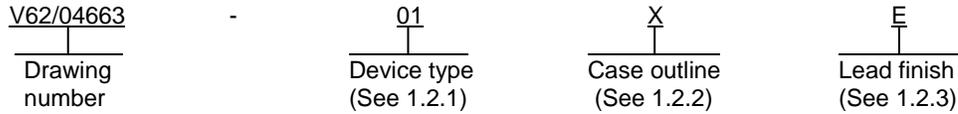


1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance octal edge-triggered D-type flip-flop with 3-state outputs microcircuit, with an operating temperature range of -40°C to +125°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:



1.2.1 Device type(s).

<u>Device type</u>	<u>Generic</u>	<u>Circuit function</u>
01	SN74LVC374A-EP	Octal edge-triggered D-type flip-flop with 3-state outputs

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	20	MS-013	Plastic small-outline
Y	20	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 6.5 V
Input voltage range (V_I)	-0.5 V to 6.5 V 2/
Voltage range applied to any output in the high-impedance or power-off state (V_O)	-0.5 V to 6.5 V 2/
Voltage range applied to any output in the high or low state (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)	± 50 mA
Continuous current through V_{CC} or GND	± 100 mA
Package thermal impedance (θ_{JA}): 4/	
X package	58°C/W
Y package	83°C/W
Storage temperature range (T_{STG})	-65°C to 150°C 5/

1.4 Recommended operating conditions. 6/ 7/

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):	
High or low state	0.0 V to V_{CC}
3-state	0.0 V to 5.5 V
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)	-40°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 JEDEC 51-7.
- 5/ Long-term high-temperature storage and/or extended use at maximum recommended operating conditions may result in a reduction of overall device life.
- 6/ All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
- 7/ Use of this product beyond the manufacturer's 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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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 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	V _{CC}	Temperature, T _A	Device type	Limits		Unit	
						Min	Max		
High level output voltage	V _{OH}	I _{OH} = -100 μA	2.7 V to 3.6 V	25°C, -40°C to 125°C	All	V _{CC} - 0.2		V	
		I _{OH} = -12 mA	2.7 V			2.2			
			3.0 V			2.4			
		I _{OH} = -24 mA	3.0 V			2.2			
Low level output voltage	V _{OL}	I _{OL} = 100 μA	2.7 V to 3.6 V					0.2	V
		I _{OL} = 12 mA	2.7 V				0.4		
		I _{OL} = 24 mA	3.0 V				0.55		
Input current	I _I	V _I = 0 to 5.5 V	3.6 V			±5	μA		
Three-state output leakage current	I _{OZ}	V _O = 0 to 5.5 V	3.6 V			±15	μA		
Quiescent supply current	I _{CC}	V _I = V _{CC} or GND I _O = 0 A	3.6 V			10	μA		
		3.6 V ≤ V _I ≤ 5.5 V 2/ I _O = 0 A		10					
Quiescent supply current delta	ΔI _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V			500	μA		
Input capacitance	C _i	V _I = V _{CC} or GND	3.3 V	25°C	4 TYP		pF		
				-40°C to 125°C	12				
Output capacitance	C _O	V _O = V _{CC} or GND	3.3 V	25°C	5.5 TYP		pF		
				-40°C to 125°C	12				
Power dissipation capacitance per latch	C _{pd}	Outputs enabled f = 10 MHz	3.3 V	25°C	54.5 TYP		pF		
		Outputs disabled f = 10 MHz	3.3 V		13.5 TYP				

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued. 1/

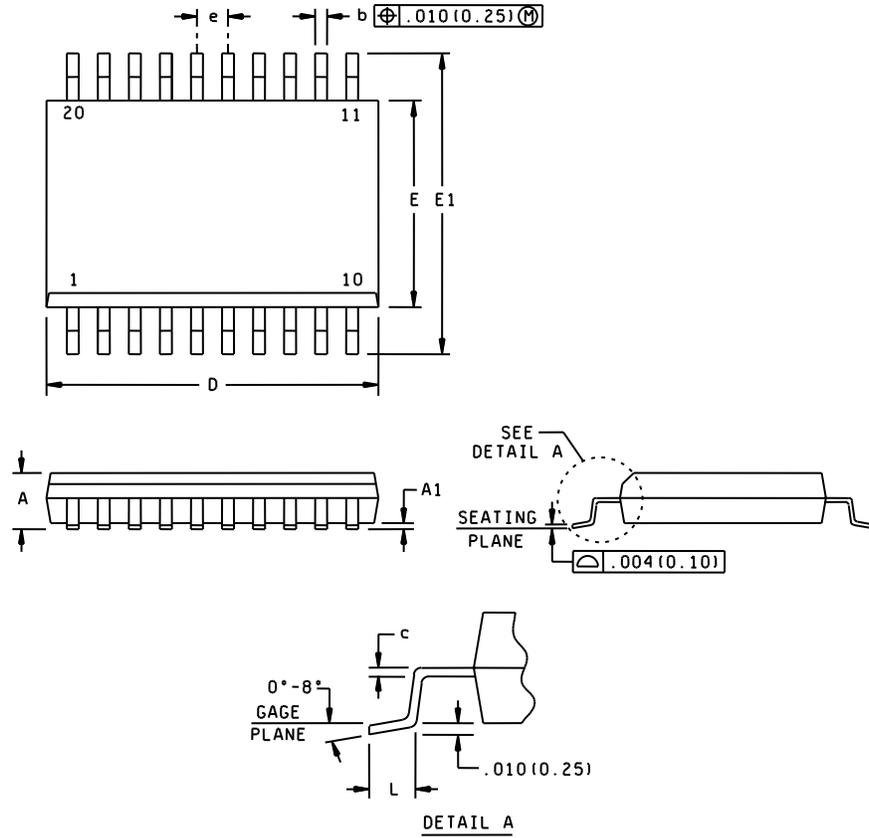
Test	Symbol	Conditions	V _{CC}	Temperature, T _A	Device type	Limits		Unit
						Min	Max	
Maximum clock frequency	f _{max}		2.7 V	25°C, -40°C to 125°C	All	80		MHz
			3.3 V ±0.3 V			100		
Propagation delay time, CLK to Q	t _{pd}	See figure 5.	2.7 V				9.5	ns
			3.3 V ±0.3 V			1	8.5	
Propagation delay time, output enable, OE to Q	t _{en}		2.7 V				9.5	ns
			3.3 V ±0.3 V			1	8.5	
Propagation delay time, output disable, OE to Q	t _{dis}		2.7 V				8	ns
			3.3 V ±0.3 V			1	7	
Clock frequency	f _{clock}		2.7 V				80	MHz
			3.3 V ±0.3 V				100	
Pulse duration, CLK high or low	t _w	See figure 5.	2.7 V			3.3		ns
			3.3 V ±0.3 V			3.3		
Setup time, data before CLK↑	t _{su}		2.7 V			2		ns
			3.3 V ±0.3 V			2		
Hold time, data after CLK↑	t _h		2.7 V			1.5		ns
			3.3 V ±0.3 V			1.5		

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/ This applies in the disabled state only.

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Case X



Dimensions									
Symbol	Inches		Millimeters		Symbol	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	---	0.069	---	1.75	E	0.150	0.157	3.81	4.00
A1	0.004	0.010	0.10	0.25	E1	0.228	0.244	5.80	6.20
b	0.014	0.020	0.35	0.51	e	0.050 BSC		1.27 BSC	
c	0.008 NOM		0.20 NOM		L	0.016	0.044	0.40	1.12
D	0.500	0.510	12.70	12.95					

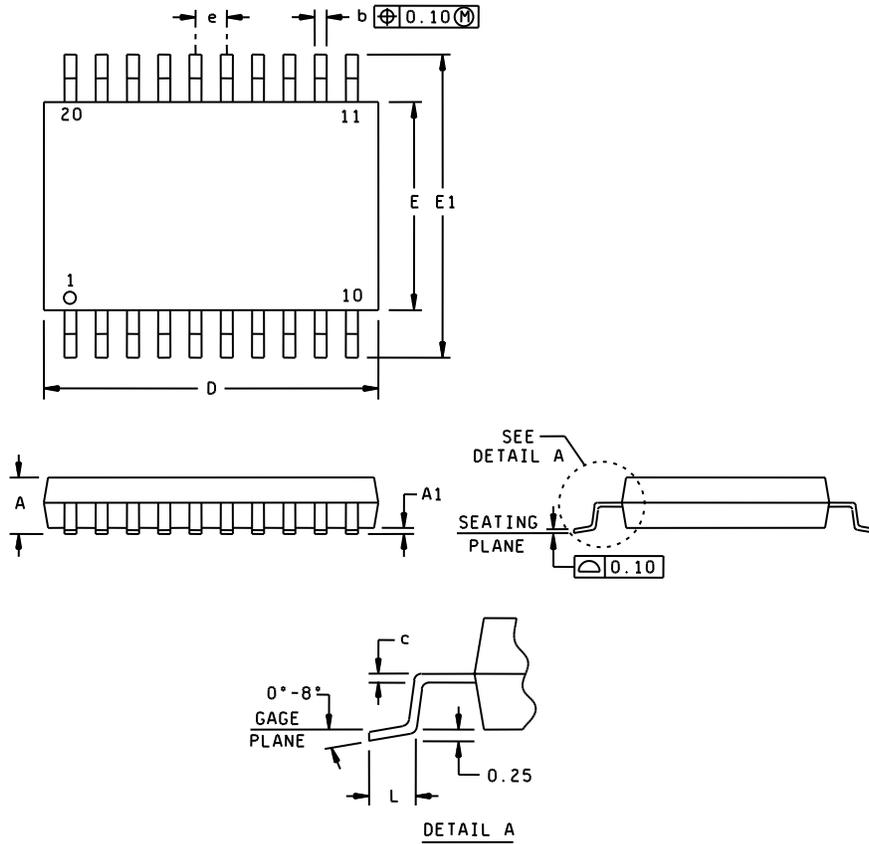
NOTES:

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 or protrusion, not to exceed 0.006 inches (0.15 mm).
4. Falls within JEDEC MS-013.

FIGURE 1. Case outlines.

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Case Y



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 BSC		0.026 BSC	
c	0.15 NOM		0.006 NOM		L	0.50	0.75	0.020	0.030
D	6.40	6.60	0.252	0.260					

NOTES:

1. All linear dimensions are in millimeters (inches).
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 (0.006 in).
4. Fall within JEDEC MO-153.

FIGURE 1. Case outlines - Continued.

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(each flip-flop)

Inputs			Output
\overline{OE}	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

H = High voltage level
 X = Immaterial
 ↑ = Transition from low to high level.
 Q_0 = Level of Q before the indicated steady-state input conditions were established.

L = Low voltage level
 Z = High-impedance state

FIGURE 2. Truth table.

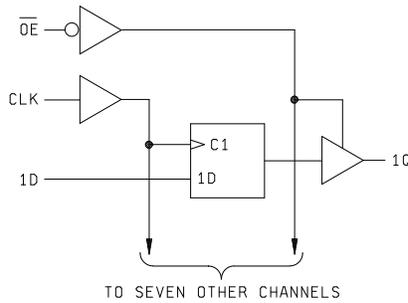
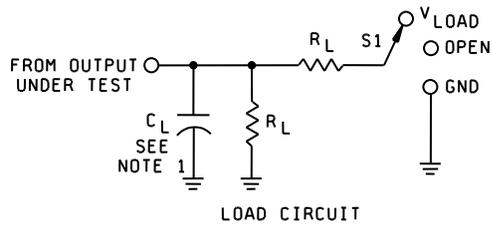


FIGURE 3. Logic diagram.

Device type 01			
Case outlines: X and Y			
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	\overline{OE}	11	CLK
2	1Q	12	5Q
3	1D	13	5D
4	2D	14	6D
5	2Q	15	6Q
6	3Q	16	7Q
7	3D	17	7D
8	4D	18	8D
9	4Q	19	8Q
10	GND	20	V_{CC}

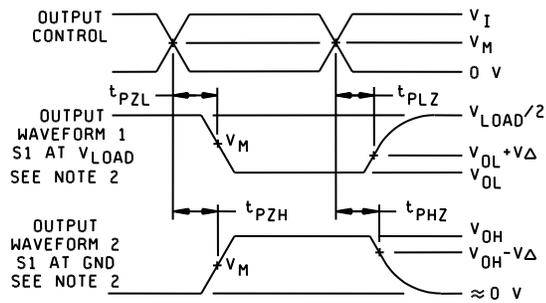
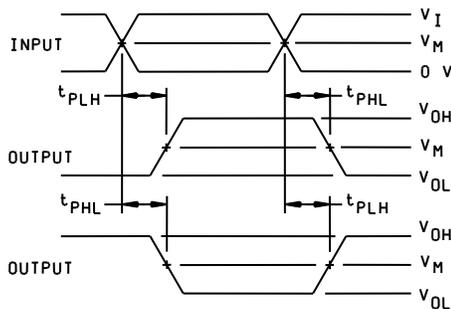
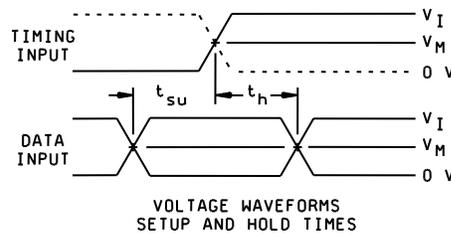
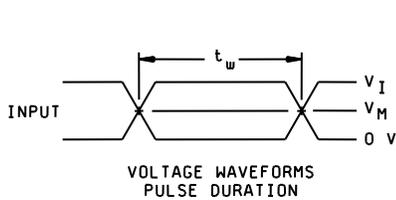
FIGURE 4. Terminal connections.

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TEST	S1
t_{PLH}/t_{PHL}	OPEN
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
2.7 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
3.3 V ± 0.3 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V



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: $PRR \leq 10$ MHz, $Z_0 = 50 \Omega$.
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_{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 <u>1/</u>	Device manufacturer CAGE code	Vendor part number	Top side marking
V62/04663-01XE	01295	SN74LVC374AQDWREP	C374AEP
V62/04663-01YE	01295	SN74LVC374AQPWREP	C374AEP

1/ 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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