



1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance dual 4-bit binary counter microcircuit, with an operating temperature range of -40°C to +105°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturer's PIN is the item of identification. The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation:

<u>V62/04695</u>	-	<u>01</u>	<u>X</u>	<u>E</u>
Drawing number		Device type (See 1.2.1)	Case outline (See 1.2.2)	Lead finish (See 1.2.3)

1.2.1 Device type(s).

<u>Device type</u>	<u>Generic</u>	<u>Circuit function</u>
01	SN74LV393A-EP	Dual 4-bit binary counter

1.2.2 Case outline(s). The case outlines are as specified herein.

<u>Outline letter</u>	<u>Number of pins</u>	<u>JEDEC PUB 95</u>	<u>Package style</u>
X	14	MO-153	Plastic small outline

1.2.3 Lead finishes. The lead finishes are as specified below or other lead finishes as provided by the device manufacturer.

<u>Finish designator</u>	<u>Material</u>
A	Hot solder dip
B	Tin-lead plate
C	Gold plate
D	Palladium
E	Gold flash palladium
Z	Other

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1.3 Absolute maximum ratings. 1/

Supply voltage range ( $V_{CC}$ ) .....	-0.5 V to 7 V
Input voltage range ( $V_I$ ) .....	-0.5 V to 7 V 2/
Output voltage range applied in high or low state ( $V_O$ ) .....	-0.5 V to $V_{CC} + 0.5$ V 2/ 3/
Output voltage range applied in power off state ( $V_O$ ) .....	-0.5 V to 7 V 2/
Input clamp current ( $I_{IK}$ ) ( $V_I < 0$ ) .....	-20 mA
Output clamp current ( $I_{OK}$ ) ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 50$ mA
Continuous output current ( $I_O$ ) ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 50$ mA
Package thermal impedance ( $\theta_{JA}$ ) .....	113°C/W 4/
Storage temperature range ( $T_{STG}$ ) .....	-65°C to 150°C

1.4 Recommended operating conditions. 5/ 6/

Supply voltage range ( $V_{CC}$ ) .....	2 V minimum to 5.5 V maximum
High level input voltage ( $V_{IH}$ ):	
$V_{CC} = 2$ V .....	1.5 V minimum
$V_{CC} = 2.3$ V to 2.7 V .....	$V_{CC} \times 0.7$ V minimum
$V_{CC} = 3$ V to 3.6 V .....	$V_{CC} \times 0.7$ V minimum
$V_{CC} = 4.5$ V to 5.5 V .....	$V_{CC} \times 0.7$ V minimum
Low level input voltage ( $V_{IL}$ ):	
$V_{CC} = 2$ V .....	0.5 V maximum
$V_{CC} = 2.3$ V to 2.7 V .....	$V_{CC} \times 0.3$ V maximum
$V_{CC} = 3$ V to 3.6 V .....	$V_{CC} \times 0.3$ V maximum
$V_{CC} = 4.5$ V to 5.5 V .....	$V_{CC} \times 0.3$ V maximum
Input voltage ( $V_I$ ) .....	0 V minimum to 5.5 V maximum
Output voltage ( $V_O$ ) .....	0 V minimum to $V_{CC}$ maximum
High level output current ( $I_{OH}$ ):	
$V_{CC} = 2$ V .....	-50 $\mu$ A maximum
$V_{CC} = 2.3$ V to 2.7 V .....	-2 mA maximum
$V_{CC} = 3$ V to 3.6 V .....	-6 mA maximum
$V_{CC} = 4.5$ V to 5.5 V .....	-12 mA maximum

- 1/ 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.
- 2/ The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- 3/ This value is limited to 5.5 V maximum.
- 4/ The package thermal impedance is calculated in accordance with JESD 51-7.
- 5/ All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.
- 6/ Use of this product beyond the manufacturers design rules or stated parameters is done at the user's risk. The manufacturer and/or distributor maintain no responsibility or liability for product used beyond the stated limits.

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1.4 Recommended operating conditions - continued. 5/ 6/

Low level output current (  $I_{OL}$  ):

$V_{CC} = 2\text{ V}$ .....	50 $\mu\text{A}$ maximum
$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ .....	2 mA maximum
$V_{CC} = 3\text{ V to } 3.6\text{ V}$ .....	6 mA maximum
$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ .....	12 mA maximum

Input transition rise or fall rate (  $\Delta t / \Delta v$  ):

$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ .....	200 ns/V maximum
$V_{CC} = 3\text{ V to } 3.6\text{ V}$ .....	100 ns/V maximum
$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ .....	20 ns/V maximum

Operating free-air temperature range (  $T_A$  )..... -40°C to +105°C

2. APPLICABLE DOCUMENTS

JEDEC – SOLID STATE TECHNOLOGY ASSOCIATION (JEDEC)

JEP95	–	Registered and Standard Outlines for Semiconductor Devices
JESD51-7	–	High Effective Thermal Conductivity Test Board for Leaded Surface Mount Packages

(Copies of these documents are available online at <http://www.jedec.org> or from JEDEC – Solid State Technology Association, 3103 North 10th Street, Suite 240–S, Arlington, VA 22201-2107).

3. REQUIREMENTS

3.1 Marking. Parts shall be permanently and legibly marked with the manufacturer’s part number as shown in 6.3 herein and as follows:

- A. Manufacturer’s name, CAGE code, or logo
- B. Pin 1 identifier
- C. ESDS identification (optional)

3.2 Unit container. The unit container shall be marked with the manufacturer’s part number and with items A and C (if applicable) above.

3.3 Electrical characteristics. The maximum and recommended operating conditions and electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.4 Design, construction, and physical dimension. The design, construction, and physical dimensions are as specified herein.

3.5 Diagrams.

3.5.1 Case outline. The case outline shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as shown in figure 2.

3.5.3 Truth table. The truth table shall be as shown in figure 3.

3.5.4 Logic diagram. The logic diagram shall be as shown in figure 4.

3.5.5 Timing waveforms and test circuit. The timing waveforms and test circuit shall be as shown in figure 5.

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TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions	Temperature, T <sub>A</sub>	Device type	Limits		Unit
					Min	Max	
Electrical characteristics section.							
High level output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -50 μA, V <sub>CC</sub> = 2 V to 5.5 V	-40°C to 105°C	01	V <sub>CC</sub> - 0.1		V
		I <sub>OH</sub> = -2 mA, V <sub>CC</sub> = 2.3 V			2		
		I <sub>OH</sub> = -6 mA, V <sub>CC</sub> = 3 V			2.48		
		I <sub>OH</sub> = -12 mA, V <sub>CC</sub> = 4.5 V			3.8		
Low level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 50 μA, V <sub>CC</sub> = 2 V to 5.5 V	-40°C to 105°C	01		0.1	V
		I <sub>OL</sub> = 2 mA, V <sub>CC</sub> = 2.3 V				0.4	
		I <sub>OL</sub> = 6 mA, V <sub>CC</sub> = 3 V				0.44	
		I <sub>OL</sub> = 12 mA, V <sub>CC</sub> = 4.5 V				0.55	
Input current	I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND, V <sub>CC</sub> = 0 to 5.5 V	-40°C to 105°C	01		±1	μA
Supply current	I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0, V <sub>CC</sub> = 5.5 V	-40°C to 105°C	01		20	μA
Off current	I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V, V <sub>CC</sub> = 0	-40°C to 105°C	01		5	μA
Input capacitance	C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>CC</sub> = 3.3 V	-40°C to 105°C	01	1.8 typical		pF
Timing requirements section. See figure 5							
Pulse duration	t <sub>w</sub>	CLK high or low, V <sub>CC</sub> = 2.5 V ±0.2 V	25°C	01	5		ns
			-40°C to 105°C		5		
		CLR high, V <sub>CC</sub> = 2.5 V ±0.2 V	25°C		5		
			-40°C to 105°C		5		
Setup time	t <sub>su</sub>	CLR inactive before CLK ↓, V <sub>CC</sub> = 2.5 V ±0.2 V	25°C	01	6		ns
			-40°C to 105°C		6		

See footnote at end of table.

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TABLE I. Electrical performance characteristics – continued. 1/

Test	Symbol	Conditions	Temperature, T <sub>A</sub>	Device type	Limits		Unit
					Min	Max	
Timing requirements section – continued. See figure 5							
Pulse duration	t <sub>w</sub>	$\overline{\text{CLK}}$ high or low, V <sub>CC</sub> = 3.3 V ±0.3 V	25°C	01	5		ns
			-40°C to 105°C		5		
		CLR high, V <sub>CC</sub> = 3.3 V ±0.3 V	25°C		5		
			-40°C to 105°C		5		
Setup time	t <sub>SU</sub>	CLR inactive before CLK ↓, V <sub>CC</sub> = 3.3 V ±0.3 V	25°C	01	5		ns
			-40°C to 105°C		5		
Pulse duration	t <sub>w</sub>	$\overline{\text{CLK}}$ high or low, V <sub>CC</sub> = 5 V ±0.5 V	25°C	01	5		ns
			-40°C to 105°C		5		
		CLR high, V <sub>CC</sub> = 5 V ±0.5 V	25°C		5		
			-40°C to 105°C		5		
Setup time	t <sub>SU</sub>	CLR inactive before CLK ↓, V <sub>CC</sub> = 5 V ±0.5 V	25°C	01	4		ns
			-40°C to 105°C		4		
Switching characteristics section See figure 5							
Maximum frequency	f <sub>max</sub>	V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	25°C	01	30		MHz
			-40°C to 105°C		25		
Power dissipation time	t <sub>pd</sub>	From input $\overline{\text{CLK}}$ , To output Q <sub>A</sub> V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	25°C	01		21.3	ns
			-40°C to 105°C		1	24.5	
		From input $\overline{\text{CLK}}$ , To output Q <sub>B</sub> V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	25°C			23.9	
			-40°C to 105°C		1	27.5	
		From input $\overline{\text{CLK}}$ , To output Q <sub>C</sub> V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	25°C			26.1	
			-40°C to 105°C		1	30	
		From input $\overline{\text{CLK}}$ , To output Q <sub>D</sub> V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	25°C			27.8	
			-40°C to 105°C		1	32	

See footnote at end of table.

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TABLE I. Electrical performance characteristics – continued. 1/

Test	Symbol	Conditions	Temperature, T <sub>A</sub>	Device type	Limits		Unit
					Min	Max	
Switching characteristics section – continued. See figure 5							
Propagation delay times high to low	t <sub>PHL</sub>	From input CLR, To output Q <sub>n</sub>	25°C	01		17.4	ns
		V <sub>CC</sub> = 2.5 V ±0.2 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	20	
Maximum frequency	f <sub>max</sub>	V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	25°C	01	45		MHz
			-40°C to 105°C		35		
Power dissipation time	t <sub>pd</sub>	From input $\overline{\text{CLK}}$ , To output Q <sub>A</sub>	25°C	01		16.7	ns
		V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	19	
		From input $\overline{\text{CLK}}$ , To output Q <sub>B</sub>	25°C			19.3	
		V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	22	
		From input $\overline{\text{CLK}}$ , To output Q <sub>C</sub>	25°C			21.5	
		V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	24.5	
		From input $\overline{\text{CLK}}$ , To output Q <sub>D</sub>	25°C			23.2	
		V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	26.5	
Propagation delay times high to low	t <sub>PHL</sub>	From input CLR, To output Q <sub>n</sub>	25°C	01		15.8	ns
		V <sub>CC</sub> = 3.3 V ±0.3 V, C <sub>L</sub> = 50 pF	-40°C to 105°C			18	
Maximum frequency	f <sub>max</sub>	V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	25°C	01	85		MHz
			-40°C to 105°C		75		
Power dissipation time	t <sub>pd</sub>	From input $\overline{\text{CLK}}$ , To output Q <sub>A</sub>	25°C	01		10.5	ns
		V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	12	
		From input $\overline{\text{CLK}}$ , To output Q <sub>B</sub>	25°C			11.8	
		V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	13.5	
		From input $\overline{\text{CLK}}$ , To output Q <sub>C</sub>	25°C			13.2	
		V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	-40°C to 105°C		1	15	

See footnote at end of table.

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TABLE I. Electrical performance characteristics – continued. 1/

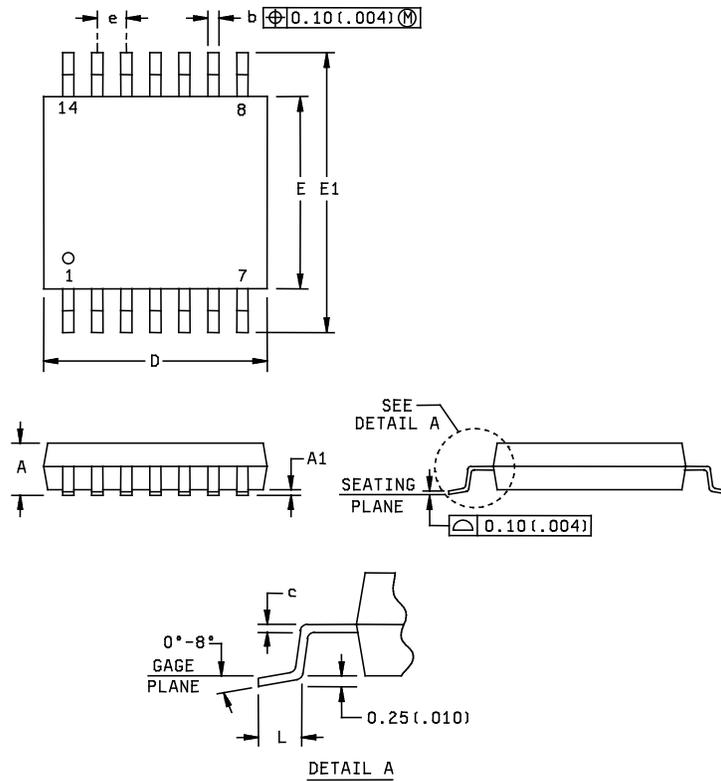
Test	Symbol	Conditions	Temperature, T <sub>A</sub>	Device type	Limits		Unit
					Min	Max	
Switching characteristics section – continued. See figure 5							
Power dissipation time	t <sub>pd</sub>	From input $\overline{\text{CLK}}$ , To output Q <sub>D</sub> V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	25°C	01		14.5	ns
			-40°C to 105°C		1	16.5	
Propagation delay times high to low	t <sub>PHL</sub>	From input CLR, To output Q <sub>n</sub> V <sub>CC</sub> = 5 V ±0.5 V, C <sub>L</sub> = 50 pF	25°C	01		10.1	ns
			-40°C to 105°C		1	11.5	
Noise characteristics section. <u>2/</u>							
Quiet output, maximum dynamic V <sub>OL</sub>	V <sub>OL(P)</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF	+25°C	01		0.8	V
Quiet output, minimum dynamic V <sub>OL</sub>	V <sub>OL(V)</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF	+25°C	01		-0.8	V
Quiet output, minimum dynamic V <sub>OH</sub>	V <sub>OH(V)</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF	+25°C	01	2.8 typical		V
High level dynamic input voltage	V <sub>IH(D)</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF	+25°C	01	2.31		V
Low level dynamic input voltage	V <sub>IL(D)</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF	+25°C	01		0.99	V
Operating characteristics section.							
Power dissipation capacitance	C <sub>pd</sub>	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF, f = 10 MHz	+25°C	01	15.2 typical		pF
		V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, f = 10 MHz			17.3 typical		

1/ Testing and other quality control techniques are used to the extent deemed necessary to assure product performance over the specified temperature range. Product may not necessarily be tested across the full temperature range and all parameters may not necessarily be tested. In the absence of specific parametric testing, product performance is assured by characterization and/or design.

2/ Characteristics are for surface mount packages only.

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Case X



Dimensions									
Symbol	Millimeters		Inches		Symbol	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A		1.20		0.047	E	4.30	4.50	0.169	0.177
A1	0.05	0.15	0.002	0.006	E1	6.20	6.60	0.244	0.260
b	0.19	0.30	0.007	0.012	e	0.65 NOM		0.026 NOM	
c	0.15 NOM		0.006 NOM		L	0.50	0.75	0.020	0.030
D	4.90	5.10	0.193	0.201					

NOTES:

1. This drawing is subject to change without notice.
2. Body dimensions do not include mold flash or protrusion not to exceed 0.15 mm (0.006 inches).
3. Falls within JEDEC MO-153.
4. All linear dimensions are shown in millimeters (inches). Inches equivalents are given for general information only.

FIGURE 1. Case outline.

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Case outlines: X and Y			
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	1 $\overline{\text{CLR}}$	8	2 Q <sub>D</sub>
2	1 CLR	9	2 Q <sub>C</sub>
3	1 Q <sub>A</sub>	10	2 Q <sub>B</sub>
4	1 Q <sub>B</sub>	11	2 Q <sub>A</sub>
5	1 Q <sub>C</sub>	12	2 CLR
6	1 Q <sub>D</sub>	13	2 $\overline{\text{CLR}}$
7	GND	14	V <sub>CC</sub>

FIGURE 2. Terminal connections.

Inputs		Function
$\overline{\text{CLR}}$	CLR	
↑	L	No change
↓	L	Advance to next stage
X	H	All outputs L

FIGURE 3. Truth table.

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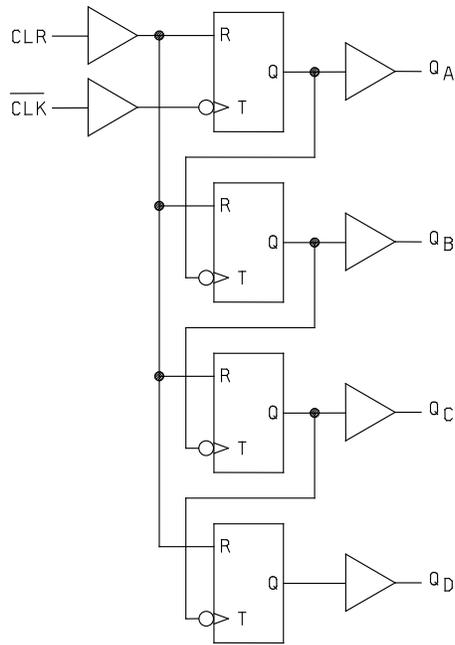


FIGURE 4. Logic diagram.

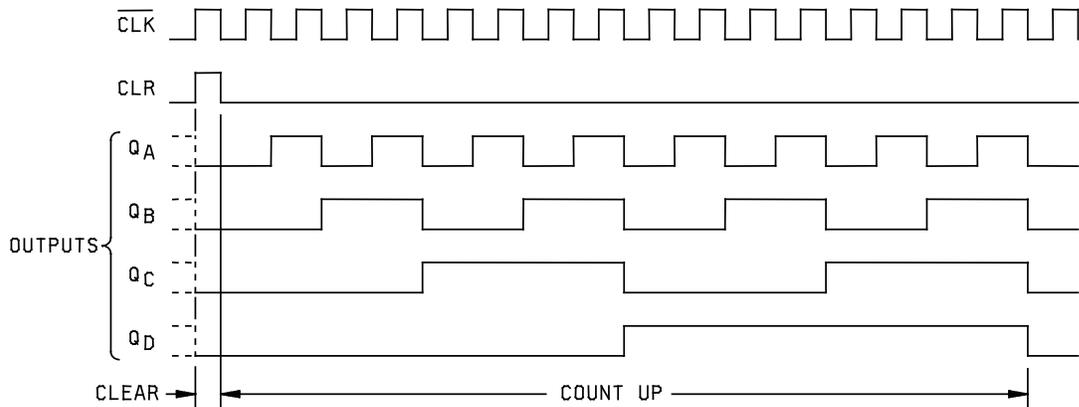
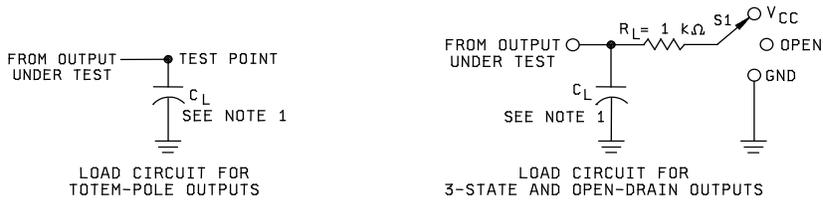
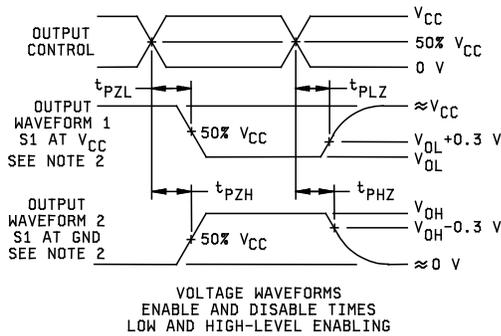
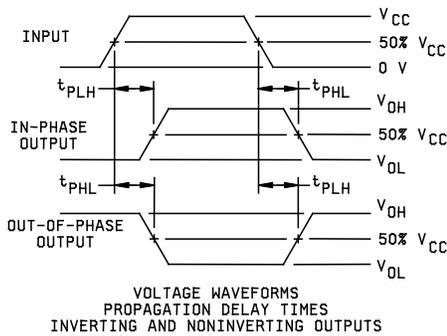
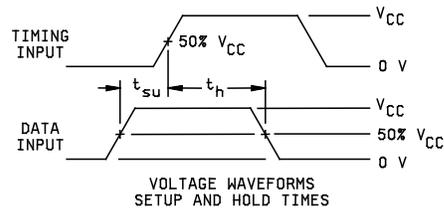
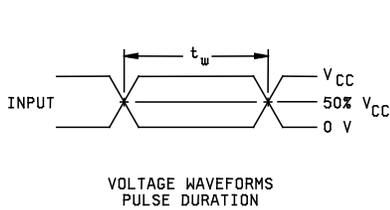


FIGURE 5. Timing waveforms and test circuit.

<p align="center"><b>DLA LAND AND MARITIME COLUMBUS, OHIO</b></p>	<p align="center"><b>SIZE A</b></p>	<p align="center"><b>CODE IDENT NO. 16236</b></p>	<p align="center"><b>DWG NO. V62/04695</b></p>
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Test	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{CC}$
$t_{PHZ}/t_{PZH}$	GND
Open Drain	$V_{CC}$



NOTES:

1.  $C_L$  includes probe and jig capacitance.
2. 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.
3. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 3$  ns, and  $t_f \leq 3$  ns.
4. The outputs are measured one at a time with one input transition per measurement.
5.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
6.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
7.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
8. All parameters and waveforms are not applicable to all devices.

FIGURE 5. Timing waveforms and test circuit – Continued.

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4. VERIFICATION

4.1 Product assurance requirements. The manufacturer is responsible for performing all inspection and test requirements as indicated in their internal documentation. Such procedures should include proper handling of electrostatic sensitive devices, classification, packaging, and labeling of moisture sensitive devices, as applicable.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Preservation, packaging, labeling, and marking shall be in accordance with the manufacturer's standard commercial practices for electrostatic discharge sensitive devices.

6. NOTES

6.1 ESDS. Devices are electrostatic discharge sensitive and are classified as ESDS class 1 minimum.

6.2 Configuration control. The data contained herein is based on the salient characteristics of the device manufacturer's data book. The device manufacturer reserves the right to make changes without notice. This drawing will be modified as changes are provided.

6.3 Suggested source(s) of supply. Identification of the suggested source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item. DLA Land and Maritime maintains an online database of all current sources of supply at <http://www.landandmaritime.dla.mil/Programs/Smcr/>.

Vendor item drawing administrative control number <sup>1/</sup>	Device manufacturer CAGE code	Package		Vendor part number	Top side marking
V62/04695-01XE	01295	TSSOP - PW	Tape and reel	SN74LV393ATPWREP	LV393EP

<sup>1/</sup> The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.

CAGE code

01295

Source of supply

Texas Instruments, Inc.  
Semiconductor Group  
8505 Forest lane  
P.O. Box 660199  
Dallas, TX 75243  
Point of contact: U.S. Highway 75 South  
P.O. Box 84, M/S 853  
Sherman, TX 75090-9493

<b>DLA LAND AND MARITIME COLUMBUS, OHIO</b>	<b>SIZE A</b>	<b>CODE IDENT NO. 16236</b>	<b>DWG NO. V62/04695</b>
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