

# MC74AC74, MC74ACT74

## Dual D-Type Positive Edge-Triggered Flip-Flop

The MC74AC74/74ACT74 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. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going 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

- Outputs Source/Sink 24 mA
- 'ACT74 Has TTL Compatible Inputs

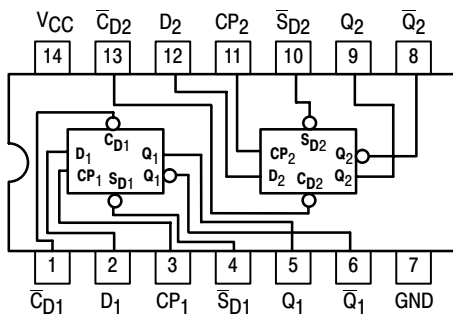


Figure 1. Pinout: 14-Lead Packages Conductors (Top View)

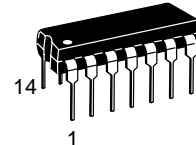
### PIN ASSIGNMENT

| PIN                              | FUNCTION            |
|----------------------------------|---------------------|
| $D_1, D_2$                       | Data Inputs         |
| $CP_1, CP_2$                     | Clock Pulse Inputs  |
| $\bar{C}_{D1}, \bar{C}_{D2}$     | Direct Clear Inputs |
| $\bar{S}_{D1}, \bar{S}_{D2}$     | Direct Set Inputs   |
| $Q_1, \bar{Q}_1, Q_2, \bar{Q}_2$ | Outputs             |

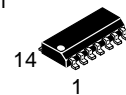


ON Semiconductor™

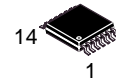
<http://onsemi.com>



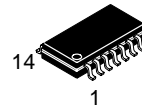
PDIP-14  
N SUFFIX  
CASE 646



SO-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



EIAJ-14  
M SUFFIX  
CASE 965

### ORDERING INFORMATION



| Device        | Package  | Shipping         |
|---------------|----------|------------------|
| MC74AC74N     | PDIP-14  | 25 Units/Rail    |
| MC74ACT74N    | PDIP-14  | 25 Units/Rail    |
| MC74AC74D     | SOIC-14  | 55 Units/Rail    |
| MC74AC74DR2   | SOIC-14  | 2500 Tape & Reel |
| MC74ACT74D    | SOIC-14  | 55 Units/Rail    |
| MC74ACT74DR2  | SOIC-14  | 2500 Tape & Reel |
| MC74AC74DT    | TSSOP-14 | 96 Units/Rail    |
| MC74AC74DTR2  | TSSOP-14 | 2500 Tape & Reel |
| MC74ACT74DT   | TSSOP-14 | 96 Units/Rail    |
| MC74ACT74DTR2 | TSSOP-14 | 2500 Tape & Reel |
| MC74AC74M     | EIAJ-14  | 50 Units/Rail    |
| MC74AC74MEL   | EIAJ-14  | 2000 Tape & Reel |
| MC74ACT74M    | EIAJ-14  | 50 Units/Rail    |
| MC74ACT74MEL  | EIAJ-14  | 2000 Tape & Reel |


### DEVICE MARKING INFORMATION

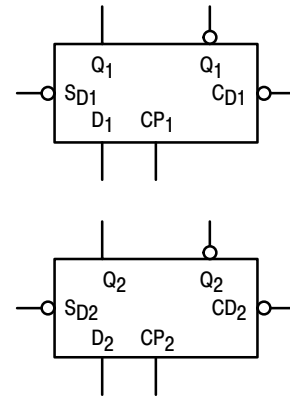
See general marking information in the device marking section on page 100 of this data sheet.

# MC74AC74, MC74ACT74

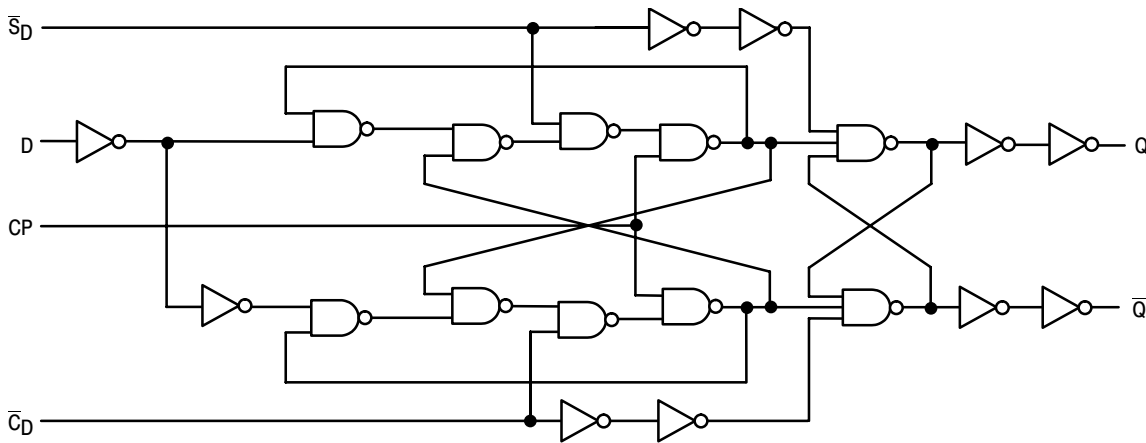
**TRUTH TABLE** (Each Half)

| 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 | $Q_0$   | $\bar{Q}_0$ |

NOTE: H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial;  
 = LOW-to-HIGH Clock Transition  
 $Q_0(\bar{Q}_0)$  = Previous Q( $\bar{Q}$ ) before LOW-to-HIGH Transition of Clock



**Figure 2. Logic Symbol**



NOTE: This diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

**Figure 3. Logic Diagram**

**MAXIMUM RATINGS\***

| Symbol    | Parameter                                 | Value                  | Unit        |
|-----------|---|------------------------|-------------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)     | -0.5 to +7.0           | V           |
| $V_{in}$  | DC Input Voltage (Referenced to GND)      | -0.5 to $V_{CC} + 0.5$ | V           |
| $V_{out}$ | DC Output Voltage (Referenced to GND)     | -0.5 to $V_{CC} + 0.5$ | V           |
| $I_{in}$  | DC Input Current, per Pin                 | $\pm 20$               | mA          |
| $I_{out}$ | DC Output Sink/Source Current, per Pin    | $\pm 50$               | mA          |
| $I_{CC}$  | DC $V_{CC}$ or GND Current per Output Pin | $\pm 50$               | mA          |
| $T_{stg}$ | Storage Temperature                       | -65 to +150            | $^{\circ}C$ |

\*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

# MC74AC74, MC74ACT74

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter  | Min                     | Typ | Max             | Unit |      |
|------------------------------------|--|-------------------------|-----|-----------------|------|------|
| V <sub>CC</sub>                    | Supply Voltage   | 'AC                     | 2.0 | 5.0             | 6.0  | V    |
|                                    |  | 'ACT                    | 4.5 | 5.0             | 5.5  |      |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Ref. to GND)                         | 0                       | –   | V <sub>CC</sub> | V    |      |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note )<br>'AC Devices except Schmitt Inputs  | V <sub>CC</sub> @ 3.0 V | –   | 150             | –    | ns/V |
|                                    |  | V <sub>CC</sub> @ 4.5 V | –   | 40              | –    |      |
|                                    |  | V <sub>CC</sub> @ 5.5 V | –   | 25              | –    |      |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note )<br>'ACT Devices except Schmitt Inputs | V <sub>CC</sub> @ 4.5 V | –   | 10              | –    | ns/V |
|                                    |  | V <sub>CC</sub> @ 5.5 V | –   | 8.0             | –    |      |
| T <sub>J</sub>                     | Junction Temperature (PDIP)  | –                       | –   | 140             | °C   |      |
| T <sub>A</sub>                     | Operating Ambient Temperature Range                                    | –40                     | 25  | 85              | °C   |      |
| I <sub>OH</sub>                    | Output Current – High  | –                       | –   | –24             | mA   |      |
| I <sub>OL</sub>                    | Output Current – Low   | –                       | –   | 24              | mA   |      |

- V<sub>in</sub> from 30% to 70% V<sub>CC</sub>; see individual Data Sheets for devices that differ from the typical input rise and fall times.
- V<sub>in</sub> from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

## DC CHARACTERISTICS

| Symbol           | Parameter                            | V <sub>CC</sub><br>(V) | 74AC                   |                   | 74ACT                                 | Unit  | Conditions   |
|------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------------|---|--|
|                  |                                      |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> =<br>–40°C to<br>+85°C |   |  |
|                  |                                      |                        | Typ                    | Guaranteed Limits |                                       |   |  |
| V <sub>IH</sub>  | Minimum High Level<br>Input Voltage  | 3.0                    | 1.5                    | 2.1               | 2.1                                   | V   | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V |
|                  |                                      | 4.5                    | 2.25                   | 3.15              | 3.15                                  |   |  |
|                  |                                      | 5.5                    | 2.75                   | 3.85              | 3.85                                  |   |  |
| V <sub>IL</sub>  | Maximum Low Level<br>Input Voltage   | 3.0                    | 1.5                    | 0.9               | 0.9                                   | V   | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V |
|                  |                                      | 4.5                    | 2.25                   | 1.35              | 1.35                                  |   |  |
|                  |                                      | 5.5                    | 2.75                   | 1.65              | 1.65                                  |   |  |
| V <sub>OH</sub>  | Minimum High Level<br>Output Voltage | 3.0                    | 2.99                   | 2.9               | 2.9                                   | V   | I <sub>OUT</sub> = –50 μA                              |
|                  |                                      | 4.5                    | 4.49                   | 4.4               | 4.4                                   |   |  |
|                  |                                      | 5.5                    | 5.49                   | 5.4               | 5.4                                   |   |  |
|                  | 3.0                                  | –                      | 2.56                   | 2.46              | V                                     | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>–12 mA<br>I <sub>OH</sub> –24 mA<br>–24 mA |  |
|                  | 4.5                                  | –                      | 3.86                   | 3.76              |                                       |   |  |
| 5.5              | –                                    | 4.86                   | 4.76                   |                   |                                       |   |  |
| V <sub>OL</sub>  | Maximum Low Level<br>Output Voltage  | 3.0                    | 0.002                  | 0.1               | 0.1                                   | V   | I <sub>OUT</sub> = 50 μA                               |
|                  |                                      | 4.5                    | 0.001                  | 0.1               | 0.1                                   |   |  |
|                  |                                      | 5.5                    | 0.001                  | 0.1               | 0.1                                   |   |  |
|                  | 3.0                                  | –                      | 0.36                   | 0.44              | V                                     | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>12 mA<br>I <sub>OL</sub> 24 mA<br>24 mA    |  |
|                  | 4.5                                  | –                      | 0.36                   | 0.44              |                                       |   |  |
| 5.5              | –                                    | 0.36                   | 0.44                   |                   |                                       |   |  |
| I <sub>IN</sub>  | Maximum Input<br>Leakage Current     | 5.5                    | –                      | ±0.1              | ±1.0                                  | μA  | V <sub>I</sub> = V <sub>CC</sub> , GND                 |
| I <sub>OLD</sub> | †Minimum Dynamic<br>Output Current   | 5.5                    | –                      | –                 | 75                                    | mA  | V <sub>OLD</sub> = 1.65 V Max                          |
| I <sub>OHD</sub> |                                      | 5.5                    | –                      | –                 | –75                                   | mA  | V <sub>OHD</sub> = 3.85 V Min                          |
| I <sub>CC</sub>  | Maximum Quiescent<br>Supply Current  | 5.5                    | –                      | 4.0               | 40                                    | μA  | V <sub>IN</sub> = V <sub>CC</sub> or GND               |

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

NOTE: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.

# MC74AC74, MC74ACT74

**AC CHARACTERISTICS** (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol           | Parameter   | V <sub>CC</sub> *<br>(V) | 74AC   |             |              | 74AC   |              | Unit | Fig. No. |
|------------------|---|--------------------------|--|-------------|--------------|--|--------------|------|----------|
|                  |   |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |             |              | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |              |      |          |
|                  |   |                          | Min  | Typ         | Max          | Min  | Max          |      |          |
| f <sub>max</sub> | Maximum Clock Frequency   | 3.3<br>5.0               | 100<br>140                                       | 125<br>160  | –<br>–       | 95<br>125  | –<br>–       | MHz  | 3–3      |
| t <sub>PLH</sub> | Propagation Delay<br>C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub> or Q <sub>n</sub> | 3.3<br>5.0               | 5.0<br>3.5                                       | 8.0<br>6.0  | 12.5<br>9.0  | 4.0<br>3.0   | 13.0<br>10.0 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub> or Q <sub>n</sub> | 3.3<br>5.0               | 4.0<br>3.0                                       | 10.5<br>8.0 | 12.0<br>9.5  | 3.5<br>2.5   | 13.5<br>10.5 | ns   | 3–6      |
| t <sub>PLH</sub> | Propagation Delay<br>C <sub>Pn</sub> to Q <sub>n</sub> or Q <sub>n</sub>                    | 3.3<br>5.0               | 4.5<br>3.5                                       | 8.0<br>6.0  | 13.5<br>10.0 | 4.0<br>3.0   | 16.0<br>10.5 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>C <sub>Pn</sub> to Q <sub>n</sub> or Q <sub>n</sub>                    | 3.3<br>5.0               | 3.5<br>2.5                                       | 8.0<br>6.0  | 14.0<br>10.0 | 3.5<br>2.5   | 14.5<br>10.5 | ns   | 3–6      |

\*Voltage Range 3.3 V is 3.3 V ±0.3 V.  
Voltage Range 5.0 V is 5.0 V ±0.5 V.

## AC OPERATING REQUIREMENTS

| Symbol           | Parameter  | V <sub>CC</sub> *<br>(V) | 74AC   |                    | 74AC   |  | Unit | Fig. No. |
|------------------|--|--------------------------|--|--------------------|--|--|------|----------|
|                  |  |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |                    | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |  |      |          |
|                  |  |                          | Typ  | Guaranteed Minimum |  |  |      |          |
| t <sub>s</sub>   | Set-up Time, HIGH or LOW<br>D <sub>n</sub> to C <sub>Pn</sub>        | 3.3<br>5.0               | 1.5<br>1.0                                       | 4.0<br>3.0         | 4.5<br>3.0   |  | ns   | 3–9      |
| t <sub>h</sub>   | Hold Time, HIGH or LOW<br>D <sub>n</sub> to C <sub>Pn</sub>          | 3.3<br>5.0               | -2.0<br>-1.5                                     | 0.5<br>0.5         | 0.5<br>0.5   |  | ns   | 3–9      |
| t <sub>w</sub>   | C <sub>Pn</sub> or C <sub>Dn</sub> or S <sub>Dn</sub><br>Pulse Width | 3.3<br>5.0               | 3.0<br>2.5                                       | 5.5<br>4.5         | 7.0<br>5.0   |  | ns   | 3–6      |
| t <sub>rec</sub> | Recovery Time<br>C <sub>Dn</sub> or S <sub>Dn</sub> to CP            | 3.3<br>5.0               | -2.5<br>-2.0                                     | 0<br>0             | 0<br>0   |  | ns   | 3–9      |

\*Voltage Range 3.3 V is 3.3 V ±0.3 V.  
Voltage Range 5.0 V is 5.0 V ±0.5 V.

# MC74AC74, MC74ACT74

## DC CHARACTERISTICS

| Symbol             | Parameter                              | V <sub>CC</sub><br>(V) | 74ACT                  |                   | 74ACT                                 |    | Unit  | Conditions |
|--------------------|--|------------------------|------------------------|-------------------|---------------------------------------|----|---|------------|
|                    |  |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> =<br>-40°C to<br>+85°C |    |   |            |
|                    |  |                        | Typ                    | Guaranteed Limits |                                       |    |   |            |
| V <sub>IH</sub>    | Minimum High Level<br>Input Voltage    | 4.5                    | 1.5                    | 2.0               | 2.0                                   | V  | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> - 0.1 V          |            |
|                    |  | 5.5                    | 1.5                    | 2.0               | 2.0                                   |    |   |            |
| V <sub>IL</sub>    | Maximum Low Level<br>Input Voltage     | 4.5                    | 1.5                    | 0.8               | 0.8                                   | V  | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> - 0.1 V          |            |
|                    |  | 5.5                    | 1.5                    | 0.8               | 0.8                                   |    |   |            |
| V <sub>OH</sub>    | Minimum High Level<br>Output Voltage   | 4.5                    | 4.49                   | 4.4               | 4.4                                   | V  | I <sub>OUT</sub> = -50 μA                                       |            |
|                    |  | 5.5                    | 5.49                   | 5.4               | 5.4                                   |    |   |            |
|                    |  | 4.5                    | -                      | 3.86              | 3.76                                  | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>-24 mA |            |
|                    |  | 5.5                    | -                      | 4.86              | 4.76                                  |    |   |            |
| V <sub>OL</sub>    | Maximum Low Level<br>Output Voltage    | 4.5                    | 0.001                  | 0.1               | 0.1                                   | V  | I <sub>OUT</sub> = 50 μA  |            |
|                    |  | 5.5                    | 0.001                  | 0.1               | 0.1                                   |    |   |            |
|                    |  | 4.5                    | -                      | 0.36              | 0.44                                  | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>24 mA  |            |
|                    |  | 5.5                    | -                      | 0.36              | 0.44                                  |    |   |            |
| I <sub>IN</sub>    | Maximum Input<br>Leakage Current       | 5.5                    | -                      | ±0.1              | ±1.0                                  | μA | V <sub>I</sub> = V <sub>CC</sub> , GND                          |            |
| ΔI <sub>CCCT</sub> | Additional Max. I <sub>CC</sub> /Input | 5.5                    | 0.6                    | -                 | 1.5                                   | mA | V <sub>I</sub> = V <sub>CC</sub> - 2.1 V                        |            |
| I <sub>OLD</sub>   | †Minimum Dynamic<br>Output Current     | 5.5                    | -                      | -                 | 75                                    | mA | V <sub>OLD</sub> = 1.65 V Max                                   |            |
| I <sub>OHD</sub>   |  | 5.5                    | -                      | -                 | -75                                   | mA | V <sub>OHD</sub> = 3.85 V Min                                   |            |
| I <sub>CC</sub>    | Maximum Quiescent<br>Supply Current    | 5.5                    | -                      | 4.0               | 40                                    | μA | V <sub>IN</sub> = V <sub>CC</sub> or GND                        |            |

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

## AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol           | Parameter   | V <sub>CC</sub> *<br>(V) | 74ACT  |     |      | 74ACT  |      | Unit | Fig.<br>No. |
|------------------|---|--------------------------|--|-----|------|--|------|------|-------------|
|                  |   |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |     |      | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |      |      |             |
|                  |   |                          | Min  | Typ | Max  | Min  | Max  |      |             |
| f <sub>max</sub> | Maximum Clock<br>Frequency  | 5.0                      | 145  | 210 | -    | 125  | -    | MHz  | 3-3         |
| t <sub>PLH</sub> | Propagation Delay<br>C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub> or Q <sub>n</sub> | 5.0                      | 3.0  | 5.5 | 9.5  | 2.5  | 10.5 | ns   | 3-6         |
| t <sub>PHL</sub> | Propagation Delay<br>C <sub>Dn</sub> or S <sub>Dn</sub> to Q <sub>n</sub> or Q <sub>n</sub> | 5.0                      | 3.0  | 6.0 | 10.0 | 3.0  | 11.5 | ns   | 3-6         |
| t <sub>PLH</sub> | Propagation Delay<br>C <sub>Pn</sub> to Q <sub>n</sub> or Q <sub>n</sub>                    | 5.0                      | 4.0  | 7.5 | 11.0 | 4.0  | 13.0 | ns   | 3-6         |
| t <sub>PHL</sub> | Propagation Delay<br>C <sub>Pn</sub> to Q <sub>n</sub> or Q <sub>n</sub>                    | 5.0                      | 3.5  | 6.0 | 10.0 | 3.0  | 11.5 | ns   | 3-6         |

\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

# MC74AC74, MC74ACT74

## AC OPERATING REQUIREMENTS

| Symbol           | Parameter  | V <sub>CC</sub> *<br>(V) | 74ACT  |                    | 74ACT  |    | Unit | Fig. No. |
|------------------|--|--------------------------|--|--------------------|--|----|------|----------|
|                  |  |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |                    | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |    |      |          |
|                  |  |                          | Typ  | Guaranteed Minimum |  |    |      |          |
| t <sub>s</sub>   | Set-up Time, HIGH or LOW<br>D <sub>n</sub> to CP <sub>n</sub>                                  | 5.0                      | 1.0  | 3.0                | 3.5  | ns | 3-9  |          |
| t <sub>h</sub>   | Hold Time, HIGH or LOW<br>D <sub>n</sub> to CP <sub>n</sub>                                    | 5.0                      | -0.5   | 1.0                | 1.0  | ns | 3-9  |          |
| t <sub>w</sub>   | CP <sub>n</sub> or $\overline{C}$ <sub>Dn</sub> or $\overline{S}$ <sub>Dn</sub><br>Pulse Width | 5.0                      | 3.0  | 5.0                | 6.0  | ns | 3-6  |          |
| t <sub>rec</sub> | Recovery Time<br>$\overline{C}$ <sub>Dn</sub> or $\overline{S}$ <sub>Dn</sub> to CP            | 5.0                      | -2.5   | 0                  | 0  | ns | 3-9  |          |

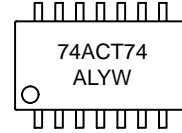
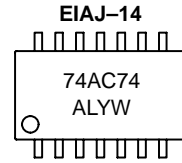
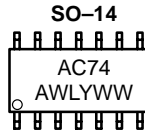
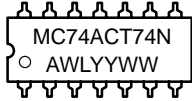
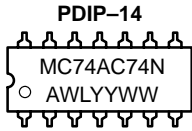
\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## CAPACITANCE

| Symbol          | Parameter                     | Value<br>Typ | Unit | Test Conditions         |
|-----------------|-------------------------------|--------------|------|-------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5          | pF   | V <sub>CC</sub> = 5.0 V |
| C <sub>PD</sub> | Power Dissipation Capacitance | 35           | pF   | V <sub>CC</sub> = 5.0 V |

# MC74AC74, MC74ACT74

## MARKING DIAGRAMS



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week