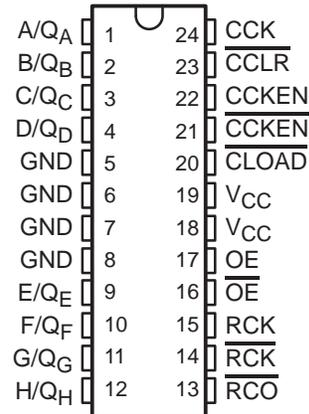


74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS

SCAS202 – MARCH 1992 – REVISED APRIL 1993

- 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- μ m 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 74AC11593 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{CCKEN}) and output-enable (OE, \overline{OE}) inputs. A register clock-enable (\overline{RCK}) input is also provided.

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

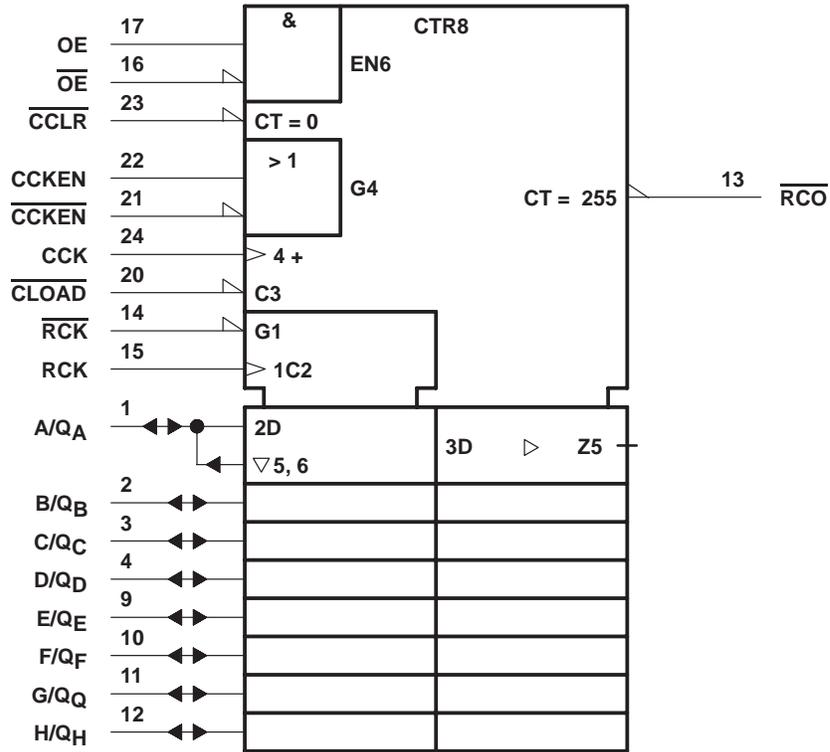
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS

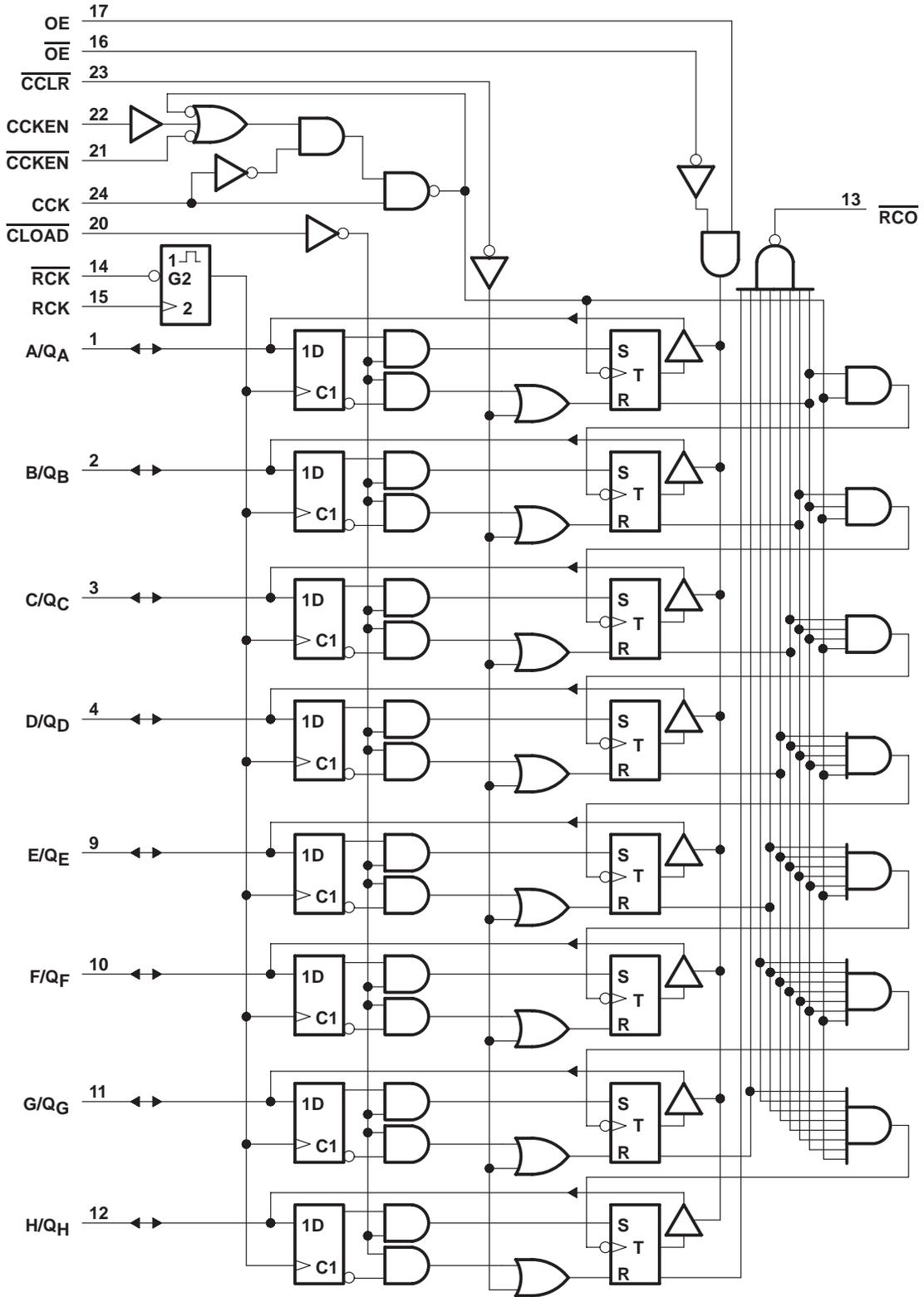
SCAS202 – MARCH 1992 – REVISED APRIL 1993

logic symbol†



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

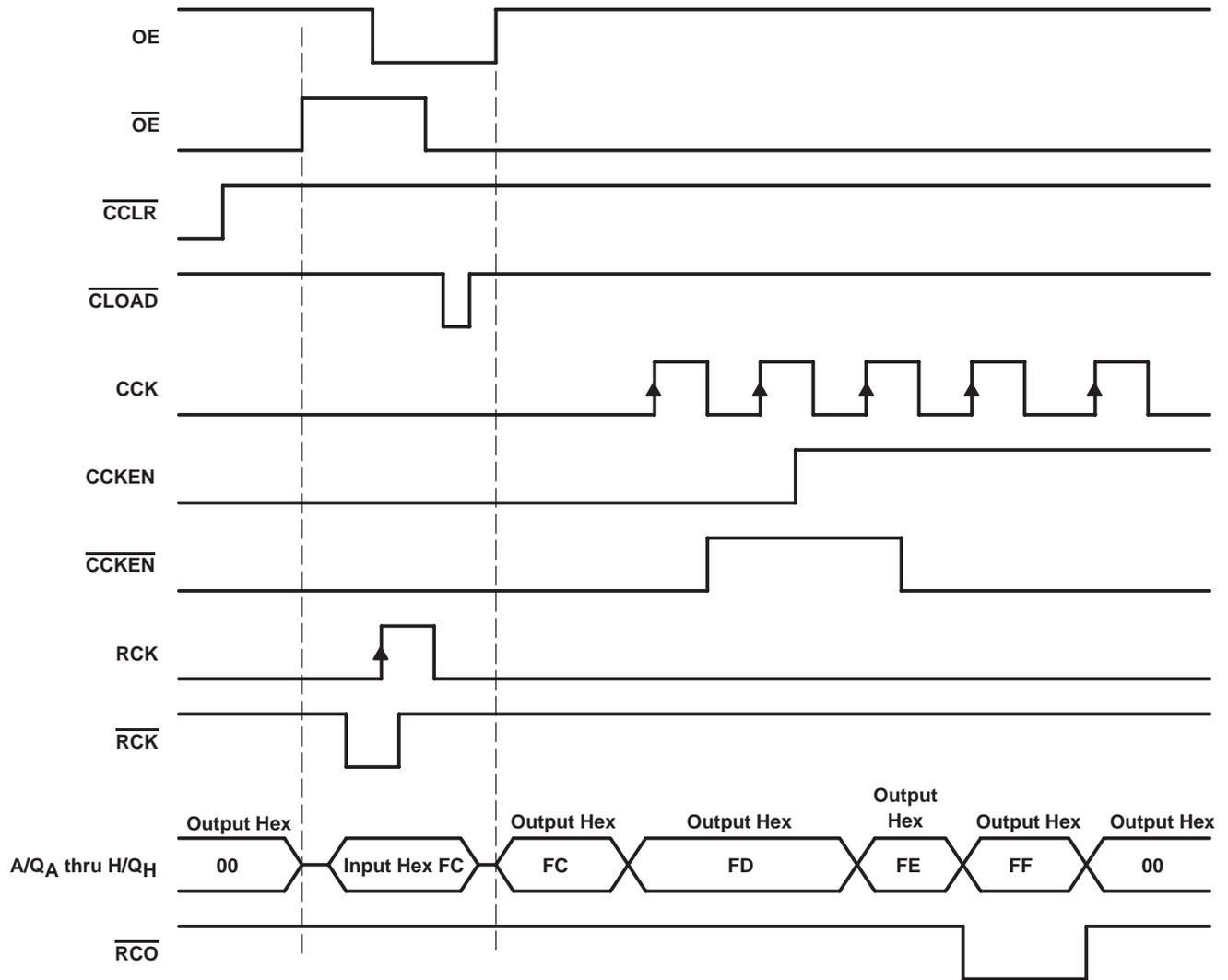
logic diagram (positive logic)



74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS

SCAS202 – MARCH 1992 – REVISED APRIL 1993

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.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS
 SCAS202 – MARCH 1992 – REVISED APRIL 1993

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		
Δt/Δv	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			
		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		V	
		4.5 V			0.1			
		5.5 V			0.1			
	I _{OL} = 12 mA	3 V			0.36			
		4.5 V			0.36			
		5.5 V			0.36			
I _{OL} = 24 mA	5.5 V			0.36				
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.



74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS

SCAS202 – MARCH 1992 – REVISED APRIL 1993

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

		$T_A = 25^\circ\text{C}$		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 \uparrow	5.2		5.2		ns
		CCKEN high before CCK \uparrow	6.4		6.4		
		$\overline{\text{CCLR}}$ high before CCK \uparrow	1.7		1.7		
		$\overline{\text{CLOAD}}$ high before CCK \uparrow	8.2		8.2		
		RCK \uparrow before $\overline{\text{CLOAD}}\uparrow^\dagger$	11.1		11.1		
		Data A thru H before RCK \uparrow	2.3		2.3		
t_h	Hold time	Data A thru H after RCK \uparrow	0.5		0.5		ns
		All others	0.2		0.2		

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

		$T_A = 25^\circ\text{C}$		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 \uparrow	3.1		3.1		ns
		CCKEN high before CCK \uparrow	4.3		4.3		
		$\overline{\text{CCLR}}$ high before CCK \uparrow	1.1		1.1		
		$\overline{\text{CLOAD}}$ high before CCK \uparrow	5.4		5.4		
		RCK \uparrow before $\overline{\text{CLOAD}}\uparrow^\dagger$	7.8		7.8		
		Data A thru H before RCK \uparrow	2		2		
t_h	Hold time	Data A thru H after RCK \uparrow	1.1		1.1		ns
		All others	0.8		0.8		

\dagger This time insures the data saved by RCK \uparrow will also be loaded into the counter.



74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS
 SCAS202 – MARCH 1992 – REVISED APRIL 1993

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)	$T_A = 25^\circ\text{C}$			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}	$\overline{\text{CLOAD}}$	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}	$\overline{\text{CCLR}}$	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}	$\overline{\text{OE}}$	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}	$\overline{\text{OE}}$	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	$\overline{\text{RCO}}$	5.3	12	16	5.3	18.6	ns
t_{PHL}			7.1	15.4	20.3	7.1	23.1	
t_{PLH}	$\overline{\text{CLOAD}}$	$\overline{\text{RCO}}$	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}	$\overline{\text{CCLR}}$	$\overline{\text{RCO}}$	5.6	12.3	16.6	5.6	19.2	ns
t_{PLH}	RCK	$\overline{\text{RCO}}$	8.6	17.3	22.2	8.6	25.8	ns
t_{PHL}			10.3	20.3	26.2	10.3	30.3	

74AC11593
8-BIT BINARY COUNTER
WITH 3-STATE I/O INPUT REGISTERS

SCAS202 – MARCH 1992 – REVISED APRIL 1993

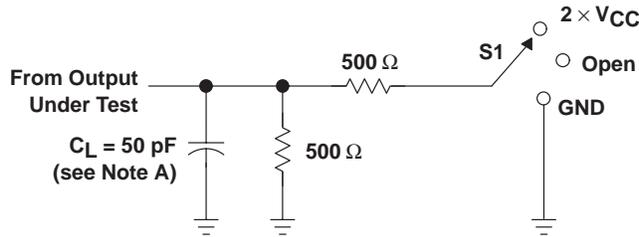
switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			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}	$\overline{\text{CLOAD}}$	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}	$\overline{\text{CCLR}}$	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}	$\overline{\text{OE}}$	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}	$\overline{\text{OE}}$	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	$\overline{\text{RCO}}$	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}	$\overline{\text{CLOAD}}$	$\overline{\text{RCO}}$	3.5	7.8	11.2	3.5	12.8	ns
t_{PHL}			5.6	11.7	16.6	5.6	19	
t_{PLH}	$\overline{\text{CCLR}}$	$\overline{\text{RCO}}$	3.6	8	11.6	3.6	13.4	ns
t_{PLH}	RCK	$\overline{\text{RCO}}$	5	10.3	14.4	5	16.7	ns
t_{PHL}			5.5	11.7	16.6	5.5	19.2	

operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

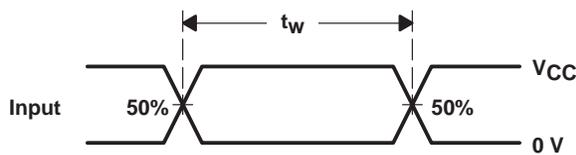
PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	$C_L = 50\text{ pF}$, $f = 1\text{ MHz}$	66	pF
			15	

PARAMETER MEASUREMENT INFORMATION

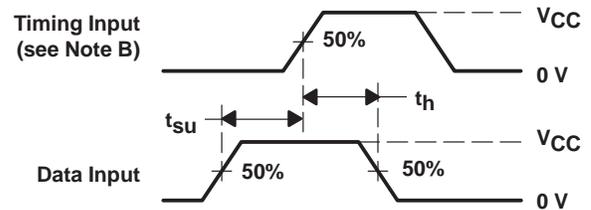


LOAD CIRCUIT

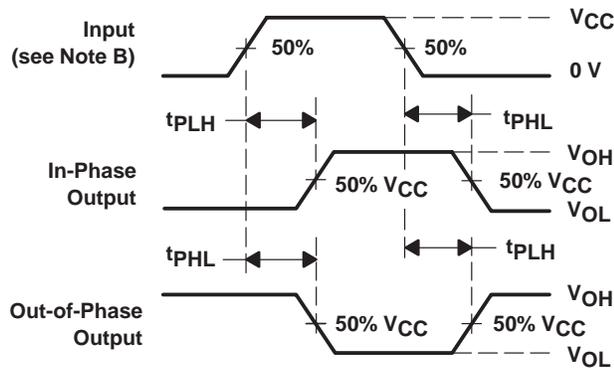
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND



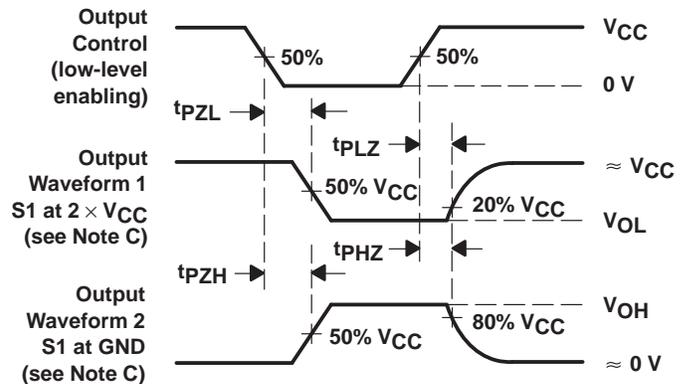
VOLTAGE WAVEFORMS



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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 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

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

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

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. 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 of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.