

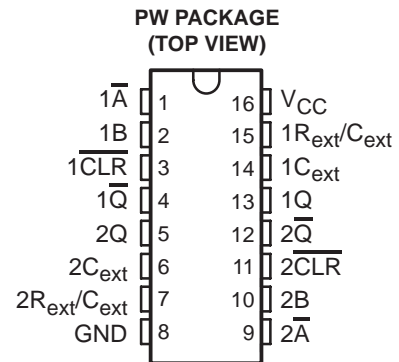
SN74LV123A-EP

DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

- **Controlled Baseline**
 - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of –40°C to 105°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$**
- **Supports Mixed-Mode Voltage Operation on All Ports**
- **Schmitt-Trigger Circuitry on \overline{A} , B, and \overline{CLR} Inputs for Slow Input Transition Rates**
- **Edge Triggered From Active-High or Active-Low Gated Logic Inputs**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Retriggerable for Very Long Output Pulses, Up To 100% Duty Cycle**
- **Overriding Clear Terminates Output Pulse**
- **Glitch-Free Power-Up Reset on Outputs**
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.



description/ordering information

The SN74LV123A is a dual retriggerable monostable multivibrator designed for 2-V to 5.5-V V_{CC} operation.

This edge-triggered multivibrator features output pulse-duration control by three methods. In the first method, the \overline{A} input is low, and the B input goes high. In the second method, the B input is high, and the \overline{A} input goes low. In the third method, the \overline{A} input is low, the B input is high, and the clear (\overline{CLR}) input goes high.

The output pulse duration is programmable by selecting external resistance and capacitance values. The external timing capacitor must be connected between C_{ext} and R_{ext}/C_{ext} (positive) and an external resistor connected between R_{ext}/C_{ext} and V_{CC} . To obtain variable pulse durations, connect an external variable resistance between R_{ext}/C_{ext} and V_{CC} . The output pulse duration also can be reduced by taking \overline{CLR} low.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. The \overline{A} , B, and \overline{CLR} inputs have Schmitt triggers with sufficient hysteresis to handle slow input transition rates with jitter-free triggering at the outputs.

ORDERING INFORMATION

| T_A | PACKAGE‡ | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------------|-----------------------|------------------|
| –40°C to 105°C | TSSOP – PW Tape and reel | SN74LV123ATPWREP | L123AEP |

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2004, Texas Instruments Incorporated

SN74LV123A-EP DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

description/ordering information (continued)

Once triggered, the basic pulse duration can be extended by retriggering the gated low-level-active (\bar{A}) or high-level-active (B) input. Pulse duration can be reduced by taking $\overline{\text{CLR}}$ low. The input/output timing diagram illustrates pulse control by retriggering the inputs and early clearing.

During power up, Q outputs are in the low state, and \bar{Q} outputs are in the high state. The outputs are glitch free, without applying a reset pulse.

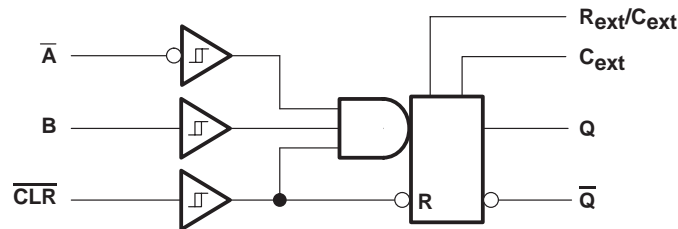
This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

FUNCTION TABLE
(each multivibrator)

| INPUTS | | | OUTPUTS | |
|-------------------------|-----------|---|---------|-----------|
| $\overline{\text{CLR}}$ | \bar{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 | ⌋ | ⌋ |

† These outputs are based on the assumption 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 setup.

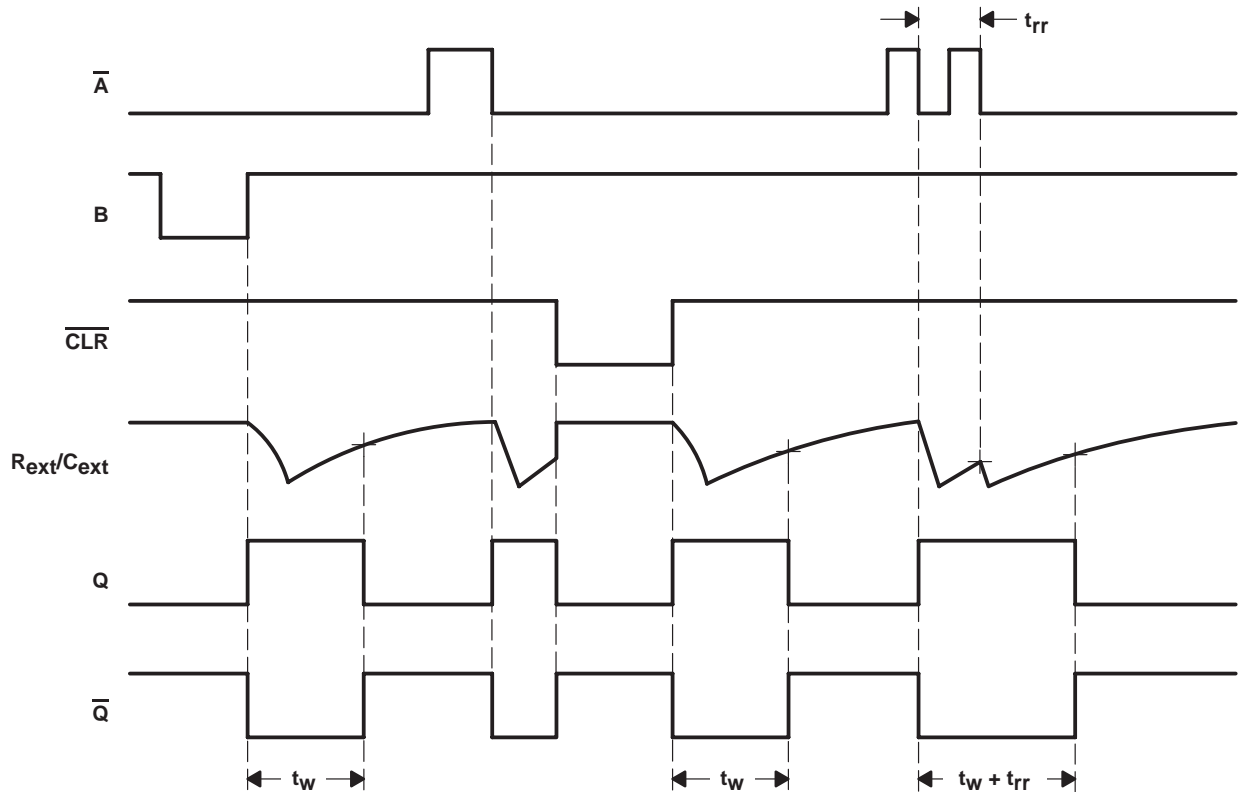
logic diagram, each multivibrator (positive logic)



SN74LV123A-EP DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

input/output timing diagram



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

| | |
|--|----------------------------|
| Supply voltage range, V_{CC} | -0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | -0.5 V to 7 V |
| Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1) | -0.5 V to 7 V |
| Output voltage range in high or low state, V_O (see Notes 1 and 2) | -0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range in power-off state, V_O (see Note 1) | -0.5 V to 7 V |
| Input clamp current, I_{IK} ($V_I < 0$) | -20 mA |
| Output clamp current, I_{OK} ($V_O < 0$) | -50 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ± 25 mA |
| Continuous current through V_{CC} or GND | ± 50 mA |
| Package thermal impedance, θ_{JA} (see Note 3) | 113°C/W |
| Storage temperature range, T_{stg} | -65°C to 150°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
 2. This value is limited to 5.5 V maximum.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

SN74LV123A-EP

DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

recommended operating conditions (see Note 4)

| | | MIN | MAX | UNIT |
|--------------------------|--------------------------------|---|---------------------|--------------------|
| V_{CC} | Supply voltage | 2 | 5.5 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 2\text{ V}$ | 1.5 | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | $V_{CC} \times 0.7$ | |
| | | $V_{CC} = 3\text{ V to }3.6\text{ V}$ | $V_{CC} \times 0.7$ | |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | $V_{CC} \times 0.7$ | |
| V_{IL} | Low-level input voltage | $V_{CC} = 2\text{ V}$ | 0.5 | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | $V_{CC} \times 0.3$ | |
| | | $V_{CC} = 3\text{ V to }3.6\text{ V}$ | $V_{CC} \times 0.3$ | |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | $V_{CC} \times 0.3$ | |
| V_I | Input voltage | 0 | 5.5 | V |
| V_O | Output voltage | 0 | V_{CC} | V |
| I_{OH} | High-level output current | $V_{CC} = 2\text{ V}$ | -50 | mA |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | -2 | |
| | | $V_{CC} = 3\text{ V to }3.6\text{ V}$ | -6 | |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | -12 | |
| I_{OL} | Low-level output current | $V_{CC} = 2\text{ V}$ | 50 | mA |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 2 | |
| | | $V_{CC} = 3\text{ V to }3.6\text{ V}$ | 6 | |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | 12 | |
| R_{ext} | External timing resistance | $V_{CC} = 2\text{ V}$ | 5k | Ω |
| | | $V_{CC} \geq 3\text{ V}$ | 1k | |
| C_{ext} | External timing capacitance | No restriction | | pF |
| $\Delta t/\Delta V_{CC}$ | Power-up ramp rate | 1 | | ms/V |
| T_A | Operating free-air temperature | -40 | 105 | $^{\circ}\text{C}$ |

NOTE 4: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

SN74LV123A-EP

DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

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

| PARAMETER | | TEST CONDITIONS | V _{CC} | MIN | TYP | MAX | UNIT |
|------------------|---|---|-----------------|----------------------|-----|-----|------|
| V _{OH} | | I _{OH} = -50 μA | 2 V to 5.5 V | V _{CC} -0.1 | | | V |
| | | I _{OH} = -2 mA | 2.3 V | 2 | | | |
| | | I _{OH} = -6 mA | 3 V | 2.48 | | | |
| | | I _{OH} = -12 mA | 4.5 V | 3.8 | | | |
| V _{OL} | | I _{OL} = 50 μA | 2 V to 5.5 V | 0.1 | | | V |
| | | I _{OL} = 2 mA | 2.3 V | 0.4 | | | |
| | | I _{OL} = 6 mA | 3 V | 0.44 | | | |
| | | I _{OL} = 12 mA | 4.5 V | 0.55 | | | |
| I _I | R _{ext} /C _{ext} [†] | V _I = 5.5 V or GND | 2 V to 5.5 V | ±2.5 | | | μA |
| | \overline{A} , B, and \overline{CLR} | V _I = 5.5 V or GND | 0 0 to 5.5 V | ±1 ±1 | | | |
| I _{CC} | Quiescent | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | 20 | | | μA |
| I _{CC} | Active state (per circuit) | V _I = V _{CC} or GND, R _{ext} /C _{ext} = 0.5 V _{CC} | 3 V | 280 | | | μA |
| | | | 4.5 V | 650 | | | |
| | | | 5.5 V | 975 | | | |
| I _{off} | | V _I or V _O = 0 to 5.5 V | 0 | 5 | | | μA |
| C _i | | V _I = V _{CC} or GND | 3.3 V | 1.9 | | | pF |
| | | | 5 V | 1.9 | | | |

[†] This test is performed with the terminal in the off-state condition.

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| | | TEST CONDITIONS | | T _A = 25°C | | | MIN | MAX | UNIT |
|-----------------|----------------------|-----------------------------|----------------------------|-----------------------|-----|-----|-----|-----|------|
| | | | | MIN | TYP | MAX | | | |
| t _w | Pulse duration | \overline{CLR} | | 5 | | | 5 | | ns |
| | | \overline{A} or B trigger | | 5 | | | 5 | | |
| t _{rr} | Pulse retrigger time | R _{ext} = 1 kΩ | C _{ext} = 100 pF | ‡ | 76 | | ‡ | | ns |
| | | | C _{ext} = 0.01 μF | ‡ | 1.8 | | ‡ | | μs |

[‡] See retriggering data in the *application information* section.

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| | | TEST CONDITIONS | | T _A = 25°C | | | MIN | MAX | UNIT |
|-----------------|----------------------|-----------------------------|----------------------------|-----------------------|-----|-----|-----|-----|------|
| | | | | MIN | TYP | MAX | | | |
| t _w | Pulse duration | \overline{CLR} | | 5 | | | 5 | | ns |
| | | \overline{A} or B trigger | | 5 | | | 5 | | |
| t _{rr} | Pulse retrigger time | R _{ext} = 1 kΩ | C _{ext} = 100 pF | ‡ | 59 | | ‡ | | ns |
| | | | C _{ext} = 0.01 μF | ‡ | 1.5 | | ‡ | | μs |

[‡] See retriggering data in the *application information* section.



SN74LV123A-EP DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | $T_A = 25^\circ\text{C}$ | | | MIN | MAX | UNIT |
|-----------------------|---------------------------------|----------------|--|--------------------------|------|-----|-----|------|---------------|
| | | | | MIN | TYP | MAX | | | |
| t_{pd} | \bar{A} or B | Q or \bar{Q} | $C_L = 50\text{ pF}$ | 11.8 | 24.1 | | 1 | 27.5 | ns |
| | $\overline{\text{CLR}}$ | Q or \bar{Q} | | 10.5 | 19.3 | | 1 | 22 | |
| | $\overline{\text{CLR}}$ trigger | Q or \bar{Q} | | 12.3 | 25.9 | | 1 | 29.5 | |
| t_w^\dagger | | Q or \bar{Q} | $C_L = 50\text{ pF}$, $C_{ext} = 28\text{ pF}$, $R_{ext} = 2\text{ k}\Omega$ | 182 | 240 | | | 300 | ns |
| | | | $C_L = 50\text{ pF}$, $C_{ext} = 0.01\text{ }\mu\text{F}$, $R_{ext} = 10\text{ k}\Omega$ | 90 | 100 | 110 | 90 | 110 | μs |
| | | | $C_L = 50\text{ pF}$, $C_{ext} = 0.1\text{ }\mu\text{F}$, $R_{ext} = 10\text{ k}\Omega$ | 0.9 | 1 | 1.1 | 0.9 | 1.1 | ms |
| Δt_w^\ddagger | | | $C_L = 50\text{ pF}$ | ± 1 | | | | | % |

$^\dagger t_w$ = Duration of pulse at Q and \bar{Q} outputs

$^\ddagger \Delta t_w$ = Output pulse-duration variation (Q and \bar{Q}) between circuits in same package

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | $T_A = 25^\circ\text{C}$ | | | MIN | MAX | UNIT |
|-----------------------|---------------------------------|----------------|--|--------------------------|------|-----|-----|-----|---------------|
| | | | | MIN | TYP | MAX | | | |
| t_{pd} | \bar{A} or B | Q or \bar{Q} | $C_L = 50\text{ pF}$ | 8.3 | 14 | | 1 | 16 | ns |
| | $\overline{\text{CLR}}$ | Q or \bar{Q} | | 7.4 | 11.4 | | 1 | 13 | |
| | $\overline{\text{CLR}}$ trigger | Q or \bar{Q} | | 8.7 | 14.9 | | 1 | 17 | |
| t_w^\dagger | | Q or \bar{Q} | $C_L = 50\text{ pF}$, $C_{ext} = 28\text{ pF}$, $R_{ext} = 2\text{ k}\Omega$ | 167 | 200 | | | 240 | ns |
| | | | $C_L = 50\text{ pF}$, $C_{ext} = 0.01\text{ }\mu\text{F}$, $R_{ext} = 10\text{ k}\Omega$ | 90 | 100 | 110 | 90 | 110 | μs |
| | | | $C_L = 50\text{ pF}$, $C_{ext} = 0.1\text{ }\mu\text{F}$, $R_{ext} = 10\text{ k}\Omega$ | 0.9 | 1 | 1.1 | 0.9 | 1.1 | ms |
| Δt_w^\ddagger | | | | ± 1 | | | | | % |

$^\dagger t_w$ = Duration of pulse at Q and \bar{Q} outputs

$^\ddagger \Delta t_w$ = Output pulse-duration variation (Q and \bar{Q}) between circuits in same package

operating characteristics, $T_A = 25^\circ\text{C}$

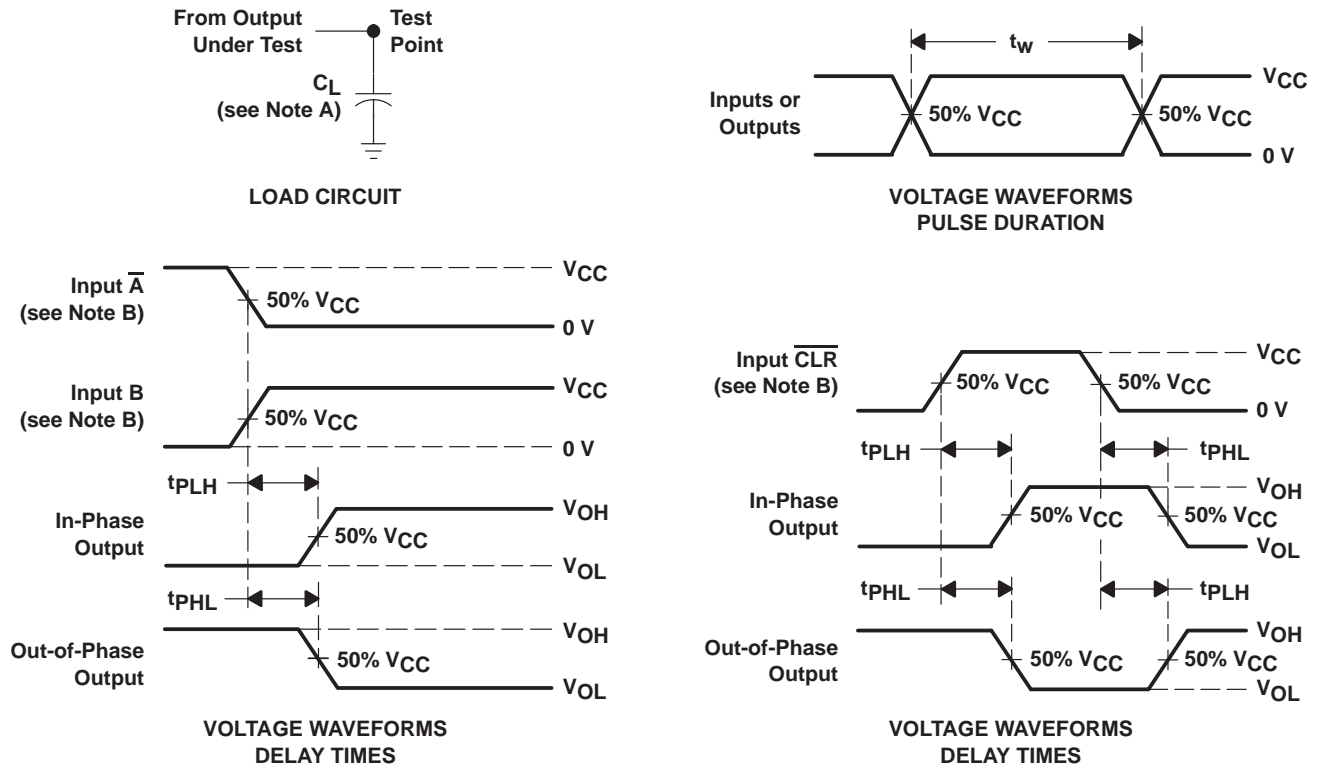
| PARAMETER | TEST CONDITIONS | V_{CC} | TYP | UNIT |
|--|--|----------|-----|------|
| C_{pd} Power dissipation capacitance | $C_L = 50\text{ pF}$, $f = 10\text{ MHz}$ | 3.3 V | 44 | pF |
| | | 5 V | 49 | |



SN74LV123A-EP DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r = 3\text{ ns}$, $t_f = 3\text{ ns}$.
 C. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

SN74LV123A-EP DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

SCLS498A – MAY 2003 – REVISED MAY 2004

APPLICATION INFORMATION†

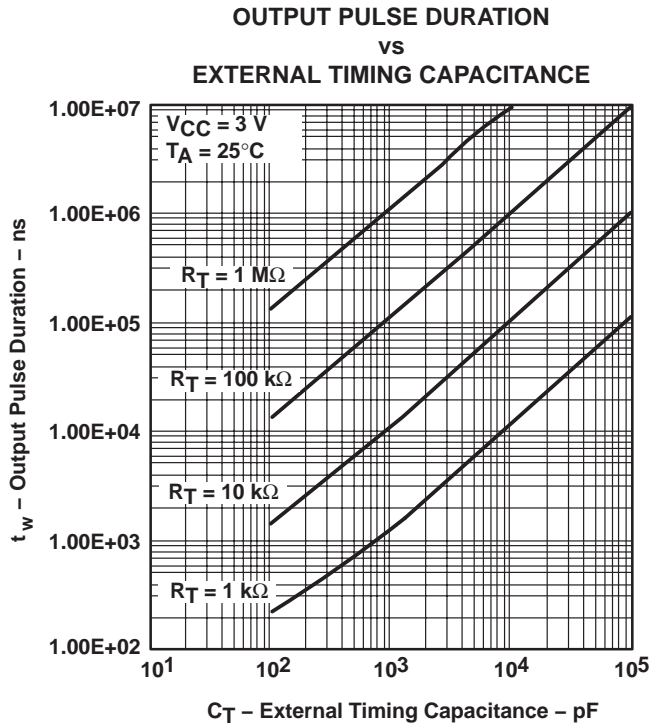


Figure 2

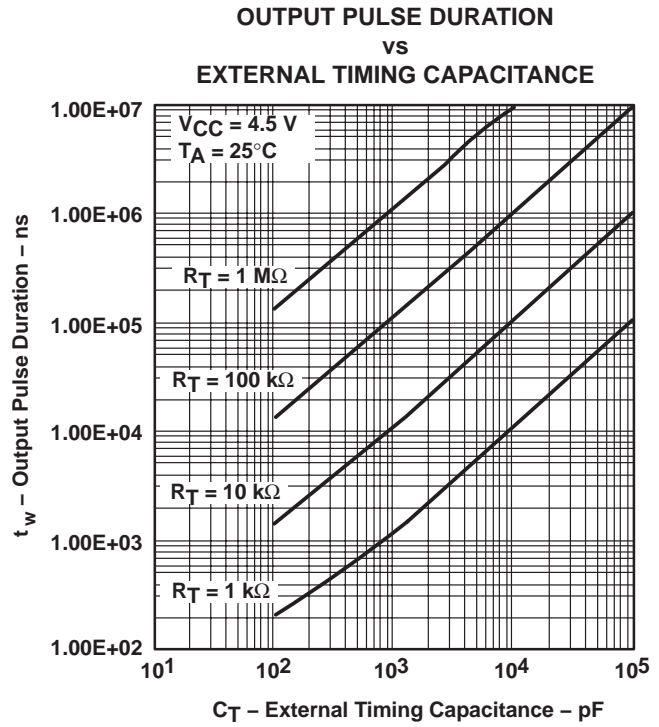


Figure 3

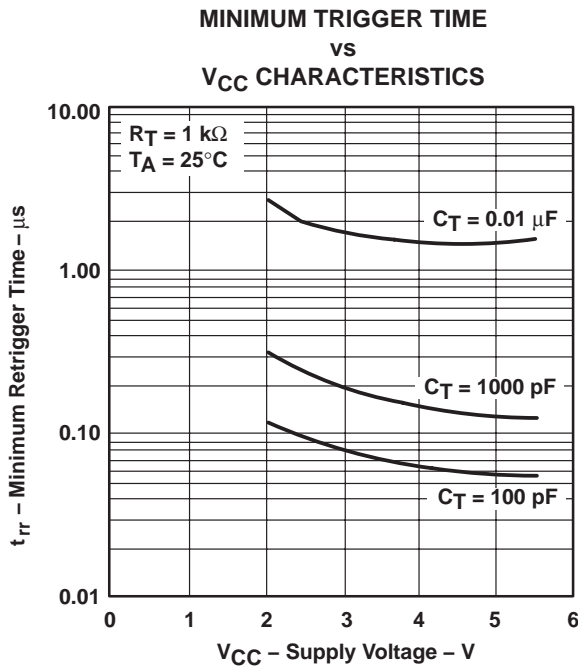


Figure 4

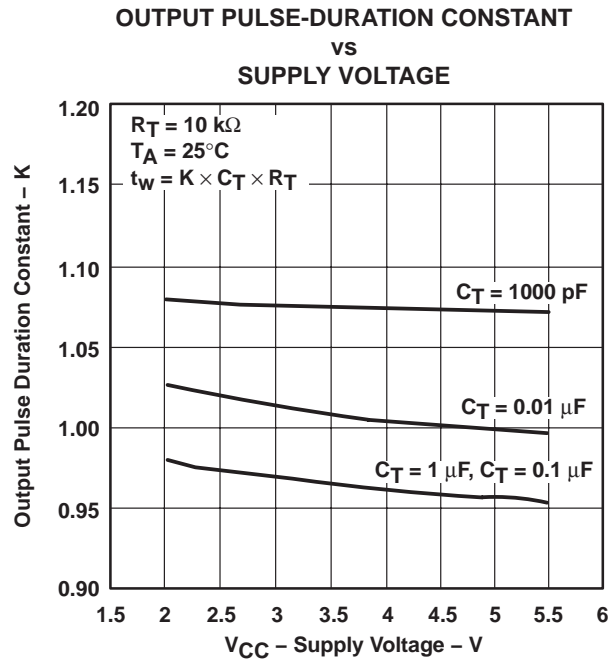


Figure 5

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74LV123ATPWREP | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| V62/03661-01XE | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

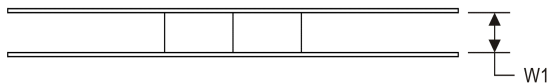
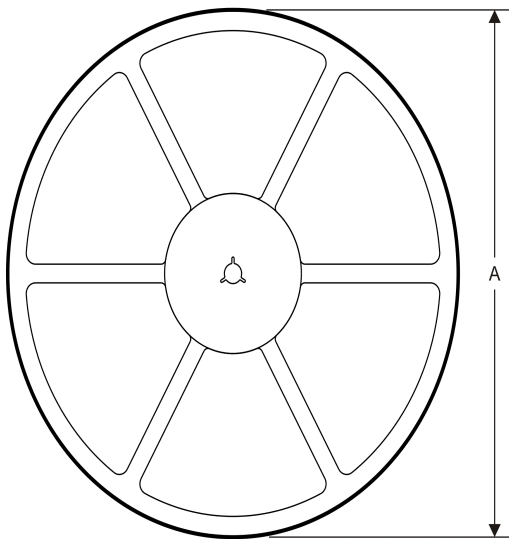
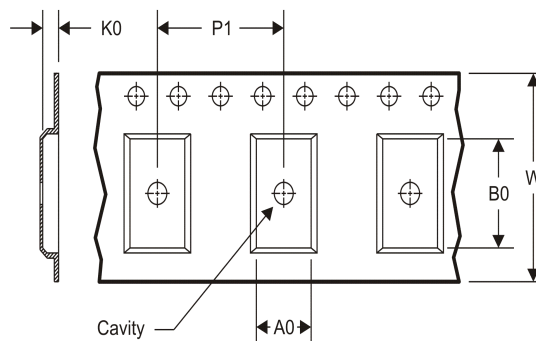
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74LV123A-EP :

- Catalog: [SN74LV123A](#)
- Automotive: [SN74LV123A-Q1](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LV123ATPWREP | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LV123ATPWREP | TSSOP | PW | 16 | 2000 | 367.0 | 367.0 | 35.0 |

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46C and to discontinue any product or service per JESD48B. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

Products

| | |
|------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| OMAP Mobile Processors | www.ti.com/omap |
| Wireless Connectivity | www.ti.com/wirelessconnectivity |

Applications

| | |
|-------------------------------|--|
| Automotive and Transportation | www.ti.com/automotive |
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Video and Imaging | www.ti.com/video |

TI E2E Community e2e.ti.com