

# 74LCX74

## Low Voltage Dual D-Type Positive Edge-Triggered Flip-Flop with 5V Tolerant Inputs

### General Description

The LCX74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q,  $\bar{Q}$ ) 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  $\bar{S}_D$  (Set) sets Q to HIGH level

LOW input to  $\bar{C}_D$  (Clear) sets Q to LOW level

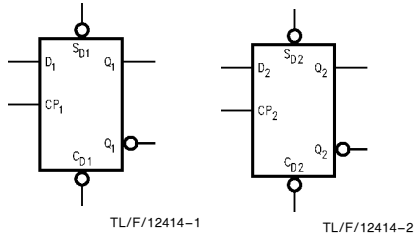
Clear and Set are independent of clock

Simultaneous LOW on  $\bar{C}_D$  and  $\bar{S}_D$  makes both Q and  $\bar{Q}$  HIGH

### Features

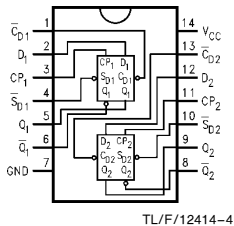
- 5V tolerant inputs
- 7.0 ns  $t_{PD}$  max, 10  $\mu A$   $I_{CCQ}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V  $V_C$  supply operation
- $\pm 24$  mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally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

### Logic Symbols



### Connection Diagram

#### Pin Assignment for SOIC and TSSOP



### Truth Table (Each Half)

| Pin Names                                                   | Description         |
|-------------------------------------------------------------|---------------------|
| D <sub>1</sub> , D <sub>2</sub>                             | Data Inputs         |
| CP <sub>1</sub> , CP <sub>2</sub>                           | Clock Pulse Inputs  |
| $\bar{C}_D$ <sub>1</sub> , $\bar{C}_D$ <sub>2</sub>         | Direct Clear Inputs |
| $\bar{S}_D$ <sub>1</sub> , $\bar{S}_D$ <sub>2</sub>         | Direct Set Inputs   |
| Q <sub>1</sub> , $\bar{Q}_1$ , Q <sub>2</sub> , $\bar{Q}_2$ | Outputs             |

| Inputs      |             |    |   | Outputs        |             |
|-------------|-------------|----|---|----------------|-------------|
| $\bar{S}_D$ | $\bar{C}_D$ | CP | D | Q              | $\bar{Q}$   |
| 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 <sub>0</sub> | $\bar{Q}_0$ |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

— = LOW-to-HIGH Clock Transition

Q<sub>0</sub>( $\bar{Q}_0$ ) = Previous Q( $\bar{Q}$ ) before LOW-

to-HIGH Transition of Clock

|                       | SOIC JEDEC            | SOIC EIAJ               | TSSOP                     |
|-----------------------|-----------------------|-------------------------|---------------------------|
| Order Number          | 74LCX74M<br>74LCX74MX | 74LCX74SJ<br>74LCX74SJX | 74LCX74MTC<br>74LCX74MTCX |
| See NS Package Number | M14A                  | M14D                    | MTC14                     |

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## Absolute Maximum Ratings (Note 1)

| 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 $V_{CC} + 0.5$ | Output in High or Low State (Note 2) | V     |
| $I_{IK}$  | DC Input Diode Current           | −50                    | $V_I < \text{GND}$                   | mA    |
| $I_{OK}$  | DC Output Diode Current          | −50<br>+50             | $V_O < \text{GND}$<br>$V_O > V_{CC}$ | 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              | −65 to +150            |                                      | °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<br>Operating<br>Data Retention               | 2.0<br>1.5 | 3.6<br>3.6 | V     |
| $V_I$               | Input Voltage                                               | 0          | 5.5        | V     |
| $V_O$               | Output Voltage<br>HIGH or LOW State                         | 0          | $V_{CC}$   | V     |
| $I_{OH}/I_{OL}$     | Output Current<br>$V_{CC} = 3.0V - 3.6V$<br>$V_{CC} = 2.7V$ |            | ±24<br>±12 | mA    |
| $T_A$               | Free-Air Operating Temperature                              | −40        | 85         | °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                     | $V_{CC}$<br>(V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      | 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         |                                                 | ±5.0 | $\mu A$ |
| $I_{OFF}$       | Power-Off Leakage Current      | $V_I$ or $V_O = 5.5V$          | 0               |                                                 | 10   | $\mu A$ |
| $I_{CC}$        | 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         |                                                 | ±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 <sub>A</sub> = −40°C to +85°C |            |                        |            | Units |
|----------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------|------------|------------------------|------------|-------|
|                                        |                                                                                                | V <sub>CC</sub> = 3.3V ±0.3V    |            | V <sub>CC</sub> = 2.7V |            |       |
|                                        |                                                                                                | Min                             | Max        | Min                    | Max        |       |
| f <sub>MAX</sub>                       | Maximum Clock Frequency                                                                        | 150                             |            | 150                    |            | MHz   |
| t <sub>PHL</sub><br>t <sub>PLH</sub>   | Propagation Delay<br>CP <sub>n</sub> to Q <sub>n</sub> or Q̄ <sub>n</sub>                      | 1.5<br>1.5                      | 7.0<br>7.0 | 1.5<br>1.5             | 8.0<br>8.0 | ns    |
| t <sub>PHL</sub><br>t <sub>PLH</sub>   | Propagation Delay<br>C̄ <sub>Dn</sub> or S̄ <sub>Dn</sub> to Q <sub>n</sub> or Q̄ <sub>n</sub> | 1.5<br>1.5                      | 7.0<br>7.0 | 1.5<br>1.5             | 8.0<br>8.0 | ns    |
| t <sub>S</sub>                         | Setup Time                                                                                     | 2.5                             |            | 2.5                    |            | ns    |
| t <sub>H</sub>                         | Hold Time                                                                                      | 1.5                             |            | 1.5                    |            | ns    |
| t <sub>W</sub>                         | Pulse Width CP                                                                                 | 3.3                             |            | 3.3                    |            | ns    |
| t <sub>W</sub>                         | Pulse Width and C̄ <sub>D</sub> , S̄ <sub>D</sub>                                              | 3.3                             |            | 3.6                    |            | ns    |
| t <sub>rem</sub>                       | Removal Time                                                                                   | 2.5                             |            | 3.0                    |            | ns    |
| t <sub>OSHL</sub><br>t <sub>OSLH</sub> | Output to Output Skew<br>(Note 3)                                                              |                                 | 1.0<br>1.0 |                        |            | ns    |

**Note 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 ( $t_{\text{OSHL}}$ ) or LOW to HIGH ( $t_{\text{OSLH}}$ ).

## Dynamic Switching Characteristics

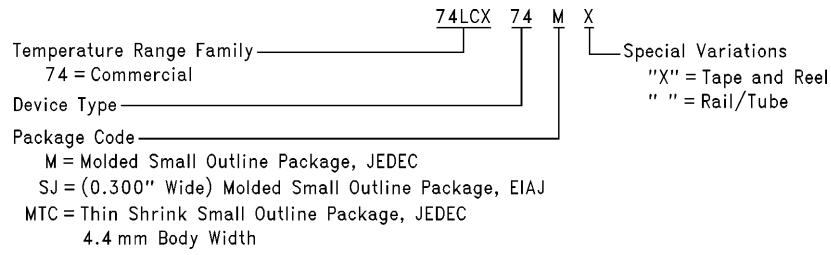
| Symbol           | Parameter                                   | Conditions                                                                         | $V_{CC}$<br>(V) | $T_A = 25^{\circ}\text{C}$ | Unit |
|------------------|---------------------------------------------|------------------------------------------------------------------------------------|-------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

## Capacitance

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

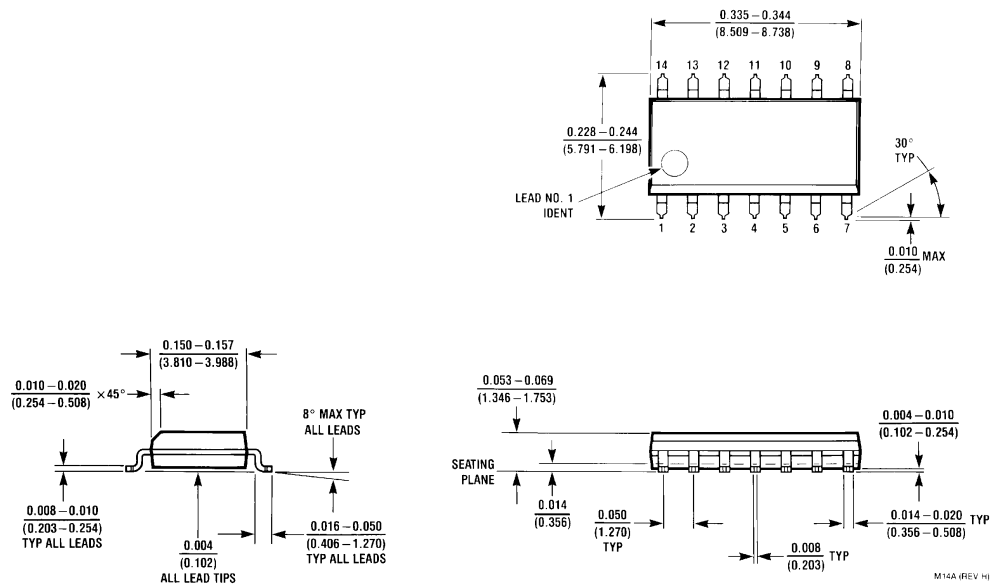
## 74LCX74 Ordering Information

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

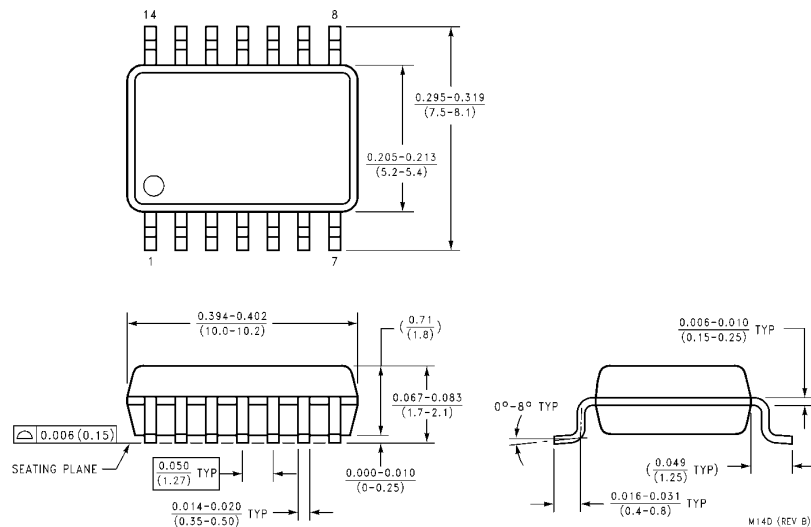


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**Physical Dimensions** inches (millimeters) unless otherwise noted



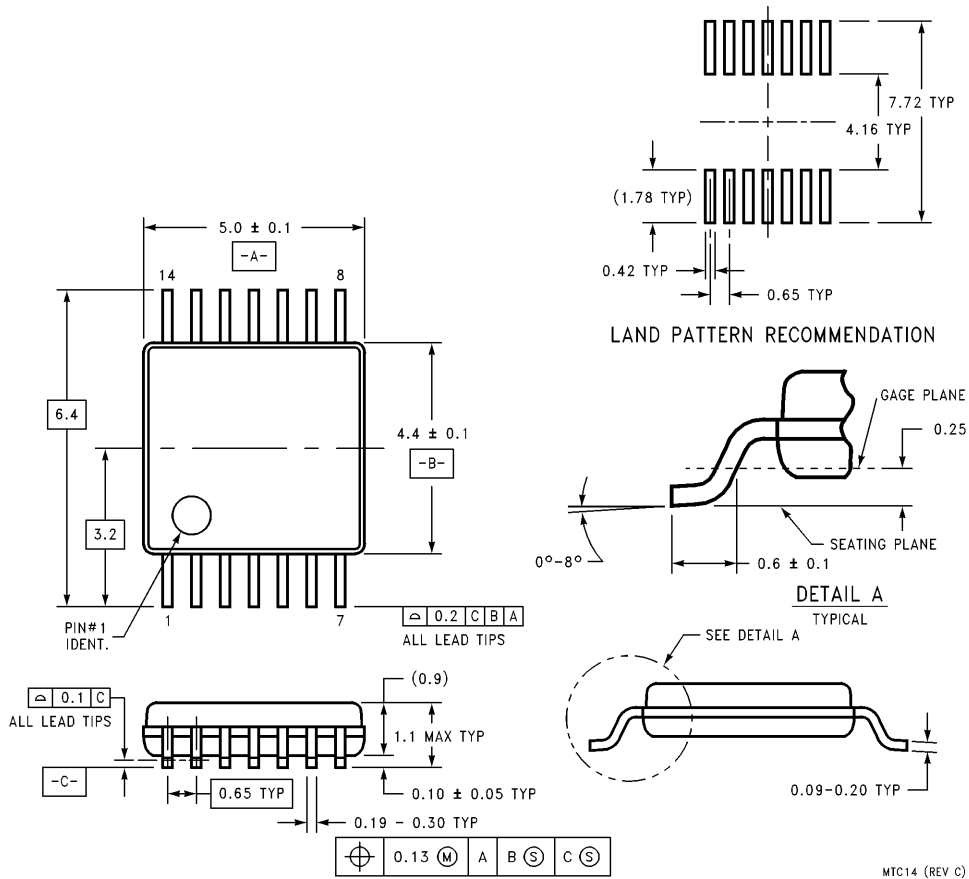
**16-Lead (0.0150" Wide) Molded Small Outline Package JEDEC**  
**Order Number 74LCX74M or 74LCX74MX**  
**NS Package Number M14A**



**14-Lead Small Outline Package EIAJ (SJ)**  
**Order Number 74LCX74SJ or 74LCX74SJX**  
**NS Package Number M14D**

# Physical Dimensions

All dimensions are in millimeters (Continued)



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