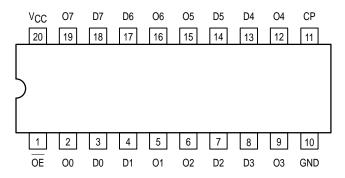
Low-Voltage CMOS Octal D-Type Flip-Flop With 5V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX374 is a high performance, non–inverting octal D–type flip–flop operating from a 2.7 to 3.6V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A VI specification of 5.5V allows MC74LCX374 inputs to be safely driven from 5V devices.

The MC74LCX374 consists of 8 edge–triggered flip–flops with individual D–type inputs and 3–state true outputs. The buffered clock and buffered Output Enable (OE) are common to all flip–flops. The eight flip–flops will store the state of individual D inputs that meet the setup and hold time requirements on the LOW–to–HIGH Clock (CP) transition. With the OE LOW, the contents of the eight flip–flops are available at the outputs. When the OE is HIGH, the outputs go to the high impedance state. The OE input level does not affect the operation of the flip–flops.

- Designed for 2.7 to 3.6V V_{CC} Operation
- 5V Tolerant Interface Capability With 5V TTL Logic
- · Supports Live Insertion and Withdrawal
- IOFF Specification Guarantees High Impedance When V_{CC} = 0V
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
- ESD Performance: Human Body Model >2000V; Machine Model >200V

Pinout: 20-Lead (Top View)



MC74LCX374



LOW-VOLTAGE CMOS
OCTAL D-TYPE FLIP-FLOP



DW SUFFIXPLASTIC SOIC
CASE 751D-04



M SUFFIX PLASTIC SOIC EIAJ CASE 967-01



SD SUFFIX PLASTIC SSOP CASE 940C-03

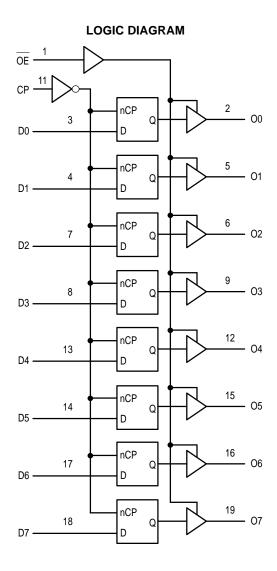


DT SUFFIX PLASTIC TSSOP CASE 948E-02

PIN NAMES

Pins	Function
OE CP D0-D7 O0-O7	Output Enable Input Clock Pulse Input Data Inputs 3-State Outputs





	INPUTS		OUTPUTS	
OE CP Dn		On	OPERATING MODE	
L L	\uparrow	l h	L H	Load and Read Register
L	1	Х	NC	Hold and Read Register
Н	1	Х	Z	Hold and Disable Outputs
H H	↑	l h	Z Z	Load Internal Register and Disable Outputs

 $H = High\ \mbox{Voltage Level}; \ h = High\ \mbox{Voltage Level One Setup Time Prior to the Low-to-High Clock Transition}; \ L = Low\ \mbox{Voltage Level}; \ l = Low\ \mbox{Voltage Level One Setup Time Prior to the Low-to-High Clock Transition}; \ NC = No\ Change, State\ Prior to Low-to-High Clock Transition; \ X = High\ or\ Low\ \mbox{Voltage Level and Transitions} \ are\ Acceptable; \ Z = High\ Impedance\ State; \ 1 = Low-to-High\ Transition; \ 1 = Not\ a\ Low-to-High\ Transition; \ For\ I_{CC}\ Reasons\ DO\ NOT\ FLOAT\ Inputs$

ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Condition	Unit
VCC	DC Supply Voltage	-0.5 to +7.0		V
VI	DC Input Voltage	-0.5 ≤ V _I ≤ +7.0		V
VO	DC Output Voltage	$-0.5 \le V_{O} \le +7.0$	Output in 3-State	V
		$-0.5 \le V_{O} \le V_{CC} + 0.5$	Note 1.	V
lικ	DC Input Diode Current	-50	V _I < GND	mA
lok	DC Output Diode Current	-50	V _O < GND	mA
		+50	AO > ACC	mA
Io	DC Output Source/Sink Current	±50		mA
Icc	DC Supply Current Per Supply Pin	±100		mA
IGND	DC Ground Current Per Ground Pin	±100		mA
TSTG	Storage Temperature Range	-65 to +150		°C

^{*} Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute—maximum—rated conditions is not implied.

1. Output in HIGH or LOW State. Io absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Тур	Max	Unit
Vcc	Supply Voltage Operating Data Retention Only	2.0 1.5	3.3 3.3	3.6 3.6	V
VI	Input Voltage	0		5.5	V
Vo	Output Voltage (HIGH or LOW State) (3–State)	0 0		V _{CC} 5.5	V
IOH	HIGH Level Output Current, V _{CC} = 3.0V – 3.6V			-24	mA
loL	LOW Level Output Current, V _{CC} = 3.0V – 3.6V			24	mA
lон	HIGH Level Output Current, V _{CC} = 2.7V – 3.0V			-12	mA
loL	LOW Level Output Current, V _{CC} = 2.7V – 3.0V			12	mA
TA	Operating Free–Air Temperature	-40		+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate, V_{IN} from 0.8V to 2.0V, V_{CC} = 3.0V	0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		
Symbol	Characteristic	Condition	Min	Max	Unit
V _{IH}	HIGH Level Input Voltage (Note 2.)	2.7V ≤ V _{CC} ≤ 3.6V	2.0		V
VIL	LOW Level Input Voltage (Note 2.)	2.7V ≤ V _{CC} ≤ 3.6V		0.8	V
Vон	HIGH Level Output Voltage $2.7V \le V_{CC} \le 3.6V$; $I_{OH} = -100\mu A$		V _{CC} – 0.2		V
		$V_{CC} = 2.7V; I_{OH} = -12mA$	2.2		
		$V_{CC} = 3.0V; I_{OH} = -18mA$	2.4		
		$V_{CC} = 3.0V; I_{OH} = -24mA$	2.2		
VOL	LOW Level Output Voltage	$2.7V \le V_{CC} \le 3.6V$; $I_{OL} = 100\mu A$		0.2	V
		V _{CC} = 2.7V; I _{OL} = 12mA		0.4	
		V _{CC} = 3.0V; I _{OL} = 16mA		0.4	
		$V_{CC} = 3.0V; I_{OL} = 24mA$		0.55	

^{2.} These values of V_I are used to test DC electrical characteristics only.

DC ELECTRICAL CHARACTERISTICS (continued)

			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		
Symbol	Characteristic	Condition	Min	Max	Unit
Ц	Input Leakage Current	$2.7V \le V_{CC} \le 3.6V; \ 0V \le V_{I} \le 5.5V$		±5.0	μΑ
loz	3–State Output Current	$2.7 \le V_{CC} \le 3.6V$; $0V \le V_{O} \le 5.5V$; $V_{I} = V_{IH}$ or V_{IL}		±5.0	μΑ
loff	Power-Off Leakage Current	$V_{CC} = 0V$; V_I or $V_O = 5.5V$		10	μΑ
ICC	Quiescent Supply Current	$2.7 \le V_{CC} \le 3.6V$; $V_I = GND \text{ or } V_{CC}$		10	μΑ
		$2.7 \le V_{CC} \le 3.6V$; $3.6 \le V_I$ or $V_O \le 5.5V$		±10	μΑ
ΔlCC	Increase in I _{CC} per Input	$2.7 \le V_{CC} \le 3.6V; V_{IH} = V_{CC} - 0.6V$		500	μΑ

AC CHARACTERISTICS ($t_R = t_F = 2.5 ns$; $C_L = 50 pF$; $R_L = 500 \Omega$)

				Lin	nits		
			T _A = -40°C to +85°C				
			V _{CC} = 3.	0V to 3.6V	V _{CC} =	= 2.7V	
Symbol	Parameter	Waveform	Min	Max	Min	Max	Unit
f _{max}	Clock Pulse Frequency	1	150				MHz
^t PLH ^t PHL	Propagation Delay CP to O _n	1	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
^t PZH ^t PZL	Output Enable Time to HIGH and LOW Levels	2	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
^t PHZ ^t PLZ	Output Disable Time from HIGH and LOW Levels	2	1.5 1.5	7.5 7.5	1.5 1.5	8.5 8.5	ns
t _S	Setup Time, HIGH or LOW Dn to CP	1	2.5		2.5		ns
th	Hold Time, HIGH or LOW Dn to CP	1	1.5		1.5		ns
t _W	CP Pulse Width, HIGH or LOW	3	3.3		3.3		ns
tOSHL tOSLH	Output-to-Output Skew (Note 3.)			1.0 1.0			ns

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 (tOSHL) or LOW-to-HIGH (tOSLH); parameter guaranteed by design.

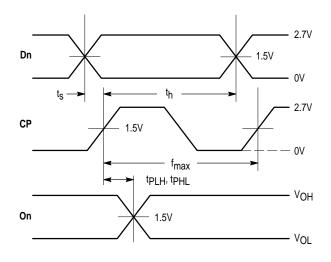
DYNAMIC SWITCHING CHARACTERISTICS

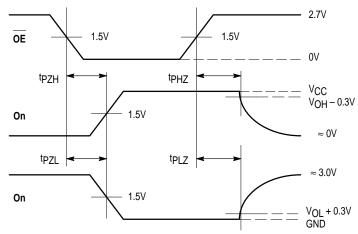
			T _A = +25°C			
Symbol	Characteristic	Condition	Min	Тур	Max	Unit
V _{OLP}	Dynamic LOW Peak Voltage (Note 4.)	$V_{CC} = 3.3V$, $C_L = 50pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$		0.8		V
V _{OLV}	Dynamic LOW Valley Voltage (Note 4.)	$V_{CC} = 3.3V$, $C_L = 50pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$		0.8		V

^{4.} Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C _{IN}	Input Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}	7	pF
COUT	Output Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}	8	pF
C _{PD}	Power Dissipation Capacitance	10MHz, $V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}	25	pF



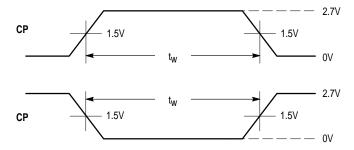


WAVEFORM 1 - PROPAGATION DELAYS, SETUP AND HOLD TIMES

 $t_R = t_F = 2.5$ ns, 10% to 90%; f = 1MHz; $t_W = 500$ ns

WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

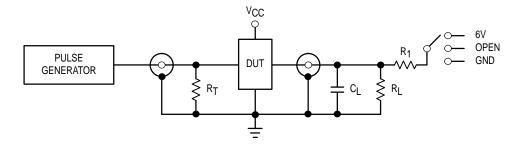
 $t_R = t_F = 2.5$ ns, 10% to 90%; f = 1MHz; $t_W = 500$ ns



WAVEFORM 3 - PULSE WIDTH

 t_R = t_F = 2.5ns (or fast as required) from 10% to 90%; Output requirements: $V_{OL} \le 0.8V$, $V_{OH} \ge 2.0V$

Figure 1. AC Waveforms



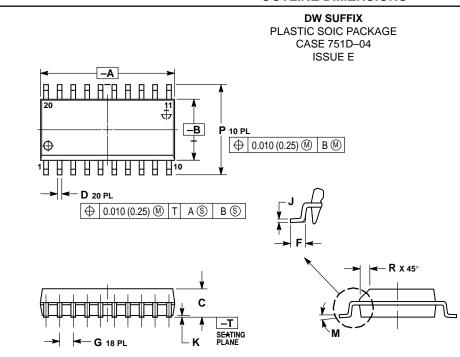
TEST	SWITCH
tPLH, tPHL	Open
tPZL, tPLZ	6V
Open Collector/Drain tpLH and tpHL	6V
^t PZH ^{, t} PHZ	GND

 C_L = 50pF or equivalent (Includes jig and probe capacitance) R_L = R_1 = 500 Ω or equivalent R_T = Z_{OUT} of pulse generator (typically 50 Ω)

Figure 2. Test Circuit

5

OUTLINE DIMENSIONS

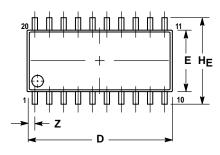


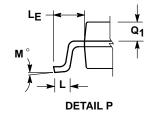
- NOTES:
 1. DIMENSIONING AND TOLERANCING PER
- ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
- 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

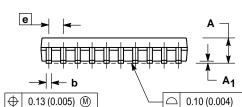
	MILLIM	ETERS	INC	HES	
DIM	MIN	MAX	MIN	MAX	
Α	12.65	12.95	0.499	0.510	
В	7.40	7.60	0.292	0.299	
С	2.35	2.65	0.093	0.104	
D	0.35	0.49	0.014	0.019	
F	0.50	0.90	0.020	0.035	
G	1.27	BSC	0.050 BSC		
J	0.25	0.32	0.010	0.012	
K	0.10	0.25	0.004	0.009	
M	0°	7°	0°	7°	
Р	10.05	10.55	0.395	0.415	
R	0.25	0.75	0.010	0.029	

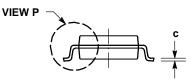
M SUFFIX

PLASTIC SOIC EIAJ PACKAGE CASE 967-01 ISSUE O









NOTES:

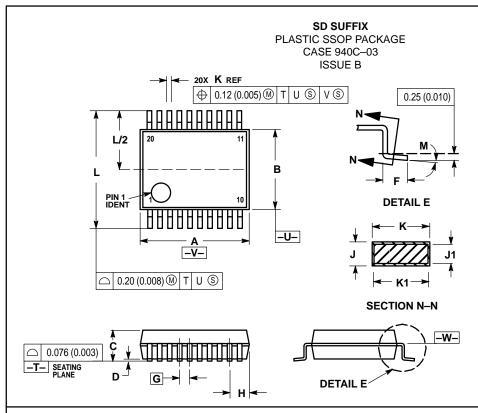
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- Y14.5M, 1982.

 2 CONTROLLING DIMENSION: MILLIMETER.

 3 DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- PER SIDE.
 TERMINAL NUMBERS ARE SHOWN FOR
 REFERENCE ONLY.
 THE LEAD WIDTH DIMENSION (b) DOES NOT
 INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) DANIORAR FRO I RUSION SHALL BE 0.08 (0.003)
 TOTAL IN EXCESS OF THE LEAD WIDTH
 DIMENSION AT MAXIMUM MATERIAL CONDITION.
 DAMBAR CANNOT BE LOCATED ON THE LOWER
 RADIUS OR THE FOOT. MINIMUM SPACE
 BETWEEN PROTRUSIONS AND ADJACENT LEAD
 TO BE 0.46 (0.018).

	MILLIN	IETERS	INC	HES		
DIM	MIN	MAX	MIN	MAX		
Α		2.05		0.081		
A ₁	0.05	0.20	0.002	0.008		
b	0.35	0.50	0.014	0.020		
С	0.18	0.27	0.007	0.011		
D	12.35	12.80	0.486	0.504		
E	5.10	5.45	0.201	0.215		
е	1.27	BSC	0.050) BSC		
HE	7.40	8.20	0.291	0.323		
L	0.50	0.85	0.020	0.033		
LE	1.10	1.50	0.043	0.059		
М	0 °	10 °	0 °	10°		
Q_1	0.70	0.90	0.028	0.035		
Z		0.81		0.032		

OUTLINE DIMENSIONS



- NOTES:
 13 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

 14 CONTROLLING DIMENSION: MILLIMETER.
- 14 CONTROCLING DIMENSION, MILLIUMETER.
 15 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.

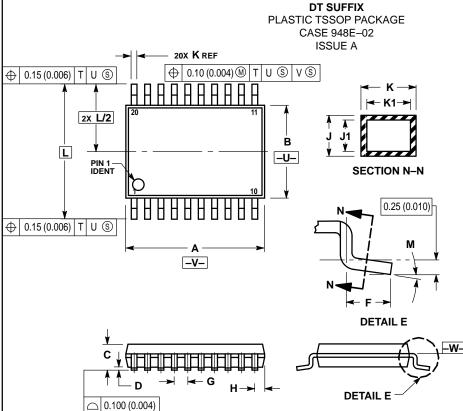
 16 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15 (0.006) PER SIDE.

 17 DIMENSION K DOES NOT INCLUDE DAMBAR
- PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF K DIMENSION AT MAXIMUM MATERIAL CONDITION DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION K BY MORE THAN 0.07 (0.002) AT LEAST MATERIAL
 CONDITION.

 18 TERMINAL NUMBERS ARE SHOWN FOR
 REFERENCE ONLY.

 19 DIMENSION A AND B ARE TO BE DETERMINED
 AT DATUM PLANE—W—.

	MILLIN	IETERS	INCHES	
DIM	MIN	MAX	MIN	MAX
Α	7.07	7.33	0.278	0.288
В	5.20	5.38	0.205	0.212
С	1.73	1.99	0.068	0.078
D	0.05	0.21	0.002	0.008
F	0.63	0.95	0.024	0.037
G	0.65 BSC		0.026 BSC	
Н	0.59	0.75	0.023	0.030
J	0.09	0.20	0.003	0.008
J1	0.09	0.16	0.003	0.006
K	0.25	0.38	0.010	0.015
K1	0.25	0.33	0.010	0.013
Ĺ	7.65	7.90	0.301	0.311
М	0 °	8°	0 °	8 °



-T- SEATING PLANE

- 6 DIMENSIONING AND TOLERANCING PER ANSI
- 714.5M, 1982.
 7 CONTROLLING DIMENSION: MILLIMETER.
 8 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.
- DIMENSION B DOES NOT INCLUDE INTERLEAD
 FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- 10 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.

 11 TERMINAL NUMBERS ARE SHOWN FOR
- REFERENCE ONLY.

 12 DIMENSION A AND B ARE TO BE DETERMINED
- AT DATUM PLANE -W-.

	MILLIN	IETERS	INCHES	
DIM	MIN	MAX	MIN	MAX
Α	6.40	6.60	0.252	0.260
В	4.30	4.50	0.169	0.177
С		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	
Н	0.27	0.37	0.011	0.015
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°

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MC74LCX374/D