

# 74LCX574

## Octal D-Type Flip-Flop with 5V Tolerant Inputs and Outputs

### General Description

The 'LCX574 is a high-speed, low power octal flip-flop with a buffered common Clock (CP) and a buffered common Output Enable ( $\overline{OE}$ ). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

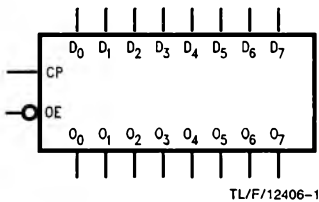
The 'LCX574 is functionally identical to the LCX374 except for the pinouts.

The 'LCX574 is designed for low voltage (3.3V)  $V_{CC}$  applications with capability of interfacing to a 5V signal environment. The 'LCX574 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

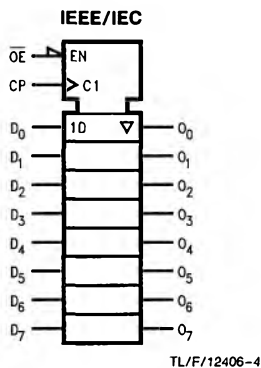
### Features

- 5V tolerant inputs and outputs
- 7.5 ns  $t_{PD}$  max, 10  $\mu A$   $I_{CCQ}$  max
- Power down high impedance inputs and outputs
- 2.0V–3.6V  $V_{CC}$  supply operation
- $\pm 24$  mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with 74 series 574
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

### Logic Symbols

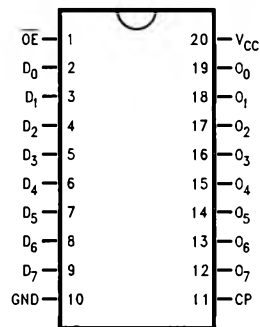


Pin Names	Description
D <sub>0</sub> –D <sub>7</sub>	Data Inputs
CP	Clock Pulse Input
$\overline{OE}$	TRI-STATE® Output Enable Input
O <sub>0</sub> –O <sub>7</sub>	TRI-STATE Outputs



### Connection Diagrams

Pin Assignment for SOIC, SSOP and TSSOP



	SOIC JEDEC	SOIC EIAJ	SSOP Type II	TSSOP JEDEC
Order Number	74LCX574WM 74LCX574WMX	74LCX574SJ 74LCX574SJX	74LCX574MSA 74LCX574MSAX	74LCX574MTC 74LCX574MTCX
See NS Package Number	M20A	M20D	MSA20	MTC20

## Functional Description

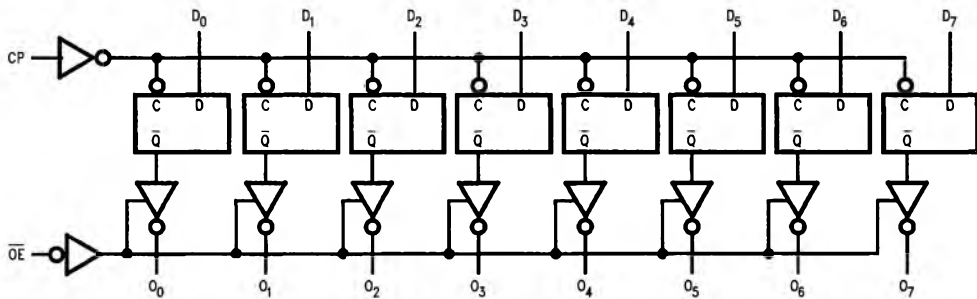
The LCX574 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ( $\overline{OE}$ ) LOW, the contents of the eight flip-flops are available at the outputs. When  $\overline{OE}$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

Function Table

Inputs			Internal	Outputs	Function
$\overline{OE}$	CP	D	Q	$O_N$	
H	H	L	NC	Z	Hold
H	H	H	NC	Z	Hold
H	↗	L	L	Z	Load
H	↗	H	H	Z	Load
L	↗	L	L	L	Data Available
L	↗	H	H	H	Data Available
L	H	L	NC	NC	No Change in Data
L	H	H	NC	NC	No Change in Data

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance  
 ↗ = LOW-to-HIGH Transition  
 NC = No Change

## Logic Diagram



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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)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
$V_{CC}$	Supply Voltage	-0.5 to +7.0		V
$V_I$	DC Input Voltage	-0.5 to +7.0		V
$V_O$	DC Output Voltage	-0.5 to +7.0	Output in TRI-STATE	V
		-0.5 to $V_{CC} + 0.5$	Output in High or Low State (Note 2)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < GND$	mA
$I_{OK}$	DC Output Diode Current	-50	$V_O < GND$	mA
		+50	$V_O > V_{CC}$	
$I_O$	DC Output Source/Sink Current	$\pm 50$		mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		$^{\circ}C$

**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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:**  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
$V_{CC}$	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	
$V_I$	Input Voltage	0	5.5	V	
$V_O$	Output Voltage	HIGH or LOW State	0	$V_{CC}$	V
		TRI-STATE	0	5.5	
$I_{OH}/I_{OL}$	Output Current	$V_{CC} = 3.0V - 3.6V$ $V_{CC} = 2.7V$	$\pm 24$ $\pm 12$	mA	
$(T_A)$	Free-Air Operating Temperature	-40	85	$^{\circ}C$	
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8V - 2.0V$ , $V_{CC} = 3.0V$	0	10	ns/V	

## DC Electrical Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^{\circ}C$ to $+85^{\circ}C$		Units
				Min	Max	
$V_{IH}$	HIGH Level Input Voltage		2.7-3.6	2.0		V
$V_{IL}$	LOW Level Input Voltage		2.7-3.6		0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	2.7-3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		V
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		V
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		V
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu A$	2.7-3.6		0.2	V
		$I_{OL} = 12 \text{ mA}$	2.7		0.4	V
		$I_{OL} = 16 \text{ mA}$	3.0		0.4	V
		$I_{OL} = 24 \text{ mA}$	3.0		0.55	V
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5V$	2.7-3.6		$\pm 5.0$	$\mu A$
$I_{OZ}$	TRI-STATE Output Leakage	$0 \leq V_O \leq 5.5V$ $V_I = V_{IH}$ or $V_{IL}$	2.7-3.6		$\pm 5.0$	$\mu A$
$I_{OFF}$	Power-Off Leakage Current	$V_I$ or $V_O = 5.5V$	0		100	$\mu A$
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.7-3.6		10	$\mu A$
		$3.6V \leq V_I$ , $V_O \leq 5.5V$	2.7-3.6		$\pm 10$	$\mu A$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6V$	2.7-3.6		500	$\mu A$

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
$f_{MAX}$	Maximum Clock Frequency	150				MHz
$t_{PHL}$	Propagation Delay	1.5	7.5	1.5	8.5	ns
$t_{PLH}$	CP to $O_n$	1.5	7.5	1.5	8.5	
$t_{PZL}$	Output Enable Time	1.5	7.5	1.5	8.0	ns
$t_{PZH}$		1.5	7.5	1.5	8.0	
$t_{PLZ}$	Output Disable Time	1.5	6.0	1.5	6.5	ns
$t_{PHZ}$		1.5	6.0	1.5	6.5	
$t_S$	Setup Time	2.5		2.5		ns
$t_H$	Hold Time	1.5		1.5		ns
$t_W$	Pulse Width	3.3		3.3		ns
$t_{OSHL}$	Output to Output Skew (Note 1)		1.0			ns
$t_{OSLH}$			1.0			

**Note 1:** 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 ( $t_{OSHL}$ ) or LOW to HIGH ( $t_{OSLH}$ ).

## Dynamic Switching Characteristics

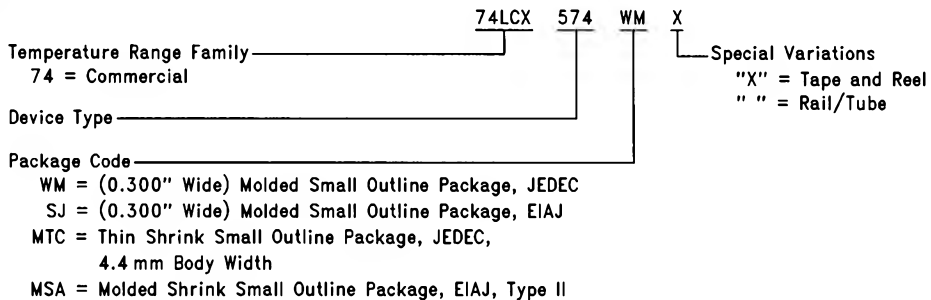
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V

## Capacitance

Symbol	Parameter	Conditions	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}, V_I = 0V \text{ or } V_{CC}$	7	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}$	8	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}, F = 10 \text{ MHz}$	25	pF

## 74LCX574 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



TL/F/12406-6