

## 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

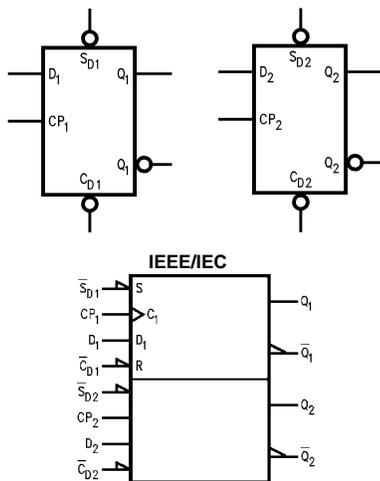
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin skew AC performance
- Guaranteed incident wave switching into 75 $\Omega$

#### Ordering Code:

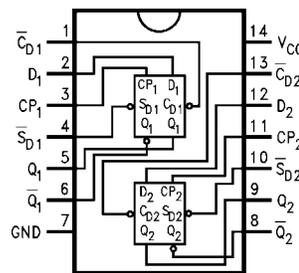
Order Number	Package Number	Package Description
74LVQ74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LVQ74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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

#### Logic Symbols



#### Connection Diagram



#### Pin Descriptions

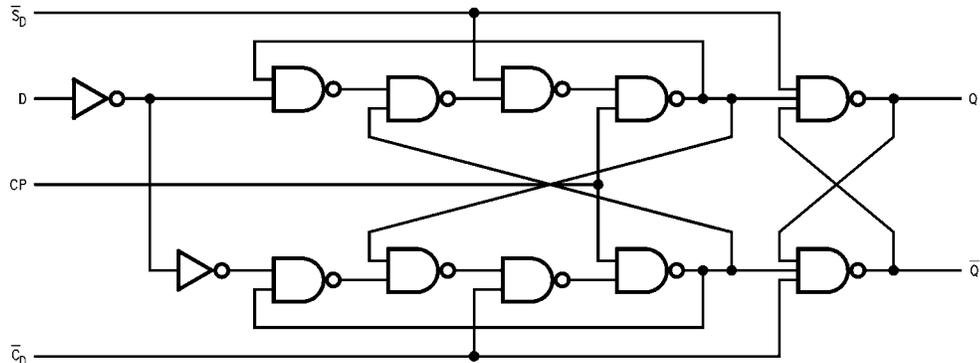
Pin Names	Description
D <sub>1</sub> , D <sub>2</sub>	Data Inputs
CP <sub>1</sub> , CP <sub>2</sub>	Clock Pulse Inputs
$\bar{C}_D1$ , $\bar{C}_D2$	Direct Clear Inputs
$\bar{S}_D1$ , $\bar{S}_D2$	Direct Set Inputs
Q <sub>1</sub> , $\bar{Q}_1$ , Q <sub>2</sub> , $\bar{Q}_2$	Outputs

**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)

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current ( $I_{CC}$ or $I_{GND}$ )	$\pm 200$ mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
DC Latch-Up Source or Sink Current	$\pm 100$ mA

**Recommended Operating Conditions** (Note 2)

Supply Voltage ( $V_{CC}$ )	2.0V to 3.6V
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	-40°C to +85°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
$V_{IN}$ from 0.8V to 2.0V	
$V_{CC}$ @ 3.0V	125 mV/ns

**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)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		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	$I_{OUT} = -50 \mu\text{A}$	
		3.0		2.58	2.48	V	$V_{IN} = V_{IL}$ or $V_{IH}$ (Note 3) $I_{OH} = -12 \text{ mA}$	
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$	
		3.0		0.36	0.44	V	$V_{IN} = V_{IL}$ or $V_{IH}$ (Note 3) $I_{OL} = 12 \text{ mA}$	
$I_{IN}$	Maximum Input Leakage Current	3.6		$\pm 0.1$	$\pm 1.0$	$\mu\text{A}$	$V_I = V_{CC}$ , 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	$\mu\text{A}$	$V_{IN} = V_{CC}$ 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 $\Omega$  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 ( $V_{IHD}$ ),  $f = 1 \text{ MHz}$ .

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
t <sub>MAX</sub>	Maximum Clock Frequency	2.7 3.3 ± 0.3	50 100	100 125		40 95		MHz
t <sub>PLH</sub>	Propagation Delay C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub>	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 <sub>PHL</sub>	Propagation Delay C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub>	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 <sub>PLH</sub>	Propagation Delay CP <sub>n</sub> to Q <sub>n</sub> or Q <sub>n</sub>	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 <sub>PHL</sub>	Propagation Delay CP <sub>n</sub> to Q <sub>n</sub> or Q <sub>n</sub>	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 <sub>OSSL</sub>	Output to Output Skew (Note 9)	2.7		1.0	1.5		1.5	ns
t <sub>OSLH</sub>	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<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>). Parameter guaranteed by design.

## AC Operating Requirements

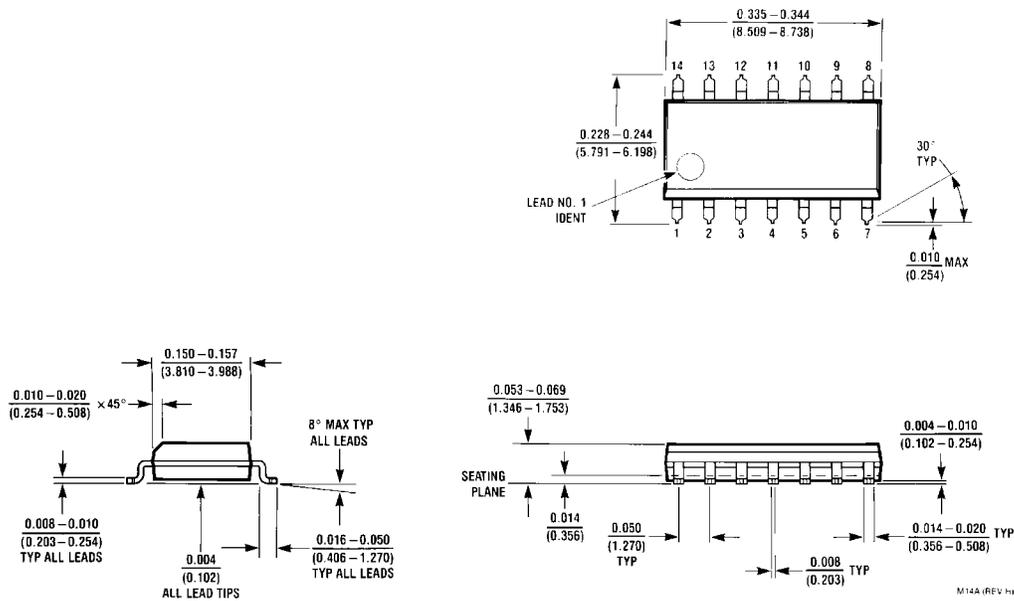
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF	Units
			Typ	Guaranteed Minimum		
t <sub>S</sub>	Set-up Time, HIGH or LOW	2.7 3.3 ± 0.3	1.8 1.5	5.0 4.0	6.5 4.5	ns
t <sub>H</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP <sub>n</sub>	2.7 3.3 ± 0.3	-2.4 -2.0	0.5 0.5	0.5 0.5	ns
t <sub>W</sub>	Pulse Width	2.7 3.3 ± 0.3	3.6 3.0	7.0 5.5	10.0 7.0	ns
t <sub>REC</sub>	Recovery Time	2.7 3.3 ± 0.3	-3.0 -2.5	0 0	0 0	ns

## Capacitance

Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = Open
C <sub>PD</sub> (Note 10)	Power Dissipation Capacitance	25	pF	V <sub>CC</sub> = 3.3V

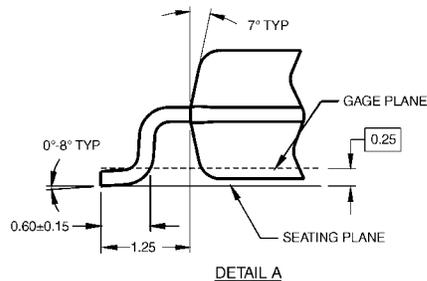
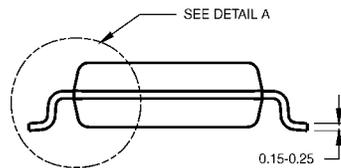
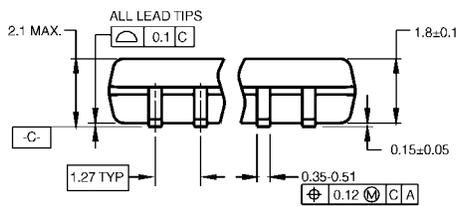
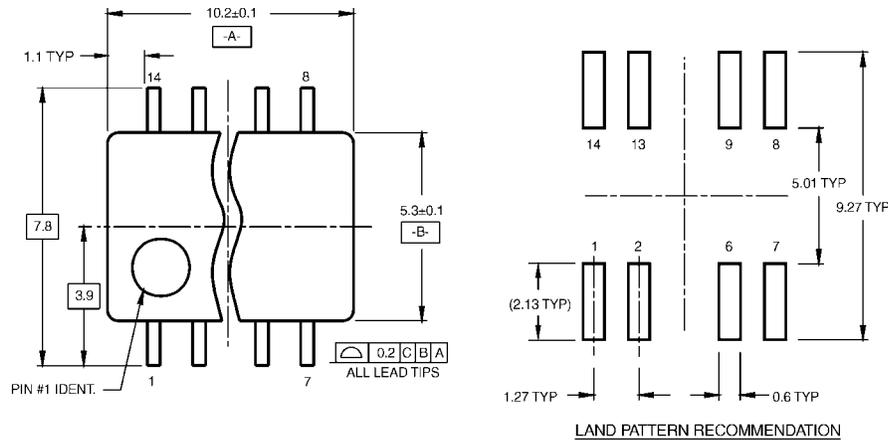
**Note 10:** C<sub>PD</sub> is measured at 10 MHz.

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



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

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



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.

M14DRvB1

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

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