

Low-Voltage CMOS Octal D-Type Flip-Flop

**With 5 V-Tolerant Inputs and
Outputs (3-State, Non-Inverting)**

MC74LCX374

The MC74LCX374 is a high performance, non-inverting octal D-type flip-flop operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX374 inputs to be safely driven from 5 V devices.

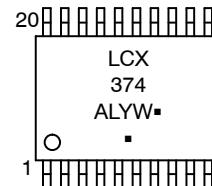
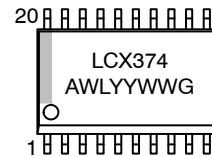
The MC74LCX374 consists of 8 edge-triggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable (\overline{OE}) are common to all flip-flops. The eight flip-flops will store the state of individual D inputs that meet the setup and hold time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

Features

- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V
- LVTTL Compatible
- LVCMS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
 - ◆ Human Body Model >2000 V
 - ◆ Machine Model >200 V
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



MARKING DIAGRAMS



A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been DISCONTINUED. Please refer to the table on page 6.

MC74LCX374

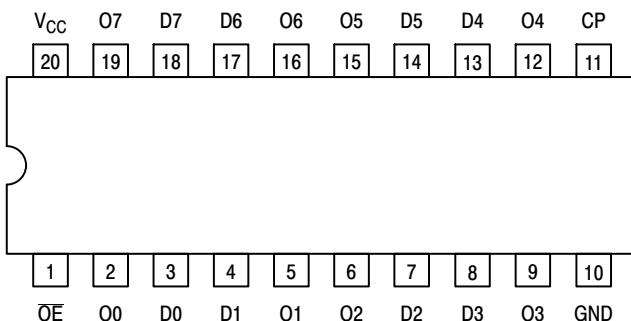


Figure 1. Pinout: 20-Lead (Top View)

PIN NAMES

Pins	Function
OE	Output Enable Input
CP	Clock Pulse Input
D0-D7	Data Inputs
00-07	3-State Outputs

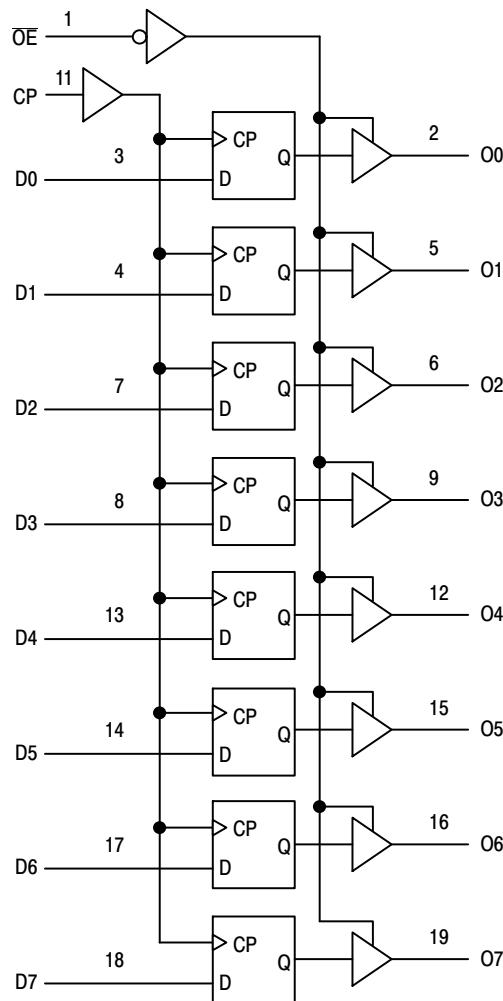


Figure 2. LOGIC DIAGRAM

TRUTH TABLE

INPUTS			OUTPUTS	OPERATING MODE
OE	CP	Dn	On	
L	↑	I	L	Load and Read Register
L	↑	h	H	
L	↑	X	NC	Hold and Read Register
H	↑	X	Z	Hold and Disable Outputs
H	↑	I	Z	Load Internal Register and Disable Outputs
H	↑	h	Z	

H = High Voltage Level

h = High Voltage Level One Setup Time Prior to the Low-to-High Clock Transition

L = Low Voltage Level

I = Low 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 Voltage Level and Transitions are Acceptable

Z = High Impedance State

↑ = Low-to-High Transition

† = Not a Low-to-High Transition; For I_{CC} Reasons, DO NOT FLOAT Inputs

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Units
V_{CC}	DC Supply Voltage	-0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
V_O	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in 3-State	V
		$-0.5 \leq V_O \leq V_{CC} + 0.5$	(Note 1)	V
I_{IK}	DC Input Diode Current	-50	$V_I < GND$	mA
I_{OK}	DC Output Diode Current	-50	$V_O < GND$	mA
		+50	$V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	± 50		mA
I_{CC}	DC Supply Current Per Supply Pin	± 100		mA
I_{GND}	DC Ground Current Per Ground Pin	± 100		mA
T_{STG}	Storage Temperature Range	-65 to +150		°C
MSL	Moisture Sensitivity		Level 1	

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.

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Units
V_{CC}	Supply Voltage Operating Data Retention Only	2.0 1.5	3.3 3.3	3.6 3.6	V
V_I	Input Voltage	0		5.5	V
V_O	Output Voltage (HIGH or LOW State) (3-State)	0 0		V_{CC} 5.5	V
I_{OH}	HIGH Level Output Current, $V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$			-24	mA
I_{OL}	LOW Level Output Current, $V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$			24	mA
I_{OH}	HIGH Level Output Current, $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$			-12	mA
I_{OL}	LOW Level Output Current, $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$			12	mA
T_A	Operating Free-Air Temperature	-40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V_{IN} from 0.8 V to 2.0 V, $V_{CC} = 3.0 \text{ V}$	0		10	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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	TA = -40°C to +85°C		Units
			Min	Max	
V _{IH}	HIGH Level Input Voltage (Note 2)	2.7 V ≤ V _{CC} ≤ 3.6 V	2.0		V
V _{IL}	LOW Level Input Voltage (Note 2)	2.7 V ≤ V _{CC} ≤ 3.6 V		0.8	V
V _{OH}	HIGH Level Output Voltage	2.7 V ≤ V _{CC} ≤ 3.6 V; I _{OH} = -100 μA	V _{CC} - 0.2		V
		V _{CC} = 2.7 V; I _{OH} = -12 mA	2.2		
		V _{CC} = 3.0 V; I _{OH} = -18 mA	2.4		
		V _{CC} = 3.0 V; I _{OH} = -24 mA	2.2		
V _{OL}	LOW Level Output Voltage	2.7 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA		0.2	V
		V _{CC} = 2.7 V; I _{OL} = 12 mA		0.4	
		V _{CC} = 3.0 V; I _{OL} = 16 mA		0.4	
		V _{CC} = 3.0 V; I _{OL} = 24 mA		0.55	
I _{OZ}	3-State Output Current	V _{CC} = 3.6 V, V _{IN} = V _{IH} or V _{IL} , V _{OUT} = 0 to 5.5 V		±5	μA
I _{OFF}	Power Off Leakage Current	V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V		10	μA
I _{IN}	Input Leakage Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		±5	μA
I _{CC}	Quiescent Supply Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		10	μA
ΔI _{CC}	Increase in I _{CC} per Input	2.3 ≤ V _{CC} ≤ 3.6 V; V _{IH} = V _{CC} - 0.6 V		500	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

AC CHARACTERISTICS (t_R = t_F = 2.5 ns; C_L = 50 pF; R_L = 500 Ω)

Symbol	Parameter	Waveform	Limits				Units	
			TA = -40°C to +85°C					
			V _{CC} = 3.0 V to 3.6 V		V _{CC} = 2.7 V			
			Min	Max	Min	Max		
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 D _n to CP	1	2.5		2.5		ns	
t _h	Hold Time, HIGH or LOW D _n to CP	1	1.5		1.5		ns	
t _w	CP Pulse Width, HIGH or LOW	3	3.3		3.3		ns	
t _{OSHL} t _{OSLH}	Output-to-Output Skew (Note 3)			1.0 1.0			ns	

3. 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}); parameter guaranteed by design.

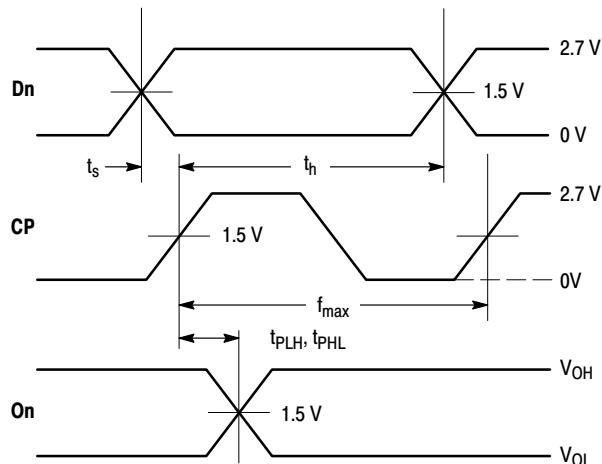
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	TA = +25°C			Units
			Min	Typ	Max	
V _{OLP}	Dynamic LOW Peak Voltage (Note 4)	V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V		0.8		V
V _{OLV}	Dynamic LOW Valley Voltage (Note 4)	V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V		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.

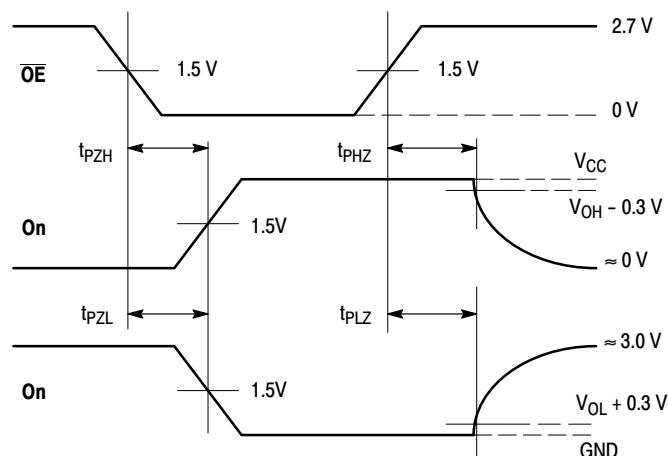
CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Units
C _{IN}	Input Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	7	pF
C _{OUT}	Output Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	8	pF
C _{PD}	Power Dissipation Capacitance	10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	25	pF



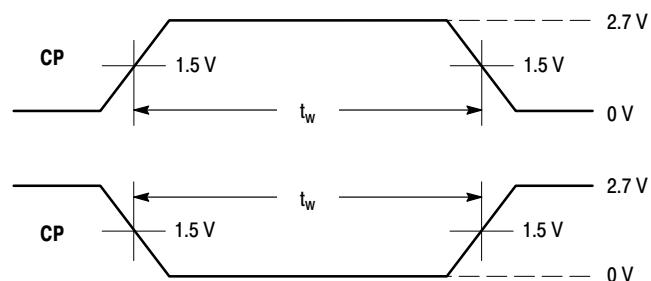
WAVEFORM 1 - PROPAGATION DELAYS, SETUP AND HOLD TIMES

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



WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

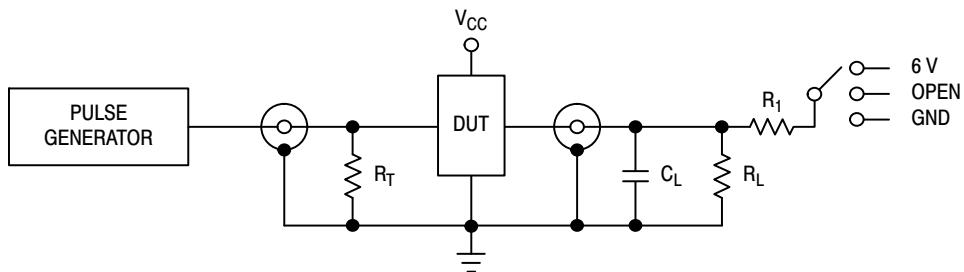
t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 3 - PULSE WIDTH
t_R = t_F = 2.5 ns (or fast as required) from 10% to 90%;
Output requirements: V_{OL} ≤ 0.8 V, V_{OH} ≥ 2.0 V

Figure 3. AC Waveforms

MC74LCX374



TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6 V
Open Collector/Drain t_{PLH} and t_{PHL}	6 V
t_{PZH}, t_{PHZ}	GND

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

Figure 4. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74LCX374DWR2G	SOIC-20 WB (Pb-Free)	1000 / Tape & Reel
MC74LCX374DTR2G	TSSOP-20 (Pb-Free)	2500 / Tape & Reel

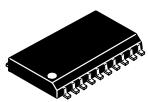
DISCONTINUED (Note 5)

NLV74LCX374DTR2G*	TSSOP-20 (Pb-Free)	2500 / Tape & Reel
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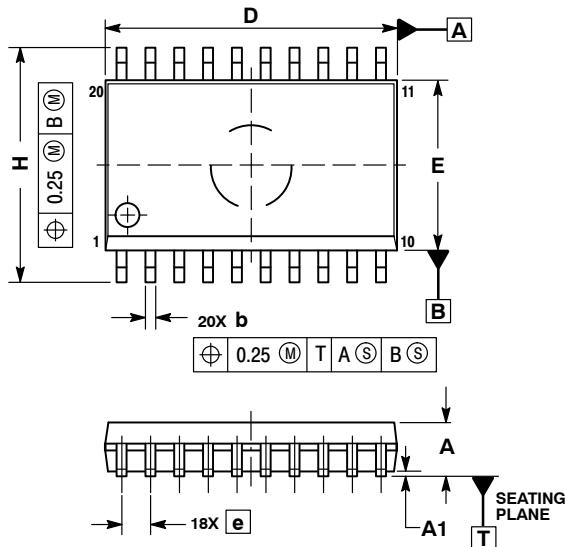
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

5. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

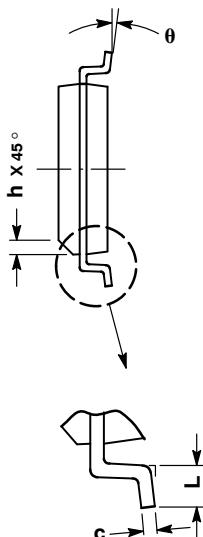
*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.



SCALE 1:1

SOIC-20 WB
CASE 751D-05
ISSUE H

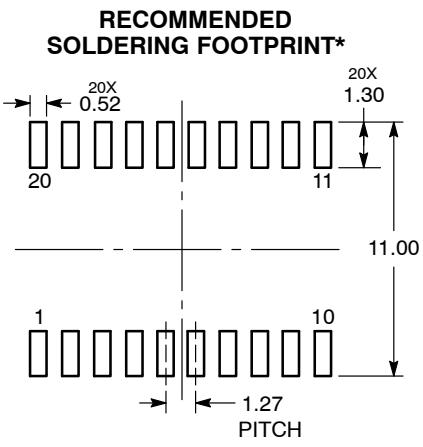
DATE 22 APR 2015



NOTES:

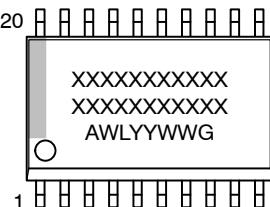
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2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

MILLIMETERS		
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
b	0.35	0.49
c	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0 °	7 °



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the [onsemi](#) Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC
MARKING DIAGRAM*

XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb-Free Package

*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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