

# MC74AC109, MC74ACT109

## Dual JK Positive Edge-Triggered Flip-Flop

The MC74AC109/74ACT109 consists of two high-speed completely independent transition clocked JK flip-flops. The clocking operation is independent of rise and fall times of the clock waveform. The JK design allows operation as a D flip-flop (refer to MC74AC74/74ACT74 data sheet) by connecting the J and K inputs together.

### 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
- 'ACT109 Has TTL Compatible Inputs

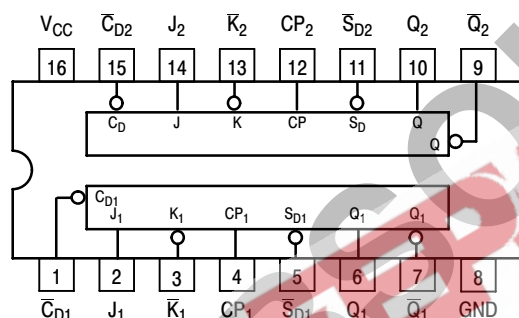


Figure 1. Pinout; 16-Lead Packages Conductors (Top View)

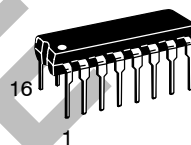
### PIN ASSIGNMENT

| PIN                                                                        | FUNCTION            |
|----------------------------------------------------------------------------|---------------------|
| J <sub>1</sub> , J <sub>2</sub> , K <sub>1</sub> , K <sub>2</sub>          | Data Inputs         |
| CP <sub>1</sub> , CP <sub>2</sub>                                          | Clock Pulse Inputs  |
| $\bar{C}_D1$ , $\bar{C}_D2$                                                | Direct Clear Inputs |
| $\bar{S}_D1$ , $\bar{S}_D2$                                                | Direct Set Inputs   |
| Q <sub>1</sub> , Q <sub>2</sub> , Q <sub>1</sub> -bar, Q <sub>2</sub> -bar | Outputs             |

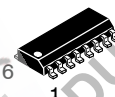


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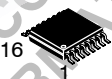
<http://onsemi.com>



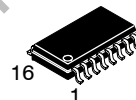
DIP-16  
N SUFFIX  
CASE 648



SO-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F



EIAJ-16  
M SUFFIX  
CASE 966

### ORDERING INFORMATION

| Device         | Package  | Shipping         |
|----------------|----------|------------------|
| MC74AC109N     | PDIP-16  | 25 Units/Rail    |
| MC74ACT109N    | PDIP-16  | 25 Units/Rail    |
| MC74AC109D     | SOIC-16  | 48 Units/Rail    |
| MC74ACT109D    | SOIC-16  | 48 Units/Rail    |
| MC74AC109DR2   | SOIC-16  | 2500 Tape & Reel |
| MC74ACT109DR2  | SOIC-16  | 2500 Tape & Reel |
| MC74AC109DT    | TSSOP-16 | 96 Units/Rail    |
| MC74ACT109DT   | TSSOP-16 | 96 Units/Rail    |
| MC74AC109DTR2  | TSSOP-16 | 2500 Tape & Reel |
| MC74ACT109DTR2 | TSSOP-16 | 2500 Tape & Reel |
| MC74AC109M     | EIAJ-16  | 50 Units/Rail    |
| MC74ACT109M    | EIAJ-16  | 50 Units/Rail    |
| MC74AC109MEL   | EIAJ-16  | 2000 Tape & Reel |
| MC74ACT109MEL  | EIAJ-16  | 2000 Tape & Reel |

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 6 of this data sheet.

## MC74AC109, MC74ACT109

**TRUTH TABLE**

| Inputs      |             |              |   |           | Outputs |             |
|-------------|-------------|--------------|---|-----------|---------|-------------|
| $\bar{S}_D$ | $\bar{C}_D$ | CP           | J | $\bar{K}$ | Q       | $\bar{Q}$   |
| L           | H           | X            | X | X         | H       | L           |
| H           | L           | X            | X | X         | L       | H           |
| L           | L           | X            | X | X         | H       | H           |
| H           | H           | $\downarrow$ | L | L         | L       | H           |
| H           | H           | $\downarrow$ | H | L         | Toggle  |             |
| H           | H           | $\downarrow$ | L | H         | $Q_0$   | $\bar{Q}_0$ |
| H           | H           | $\downarrow$ | H | H         | H       | L           |
| H           | H           | L            | X | X         | $Q_0$   | $\bar{Q}_0$ |

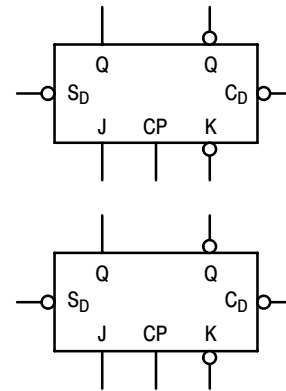
H = HIGH Voltage Level

L = LOW Voltage Level

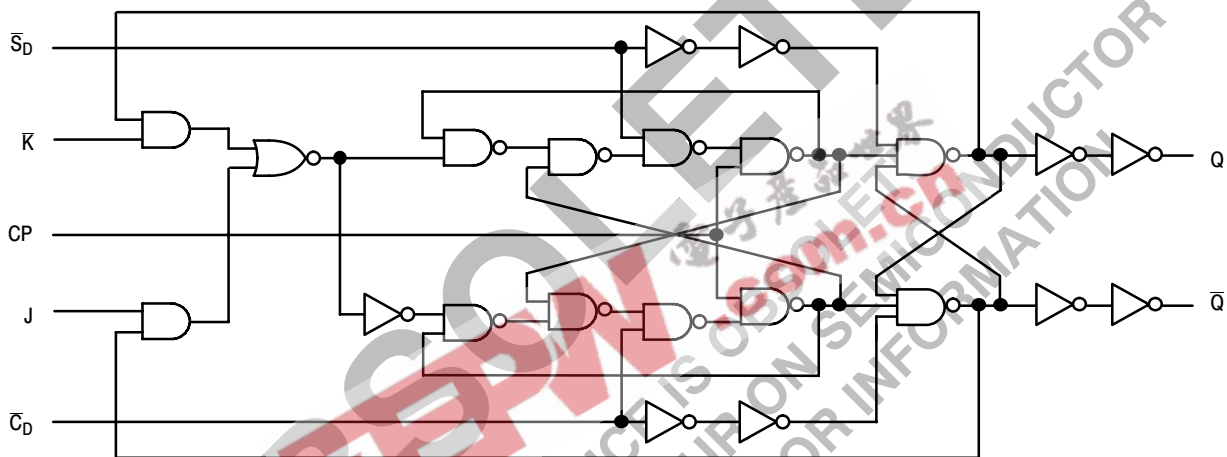
$\downarrow$  = LOW-to-HIGH Clock Transition

X = Immaterial

$Q_0(\bar{Q}_0)$  = Previous  $Q_0(\bar{Q}_0)$  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**  
(One Half Shown)

### 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            | $^{\circ}\text{C}$ |

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

# MC74AC109, MC74ACT109

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                                               | Min                     | Typ | Max             | Unit |
|------------------------------------|-------------------------------------------------------------------------|-------------------------|-----|-----------------|------|
| V <sub>CC</sub>                    | Supply Voltage                                                          | 'AC                     | 2.0 | 5.0             | V    |
|                                    |                                                                         | 'ACT                    | 4.5 | 5.0             |      |
| 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 1)<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 2)<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   |

1. 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.

2. 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 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 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 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 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 Leakage Current     | 5.5                    | –                      | ±0.1              | ±1.0                                  | μA   | V <sub>I</sub> = V <sub>CC</sub> , GND                                                              |
| I <sub>OLD</sub> | †Minimum Dynamic 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 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>.

# MC74AC109, MC74ACT109

## 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 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               | 125<br>150                                       | –<br>– | –<br>–       | 100<br>125                                                | –<br>–       | MHz  | 3–3      |
| t <sub>PLH</sub> | Propagation Delay<br>CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$                            | 3.3<br>5.0               | 4.0<br>2.5                                       | –<br>– | 13.5<br>10.0 | 3.5<br>2.0                                                | 16.0<br>10.5 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$                            | 3.3<br>5.0               | 3.0<br>2.0                                       | –<br>– | 14.0<br>10.0 | 3.0<br>1.5                                                | 14.5<br>10.5 | ns   | 3–6      |
| t <sub>PLH</sub> | Propagation Delay<br>$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$ | 3.3<br>5.0               | 3.0<br>2.5                                       | –<br>– | 12.0<br>9.0  | 2.5<br>2.0                                                | 13.0<br>10.0 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$ | 3.3<br>5.0               | 3.0<br>2.0                                       | –<br>– | 12.0<br>9.5  | 3.0<br>2.0                                                | 13.5<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>J <sub>n</sub> or K <sub>n</sub> to CP <sub>n</sub> | 3.3                      | –                                                | 6.5                | 7.5                                                          | ns | 3–9  |          |
|                  |                                                                                 | 5.0                      | –                                                | 4.5                | 5.0                                                          |    |      |          |
| t <sub>h</sub>   | Hold Time, HIGH or LOW<br>J <sub>n</sub> or K <sub>n</sub> to CP <sub>n</sub>   | 3.3                      | –                                                | 0                  | 0                                                            | ns | 3–9  |          |
|                  |                                                                                 | 5.0                      | –                                                | 0.5                | 0.5                                                          |    |      |          |
| t <sub>w</sub>   | Pulse Width<br>CP <sub>n</sub> or C <sub>Dn</sub> or S <sub>Dn</sub>            | 3.3                      | –                                                | 4.0                | 4.5                                                          | ns | 3–6  |          |
|                  |                                                                                 | 5.0                      | –                                                | 3.5                | 3.5                                                          |    |      |          |
| t <sub>rec</sub> | Recovery Time<br>C <sub>Dn</sub> or S <sub>Dn</sub> to CP                       | 3.3                      | –                                                | 0                  | 0                                                            | ns | 3–9  |          |
|                  |                                                                                 | 5.0                      | –                                                | 0                  | 0                                                            |    |      |          |

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

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

## DC CHARACTERISTICS

| Symbol          | Parameter                         | V <sub>CC</sub><br>(V) | 74ACT                  |                   | 74ACT                           |   | Unit                                                                                      | Conditions |
|-----------------|-----------------------------------|------------------------|------------------------|-------------------|---------------------------------|---|-------------------------------------------------------------------------------------------|------------|
|                 |                                   |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = –40°C to +85°C |   |                                                                                           |            |
|                 |                                   |                        | Typ                    | Guaranteed Limits |                                 |   |                                                                                           |            |
| V <sub>IH</sub> | Minimum High Level Input Voltage  | 4.5<br>5.5             | 1.5<br>1.5             | 2.0<br>2.0        | 2.0<br>2.0                      | V | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V                                       |            |
| V <sub>IL</sub> | Maximum Low Level Input Voltage   | 4.5<br>5.5             | 1.5<br>1.5             | 0.8<br>0.8        | 0.8<br>0.8                      | V | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V                                       |            |
| V <sub>OH</sub> | Minimum High Level Output Voltage | 4.5<br>5.5             | 4.49<br>5.49           | 4.4<br>5.4        | 4.4<br>5.4                      | V | I <sub>OUT</sub> = –50 μA                                                                 |            |
|                 |                                   | 4.5<br>5.5             | –<br>–                 | 3.86<br>4.86      | 3.76<br>4.76                    | V | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>–24 mA<br>I <sub>OH</sub> –24 mA |            |

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

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

# MC74AC109, MC74ACT109

## DC CHARACTERISTICS (continued)

| 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>OL</sub>    | Maximum Low Level 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<br>I <sub>OL</sub> 24 mA |            |
|                    |                                        | 5.5                    | –                      | 0.36              | 0.44                                  |    |                                                                                         |            |
| I <sub>IN</sub>    | Maximum Input Leakage Current          | 5.5                    | –                      | ±0.1              | ±1.0                                  | μA | V <sub>I</sub> = V <sub>CC</sub> , GND                                                  |            |
| ΔI <sub>CC</sub> T | 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 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 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. 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                                                                               | 5.0                      | 145                                              | –   | –    | 125                                                          | –    | MHz  | 3–3      |
| t <sub>PLH</sub> | Propagation Delay<br>CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$                            | 5.0                      | 4.0                                              | –   | 11.0 | 3.5                                                          | 13.0 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$                            | 5.0                      | 3.0                                              | –   | 10.0 | 2.5                                                          | 11.5 | ns   | 3–6      |
| t <sub>PLH</sub> | Propagation Delay<br>$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$ | 5.0                      | 2.5                                              | –   | 9.5  | 2.0                                                          | 10.5 | ns   | 3–6      |
| t <sub>PHL</sub> | Propagation Delay<br>$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$ | 5.0                      | 2.5                                              | –   | 10.0 | 2.0                                                          | 11.5 | ns   | 3–6      |

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

## AC OPERATING REQUIREMENTS

| 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 |      |             |
|                |                                                                                 |                          | Typ                                              | Guaranteed Minimum |                                                              |      |             |
| t <sub>s</sub> | Set-up Time, HIGH or LOW<br>J <sub>n</sub> or K <sub>n</sub> to CP <sub>n</sub> | 5.0                      | –                                                | 2.0                | 2.5                                                          | ns   | 3–9         |
| t <sub>h</sub> | Hold Time, HIGH or LOW<br>J <sub>n</sub> or K <sub>n</sub> to CP <sub>n</sub>   | 5.0                      | –                                                | 2.0                | 2.0                                                          | ns   | 3–9         |
| t <sub>w</sub> | Pulse Width<br>CP <sub>n</sub> or C <sub>Dn</sub> or S <sub>Dn</sub>            | 5.0                      | –                                                | 5.0                | 6.0                                                          | ns   | 3–6         |

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

## MC74AC109, MC74ACT109

### AC OPERATING REQUIREMENTS (continued)

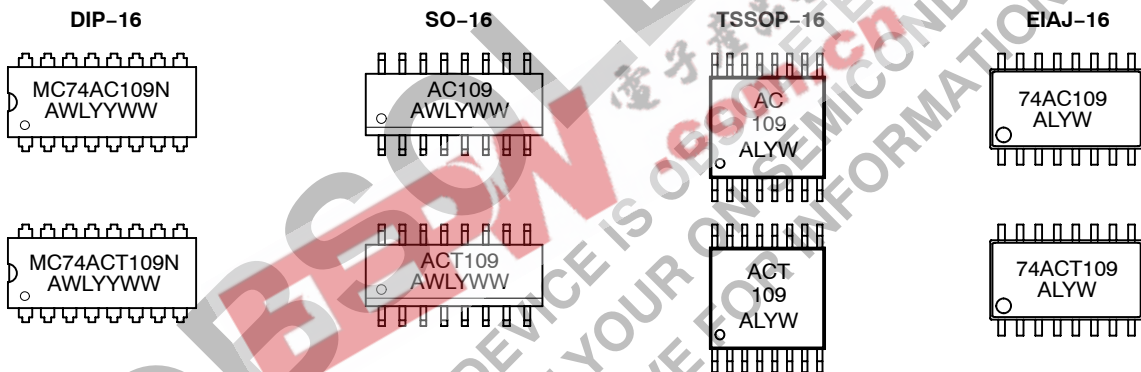
| Symbol           | Parameter                                                 | V <sub>CC</sub> *<br>(V) | 74ACT                                            |                    | 74ACT                                                        | Unit | Fig.<br>No. |
|------------------|-----------------------------------------------------------|--------------------------|--------------------------------------------------|--------------------|--------------------------------------------------------------|------|-------------|
|                  |                                                           |                          | 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 |      |             |
|                  |                                                           |                          | Typ                                              | Guaranteed Minimum |                                                              |      |             |
| t <sub>rec</sub> | Recovery Time<br>C <sub>Dn</sub> or S <sub>Dn</sub> to CP | 5.0                      | –                                                | 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 |

### MARKING DIAGRAMS



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

# MC74AC109, MC74ACT109

## PACKAGE DIMENSIONS

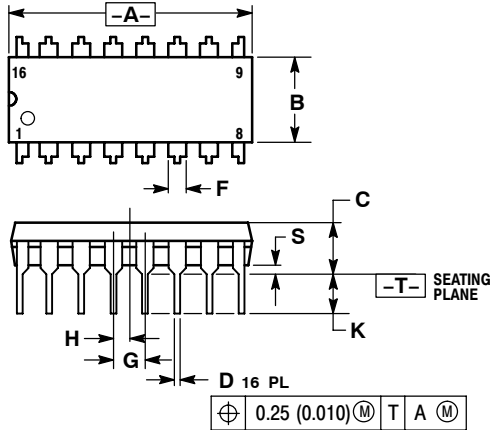
### PDIP-16

#### N SUFFIX

16 PIN PLASTIC DIP PACKAGE

CASE 648-08

ISSUE R



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

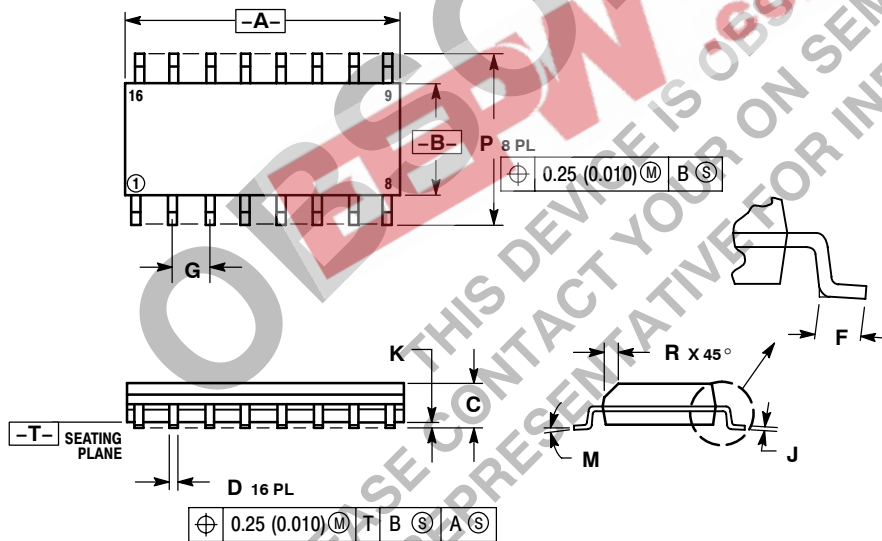
### SO-16

#### D SUFFIX

16 PIN PLASTIC SOIC PACKAGE

CASE 751B-05

ISSUE J



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

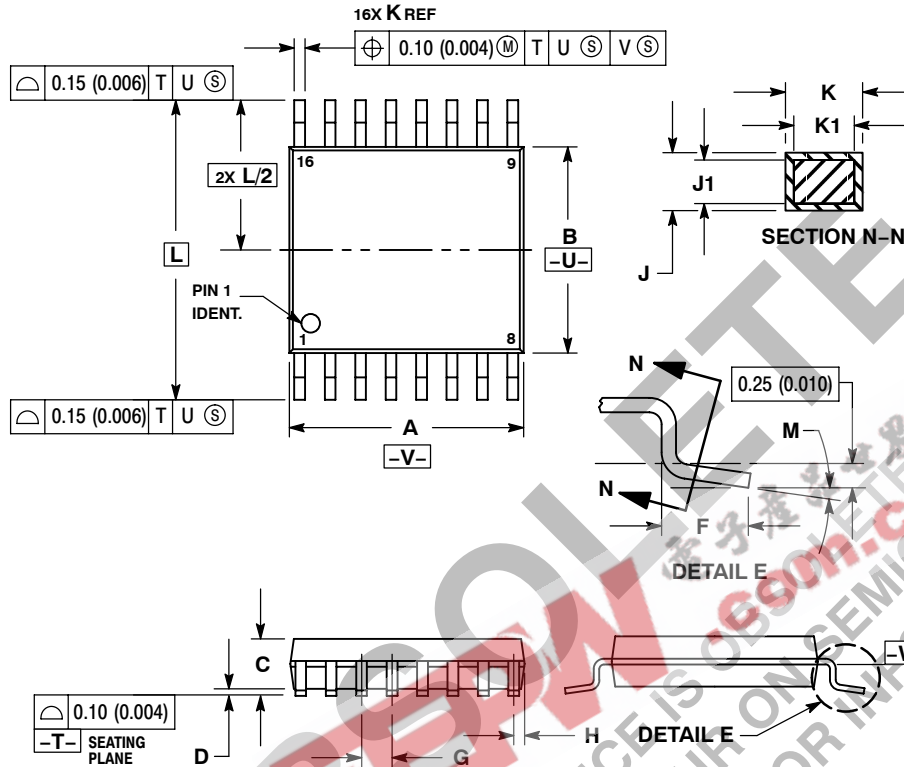
| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

# MC74AC109, MC74ACT109

## PACKAGE DIMENSIONS

### TSSOP-16 DT SUFFIX

16 PIN PLASTIC TSSOP PACKAGE  
CASE948F-01  
ISSUE O

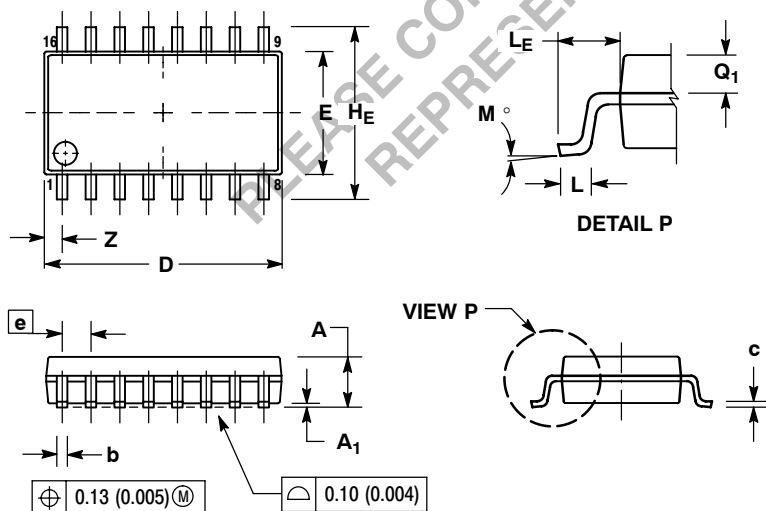


#### NOTES:

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   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| E   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.18        | 0.28 | 0.007     | 0.011 |
| 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°    |

### EIAJ-16 M SUFFIX 16 PIN PLASTIC EIAJ PACKAGE CASE966-01 ISSUE O



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | ---         | 2.05  | ---       | 0.081 |
| A1  | 0.05        | 0.20  | 0.002     | 0.008 |
| b   | 0.35        | 0.50  | 0.014     | 0.020 |
| c   | 0.18        | 0.27  | 0.007     | 0.011 |
| D   | 9.90        | 10.50 | 0.390     | 0.413 |
| E   | 5.10        | 5.45  | 0.201     | 0.215 |
| e   | 1.27 BSC    |       | 0.050 BSC |       |
| H_E | 7.40        | 8.20  | 0.291     | 0.323 |
| L   | 0.50        | 0.85  | 0.020     | 0.033 |
| L_E | 1.10        | 1.50  | 0.043     | 0.059 |
| M   | 0°          | 10°   | 0°        | 10°   |
| Q1  | 0.70        | 0.90  | 0.028     | 0.035 |
| Z   | ---         | 0.78  | ---       | 0.031 |

## MC74AC109, MC74ACT109

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