449.0      | 35.0        |
| SN74LS122NSR | SO           | NS              | 14   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LS123DBR | SSOP         | DB              | 16   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LS123DR  | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| SN74LS123NSR | SO           | NS              | 16   | 2000 | 853.0       | 449.0      | 35.0        |



## TUBE



\*All dimensions are nominal

| Device           | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| JM38510/31401B2A | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| M38510/31401B2A  | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| SN74123N         | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74123N         | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS122D       | D            | SOIC         | 14   | 50  | 506.6  | 8      | 3940   | 4.32   |
| SN74LS122N       | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS122N       | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS122NE4     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS122NE4     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS123D       | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74LS123DE4     | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74LS123DG4     | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74LS123N       | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS123N       | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS123NE4     | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74LS123NE4     | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SNJ54LS123FK     | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |



NS0016A

# PACKAGE OUTLINE

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

## NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040047-5/M 06/11

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

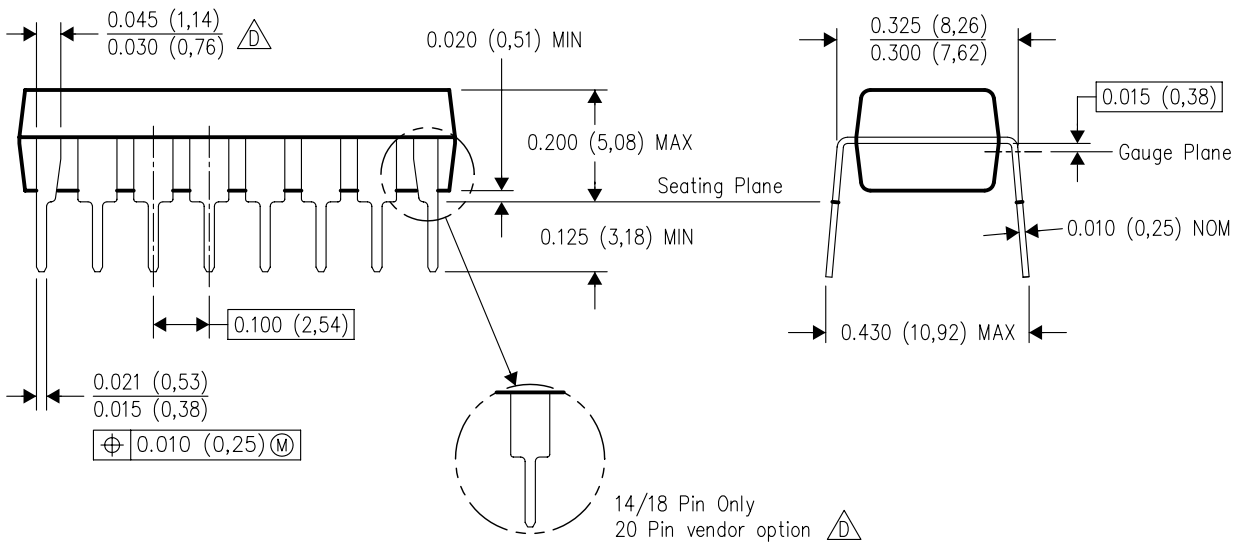
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF<br>TERMINALS<br>** | A                |                  | B                |                  |
|---------------------------|------------------|------------------|------------------|------------------|
|                           | MIN              | MAX              | MIN              | MAX              |
| 20                        | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                        | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                        | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                        | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                        | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                        | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



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