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May 1993
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74LVX74

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

General Description

The LVX74 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. 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

- Input voltage level translation from 5V to 3V
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance

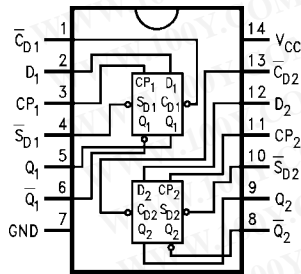
Ordering Code:

Order Number	Package Number	Package Description
74LVX74M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LVX74SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LVX74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74LVX74MTCX_NL (Note 1)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.
 Pb-Free package per JEDEC J-STD-020B.

Note 1: "_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

Connection Diagram



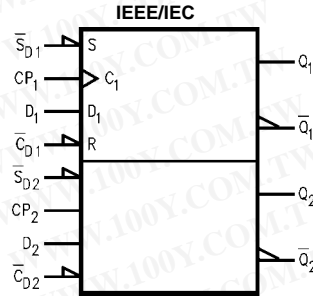
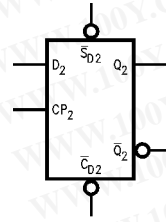
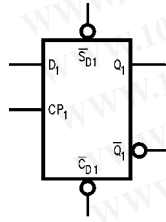
Pin Descriptions

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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Logic Symbols



Truth Table

(Each Half)

Inputs				Outputs	
\bar{S}_D	\bar{C}_D	CP	D	Q	\bar{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	\bar{Q}_0

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 ↗ = LOW-to-HIGH Clock Transition
 ↘ = LOW-to-HIGH Clock Transition
 $Q_0(\bar{Q}_0)$ = Previous $Q(\bar{Q})$ before LOW-to-HIGH Transition of Clock

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Absolute Maximum Ratings (Note 2)

Supply Voltage (V_{CC})	-0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = -0.5V$	-20 mA
DC Input Voltage (V_I)	-0.5V to 7V
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)	±25 mA
DC V_{CC} or Ground Current (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	-65°C to +150°C
Power Dissipation	180 mW

Recommended Operating Conditions (Note 3)

Supply Voltage (V_{CC})	2.0V to 3.6V
Input Voltage (V_I)	0V to 5.5V
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	-40°C to +85°C
Input Rise and Fall Time ($\Delta t/\Delta V$)	0 ns/V to 100 ns/V

Note 2: 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 3: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC}	$T_A = +25^\circ C$			$T_A = -40^\circ C$ to $+85^\circ C$		Units	Conditions
			Min	Typ	Max	Min	Max		
V_{IH}	HIGH Level Input Voltage	2.0	1.5			1.5		V	
		3.0	2.0			2.0			
		3.6	2.4			2.4			
V_{IL}	LOW Level Input Voltage	2.0			0.5		0.5	V	
		3.0			0.8		0.8		
		3.6			0.8		0.8		
V_{OH}	HIGH Level Output Voltage	2.0	1.9	2.0		1.9		V	$V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -50 \mu A$ $I_{OH} = -50 \mu A$ $I_{OH} = -4 mA$
		3.0	2.9	3.0		2.9			
		3.0	2.58			2.48			
V_{OL}	LOW Level Output Voltage	2.0		0.0	0.1		0.1	V	$V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 50 \mu A$ $I_{OL} = 50 \mu A$ $I_{OL} = 4 mA$
		3.0		0.0	0.1		0.1		
		3.0			0.36		0.44		
I_{IN}	Input Leakage Current	3.6			±0.1		±1.0	μA	$V_{IN} = 5.5V$ or GND
I_{CC}	Quiescent Supply Current	3.6			2.0		20.0	μA	$V_{IN} = V_{CC}$ or GND

Noise Characteristics (Note 4)

Symbol	Parameter	V_{CC} (V)	$T_A = 25^\circ C$		Units	C_L (pF)
			Typ	Limit		
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3	0.3	0.5	V	50
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3	-0.3	-0.5	V	50
V_{IHD}	Minimum High Level Dynamic Input Voltage	3.3		2.0	V	50
V_{ILD}	Maximum Low Level Dynamic Input Voltage	3.3		0.8	V	50

Note 4: Input $t_r = t_f = 3 ns$

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AC Electrical Characteristics									
Symbol	Parameter	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C		Units	C _L (pF)
			Min	Typ	Max	Min	Max		
t _{PLH}	Propagation Delay	2.7		7.3	15	1.0	18.5	ns	15
t _{PHL}	CP _n to Q _n or \overline{Q}_n			9.8	18.5	1.0	22		50
		3.3 ± 0.3		5.7	9.7	1.0	11.5		15
				8.2	13.2	1.0	15		50
t _{PLH}	Propagation Delay	2.7		8.4	15.6	1.0	18.5	ns	15
t _{PHL}	\overline{C}_{Dn} to \overline{S}_{Dn} to Q _n or \overline{Q}_n			10.9	19.1	1.0	22		50
		3.3 ± 0.3		6.6	10.1	1.0	12		15
				9.1	13.6	1.0	15.5		50
t _w	CP _n or \overline{C}_{Dn} or \overline{S}_{Dn} Pulse Width	2.7	8.5			10		ns	
		3.3 ± 0.3	6			7			
t _s	Setup Time D _n to CP _n	2.7	8.0			9.5		ns	
		3.3 ± 0.3	5.5			6.5			
t _h	Hold Time D _n to CP _n	2.7	0.5			0.5		ns	
		3.3 ± 0.3	0.5			0.5			
t _{REC}	Recovery Time CP _n or \overline{S}_{Dn} to CP _n	2.7	6.5			7.5		ns	
		3.3 ± 0.3	5.0			5.0			
f _{MAX}	Maximum Clock Frequency	2.7	55	135		50		MHz	15
			45	60		40			50
		3.3 ± 0.3	95	145		80			15
			60	85		50			50
t _{OSLH}	Output to Output Skew	2.7			1.5		1.5	ns	50
t _{OSHL}	(Note 5)	3.3			1.5		1.5		

Note 5: Parameter guaranteed by design. t_{OSLH} = |t_{PLHm} - t_{PHLn}|, t_{OSLH} = |t_{PHLm} - t_{PLLn}|

Capacitance

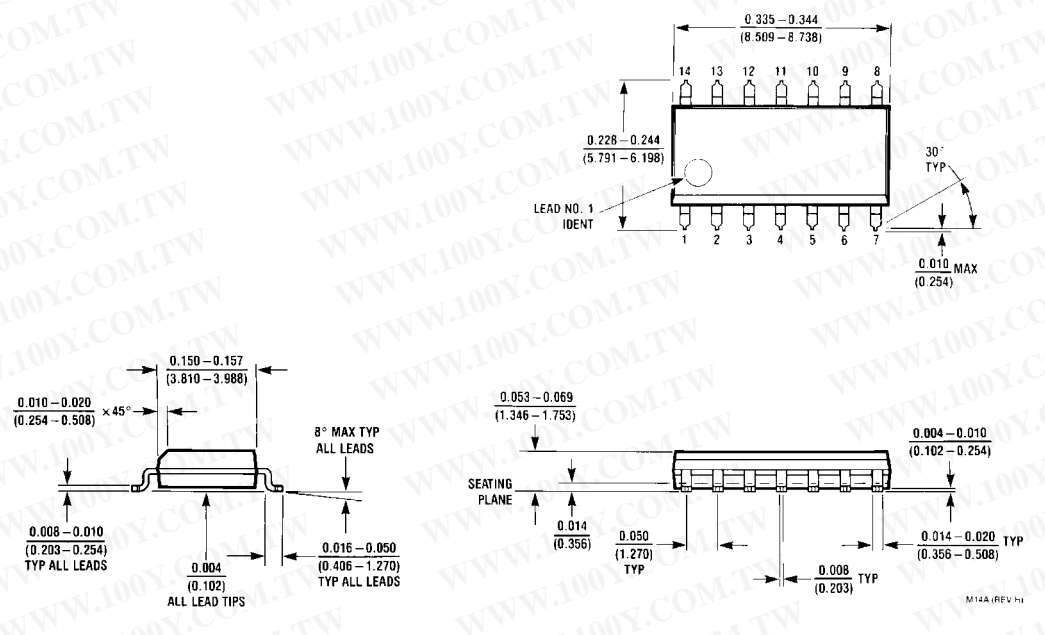
Symbol	Parameter	T _A = +25°C			T _A = -40°C to +85°C		Units
		Min	Typ	Max	Min	Max	
C _{IN}	Input Capacitance		4	10		10	pF
C _{PD}	Power Dissipation Capacitance (Note 6)		25				pF

Note 6: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation: $I_{CC(opr.)} = \frac{C_{PD} \times V_{CC} \times f_{IN} + I_{CC}}{2 \text{ (per F/F)}}$

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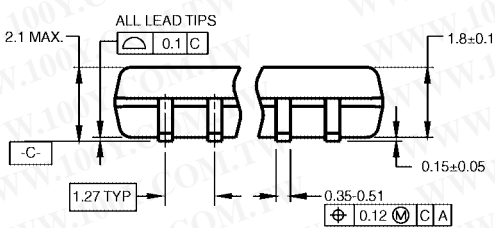
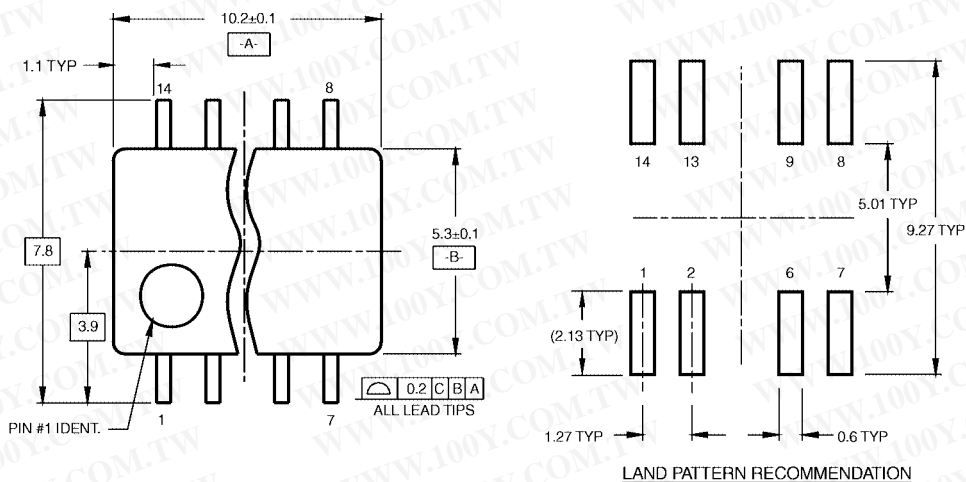
Physical Dimensions inches (millimeters) unless otherwise noted



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

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

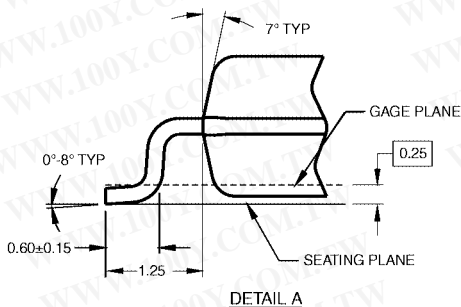


DIMENSIONS ARE IN MILLIMETERS

NOTES:

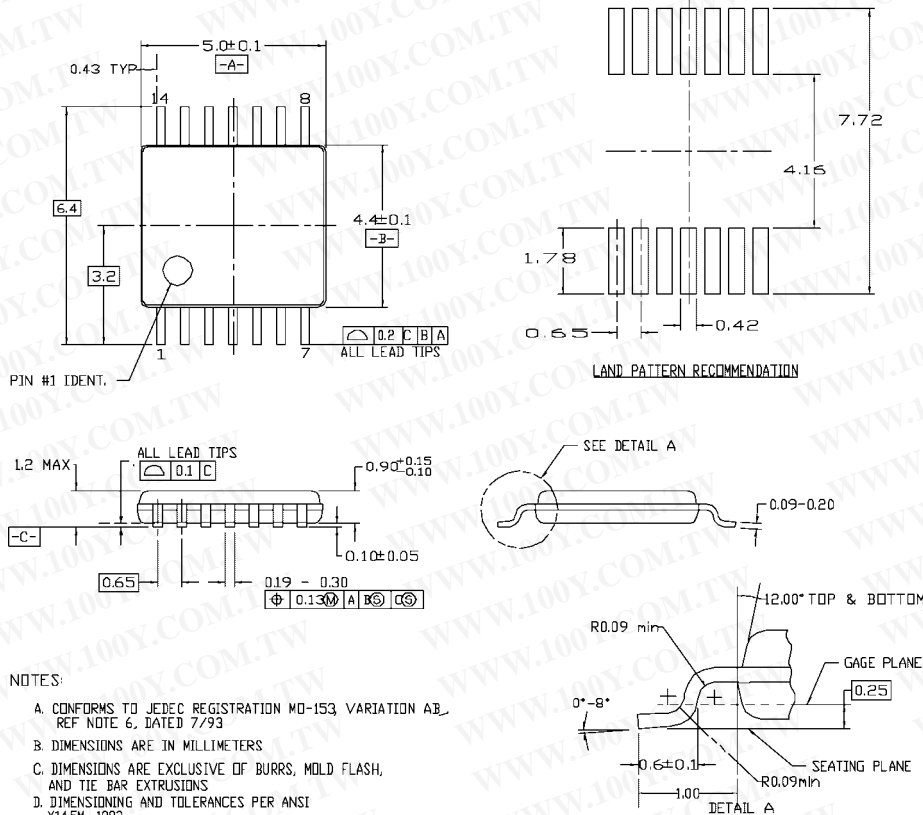
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M14DRevB1



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

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



- NOTES:
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 - DIMENSIONS ARE IN MILLIMETERS
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MTC14revD

14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14

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