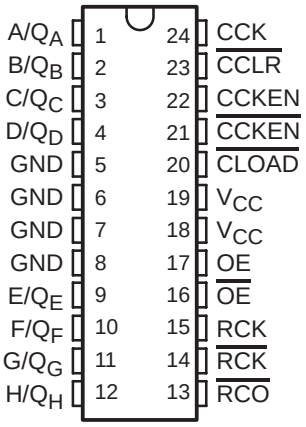
- **Parallel 3-State I/O: Register Inputs/ Counter Outputs**
- **Counter Has Direct Overriding Load and Clear**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Center-Pin $V_{CC}$ and GND Configurations Minimize High-Speed Switching Noise**
- ***EPIC*™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**
- **Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs**

**DW OR NT PACKAGE**
**(TOP VIEW)**




## description

The 74AC11953 consists of a parallel input, an 8-bit storage register feeding an 8-bit counter, and a 3-state I/O which provides parallel count outputs. Both the register and the counter have individual positive-edge triggered clocks.

The function tables show the operation of the counter clock-enable (CCKEN, $\overline{\text{CCKEN}}$) and output-enable (OE, $\overline{\text{OE}}$) inputs. A register clock-enable ($\overline{\text{RCK}}$) input is also provided.

The counter ($\overline{\text{RCO}}$) input has direct load and clear functions. A low-going $\overline{\text{RCO}}$ pulse will be obtained when the counter reaches the hex word FF. Expansion is easily accomplished for two stages by connecting $\overline{\text{RCO}}$ of the first stage to $\overline{\text{CCKEN}}$ of the second stage. Cascading for larger count chains can be accomplished by connecting $\overline{\text{RCO}}$ of each stage to CCK of the following stage.

The 74AC11593 is characterized for operation from − 40°C to 85°C.

### Function Tables

**COUNTER CLOCK ENABLE**

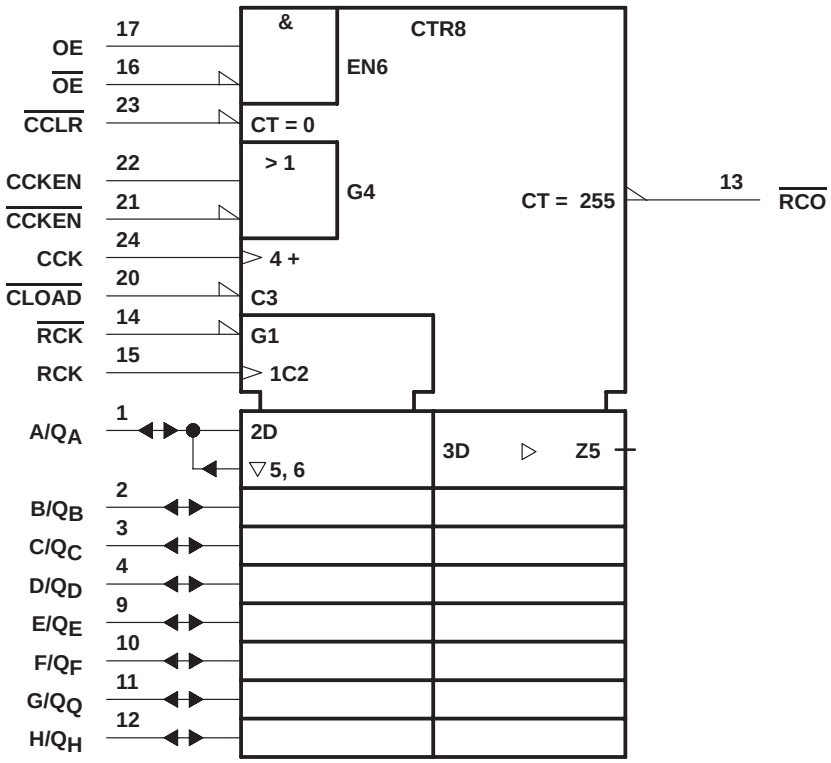
| INPUTS | | OUTPUTS |
|---|---|---|
| CCKEN | $\overline{\text{CCKEN}}$ | $A/Q_A$ THRU $H/Q_H$ |
| L | L | Enable |
| L | H | Disable |
| H | L | Enable |
| H | H | Enable |

**OUTPUT ENABLE**

| INPUTS | | OUTPUTS |
|---|---|---|
| OE | $\overline{\text{OE}}$ | $A/Q_A$ THRU $H/Q_H$ |
| L | L | Input mode |
| L | H | Input mode |
| H | L | Output mode |
| H | H | Input mode |

EPIC is a trademark of Texas Instruments Incorporated.

## logic symbol†

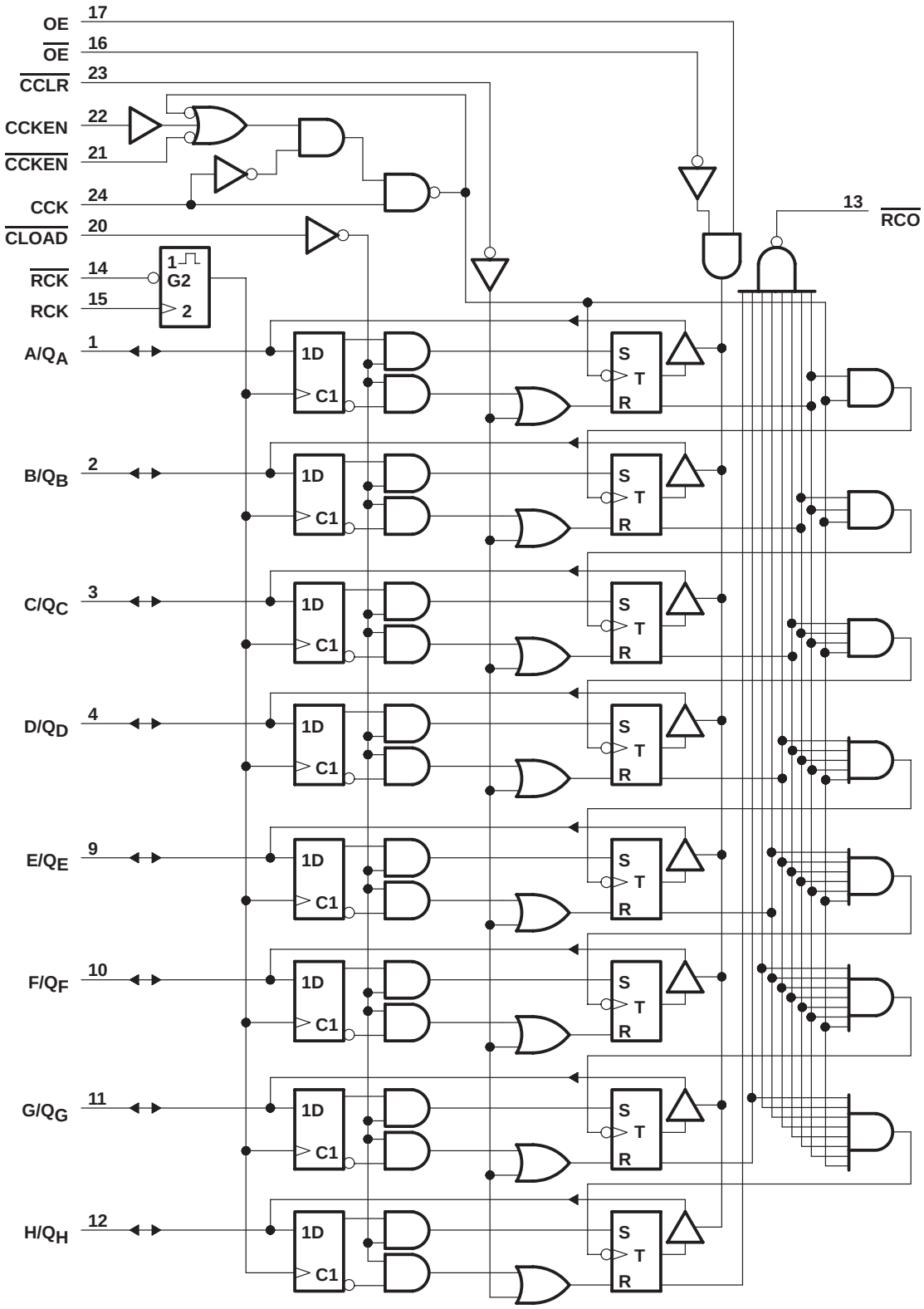



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

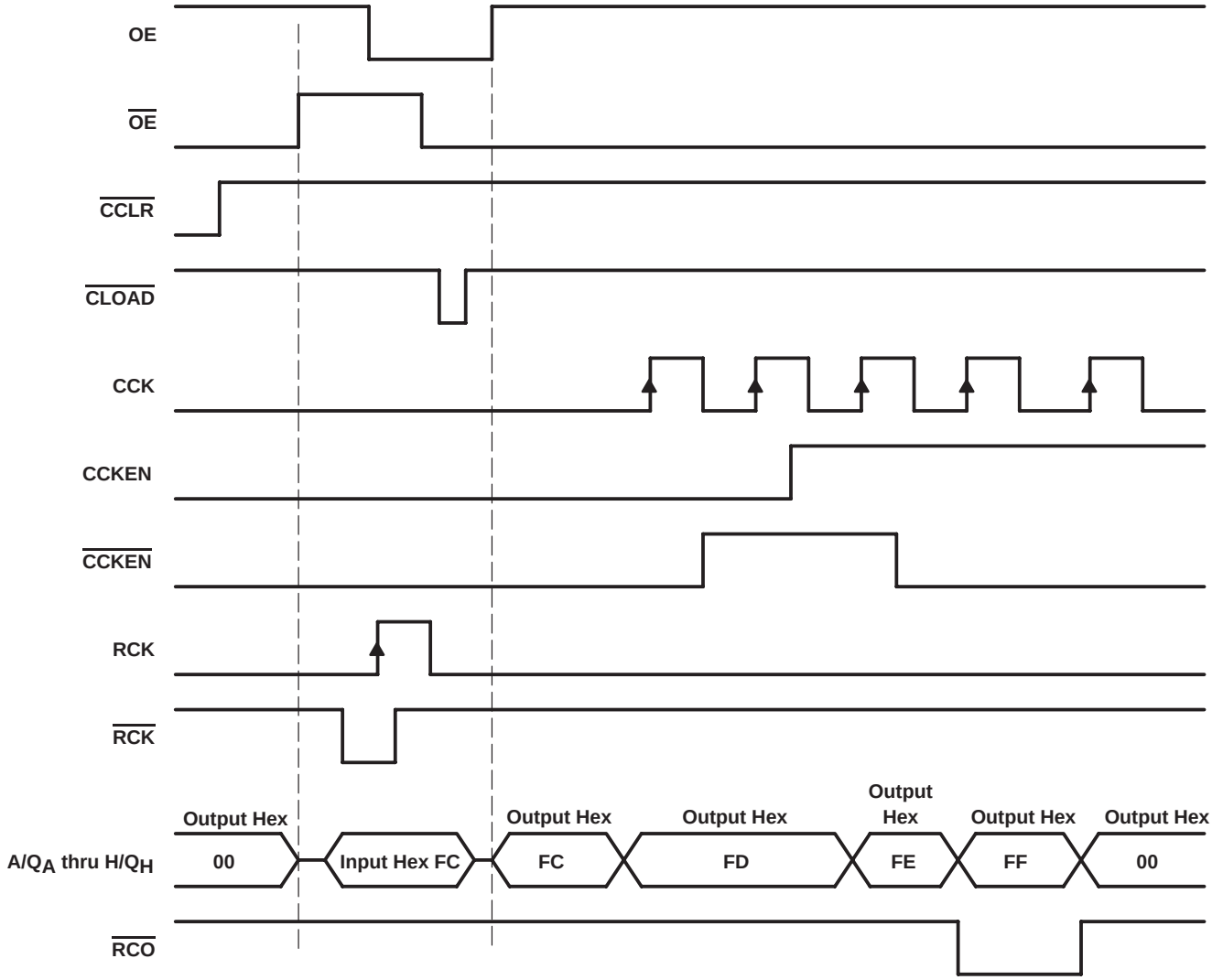


TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77001

## logic diagram (positive logic)



## typical operating sequence




## absolute maximum ratings over operating free-air temperature range (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 $V_{CC}$ + 0.5 V
Output voltage range, $V_O$ (see Note 1) . . . . . −0.5 V to $V_{CC}$ + 0.5 V
Input clamp current, $I_{IK}$ ($V_I$ < 0 or $V_I$ > $V_{CC}$) . . . . . ± 20 mA
Output clamp current, $I_{OK}$ ($V_O$ < 0 or $V_O$ > $V_{CC}$) . . . . . ± 50 mA
Continuous output current, $I_O$ ($V_O$ = 0 to $V_{CC}$) . . . . . ± 50 mA
Continuous current through $V_{CC}$ or GND . . . . . ± 225 mA
Storage temperature range . . . . . −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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## recommended operating conditions (see Note 2)

| | | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 3 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 3 V | 2.1 | | | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | | | |
| | | $V_{CC}$ = 5.5 V | 3.85 | | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 3 V | | | 0.9 | V |
| | | $V_{CC}$ = 4.5 V | | | 1.35 | |
| | | $V_{CC}$ = 5.5 V | | | 1.65 | |
| $V_I$ | Input voltage | | 0 | | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 3 V | | | − 4 | mA |
| | | $V_{CC}$ = 4.5 V | | | − 24 | |
| | | $V_{CC}$ = 5.5 V | | | −24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 3 V | | | 12 | mA |
| | | $V_{CC}$ = 4.5 V | | | 24 | |
| | | $V_{CC}$ = 5.5 V | | | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | | 0 | | 10 | ns/V |
| $T_A$ | Operating free-air temperature | | − 40 | | 85 | °C |

NOTE 2: Unused or floating inputs must be held high or low.

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

| PARAMETER | TEST CONDITIONS | $V_{CC}$ | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $V_{OH}$ | $I_{OH}$ = − 50 μA | 3 V | 2.9 | | | 2.9 | | V |
| | | 4.5 V | 4.4 | | | 4.4 | | |
| | | 5.5 V | 5.4 | | | 5.4 | | |
| | $I_{OH}$ = − 4 mA | 3 V | 2.58 | | | 2.48 | | |
| | $I_{OH}$ = − 24 mA | 4.5 V | 3.94 | | | 3.8 | | |
| | | 5.5 V | 4.94 | | | 4.8 | | |
| | $I_{OH}$ = − 75 mA† | 5.5 V | | | | 3.85 | | |
| $V_{OL}$ | $I_{OL}$ = 50 μA | 3 V | | | 0.1 | | 0.1 | V |
| | | 4.5 V | | | 0.1 | | 0.1 | |
| | | 5.5 V | | | 0.1 | | 0.1 | |
| | $I_{OL}$ = 12 mA | 3 V | | | 0.36 | | 0.44 | |
| | $I_{OL}$ = 24 mA | 4.5 V | | | 0.36 | | 0.44 | |
| | | 5.5 V | | | 0.36 | | 0.44 | |
| | $I_{OL}$ = 75 mA† | 5.5 V | | | | | 1.65 | |
| $I_I$ | $V_I$ = $V_{CC}$ or GND | 5.5 V | | | ± 0.1 | | ± 1 | μA |
| $I_{OZ}$ | $V_O$ = $V_{CC}$ or GND | 5.5 V | | | ± 0.5 | | ± 5 | μA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND, $I_O$ = 0 | 5.5 V | | | 8 | | 80 | μA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | 5 V | | 4.5 | | | | pF |

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

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

| | | | $T_A$ = 25°C | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | | | |
| $f_{clock}$ | Clock frequency, CCK or RCK | | | 40 | | 40 | MHz |
| $t_w$ | Pulse duration | CCK high or low | 6 | | 6 | | ns |
| | | RCK high or low | 6 | | 6 | | |
| | | $\overline{\text{RCK}}$ high or low | 4.5 | | 4.5 | | |
| | | $\overline{\text{CCLR}}$ low | 7.5 | | 7.5 | | |
| | | $\overline{\text{CLOAD}}$ low | 6.1 | | 6.1 | | |
| $t_{su}$ | Setup time | $\overline{\text{CCKEN}}$ low before CCK↑ | 5.2 | | 5.2 | | ns |
| | | CCKEN high before CCK↑ | 6.4 | | 6.4 | | |
| | | $\overline{\text{CCLR}}$ high before CCK↑ | 1.7 | | 1.7 | | |
| | | $\overline{\text{CLOAD}}$ high before CCK↑ | 8.2 | | 8.2 | | |
| | | RCK↑ before $\overline{\text{CLOAD}}$↑† | 11.1 | | 11.1 | | |
| | | Data A thru H before RCK↑ | 2.3 | | 2.3 | | |
| $t_h$ | Hold time | Data A thru H after RCK↑ | 0.5 | | 0.5 | | ns |
| | | All others | 0.2 | | 0.2 | | |

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

| | | | $T_A$ = 25°C | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | | | |
| $f_{clock}$ | Clock frequency, CCK or RCK | | | 70 | | 70 | MHz |
| $t_w$ | Pulse duration | CCK high or low | 5 | | 5 | | ns |
| | | RCK high or low | 5 | | 5 | | |
| | | $\overline{\text{RCK}}$ high or low | 4.5 | | 4.5 | | |
| | | $\overline{\text{CCLR}}$ low | 5 | | 5 | | |
| | | $\overline{\text{CLOAD}}$ low | 4.7 | | 4.7 | | |
| $t_{su}$ | Setup time | $\overline{\text{CCKEN}}$ low before CCK↑ | 3.1 | | 3.1 | | ns |
| | | CCKEN high before CCK↑ | 4.3 | | 4.3 | | |
| | | $\overline{\text{CCLR}}$ high before CCK↑ | 1.1 | | 1.1 | | |
| | | $\overline{\text{CLOAD}}$ high before CCK↑ | 5.4 | | 5.4 | | |
| | | RCK↑ before $\overline{\text{CLOAD}}$↑† | 7.8 | | 7.8 | | |
| | | Data A thru H before RCK↑ | 2 | | 2 | | |
| $t_h$ | Hold time | Data A thru H after RCK↑ | 1.1 | | 1.1 | | ns |
| | | All others | 0.8 | | 0.8 | | |

† This time insures the data saved by RCK↑ will also be loaded into the counter.

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $f_{max}$ | | | 40 | | | 40 | | MHz |
| $t_{PLH}$ | CCK | Q | 6.8 | 14.4 | 19.3 | 6.8 | 22.4 | ns |
| $t_{PHL}$ | | | 6.4 | 14.1 | 18.8 | 6.4 | 21.1 | |
| $t_{PLH}$ | $\overline{CLOAD}$ | Q | 6.7 | 17.3 | 23.6 | 6.7 | 27.1 | ns |
| $t_{PHL}$ | | | 3.9 | 18.9 | 29.1 | 3.9 | 32.3 | |
| $t_{PHL}$ | $\overline{CCLR}$ | Q | 5.4 | 13 | 17.6 | 5.4 | 19.8 | ns |
| $t_{PZH}$ | OE | Q | 7.3 | 15.7 | 20.8 | 7.3 | 24.1 | ns |
| $t_{PZL}$ | | | 8 | 17.7 | 23.2 | 8 | 26.7 | |
| $t_{PZH}$ | $\overline{OE}$ | Q | 6.9 | 15.2 | 20.2 | 6.9 | 23.3 | ns |
| $t_{PZL}$ | | | 7.8 | 17.3 | 22.7 | 7.8 | 26.1 | |
| $t_{PHZ}$ | OE | Q | 6.4 | 10.3 | 13.8 | 6.4 | 15.2 | ns |
| $t_{PLZ}$ | | | 6.6 | 10.8 | 14.1 | 6.6 | 16.1 | |
| $t_{PHZ}$ | $\overline{OE}$ | Q | 5.7 | 9.6 | 12.8 | 5.7 | 14.1 | ns |
| $t_{PLZ}$ | | | 5.9 | 10.2 | 13.4 | 5.9 | 15.2 | |
| $t_{PLH}$ | CCK | $\overline{RCO}$ | 5.3 | 12 | 16 | 5.3 | 18.6 | ns |
| $t_{PHL}$ | | | 7.1 | 15.4 | 20.3 | 7.1 | 23.1 | |
| $t_{PLH}$ | $\overline{CLOAD}$ | $\overline{RCO}$ | 5.9 | 12.4 | 16.5 | 5.9 | 18.8 | ns |
| $t_{PHL}$ | | | 10.1 | 19.6 | 25.5 | 10.1 | 29.4 | |
| $t_{PLH}$ | $\overline{CCLR}$ | $\overline{RCO}$ | 5.6 | 12.3 | 16.6 | 5.6 | 19.2 | ns |
| $t_{PLH}$ | RCK | $\overline{RCO}$ | 8.6 | 17.3 | 22.2 | 8.6 | 25.8 | ns |
| $t_{PHL}$ | | | 10.3 | 20.3 | 26.2 | 10.3 | 30.3 | |

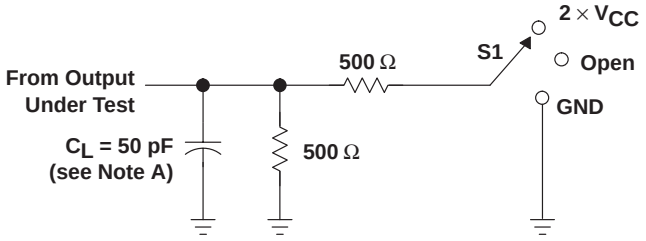
## switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $f_{max}$ | | | 70 | | | 70 | | MHz |
| $t_{PLH}$ | CCK | Q | 4.1 | 8.7 | 12.4 | 4.1 | 14.3 | ns |
| $t_{PHL}$ | | | 4.2 | 8.9 | 12.6 | 4.2 | 14.2 | |
| $t_{PLH}$ | $\overline{CLOAD}$ | Q | 3.7 | 10 | 15.3 | 3.7 | 17.4 | ns |
| $t_{PHL}$ | | | 3.4 | 11.4 | 18.3 | 3.4 | 20.6 | |
| $t_{PHL}$ | $\overline{CCLR}$ | Q | 3.3 | 7.9 | 11.8 | 3.3 | 13.4 | ns |
| $t_{PZH}$ | OE | Q | 4.1 | 9.1 | 13.2 | 4.1 | 15.3 | ns |
| $t_{PZL}$ | | | 4.1 | 9.4 | 13.8 | 4.1 | 16 | |
| $t_{PZH}$ | $\overline{OE}$ | Q | 3.8 | 8.7 | 13 | 3.8 | 15 | ns |
| $t_{PZL}$ | | | 3.9 | 9.1 | 13.4 | 3.9 | 15.4 | |
| $t_{PHZ}$ | OE | Q | 4.2 | 7.6 | 10.6 | 4.2 | 11.6 | ns |
| $t_{PLZ}$ | | | 5.3 | 8.8 | 11.8 | 5.3 | 13.1 | |
| $t_{PHZ}$ | $\overline{OE}$ | Q | 4.4 | 7.3 | 10.1 | 4.4 | 11 | ns |
| $t_{PLZ}$ | | | 5.2 | 8.5 | 11.6 | 5.2 | 13 | |
| $t_{PLH}$ | CCK | $\overline{RCO}$ | 3.5 | 7.6 | 11.2 | 3.5 | 12.8 | ns |
| $t_{PHL}$ | | | 4.1 | 9.2 | 13.4 | 4.1 | 15.4 | |
| $t_{PLH}$ | $\overline{CLOAD}$ | $\overline{RCO}$ | 3.5 | 7.8 | 11.2 | 3.5 | 12.8 | ns |
| $t_{PHL}$ | | | 5.6 | 11.7 | 16.6 | 5.6 | 19 | |
| $t_{PLH}$ | $\overline{CCLR}$ | $\overline{RCO}$ | 3.6 | 8 | 11.6 | 3.6 | 13.4 | ns |
| $t_{PLH}$ | RCK | $\overline{RCO}$ | 5 | 10.3 | 14.4 | 5 | 16.7 | ns |
| $t_{PHL}$ | | | 5.5 | 11.7 | 16.6 | 5.5 | 19.2 | |

## operating characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

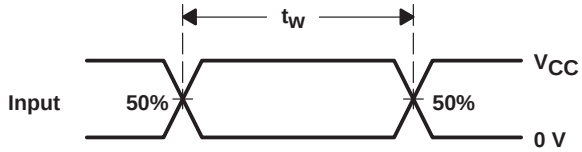
| PARAMETER | | | TEST CONDITIONS | | TYP | UNIT |
|---|---|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance | Outputs enabled | $C_L$ = 50 pF, | f = 1 MHz | 66 | pF |
| | | Outputs disabled | | | 15 | |

## PARAMETER MEASUREMENT INFORMATION

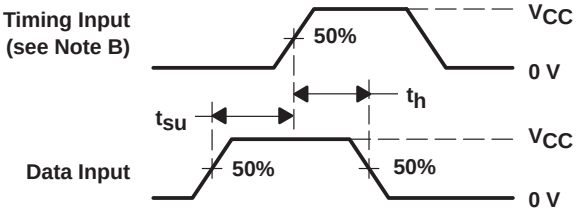



| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 2 × $V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

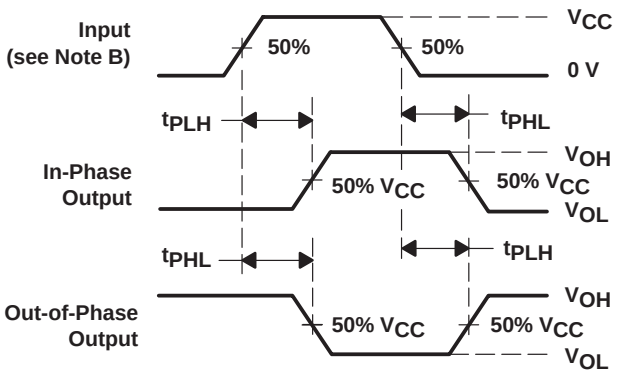
LOAD CIRCUIT



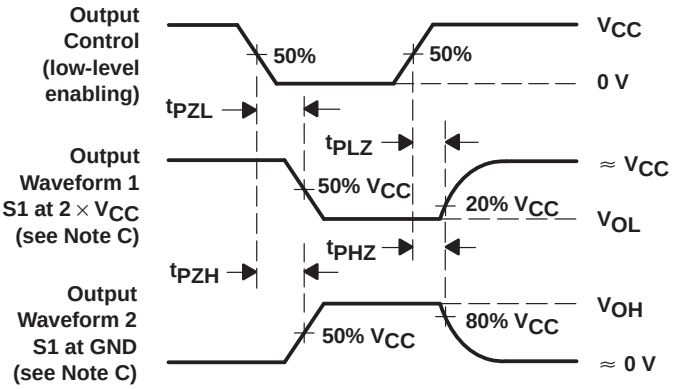

VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS

NOTES: A. $C_L$ includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O$ = 50 Ω, $t_r$ = 3 ns, $t_f$ = 3 ns.
C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
D. The outputs are measured one at a time with one input transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) |
|---|---|---|---|---|---|---|---|---|
| 74AC11593DW | OBSOLETE | SOIC | DW | 24 | | TBD | Call TI | Call TI |
| 74AC11593DWR | OBSOLETE | SOIC | DW | 20 | | TBD | Call TI | Call TI |
| 74AC11593DWR | OBSOLETE | SOIC | DW | 20 | | TBD | Call TI | Call TI |
| 74AC11593NT | OBSOLETE | PDIP | NT | 24 | | TBD | Call TI | Call TI |
| 74AC11593NT | OBSOLETE | PDIP | NT | 24 | | TBD | Call TI | Call TI |

(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) 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.
**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.

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) |
|---|---|---|---|---|---|---|---|---|
| 74AC11593DW | OBSOLETE | SOIC | DW | 24 | | TBD | Call TI | Call TI |
| 74AC11593DWR | OBSOLETE | SOIC | DW | 20 | | TBD | Call TI | Call TI |
| 74AC11593DWR | OBSOLETE | SOIC | DW | 20 | | TBD | Call TI | Call TI |
| 74AC11593NT | OBSOLETE | PDIP | NT | 24 | | TBD | Call TI | Call TI |
| 74AC11593NT | OBSOLETE | PDIP | NT | 24 | | TBD | Call TI | Call TI |

(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) 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.
**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 NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| **Products** | | **Applications** | |
|---|---|---|---|
| Amplifiers | amplifier.ti.com | Audio | www.ti.com/audio |
| Data Converters | dataconverter.ti.com | Automotive | www.ti.com/automotive |
| DLP® Products | www.dlp.com | Communications and Telecom | www.ti.com/communications |
| DSP | dsp.ti.com | Computers and Peripherals | www.ti.com/computers |
| Clocks and Timers | www.ti.com/clocks | Consumer Electronics | www.ti.com/consumer-apps |
| Interface | interface.ti.com | Energy | www.ti.com/energy |
| Logic | logic.ti.com | Industrial | www.ti.com/industrial |
| Power Mgmt | power.ti.com | Medical | www.ti.com/medical |
| Microcontrollers | microcontroller.ti.com | Security | www.ti.com/security |
| RFID | www.ti-rfid.com | Space, Avionics & Defense | www.ti.com/space-avionics-defense |
| RF/IF and ZigBee® Solutions | www.ti.com/lprf | Video and Imaging | www.ti.com/video |
| | | Wireless | www.ti.com/wireless-apps |

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265