

# Low-Voltage CMOS Octal D-Type Flip-Flop Flow Through Pinout

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

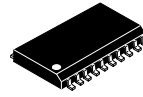
## MC74LCX574

The MC74LCX574 is a high performance, non–inverting octal D–type flip–flop operating from a 1.65 to 5.5 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 MC74LCX574 inputs to be safely driven from 5.0 V devices.

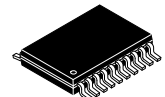
The MC74LCX574 consists of 8 edge–triggered flip–flops with individual D–type inputs and 3–state true outputs. The buffered clock and buffered Output Enable ( $\overline{OE}$ ) are common to all flip–flops. The eight flip–flops will store the state of individual D inputs that meet the setup and hold 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. The LCX574 flow through design facilitates easy PC board layout.

### Features

- Designed for 1.65 to 5.5 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
- LVTTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability at 3 V
- Near Zero Static Supply Current in All Three Logic States (10  $\mu$ A)  
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 100 mA
- ESD Performance:
  - ♦ Human Body Model >2000 V
- –Q Suffix 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

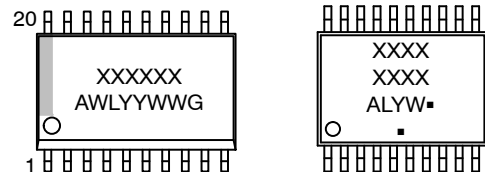


SOIC–20 WB  
DW SUFFIX  
CASE 751D–05



TSSOP–20  
DT SUFFIX  
CASE 948E

### MARKING DIAGRAM



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 8 of this data sheet.

# MC74LCX574

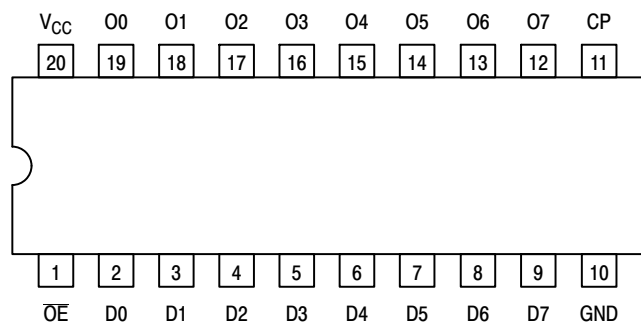


Figure 1. Pinout: 20-Lead (Top View)

## PIN NAMES

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

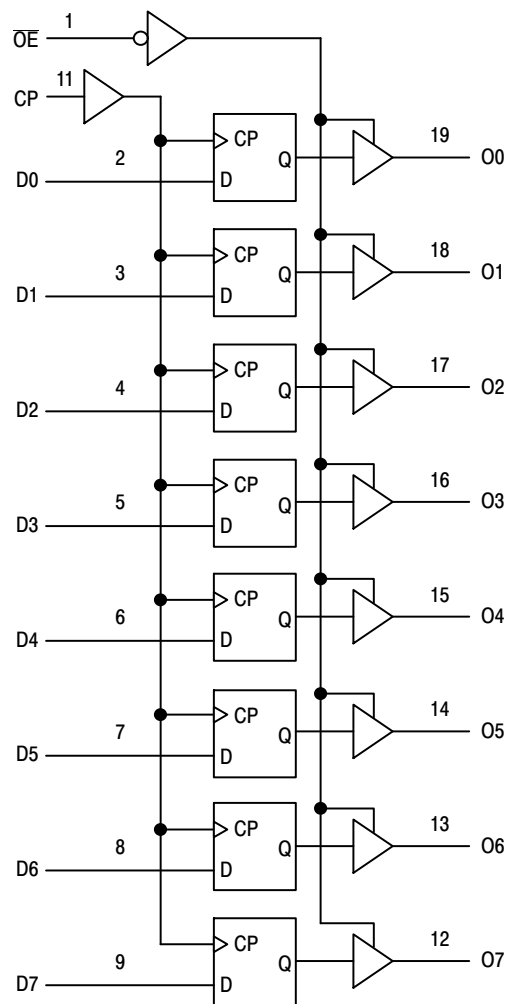


Figure 2. Logic Diagram

## TRUTH TABLE

| INPUTS |    |    | INTERNAL LATCHES | OUTPUTS | OPERATING MODE                             |
|--------|----|----|------------------|---------|--------------------------------------------|
| OE     | CP | Dn | Q                | On      |                                            |
| L      | ↑  | l  | L                | L       | Load and Read Register                     |
| L      | ↑  | h  | H                | H       |                                            |
| L      | ↱  | X  | NC               | NC      | Hold and Read Register                     |
| H      | ↱  | X  | NC               | Z       | Hold and Disable Outputs                   |
| H      | ↑  | l  | L                | Z       | Load Internal Register and Disable Outputs |
| H      | ↑  | 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  
l = Low Voltage Level One Setup Time Prior to the Low-to-High Clock Transition  
NC = No Change  
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<sub>CC</sub> Reasons, DO NOT FLOAT Inputs

# MC74LCX574

## MAXIMUM RATINGS

| Symbol                | Parameter                                                  | Value                  | Unit |
|-----------------------|------------------------------------------------------------|------------------------|------|
| $V_{CC}$              | DC Supply Voltage                                          | -0.5 to +6.5           | V    |
| $V_I$                 | DC Input Voltage (Note 1)                                  | -0.5 to +6.5           | V    |
| $V_O$                 | DC Output Voltage (Note 1) Active-Mode (High or Low State) | -0.5 to $V_{CC} + 0.5$ | V    |
|                       | Tri-State Mode                                             | -0.5 to +6.5           |      |
|                       | Power-Down Mode ( $V_{CC} = 0$ V)                          | -0.5 to +6.5           |      |
| $I_{IK}$              | DC Input Diode Current $V_{IN} < GND$                      | -50                    | mA   |
| $I_{OK}$              | DC Output Diode Current $V_{OUT} < GND$                    | -50                    | mA   |
| $I_O$                 | DC Output Source/Sink Current                              | $\pm 50$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC Supply Current per Supply Pin or Ground Pin             | $\pm 100$              | mA   |
| $T_{STG}$             | Storage Temperature Range                                  | -65 to +150            | °C   |
| $T_L$                 | Lead Temperature, 1 mm from Case for 10 secs               | 260                    | °C   |
| $T_J$                 | Junction Temperature Under Bias                            | +150                   | °C   |
| $\theta_{JA}$         | Thermal Resistance (Note 2) SOIC-20W                       | 96                     | °C/W |
|                       | TSSOP-20                                                   | 150                    |      |
| $P_D$                 | Power Dissipation in Still Air SOIC-20W                    | 1302                   | mW   |
|                       | TSSOP-20                                                   | 833                    |      |
| MSL                   | Moisture Sensitivity SOIC-20W<br>All Other Packages        | Level 3<br>Level 1     | -    |
| $F_R$                 | Flammability Rating Oxygen Index: 28 to 34                 | UL 94 V-0 @ 0.125 in   | -    |
| $V_{ESD}$             | ESD Withstand Voltage (Note 3) Human Body Model            | > 2000                 | V    |
|                       | Charged Device Model                                       | N/A                    |      |

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.  $I_O$  absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                                           | Min  | Typ | Max      | Unit |
|------------|-----------------------------------------------------|------|-----|----------|------|
| $V_{CC}$   | Supply Voltage Operating                            | 1.65 | 3.3 | 5.5      | V    |
|            | Data Retention Only                                 | 1.5  | 3.3 | 5.5      |      |
| $V_I$      | Digital Input Voltage                               | 0    | -   | 5.5      | V    |
| $V_O$      | Output Voltage Active Mode (High or Low State)      | 0    | -   | $V_{CC}$ | V    |
|            | Tri-State Mode                                      | 0    | -   | 5.5      |      |
|            | Power Down Mode ( $V_{CC} = 0$ V)                   | 0    | -   | 5.5      |      |
| $T_A$      | Operating Free-Air Temperature                      | -55  | -   | +125     | °C   |
| $t_r, t_f$ | Input Rise or Fall Rate $V_{CC} = 1.65$ V to 1.95 V | 0    | -   | 20       | nS/V |
|            | $V_{CC} = 2.3$ V to 2.7 V                           | 0    | -   | 20       |      |
|            | $V_I$ from 0.8 V to 2.0 V, $V_{CC} = 3.0$ V         | 0    | -   | 10       |      |
|            | $V_{CC} = 4.5$ V to 5.5 V                           | 0    | -   | 5        |      |

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.

4. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

# MC74LCX574

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                             | Conditions                                                                             | V <sub>CC</sub> (V) | T <sub>A</sub> = -40 °C to +85 °C |                        | T <sub>A</sub> = -55 °C to +125 °C |                        | Unit |
|------------------|---------------------------------------|----------------------------------------------------------------------------------------|---------------------|-----------------------------------|------------------------|------------------------------------|------------------------|------|
|                  |                                       |                                                                                        |                     | Min                               | Max                    | Min                                | Max                    |      |
| V <sub>IH</sub>  | High-Level Input Voltage              |                                                                                        | 1.65 to 1.95        | 0.65 x V <sub>CC</sub>            |                        | 0.65 x V <sub>CC</sub>             |                        | V    |
|                  |                                       |                                                                                        | 2.3 to 2.7          | 1.7                               |                        | 1.7                                |                        |      |
|                  |                                       |                                                                                        | 2.7 to 3.6          | 2.0                               |                        | 2.0                                |                        |      |
|                  |                                       |                                                                                        | 4.5 to 5.5          | 0.7 x V <sub>CC</sub>             |                        | 0.7 x V <sub>CC</sub>              |                        |      |
| V <sub>IL</sub>  | Low-Level Input Voltage               |                                                                                        | 1.65 to 1.95        |                                   | 0.35 x V <sub>CC</sub> |                                    | 0.35 x V <sub>CC</sub> | V    |
|                  |                                       |                                                                                        | 2.3 to 2.7          |                                   | 0.7                    |                                    | 0.7                    |      |
|                  |                                       |                                                                                        | 2.7 to 3.6          |                                   | 0.8                    |                                    | 0.8                    |      |
|                  |                                       |                                                                                        | 4.5 to 5.5          |                                   | 0.3 x V <sub>CC</sub>  |                                    | 0.3 x V <sub>CC</sub>  |      |
| V <sub>OH</sub>  | High-Level Output Voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |                     |                                   |                        |                                    |                        | V    |
|                  |                                       | I <sub>OH</sub> = -100 μA                                                              | 1.65 to 5.5         | V <sub>CC</sub> - 0.1             | -                      | V <sub>CC</sub> - 0.1              | -                      |      |
|                  |                                       | I <sub>OH</sub> = -4 mA                                                                | 1.65                | 1.2                               | -                      | 1.2                                | -                      |      |
|                  |                                       | I <sub>OH</sub> = -8 mA                                                                | 2.3                 | 1.8                               | -                      | 1.8                                | -                      |      |
|                  |                                       | I <sub>OH</sub> = -12 mA                                                               | 2.7                 | 2.2                               | -                      | 2.2                                | -                      |      |
|                  |                                       | I <sub>OH</sub> = -16 mA                                                               | 3.0                 | 2.4                               | -                      | 2.4                                | -                      |      |
|                  |                                       | I <sub>OH</sub> = -24 mA                                                               | 3.0                 | 2.2                               | -                      | 2.2                                | -                      |      |
|                  |                                       | I <sub>OH</sub> = -32 mA                                                               | 4.5                 | 3.8                               |                        | 3.8                                |                        |      |
| V <sub>OL</sub>  | Low-Level Output Voltage              | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                    |                     |                                   |                        |                                    |                        | V    |
|                  |                                       | I <sub>OL</sub> = 100 μA                                                               | 1.65 to 5.5         | -                                 | 0.1                    | -                                  | 0.1                    |      |
|                  |                                       | I <sub>OL</sub> = 4 mA                                                                 | 1.65                | -                                 | 0.45                   | -                                  | 0.45                   |      |
|                  |                                       | I <sub>OL</sub> = 8 mA                                                                 | 2.3                 | -                                 | 0.6                    | -                                  | 0.6                    |      |
|                  |                                       | I <sub>OL</sub> = 12 mA                                                                | 2.7                 | -                                 | 0.4                    | -                                  | 0.4                    |      |
|                  |                                       | I <sub>OL</sub> = 16 mA                                                                | 3.0                 | -                                 | 0.4                    | -                                  | 0.4                    |      |
|                  |                                       | I <sub>OL</sub> = 24 mA                                                                | 3.0                 | -                                 | 0.55                   | -                                  | 0.55                   |      |
|                  |                                       | I <sub>OL</sub> = 32 mA                                                                | 4.5                 |                                   | 0.6                    |                                    | 0.6                    |      |
| I <sub>I</sub>   | Input Leakage Current                 | V <sub>I</sub> = 0 to 5.5 V                                                            | 3.6                 | -                                 | ±5.0                   | -                                  | ±5.0                   | μA   |
| I <sub>OZ</sub>  | 3-State Output Leakage Current        | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>V <sub>O</sub> = 0 V to 5.5 V | 3.6                 | -                                 | ±5.0                   | -                                  | ±5.0                   | μA   |
| I <sub>OFF</sub> | Power Off Leakage Current             | V <sub>I</sub> = 5.5 V or<br>V <sub>O</sub> = 5.5 V                                    | 0                   | -                                 | 10                     | -                                  | 10                     | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | V <sub>I</sub> = 5.5 V or GND                                                          | 3.6                 | -                                 | 10                     | -                                  | 10                     | μA   |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input | V <sub>IH</sub> = V <sub>CC</sub> - 0.6 V                                              | 2.3 to 3.6          | -                                 | 500                    | -                                  | 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.

5. These values of V<sub>I</sub> are used to test DC electrical characteristics only.

# MC74LCX574

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                   | Parameter                         | Test Condition | V <sub>CC</sub> (V) | T <sub>A</sub> = -40 °C to +85 °C |      | T <sub>A</sub> = -55 °C to +125 °C |      | Unit |
|------------------------------------------|-----------------------------------|----------------|---------------------|-----------------------------------|------|------------------------------------|------|------|
|                                          |                                   |                |                     | Min                               | Max  | Min                                | Max  |      |
| f <sub>MAX</sub>                         | Propagation Delay                 | Waveform 1     | 1.65 to 1.95        | 90                                | –    | 90                                 | –    | ns   |
|                                          |                                   |                | 2.3 to 2.7          | 100                               | –    | 100                                | –    |      |
|                                          |                                   |                | 2.7                 | 150                               | –    | 150                                | –    |      |
|                                          |                                   |                | 3.0 to 3.6          | 150                               | –    | 150                                | –    |      |
|                                          |                                   |                | 4.5 to 5.5          | 150                               | –    | 150                                | –    |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub>   | Propagation Delay,<br>CP to On    | Waveform 1     | 1.65 to 1.95        | –                                 | 15.0 | –                                  | 15.0 | ns   |
|                                          |                                   |                | 2.3 to 2.7          | –                                 | 10.5 | –                                  | 10.5 |      |
|                                          |                                   |                | 2.7                 | –                                 | 9.5  | –                                  | 9.5  |      |
|                                          |                                   |                | 3.0 to 3.6          | –                                 | 8.5  | –                                  | 8.5  |      |
|                                          |                                   |                | 4.5 to 5.5          | –                                 | 6.0  | –                                  | 6.0  |      |
| t <sub>PZH</sub> ,<br>t <sub>PZL</sub>   | Output Enable Time                | Waveform 2     | 1.65 to 1.95        | –                                 | 15.0 | –                                  | 15.0 | ns   |
|                                          |                                   |                | 2.3 to 2.7          | –                                 | 10.5 | –                                  | 10.5 |      |
|                                          |                                   |                | 2.7                 | –                                 | 9.5  | –                                  | 9.5  |      |
|                                          |                                   |                | 3.0 to 3.6          | –                                 | 8.5  | –                                  | 8.5  |      |
|                                          |                                   |                | 4.5 to 5.5          | –                                 | 6.0  | –                                  | 6.0  |      |
| t <sub>PHZ</sub> ,<br>t <sub>PLZ</sub>   | Output Enable Time                | Waveform 2     | 1.65 to 1.95        | –                                 | 10.0 | –                                  | 10.0 | ns   |
|                                          |                                   |                | 2.3 to 2.7          | –                                 | 7.8  | –                                  | 7.8  |      |
|                                          |                                   |                | 2.7                 | –                                 | 7.0  | –                                  | 7.0  |      |
|                                          |                                   |                | 3.0 to 3.6          | –                                 | 6.5  | –                                  | 6.5  |      |
|                                          |                                   |                | 4.5 to 5.5          | –                                 | 4.5  | –                                  | 4.5  |      |
| t <sub>s</sub>                           | Setup Time,<br>Dn to CP           | Waveform 1     | 1.65 to 1.95        | 4.0                               | –    | 4.0                                | –    | ns   |
|                                          |                                   |                | 2.3 to 2.7          | 4.0                               | –    | 4.0                                | –    |      |
|                                          |                                   |                | 2.7                 | 2.5                               | –    | 2.5                                | –    |      |
|                                          |                                   |                | 3.0 to 3.6          | 2.5                               | –    | 2.5                                | –    |      |
|                                          |                                   |                | 4.5 to 5.5          | 2.5                               | –    | 2.5                                | –    |      |
| t <sub>h</sub>                           | Hold Time,<br>Dn to CP            | Waveform 1     | 1.65 to 1.95        | 2.0                               | –    | 2.0                                | –    | ns   |
|                                          |                                   |                | 2.3 to 2.7          | 2.0                               | –    | 2.0                                | –    |      |
|                                          |                                   |                | 2.7                 | 1.5                               | –    | 1.5                                | –    |      |
|                                          |                                   |                | 3.0 to 3.6          | 1.5                               | –    | 1.5                                | –    |      |
|                                          |                                   |                | 4.5 to 5.5          | 1.5                               | –    | 1.5                                | –    |      |
| t <sub>w</sub>                           | Pulse Width,<br>HIGH or Low       | Waveform 3     | 1.65 to 1.95        | 4.0                               | –    | 4.0                                | –    | ns   |
|                                          |                                   |                | 2.3 to 2.7          | 4.0                               | –    | 4.0                                | –    |      |
|                                          |                                   |                | 2.7                 | 3.3                               | –    | 3.3                                | –    |      |
|                                          |                                   |                | 3.0 to 3.6          | 3.3                               | –    | 3.3                                | –    |      |
|                                          |                                   |                | 4.5 to 5.5          | 3.3                               | –    | 3.3                                | –    |      |
| t <sub>OSHL</sub> ,<br>t <sub>OSLH</sub> | Output to Output<br>Skew (Note 6) |                | 1.65 to 1.95        | –                                 | –    | –                                  | –    | ns   |
|                                          |                                   |                | 2.3 to 2.7          | –                                 | –    | –                                  | –    |      |
|                                          |                                   |                | 2.7                 | –                                 | –    | –                                  | –    |      |
|                                          |                                   |                | 3.0 to 3.6          | –                                 | 1.0  | –                                  | 1.0  |      |
|                                          |                                   |                | 4.5 to 5.5          | –                                 | –    | –                                  | –    |      |

6. 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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

# MC74LCX574

## DYNAMIC SWITCHING CHARACTERISTICS

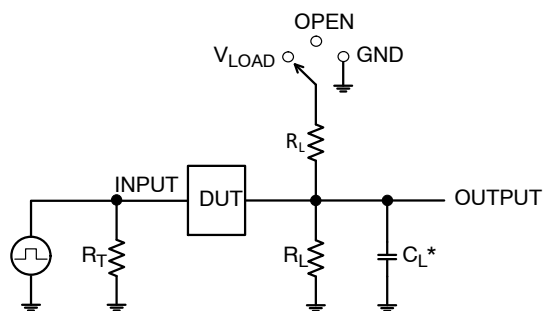
| Symbol           | Characteristic                      | Condition                                                                                       | T <sub>A</sub> = +25°C |     |     | Units |
|------------------|-------------------------------------|-------------------------------------------------------------------------------------------------|------------------------|-----|-----|-------|
|                  |                                     |                                                                                                 | Min                    | Typ | Max |       |
| V <sub>OLP</sub> | Dynamic LOW Peak Voltage (Note 7)   | V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V |                        | 0.8 |     | V     |
| V <sub>OLV</sub> | Dynamic LOW Valley Voltage (Note 7) | V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V |                        | 0.8 |     | V     |

7. 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 <sub>IN</sub>  | Input Capacitance             | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 7       | pF    |
| C <sub>OUT</sub> | Output Capacitance            | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 8       | pF    |
| C <sub>PD</sub>  | Power Dissipation Capacitance | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 25      | pF    |

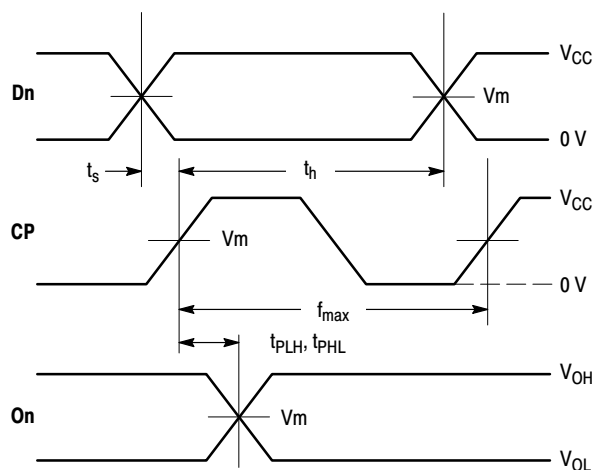
# MC74LCX574



$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

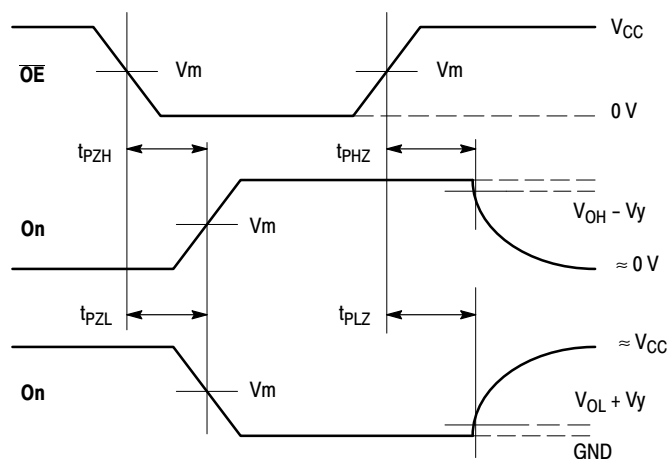
| Test                | Switch Position |
|---------------------|-----------------|
| $t_{PLH} / t_{PHL}$ | Open            |
| $t_{PLZ} / t_{PZL}$ | $V_{LOAD}$      |
| $t_{PHZ} / t_{PZH}$ | GND             |

Figure 3. Test Circuit



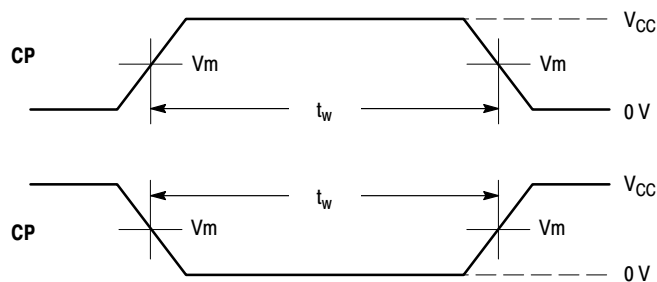
WAVEFORM 1 - PROPAGATION DELAYS, SETUP AND HOLD TIMES

$t_R = t_F = 2.5$  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:  $V_{OL} \leq 0.8$  V,  $V_{OH} \geq 2.0$  V

Figure 4. AC Waveforms

## MC74LCX574

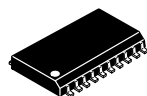
### ORDERING INFORMATION

| Device          | Marking    | Package               | Shipping <sup>†</sup> |
|-----------------|------------|-----------------------|-----------------------|
| MC74LCX574DWR2G | LCX574     | SOIC-20<br>(Pb-Free)  | 1000 / Tape & Reel    |
| MC74LCX574DTR2G | LCX<br>574 | TSSOP-20<br>(Pb-Free) | 2500 / Tape & Reel    |

<sup>†</sup>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.

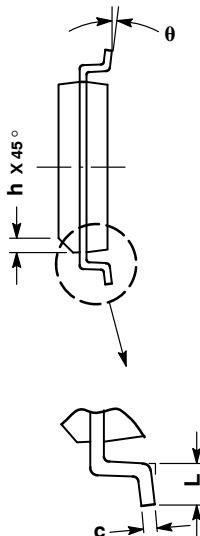
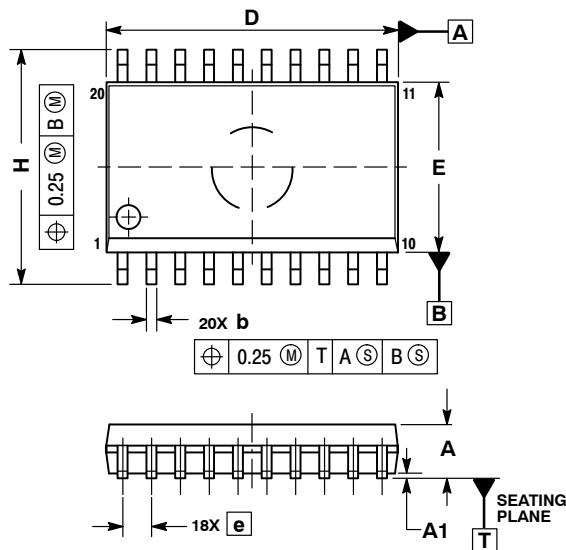




SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015

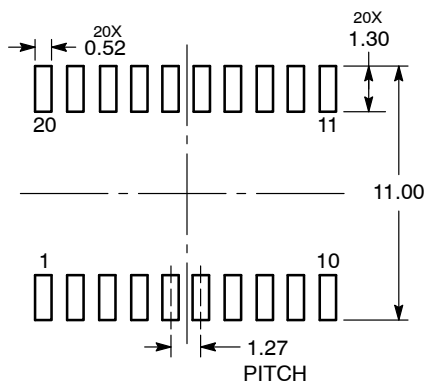


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
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.

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | 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°    |

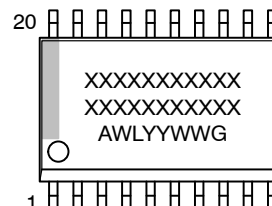
RECOMMENDED  
SOLDERING FOOTPRINT\*



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\*

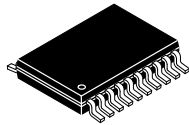


XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

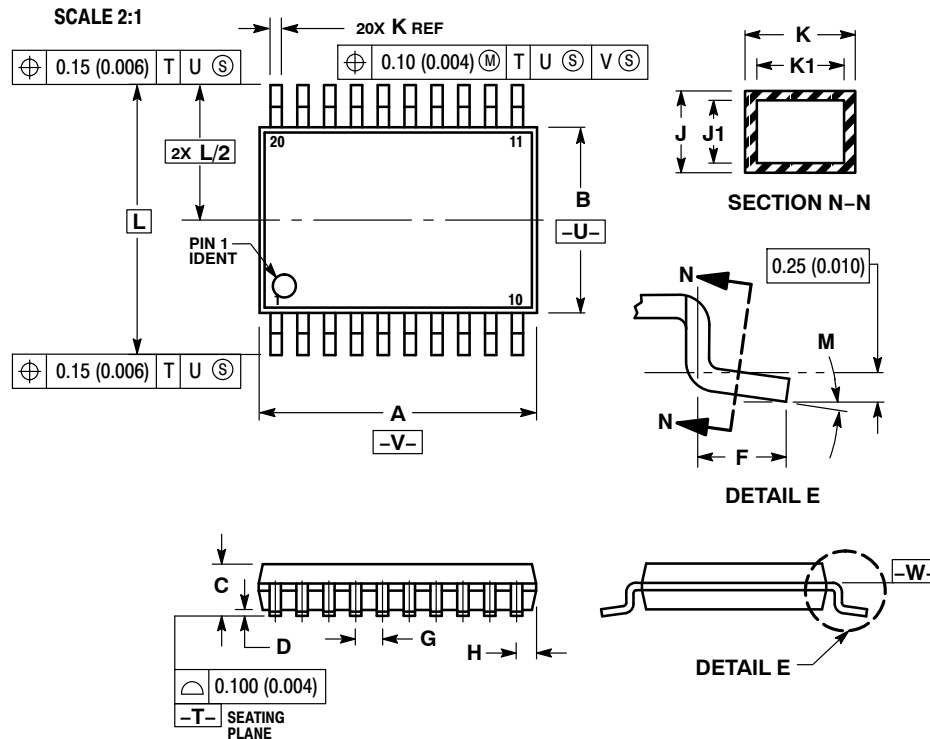
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB42343B | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | SOIC-20 WB  | PAGE 1 OF 1                                                                                                                                                                         |

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

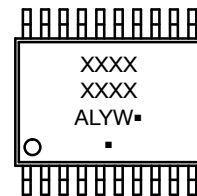

**TSSOP-20 WB**  
**CASE 948E**  
**ISSUE D**

DATE 17 FEB 2016


**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-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 6.40        | 6.60 | 0.252     | 0.260 |
| 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   | 0.27        | 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°    |

**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.

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

|                         |                    |                                                                                                                                                                                     |
|-------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DOCUMENT NUMBER:</b> | <b>98ASH70169A</b> | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>TSSOP-20 WB</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)