

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceed the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
 - Class Q Military
 - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
 - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

SN54390, SN54LS390, SN54393, SN54LS393, SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

OCTOBER 1976 — REVISED MARCH 1988

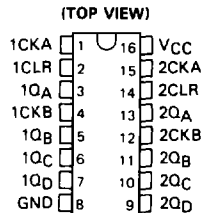
- Dual Versions of the Popular '90A, 'LS90 and '93A, 'LS93
- '390, 'LS390 . . . Individual Clocks for A and B Flip-Flops Provide Dual $\div 2$ and $\div 5$ Counters
- '393, 'LS393 . . . Dual 4-Bit Binary Counter with Individual Clocks
- All Have Direct Clear for Each 4-Bit Counter
- Dual 4-Bit Versions Can Significantly Improve System Densities by Reducing Counter Package Count by 50%
- Typical Maximum Count Frequency . . . 35 MHz
- Buffered Outputs Reduce Possibility of Collector Commutation

description

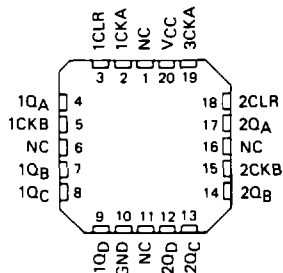
Each of these monolithic circuits contains eight master-slave flip-flops and additional gating to implement two individual four-bit counters in a single package. The '390 and 'LS390 incorporate dual divide-by-two and divide-by-five counters, which can be used to implement cycle lengths equal to any whole and/or cumulative multiples of 2 and/or 5 up to divide-by-100. When connected as a bi-quinary counter, the separate divide-by-two circuit can be used to provide symmetry (a square wave) at the final output stage. The '393 and 'LS393 each comprise two independent four-bit binary counters each having a clear and a clock input. N-bit binary counters can be implemented with each package providing the capability of divide-by-256. The '390, 'LS390, '393, and 'LS393 have parallel outputs from each counter stage so that any submultiple of the input count frequency is available for system-timing signals.

Series 54 and Series 54LS circuits are characterized for operation over the full military temperature range of -55°C to 125°C ; Series 74 and Series 74LS circuits are characterized for operation from 0°C to 70°C .

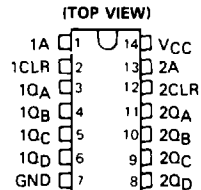
SN54390, SN54LS390 . . . J OR W PACKAGE
SN74390 . . . N PACKAGE
SN74LS390 . . . D OR N PACKAGE



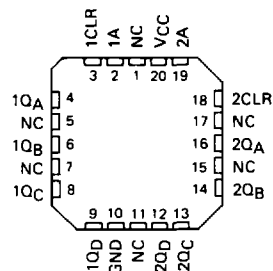
SN54LS390 . . . FK PACKAGE
(TOP VIEW)



SN54393, SN54LS393 . . . J OR W PACKAGE
SN74393 . . . N PACKAGE
SN74LS393 . . . D OR N PACKAGE



SN54LS393 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

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PRODUCTION DATA documents contain information 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.

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SN54390, SN54LS390, SN54393, SN54LS393, SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

'390, 'LS390
BCD COUNT SEQUENCE
(EACH COUNTER)
(See Note A)

COUNT	OUTPUT			
	Q _D	Q _C	Q _B	Q _A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

FUNCTION TABLES

'390, 'LS390
BI-QUINARY (5-2)
(EACH COUNTER)
(See Note B)

COUNT	OUTPUT			
	Q _A	Q _D	Q _C	Q _B
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

'393, 'LS393
COUNT SEQUENCE
(EACH COUNTER)

COUNT	OUTPUT			
	Q _D	Q _C	Q _B	Q _A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

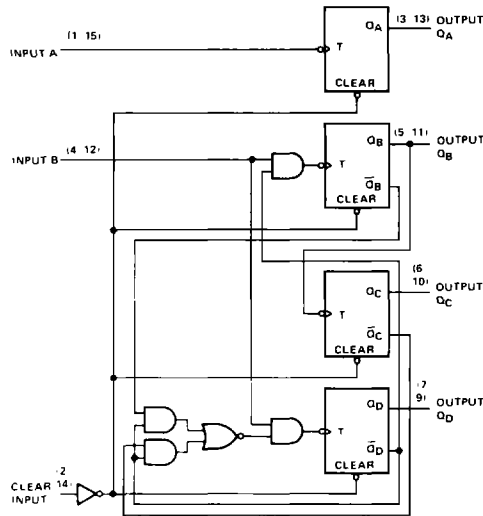
- NOTES
 A. Output Q_A is connected to input B for BCD count.
 B. Output Q_D is connected to input A for bi-quinary count.
 C. H = high level, L = low level.

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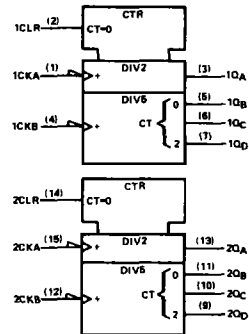
logic diagrams (positive logic)

'390, 'LS390

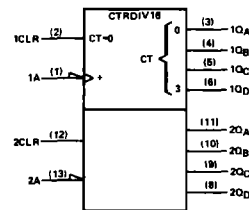


logic symbols†

'390, 'LS390



'393, 'LS393

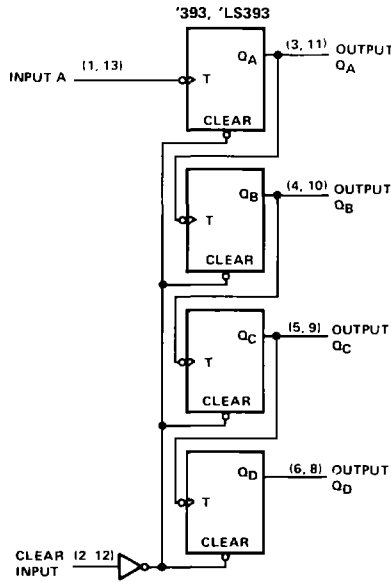


†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

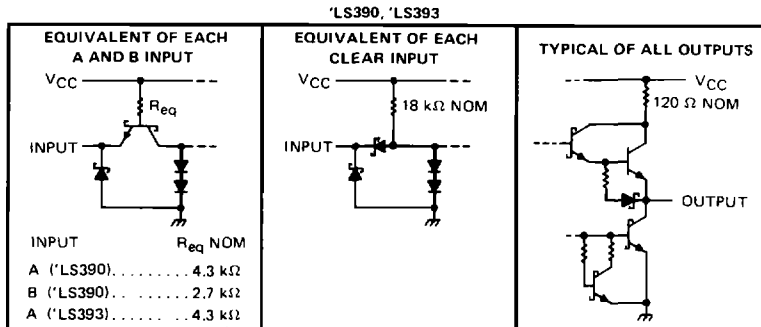
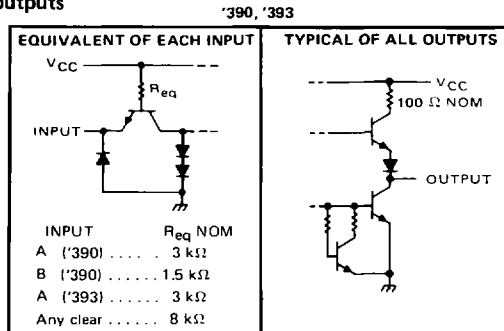
**SN54390, SN54LS390, SN54393, SN54LS393,
SN74390, SN74LS390, SN74393, SN74LS393
DUAL 4-BIT DECADE AND BINARY COUNTERS**

logic diagrams (continued)



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

schematics of inputs and outputs



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TTL Devices

SN54390, SN54393, SN74390, SN74393

DUAL 4-BIT DECADE AND BINARY COUNTERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54390, SN54393	-55°C to 125°C
SN74390, SN74393	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

recommended operating conditions

		SN54390 SN54393			SN74390 SN74393			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	μ A
Low-level output current, I_{OL}				16			16	mA
Count frequency, f_{count}	A input	0		25	0		25	MHz
	B input	0		20	0		20	
Pulse width, t_w	A input high or low	20			20			ns
	B input high or low	25			25			
	Clear high	20			20			
Clear inactive-state setup time, t_{SU}		25 \dagger			25 \dagger			ns
Operating free-air temperature, T_A		-55		125	0		70	°C

\dagger The arrow indicates that the falling edge of the clock pulse is used for reference.

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

PARAMETER	TEST CONDITIONS \dagger	'390			'393			UNIT
		MIN	TYP \ddagger	MAX	MIN	TYP \ddagger	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	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$	2.4	3.4		2.4	3.4		V
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA} \parallel$	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	Clear			40			40	μ A
	Input A	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$						
	Input B			80			80	
I_{IL} Low-level input current	Clear			-1			-1	mA
	Input A	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$						
	Input B			-3.2			-3.2	
I_{OS} Short-circuit output current \S	$V_{CC} = \text{MAX}$	SN54 \dagger	-20	-57	-20	-57		mA
		SN74 \dagger	-18	-57	-18	-57		
I_{CC} Supply current	$V_{CC} = \text{MAX},$ See Note 2	42	69		38	64		mA

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

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

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

\parallel The Q_A outputs of the '390 are tested at $I_{OL} = 16 \text{ mA}$ plus the limit value for I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability

NOTE 2: I_{CC} is measured with all outputs open, both clear inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

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**SN54390, SN54393, SN74390, SN74393
DUAL 4-BIT DECADE AND BINARY COUNTERS**

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'390			'393			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
f_{max}	A	Q_A	$C_L = 15\text{ pF}$, $R_L = 400\ \Omega$, See Note 3 and Figure 1	25	35		25	35	MHz	
	B	Q_B		20	30					
t_{PLH}	A	Q_A		12	20		12	20	ns	
t_{PHL}				13	20		13	20		
t_{PLH}	A	Q_C of '390 Q_D of '393		37	60		40	60	ns	
t_{PHL}				39	60		40	60		
t_{PLH}	B	Q_B		13	21				ns	
t_{PHL}				14	21					
t_{PLH}	B	Q_C		24	39				ns	
t_{PHL}				26	39					
t_{PLH}	B	Q_D		13	21				ns	
t_{PHL}				14	21					
t_{PHL}	Clear	Any		24	39		24	39	ns	

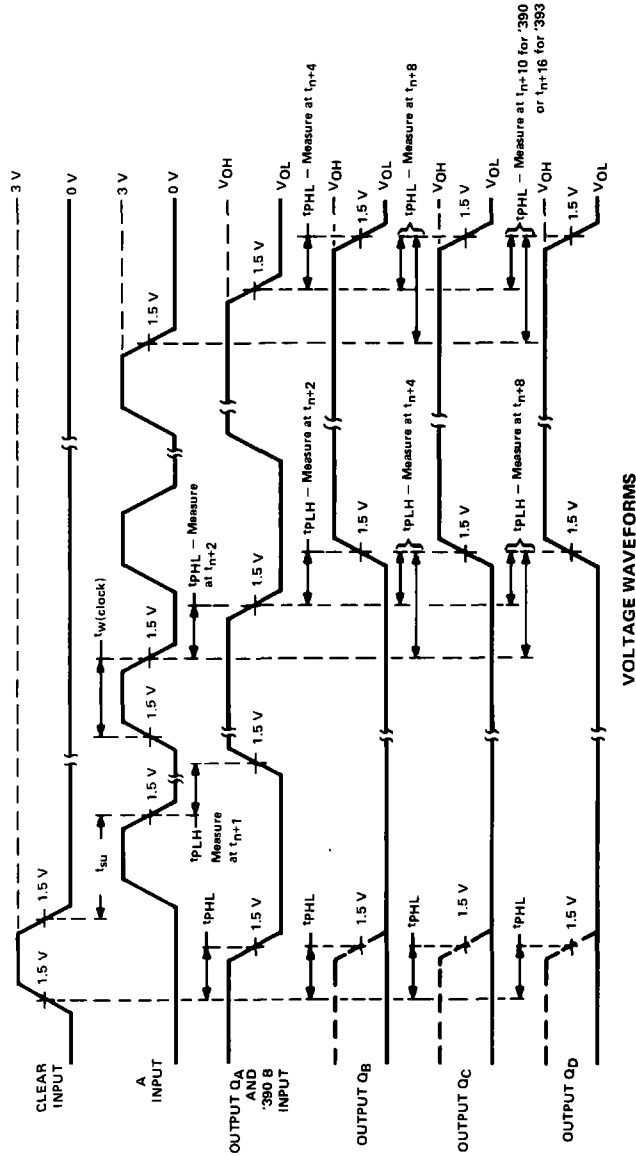
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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PARAMETER MEASUREMENT INFORMATION



NOTE A: Input pulses are supplied by a generator having the following characteristics: $t_r \leq 5$ ns, $t_f \leq 5$ ns, PRR = 1 MHz, duty cycle = 50%, $Z_{out} \approx 50$ ohms.

FIGURE 1

SN54LS390, SN54LS393, SN74LS390, SN74LS393

DUAL 4-BIT DECADE AND BINARY COUNTERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Clear input voltage	7 V
Any A or B clock input voltage	5.5 V
Operating free-air temperature range: SN54LS390, SN54LS393	-55°C to 125°C
SN74LS390, SN74LS393	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

recommended operating conditions

		SN54LS390 SN54LS393			SN74LS390 SN74LS393			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	μ A
Low-level output current, I_{OL}				4			8	mA
Count frequency, f_{count}	A input	0		25	0		25	MHz
	B input	0		12.5	0		12.5	MHz
Pulse width, t_w	A input high or low	20			20			ns
	B input high or low	40			40			ns
	Clear high	20			20			ns
Clear inactive-state setup time, t_{SU}		25			25			ns
Operating free-air temperature, T_A		-55		125	0		70	°C

† The arrow indicates that the falling edge of the clock pulse is used for reference.

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	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$	2.5	3.4		2.7	3.4	V	
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 4 \text{ mA}^{\S}, I_{OL} = 8 \text{ mA}^{\S}$	0.25	0.4		0.25	0.4	V	
					0.35	0.5		
I_I Input current at maximum input voltage	Clear Input A Input B $V_{CC} = \text{MAX}$	$V_I = 7 \text{ V}$		0.1		0.1	mA	
		$V_I = 5.5 \text{ V}$		0.2		0.2	mA	
				0.4		0.4	mA	
I_{IH} High-level input current	Clear Input A Input B $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			0.02		0.02	mA	
				0.1		0.1	mA	
				0.2		0.2	mA	
I_{IL} Low-level input current	Clear Input A Input B $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-0.4		-0.4	mA	
				-1.6		-1.6	mA	
				-2.4		-2.4	mA	
I_{OS} Short-circuit output current [¶]	$V_{CC} = \text{MAX}$	-20	-100		-20	-100	mA	
I_{CC} Supply current	$V_{CC} = \text{MAX},$ See Note 2	*LS390		15	26	15	26	mA
		*LS393		15	26	15	26	mA

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

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

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

¶ The Q_A outputs of the 'LS390 are tested at $I_{OL} = \text{MAX}$ plus the limit value for I_{IL} for the clock B input. This permits driving the clock B input while maintaining full fan-out capability.

NOTE 2: I_{CC} is measured with all outputs open, both clear inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

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SN54LS390, SN54LS393, SN74LS390, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS390			'LS393			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
f_{\max}	A	Q_A	$C_L = 15\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Note 4 and Figure 2	25	35		25	35		MHz
	B	Q_B		12.5	20					
t_{PLH}	A	Q_A		12	20		12	20		ns
t_{PHL}				13	20		13	20		
t_{PLH}	A	Q_C of 'LS390		37	60		40	60		ns
t_{PHL}		Q_D of 'LS393		39	60		40	60		
t_{PLH}	B	Q_B		13	21					ns
t_{PHL}				14	21					
t_{PLH}	B	Q_C		24	39					ns
t_{PHL}				26	39					
t_{PLH}	B	Q_D		13	21					ns
t_{PHL}				14	21					
t_{PHL}	Clear	Any		24	39		24	39		ns

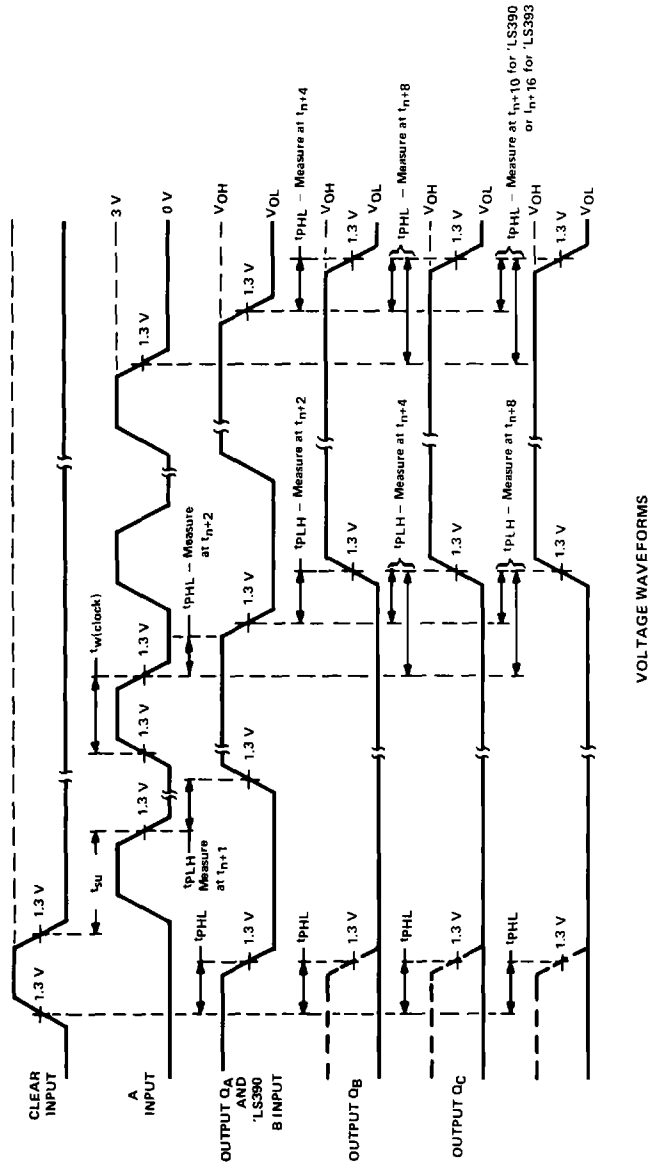
NOTE 4: Load circuits and voltage waveforms are shown in Section 1

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SN54LS390, SN54LS393, SN74LS390, SN74LS393
DUAL 4-BIT DECADE AND BINARY COUNTERS

PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

NOTE A: Input pulses are supplied by a generator having the following characteristics: $t_r = 15$ ns, $t_f = 6$ ns, PRR = 1 MHz, duty cycle = 50 %, $Z_{out} \approx 50$ ohms

FIGURE 2

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