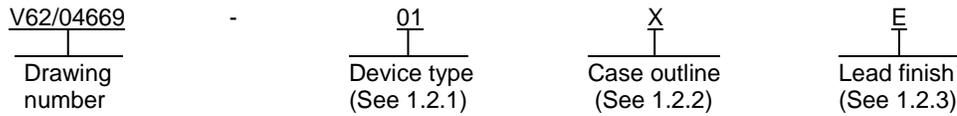




1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance dual positive-edge-triggered D-type flip-flop with clear and preset microcircuit, with an operating temperature range of -40°C to +125°C for device type 01 and an extended operating temperature range of -55°C to +125°C for device type 02.

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:



1.2.1 Device type(s).

<u>Device type</u>	<u>Operating temperature</u>	<u>Generic</u>	<u>Circuit function</u>
01	-40°C to +125°C	SN74LVC74A-EP	Dual positive-edge-triggered D-type flip flop with clear and preset
02	-55°C to +125°C	SN74LVC74A-EP	Dual positive-edge-triggered D-type flip flop with clear and preset

1.2.2 Case outlines. 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	MS-012	Plastic small-outline
Y	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

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1.3 Absolute maximum ratings. 1/

Supply voltage range ( $V_{CC}$ ) .....	-0.5 V to 6.5 V
Input voltage range ( $V_I$ ) .....	-0.5 V to 6.5 V 2/
Output voltage range ( $V_O$ ) .....	-0.5 V to $V_{CC} + 0.5$ V 2/ 3/
Input clamp current ( $I_{IK}$ ) ( $V_I < 0$ ) .....	-50 mA
Output clamp current ( $I_{OK}$ ) ( $V_O < 0$ ) .....	-50 mA
Continuous output current ( $I_O$ ) .....	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 100$ mA
Package thermal impedance ( $\theta_{JA}$ ): 4/	
X package .....	86°C/W
Y package .....	113°C/W
Storage temperature range ( $T_{STG}$ ) .....	-65°C to 150°C

1.4 Recommended operating conditions. 5/

Supply voltage range ( $V_{CC}$ ):	
Operating .....	2.0 V to 3.6 V
Data retention only .....	1.5 V minimum
Minimum high level input voltage ( $V_{IH}$ ) ( $V_{CC} = 2.7$ V to 3.6 V) .....	2.0 V
Maximum low level input voltage ( $V_{IL}$ ) ( $V_{CC} = 2.7$ V to 3.6 V) .....	0.8 V
Input voltage range ( $V_I$ ) .....	0.0 V to 5.5 V
Output voltage range ( $V_O$ ) .....	0.0 V to $V_{CC}$
Maximum high level output current ( $I_{OH}$ ):	
$V_{CC} = 2.7$ V .....	-12 mA
$V_{CC} = 3.0$ V .....	-24 mA
Maximum low level output current ( $I_{OL}$ ):	
$V_{CC} = 2.7$ V .....	12 mA
$V_{CC} = 3.0$ V .....	24 mA
Maximum input transition rise or fall rate ( $\Delta t/\Delta v$ ) .....	10 ns/V
Operating free-air temperature range ( $T_A$ ):	
Device type 01 .....	-40°C to +125°C
Device type 02 .....	-55°C to +125°C

- 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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- 3/ The value of  $V_{CC}$  is provided in the recommended operating conditions table.
- 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.

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2. APPLICABLE DOCUMENTS

JEDEC – SOLID STATE TECHNOLOGY ASSOCIATION (JEDEC)

- JEP 95 - Registered and Standard Outlines for Semiconductor Devices
- JEDSD 51-7 - 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 outlines. The case outlines shall be as shown in 1.2.2 and figure 1.

3.5.2 Truth table. The truth table shall be as shown in figure 2.

3.5.3 Logic diagram. The logic diagram shall be as shown in figure 3.

3.5.4 Terminal connections. The terminal connections shall be as shown in figure 4.

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

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TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions Device type: All 2/	V <sub>CC</sub>		Limits		Unit
			Min	Max	Min	Max	
High level output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -100 μA	2.7 V to 3.6 V		V <sub>CC</sub> - 0.2		
		I <sub>OH</sub> = -12 mA	2.7 V		2.2		
		I <sub>OH</sub> = -24 mA	3.0 V		2.4		
Low level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	2.7 V to 3.6 V			0.2	
		I <sub>OL</sub> = 12 mA	2.7 V			0.4	
		I <sub>OL</sub> = 24 mA	3.0 V			0.55	
Input current	I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	3.6 V			±5	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND I <sub>O</sub> = 0 A	3.6 V			10	μA
Quiescent supply current delta	ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.7 V to 3.6 V			500	μA
Input capacitance	C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, T <sub>A</sub> = 25°C	3.3 V		5 TYP		pF
Power dissipation capacitance per flip-flop	C <sub>pd</sub>	f = 10 MHz, T <sub>A</sub> = 25°C	2.5 V		47 TYP		
			3.3 V		51 TYP		

Test	Symbol	Conditions Device type: All 2/	Limits				Unit
			V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ±0.3 V		
			Min	Max	Min	Max	

**Timing requirements**

Clock frequency	f <sub>clock</sub>			83		100		MHz
Pulse duration	PRE or CLR low CLK high or low	t <sub>w</sub>		3.3		3.3		ns
				3.3		3.3		
Setup time before CLK↑	Data	t <sub>su</sub>		3.4		3.4		
	PRE or CLR inactive			2.2		2.0		
Hold time, data after CLK↑	t <sub>h</sub>			1.0		1.0		

**Switching characteristics**

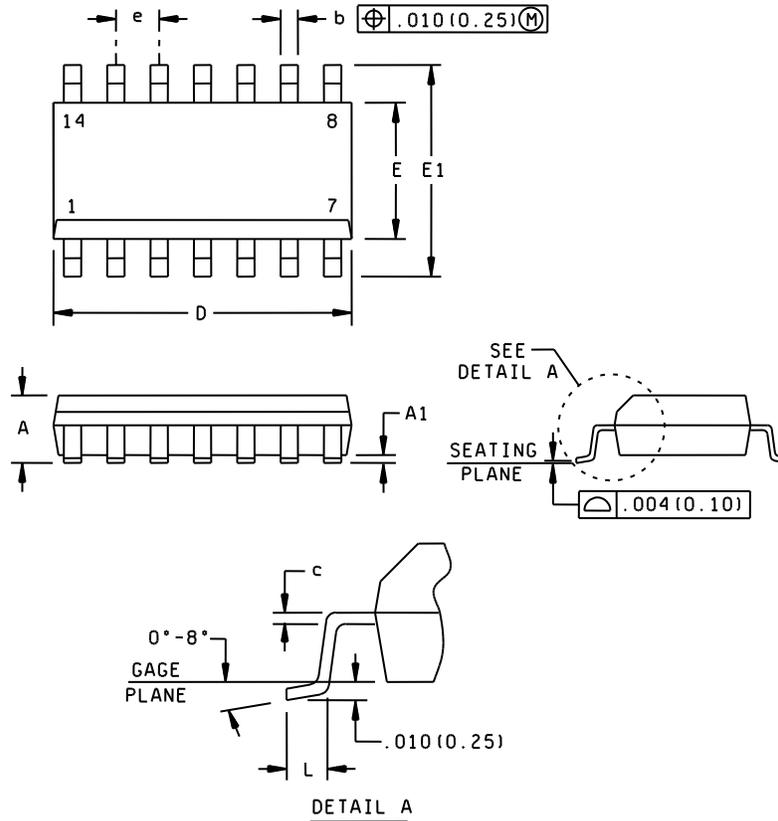
Clock frequency	f <sub>clock</sub>		83		100		MHz
Propagation delay, from input CLK to output Q or Q̄				6	1	5.2	ns
Propagation delay, from input PRE or CLR to output Q or Q̄				6.4	1	5.4	

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/ Over recommended operating free air temperature range. T<sub>A</sub> = -40°C to +125°C for device type 01 and -55°C to +125°C for device type 02. Unless otherwise noted.

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Case X



Symbol	Inches		Millimeters		Symbol	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	---	.069	---	1.75	E	.150	.157	3.81	4.00
A1	.004	.010	0.10	0.25	E1	.228	.244	5.80	6.20
b	.014	.020	0.35	0.51	e	.050 BSC		1.27 BSC	
c	.008 NOM		0.20 NOM		L	.016	.044	0.40	1.12
D	.337	.344	8.55	8.75					

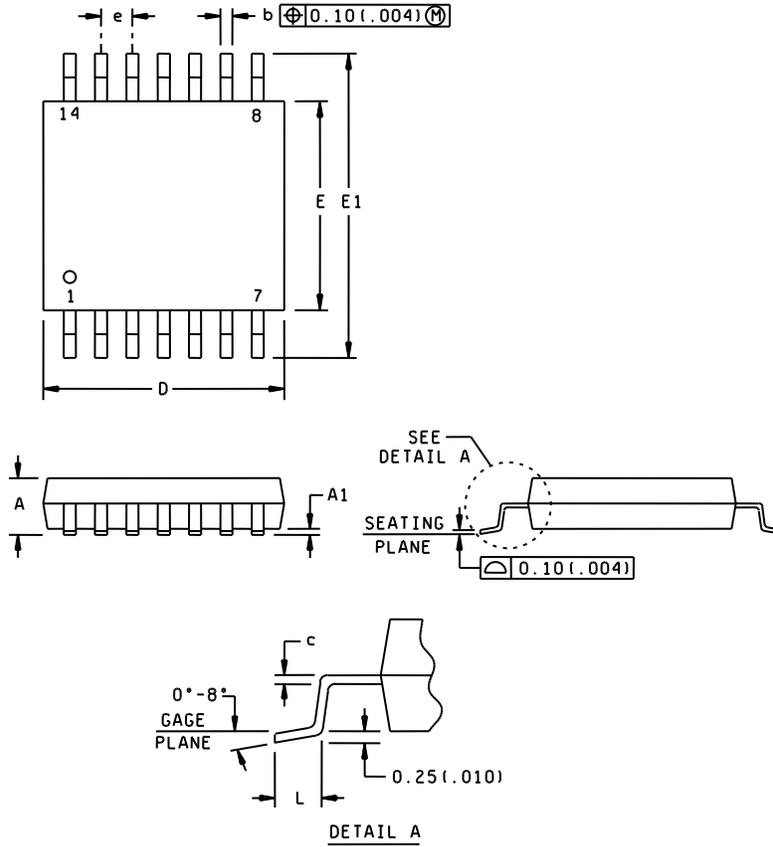
NOTES:

1. All linear dimensions are in inches (millimeters).
2. This case outline is subject to change without notice.
3. Body dimensions do not include mold flash, protrusion, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 inches (0.15 mm) per end.
4. Body width does not include interlead flash. Interlead flash shall not exceed .017 inches (0.43 mm) per side.
5. Falls within JEDEC MS-012 variation AB.

FIGURE 1. Case outlines.

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Case Y



Symbol	Millimeters		Symbol	Millimeters	
	Min	Max		Min	Max
A	---	1.20	E	4.30	4.50
A1	0.05	0.15	E1	6.20	6.60
b	0.19	0.30	e	0.65 BSC	
c	0.15 NOM		L	0.50	0.75
D	4.90	5.10			

NOTES:

1. All linear dimensions are in millimeters.
2. This case outline is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion, not to exceed 0.15 millimeters.
4. Fall within JEDEC MO-153.

FIGURE 1. Case outlines - Continued.

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Inputs				Outputs	
$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H <u>1/</u>	H <u>1/</u>
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	$Q_0$	$\overline{Q}_0$

H = High voltage level                      X = Immaterial  
L = Low voltage level                        ↑ = Transition from low to high level.  
 $Q_0$  or  $\overline{Q}_0$  = Level of Q before the indicated steady-state input conditions were established.  
1/ This configuration is nonstable; that is, it does not persist when  $\overline{PRE}$  or  $\overline{CLR}$  returns to its inactive (high) level.

FIGURE 2. Truth table.

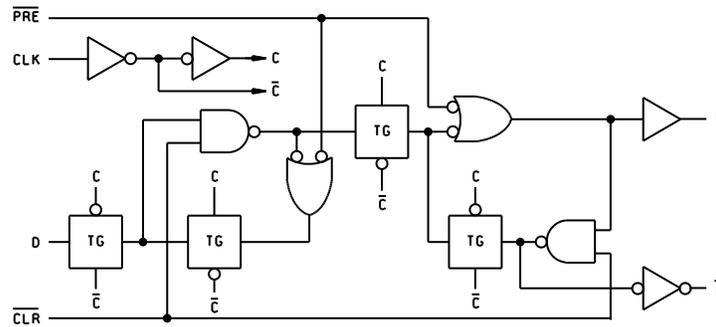
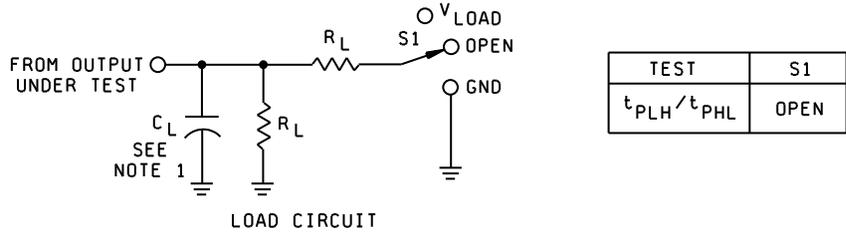


FIGURE 3. Logic diagram.

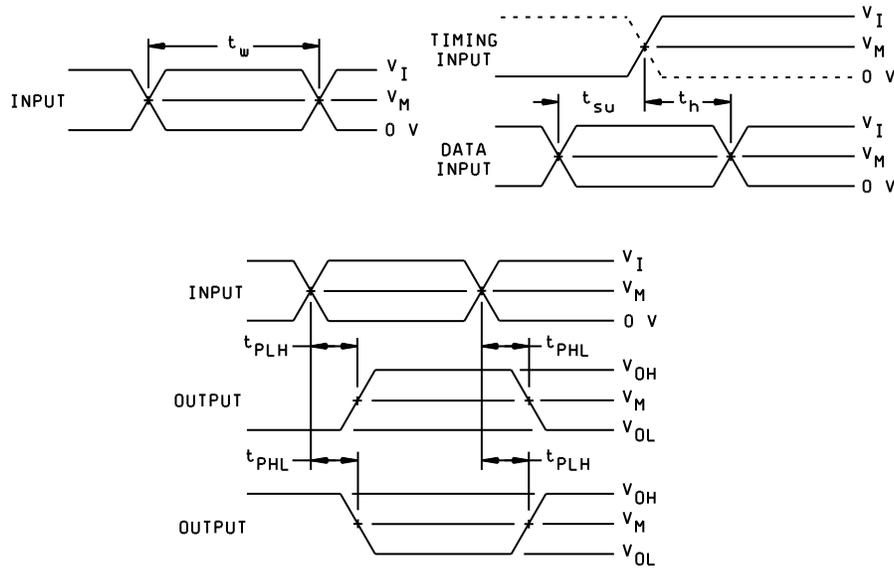
Case outline X and Y			
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	1 $\overline{CLR}$	8	2 $\overline{Q}$
2	1 D	9	2 Q
3	1 CLK	10	2 $\overline{PRE}$
4	1 $\overline{PRE}$	11	2 CLK
5	1 Q	12	2 D
6	1 $\overline{Q}$	13	2 $\overline{CLR}$
7	GND	14	$V_{CC}$

FIGURE 4. Terminal connections.

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$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$
	$V_I$	$t_r/t_f$				
2.7 V	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$
3.3 V $\pm 0.3$ V	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$



**NOTES:**

1.  $C_L$  includes probe and jig capacitance.
2. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10$  MHz,  $Z_0 = 50 \Omega$ .
3. The outputs are measured one at a time with one input transition per measurement.
4.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

FIGURE 5. Test circuit and timing waveforms.

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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	Vendor part number	Top side marking
V62/04669-01XE	01295	SN74LVC74AQDREP	LVC74AE
V62/04669-01YE	01295	SN74LVC74AQPWREP	LVC74AE
V62/04669-02XE	01295	SN74LVC74AMDREP	LVC74AM
V62/04669-02YE	01295	SN74LVC74AMPWREP	LVC74AM

<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

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