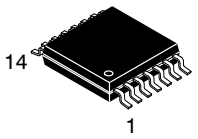
Low Voltage Dual D-Type Positive Edge-Triggered Flip-Flop

74LVX74



TSSOP−14 WB
CASE 948G

General Description

The LVX74 is a dual D−type flip−flop with Asynchronous Clear and Set inputs and complementary (Q, $\overline{Q}$) 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.

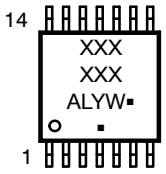
Asynchronous Inputs:

- LOW Input to $\overline{S}_D$ (Set) Sets Q to HIGH Level
- LOW Input to $\overline{C}_D$ (Clear) Sets Q to LOW Level
- Clear and Set are Independent of Clock
- Simultaneous LOW on $\overline{C}_D$ and $\overline{S}_D$ Makes Both Q and $\overline{Q}$ HIGH

Features

- Input Voltage Level Translation from 5 V to 3 V
- Ideal for Low Power/Low Noise 3.3 V Applications
- Guaranteed Simultaneous Switching Noise Level and Dynamic Threshold Performance
- Pb−Free, Halogen Free/BFR Free and RoHS Compliant

MARKING DIAGRAM



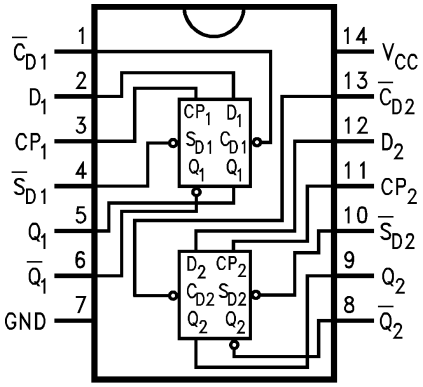
XXX	= Specific Device Code
A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
▪	= Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

Connection Diagram

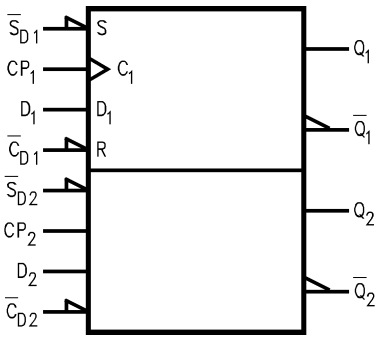


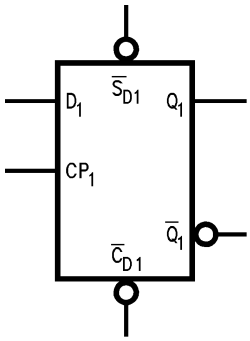
Pin Description

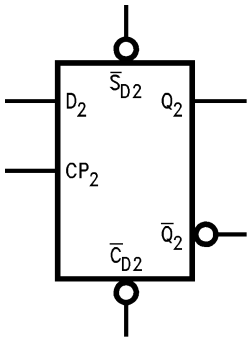
Pin Names	Description
D_1, D_2	Data Inputs
CP_1, CP_2	Clock Pulse Inputs
$\overline{C}_{D1}$, $\overline{C}_{D2}$	Direct Clear Inputs
$\overline{S}_{D1}$, $\overline{S}_{D2}$	Direct Set Inputs
Q_1, $\overline{Q}_1$, Q_2, $\overline{Q}_2$	Outputs

Logic Symbols

IEEE/IEC







Truth Table

(Each Half)

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
Q_0 ($\overline{Q}_0$) = Previous Q ($\overline{Q}$) before LOW−to−HIGH Transition of Clock

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Rating	Unit
V_{CC}	Supply Voltage		–0.5 to +6.5	V
I_{IK}	DC Input Diode Current, V_I = –0.5 V		–20	mA
V_I	DC Input Voltage		–0.5 to +6.5	V
I_{OK}	DC Output Diode Current	V_O = –0.5 V	–20	mA
		V_O = V_{CC} + 0.5 V	+20	mA
V_O	DC Output Voltage		–0.5 to V_{CC} + 0.5	V
I_O	DC Output Source or Sink Current		±25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current		±50	mA
T_{STG}	Storage Temperature		–65 to +150	°C
P_D	Power Dissipation		833	mW

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS (Note 1)

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

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

1. Unused inputs must be held HIGH or LOW. They may not float.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C			T_A = −40°C to +85°C		Unit
				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	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = -50$ μA	1.9	2.0	–	1.9	–	V
		3.0	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = -50$ μA	2.9	3.0	–	2.9	–	
			$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = -4$ mA	2.58	–	–	2.48	–	
V_{OL}	LOW Level Output Voltage	2.0	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 50$ μA	–	0.0	0.1	–	0.1	V
		3.0	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 50$ μA	–	0.0	0.1	–	0.1	
			$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 4$ mA	–	–	0.36	–	0.44	
I_{IN}	Input Leakage Current	3.6	V_{IN} = 5.5 V or GND	–	–	±0.1	–	±1.0	μA
I_{CC}	Quiescent Supply Current	3.6	$V_{IN} = V_{CC}$ or GND	–	–	2.0	–	20.0	μA

NOISE CHARACTERISTICS (Note 2)

Symbol	Characteristic	V_{CC} (V)	C_L (pF)	T_A = 25°C		Unit
				Typ	Limit	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3	50	0.3	0.5	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3	50	−0.3	−0.5	V
V_{IHD}	Minimum HIGH Level Dynamic Input Voltage	3.3	50	–	2.0	V
V_{ILD}	Maximum LOW Level Dynamic Input Voltage	3.3	50	–	0.8	V

2. Input $t_r = t_f$ = 3.0 ns

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	C_L (pF)	T_A = 25°C			T_A = −40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay CP_n to Q_n or $\overline{Q}_n$	2.7	15 50	– –	7.3 9.8	15.0 18.5	1.0 1.0	18.5 22.0	ns
		3.3 ± 0.3	15 50	– –	5.7 8.2	9.7 13.2	1.0 1.0	11.5 15.0	
t_{PLH}, t_{PHL}	Propagation Delay $\overline{C}_{Dn}$ to $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	2.7	15 50	– –	8.4 10.9	15.6 19.1	1.0 1.0	18.5 22.0	ns
		3.3 ± 0.3	15 50	– –	6.6 9.1	10.1 13.6	1.0 1.0	12.0 15.5	
t_W	CP_n or $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width	2.7	–	8.5	–	–	10.0	–	ns
		3.3 ± 0.3	–	6.0	–	–	7.0	–	
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, $\overline{C}P_n$ 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	15 50	55 45	135 60	– –	50 40	– –	MHz
		3.3 ± 0.3	15 50	95 60	145 85	– –	80 50	– –	
t_{OSLH}, t_{OSHL}	Output to Output Skew (Note 3)	2.7	50	–	–	1.5	–	1.5	ns
		3.3		–	–	1.5	–	1.5	

3. Parameter guaranteed by design $t_{OSLH} = |t_{PLHm} – t_{PLHn}|$, $t_{OSHL} = |t_{PHLm} – t_{PHLn}|$

CAPACITANCE

Symbol	Parameter	T_A = 25°C			T_A = −40 to +85°C		Unit
		Min	Typ	Max	Min	Max	
C_{IN}	Input Capacitance	–	4	10	–	10	pF
C_{PD}	Power Dissipation Capacitance (Note 4)	–	25	–	–	–	pF

4. 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: $I_{CC(opr.)} = \dfrac{C_{PD} \times V_{CC} \times f_{IN} \times I_{CC}}{2 \text{ (per F/F)}}$

ORDERING INFORMATION

Device	Package	Marking	Shipping†
74LVX74MTCX	TSSOP−14	LVX 74	2500 / Tape & Reel

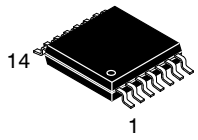
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*−Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable

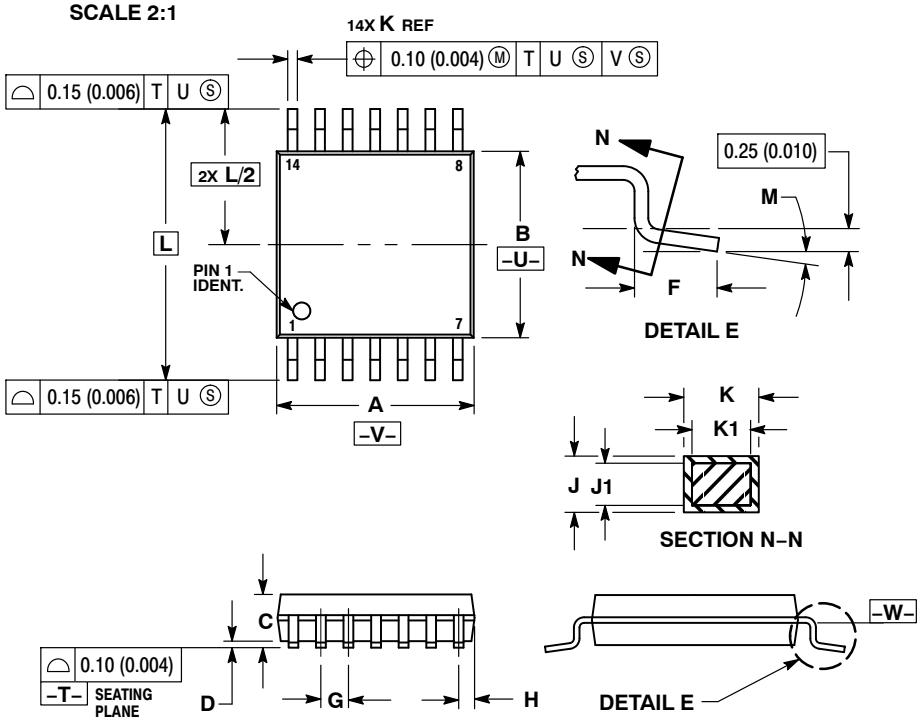
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

TSSOP−14 WB
CASE 948G
ISSUE C

DATE 17 FEB 2016



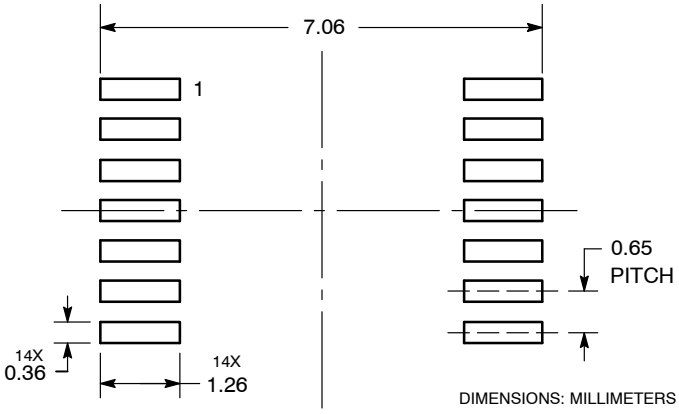
SCALE 2:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

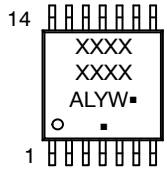
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	−−−	1.20	−−−	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0 °	8 °	0 °	8 °

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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