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February 1992
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74LVQ74

Low Voltage Dual D-Type Positive Edge-Triggered Flip-Flop

General Description

The LVQ74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q, \bar{Q}) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

- LOW input to \bar{S}_D (Set) sets Q to HIGH level
- LOW input to \bar{C}_D (Clear) sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on \bar{C}_D and \bar{S}_D makes both Q and \bar{Q} HIGH

Features

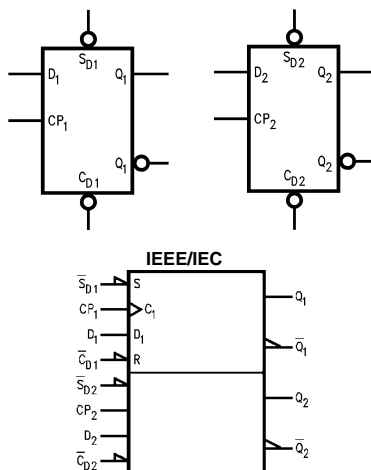
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin skew AC performance
- Guaranteed incident wave switching into 75Ω

Ordering Code:

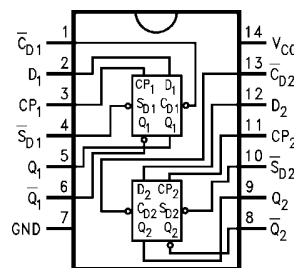
Order Number	Package Number	Package Description
74LVQ74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LVQ74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbols



Connection Diagram



Pin Descriptions

Pin Names	Description
D ₁ , D ₂	Data Inputs
CP ₁ , CP ₂	Clock Pulse Inputs
\bar{C}_D1 , \bar{C}_D2	Direct Clear Inputs
\bar{S}_D1 , \bar{S}_D2	Direct Set Inputs
Q ₁ , \bar{Q}_1 , Q ₂ , \bar{Q}_2	Outputs

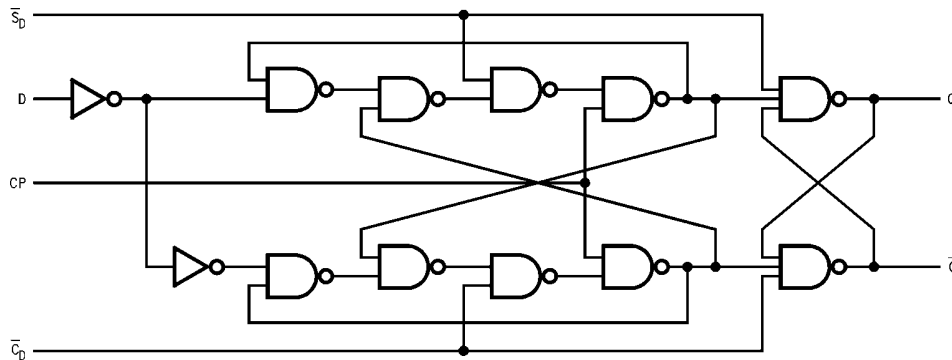
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Truth Table

Inputs				Outputs	
$\overline{S_D}$	$\overline{C_D}$	CP	D	Q	\overline{Q}
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	↗	H	H	L
H	H	↘	L	L	H
H	H	L	X	Q_0	$\overline{Q_0}$

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 ↗ = LOW-to-HIGH Clock Transition
 ↘ = HIGH-to-LOW Clock Transition
 $Q_0(\overline{Q_0})$ = Previous Q(\overline{Q}) before LOW-to-HIGH Transition of Clock

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)			Recommended Operating Conditions (Note 2)		
Supply Voltage (V_{CC})	-0.5V to +7.0V		Supply Voltage (V_{CC})	2.0V to 3.6V	
DC Input Diode Current (I_{IK})			Input Voltage (V_I)	0V to V_{CC}	
$V_I = -0.5V$	-20 mA		Output Voltage (V_O)	0V to V_{CC}	
$V_I = V_{CC} + 0.5V$	+20 mA		Operating Temperature (T_A)	-40°C to +85°C	
DC Input Voltage (V_I)	-0.5V to $V_{CC} + 0.5V$		Minimum Input Edge Rate ($\Delta V/\Delta t$)		
DC Output Diode Current (I_{OK})			V_{IN} from 0.8V to 2.0V		
$V_O = -0.5V$	-20 mA		V_{CC} @ 3.0V	125 mV/ns	
$V_O = V_{CC} + 0.5V$	+20 mA				
DC Output Voltage (V_O)	-0.5V to $V_{CC} + 0.5V$				
DC Output Source					
or Sink Current (I_O)	± 50 mA				
DC V_{CC} or Ground Current					
(I_{CC} or I_{GND})	± 200 mA				
Storage Temperature (T_{STG})	-65°C to +150°C				
DC Latch-Up Source or Sink Current	± 100 mA				

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = +25^\circ C$		$T_A = -40^\circ C$ to $+85^\circ C$		Units	Conditions
			Typ	Guaranteed Limits				
V_{IH}	Minimum High Level	3.0	1.5	2.0	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.8	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	V	$I_{OUT} = -50 \mu A$	
		3.0		2.58	2.48	V	$V_{IN} = V_{IL}$ or V_{IH} (Note 3) $I_{OH} = -12$ mA	
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50 \mu A$	
		3.0		0.36	0.44	V	$V_{IN} = V_{IL}$ or V_{IH} (Note 3) $I_{OL} = 12$ mA	
I_{IN}	Maximum Input Leakage Current	3.6		± 0.1	± 1.0	μA	$V_I = V_{CC}$, GND	
I_{OLD}	Minimum Dynamic	3.6			36	mA	$V_{OLD} = 0.8V$ Max (Note 5)	
I_{OHD}	Output Current (Note 4)	3.6			-25	mA	$V_{OHD} = 2.0V$ Min (Note 5)	
I_{CC}	Maximum Quiescent Supply Current	3.6		2.0	20.0	μA	$V_{IN} = V_{CC}$ or GND	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3	0.2	0.8		V	(Note 6)(Note 7)	
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3	-0.2	-0.8		V	(Note 6)(Note 7)	
V_{IHD}	Maximum High Level Dynamic Input Voltage	3.3	1.7	2.0		V	(Note 6)(Note 8)	
V_{ILD}	Maximum Low Level Dynamic Input Voltage	3.3	1.6	0.8		V	(Note 6)(Note 8)	

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: Incident wave switching on transmission lines with impedances as low as 75 Ω for commercial temperature range is guaranteed for 74LVQ.

Note 6: Worst case package.

Note 7: Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V; one output at GND.

Note 8: Max number of Data Inputs (n) switching. (n - 1) inputs switching 0V to 3.3V. Input-under-test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f = 1 MHz.

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AC Electrical Characteristics								
Symbol	Parameter	V _{CC} (V)	T _A = +25°C C _L = 50 pF			T _A = -40°C to +85°C C _L = 50 pF		Units
			Min	Typ	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency	2.7 3.3 ± 0.3	50 100	100 125		40 95		MHz
t _{PLH}	Propagation Delay C _{Dn} or S _{Dn} to Q _n	2.7 3.3 ± 0.3	3.5 3.5	9.6 8.0	16.9 12.0	3.5 2.5	19.0 13.0	ns
t _{PHL}	Propagation Delay C _{Dn} or S _{Dn} to Q _n	2.7 3.3 ± 0.3	4.0 4.0	12.6 10.5	16.9 12.0	3.5 3.5	19.0 13.5	ns
t _{PLH}	Propagation Delay CP _n to Q _n or Q _n	2.7 3.3 ± 0.3	4.5 4.5	9.6 8.0	19.0 13.5	4.0 4.0	23.0 16.0	ns
t _{PHL}	Propagation Delay CP _n to Q _n or Q _n	2.7 3.3 ± 0.3	3.5 3.5	9.6 8.0	19.7 14.0	3.5 3.5	21.0 14.5	ns
t _{OSSL}	Output to Output Skew (Note 9)	2.7		1.0	1.5		1.5	ns
t _{OSLH}	Data to Output	3.3 ± 0.3		1.0	1.5		1.5	ns

Note 9: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSSL}) or LOW-to-HIGH (t_{OSLH}). Parameter guaranteed by design.

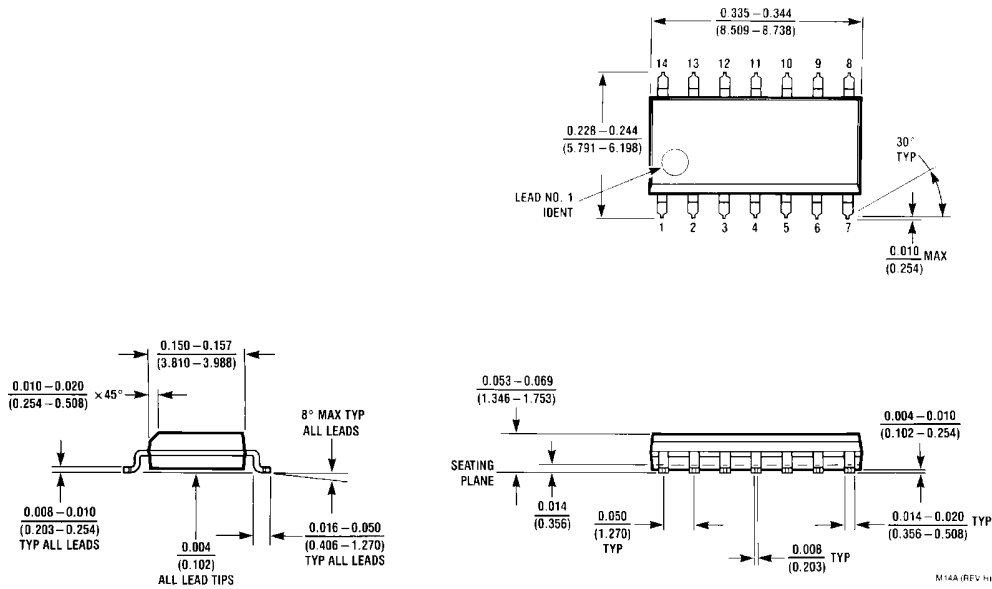
AC Operating Requirements						
Symbol	Parameter	V _{CC} (V)	T _A = +25°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF	Units
			Typ	Guaranteed Minimum		
t _S	Set-up Time, HIGH or LOW	2.7 3.3 ± 0.3	1.8 1.5	5.0 4.0	6.5 4.5	ns
t _H	Hold Time, HIGH or LOW D _n to CP _n	2.7 3.3 ± 0.3	-2.4 -2.0	0.5 0.5	0.5 0.5	ns
t _W	Pulse Width	2.7 3.3 ± 0.3	3.6 3.0	7.0 5.5	10.0 7.0	ns
t _{REC}	Recovery Time	2.7 3.3 ± 0.3	-3.0 -2.5	0 0	0 0	ns

Capacitance				
Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = Open
C _{PD} (Note 10)	Power Dissipation Capacitance	25	pF	V _{CC} = 3.3V

Note 10: C_{PD} is measured at 10 MHz.

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Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M14A

74LVQ74 Low Voltage Dual D-Type Positive Edge-Triggered Flip-Flop

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

LAND PATTERN RECOMMENDATION

DETAIL A

14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D

NOTES:
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 B. DIMENSIONS ARE IN MILLIMETERS.
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1

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