



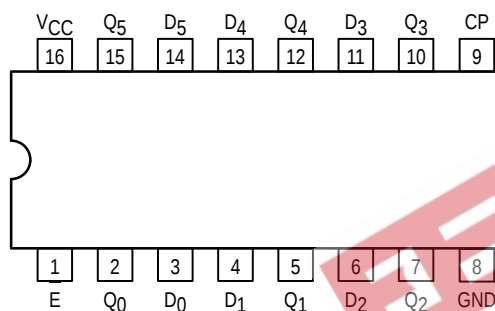
**MOTOROLA**

## MC74AC378 MC74ACT378

### Parallel D Register with Enable

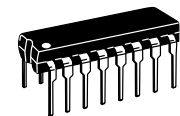
The MC74AC378/74ACT378 is a 6-bit register with a buffered common Enable. This device is similar to the MC74AC174/74ACT174, but with common Enable rather than common Master Reset.

- 6-Bit High-Speed Parallel Register
- Positive Edge-Triggered D-Type Inputs
- Fully Buffered Common Clock and Enable Inputs
- Outputs Source/Sink 24 mA
- 'ACT378 Has TTL Compatible Inputs

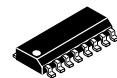


#### PIN NAMES

|                                |                   |
|--------------------------------|-------------------|
| E                              | Enable Input      |
| D <sub>0</sub> -D <sub>5</sub> | Data Inputs       |
| CP                             | Clock Pulse Input |
| Q <sub>0</sub> -Q <sub>5</sub> | Outputs           |



N SUFFIX  
CASE 648-08  
PLASTIC



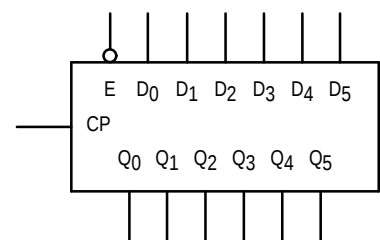
D SUFFIX  
CASE 751B-05  
PLASTIC

#### TRUTH TABLE

| Inputs |    |                | Outputs        |
|--------|----|----------------|----------------|
| E      | CP | D <sub>n</sub> | Q <sub>n</sub> |
| H      | ┐  | X              | No Change      |
| L      | ┐  | H              | H              |
| L      | ┐  | L              | L              |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
┐ = LOW-to-HIGH Transition

#### LOGIC SYMBOL



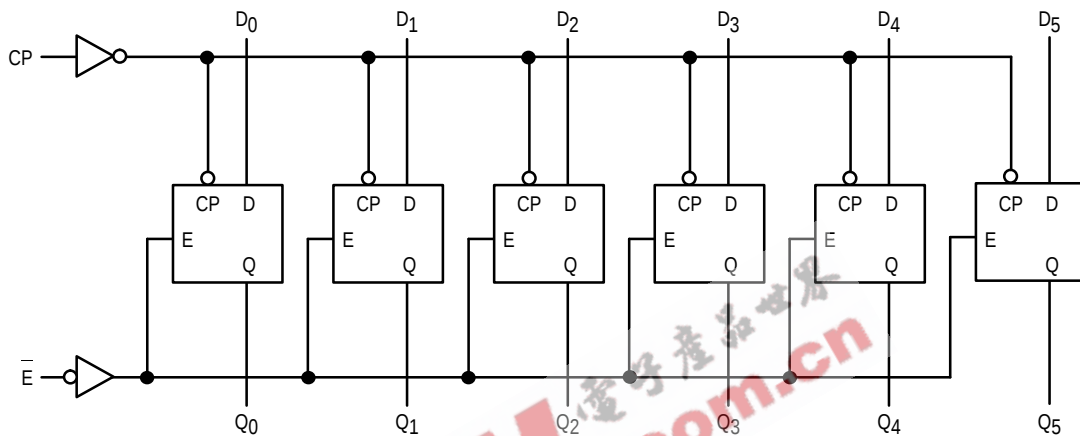
# MC74AC378 MC74ACT378

## FUNCTIONAL DESCRIPTION

The MC74AC378/74ACT378 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Enable (E) inputs are common to all flip-flops.

When the  $\overline{E}$  input is LOW, new data is entered into the register on the LOW-to-HIGH transition of the CP input. When the E input is HIGH, the register will retain the present data independent of the CP input.

## LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## MAXIMUM RATINGS\*

| Symbol           | Parameter                                        | Value                        | Unit |
|------------------|--------------------------------------------------|------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage (Referenced to GND)            | −0.5 to +7.0                 | V    |
| V <sub>in</sub>  | DC Input Voltage (Referenced to GND)             | −0.5 to V <sub>CC</sub> +0.5 | V    |
| V <sub>out</sub> | DC Output Voltage (Referenced to GND)            | −0.5 to V <sub>CC</sub> +0.5 | V    |
| I <sub>in</sub>  | DC Input Current, per Pin                        | ±20                          | mA   |
| I <sub>out</sub> | DC Output Sink/Source Current, per Pin           | ±50                          | mA   |
| I <sub>CC</sub>  | DC V <sub>CC</sub> or GND Current per Output Pin | ±50                          | mA   |
| T <sub>stg</sub> | Storage Temperature                              | −65 to +150                  | °C   |

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

# MC74AC378 MC74ACT378

## 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                   |                   | 74AC                               |    | Unit                                                                                                | Conditions |
|------------------|-----------------------------------|------------------------|------------------------|-------------------|------------------------------------|----|-----------------------------------------------------------------------------------------------------|------------|
|                  |                                   |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> =<br>−40°C to +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                    |                        | 8.0               | 80                                 | 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>.

## MC74AC378 MC74ACT378

### AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol           | Parameter                                 | V <sub>CC</sub> *<br>(V) | 74AC                                             |     |             | 74AC                                                         |             | 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                | 3.3<br>5.0               | 125<br>160                                       |     |             | 110<br>145                                                   |             | MHz  | 3-3         |
| t <sub>PLH</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 3.3<br>5.0               | 2.5<br>1.5                                       |     | 11<br>8.0   | 2.5<br>1.5                                                   | 12.5<br>9.0 | ns   | 3-6         |
| t <sub>PHL</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 3.3<br>5.0               | 2.5<br>1.5                                       |     | 10.5<br>7.5 | 2.5<br>1.5                                                   | 11<br>8.0   | 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> | Setup Time, HIGH or LOW<br>D <sub>N</sub> to CP | 3.3                      |                                                  | 3.0                | 3.5                                                          | ns | 3-9  |          |
|                |                                                 | 5.0                      |                                                  | 2.0                | 2.5                                                          |    |      |          |
| t <sub>h</sub> | Hold Time, HIGH or LOW<br>D <sub>N</sub> to CP  | 3.3                      |                                                  | 2.0                | 2.0                                                          | ns | 3-9  |          |
|                |                                                 | 5.0                      |                                                  | 2.0                | 2.0                                                          |    |      |          |
| t <sub>s</sub> | Setup Time, HIGH or LOW<br>E to CP              | 3.3                      |                                                  | 2.0                | 2.0                                                          | ns | 3-9  |          |
|                |                                                 | 5.0                      |                                                  | 2.0                | 2.0                                                          |    |      |          |
| t <sub>h</sub> | Hold Time, HIGH or LOW<br>E to CP               | 3.3                      |                                                  | 2.0                | 2.0                                                          | ns | 3-9  |          |
|                |                                                 | 5.0                      |                                                  | 2.0                | 2.0                                                          |    |      |          |
| t <sub>w</sub> | CP Pulse Width<br>HIGH or LOW                   | 3.3                      |                                                  | 4.5                | 5.5                                                          | ns | 3-6  |          |
|                |                                                 | 5.0                      |                                                  | 3.5                | 4.0                                                          |    |      |          |

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

# MC74AC378 MC74ACT378

## 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 +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<br>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<br>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             |                        | 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 |            |
| V <sub>OL</sub>   | Maximum Low Level Output Voltage       | 4.5<br>5.5             | 0.001<br>0.001         | 0.1<br>0.1        | 0.1<br>0.1                         | V  | I <sub>OUT</sub> = 50 μA                                                                  |            |
|                   |                                        | 4.5<br>5.5             |                        | 0.36<br>0.36      | 0.44<br>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   |            |
| 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>CCT</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 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                    |                        | 8.0               | 80                                 | 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)

| 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                      | 140                                              |     |     | 120                                                          |     | MHz  | 3-3         |
| t <sub>PLH</sub> | Propagation Delay<br>CP to O <sub>n</sub> | 5.0                      | 2.0                                              |     | 10  | 1.5                                                          | 11  | ns   | 3-6         |
| t <sub>PHL</sub> | Propagation Delay<br>CP to O <sub>n</sub> | 5.0                      | 2.0                                              |     | 11  | 1.5                                                          | 12  | ns   | 3-6         |

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

## MC74AC378 MC74ACT378

### 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> | Setup Time, HIGH or LOW<br>D <sub>n</sub> to CP | 5.0                      | −0.5                                             | 1.0                | 1.0                                                          | ns   | 3-9         |
| t <sub>h</sub> | Hold Time, HIGH or LOW<br>D <sub>n</sub> to CP  | 5.0                      | 1.0                                              | 1.5                | 1.5                                                          | ns   | 3-9         |
| t <sub>S</sub> | Setup Time, HIGH or LOW<br>E to CP              | 5.0                      | −0.5                                             | 1.0                | 1.0                                                          | ns   | 3-9         |
| t <sub>h</sub> | Hold Time, HIGH or LOW<br>E to CP               | 5.0                      | 2.5                                              | 3.5                | 4.0                                                          | ns   | 3-9         |
| t <sub>w</sub> | CP Pulse Width<br>HIGH or LOW                   | 5.0                      |                                                  | 3.0                | 3.5                                                          | ns   | 3-6         |

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

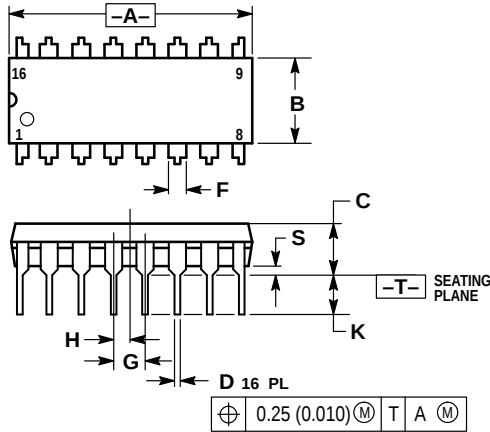
### CAPACITANCE

| 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 | 28           | pF   | V <sub>CC</sub> = 5.0 V |

# MC74AC378 MC74ACT378

## OUTLINE DIMENSIONS

### N SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R

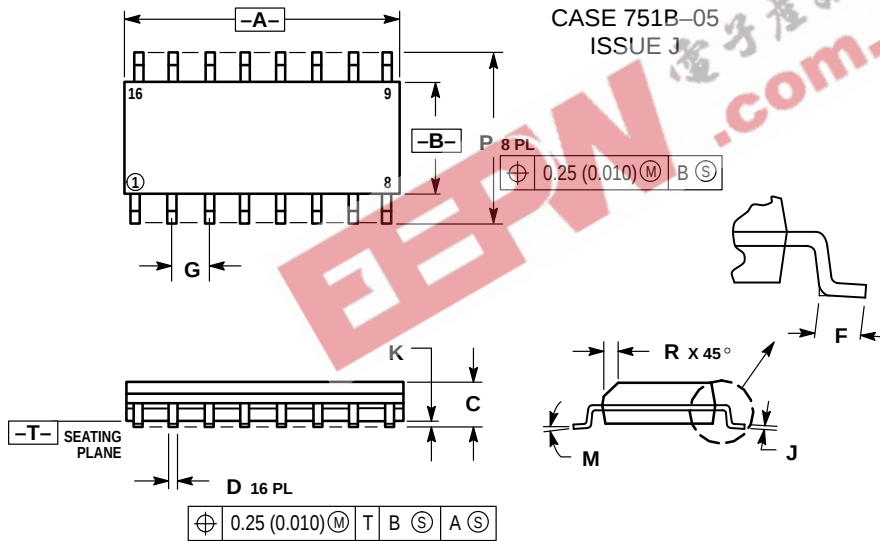


#### NOTES:

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  |

### D SUFFIX 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 |

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