

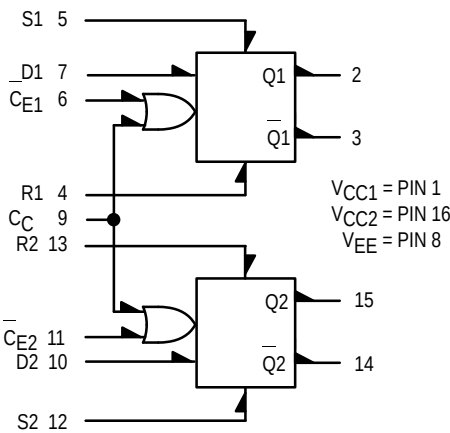
# High Speed Dual Type D Master-Slave Flip-Flop

The MC10231 is a dual master-slave type D flip-flop. Asynchronous Set (S) and Reset (R) override Clock (C<sub>C</sub>) and Clock Enable (C<sub>E</sub>) inputs. Each flip-flop may be clocked separately by holding the common clock in the low state and using the enable inputs for the clocking function. If the common clock is to be used to clock the flip-flop, the Clock Enable inputs must be in the low state. In this case, the enable inputs perform the function of controlling the common clock.

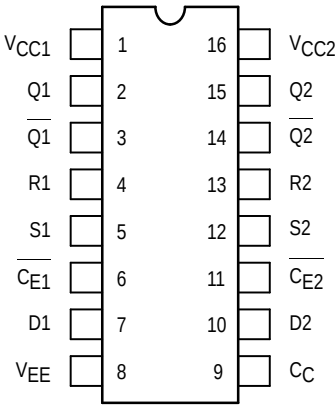
The output states of the flip-flop change on the positive transition of the clock. A change in the information present at the data (D) input will not affect the output information at any other time due to master-slave construction.

P<sub>D</sub> = 270 mW typ/pkg (No Load)  
t<sub>pd</sub> = 2 ns typ  
t<sub>Tog</sub> = 225 MHz typ  
t<sub>r</sub>, t<sub>f</sub> = 2.0 ns typ (20%–80%)

LOGIC DIAGRAM



DIP  
PIN ASSIGNMENT



Pin assignment is for Dual-in-Line Package.  
For PLCC pin assignment, see the Pin Conversion  
Tables on page 6–11 of the Motorola MECL Data  
Book (DL122/D).

CLOCKED TRUTH TABLE

| C | D | Q <sub>n+1</sub> |
|---|---|------------------|
| L | X | Q <sub>n</sub>   |
| H | L | L                |
| H | H | H                |

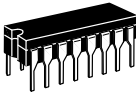
C = C<sub>E</sub> + C<sub>C</sub>. A clock H is a clock transition from a low to a high state.

R-S TRUTH TABLE

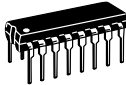
| R | S | Q <sub>n+1</sub> |
|---|---|------------------|
| L | L | Q <sub>n</sub>   |
| L | H | H                |
| H | L | L                |
| H | H | N.D.             |

N.D. = Not Defined

## MC10231



L SUFFIX  
CERAMIC PACKAGE  
CASE 620–10



P SUFFIX  
PLASTIC PACKAGE  
CASE 648–08



FN SUFFIX  
PLCC  
CASE 775–02

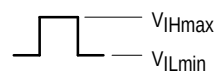


## ELECTRICAL CHARACTERISTICS

| Characteristic                               | Symbol                                                                               | Pin Under Test    | Test Limits      |                  |                  |     |                  |                  |                  | Unit |
|----------------------------------------------|--------------------------------------------------------------------------------------|-------------------|------------------|------------------|------------------|-----|------------------|------------------|------------------|------|
|                                              |                                                                                      |                   | −30°C            |                  | +25°C            |     |                  | +85°C            |                  |      |
|                                              |                                                                                      |                   | Min              | Max              | Min              | Typ | Max              | Min              | Max              |      |
| Power Supply Drain Current                   | I <sub>E</sub>                                                                       | 8                 |                  | 72               |                  | 52  | 65               |                  | 72               | mAdc |
| Input Current                                | I <sub>inH</sub>                                                                     | 4                 |                  | 650              |                  |     | 410              |                  | 410              | μAdc |
|                                              |                                                                                      | 5                 |                  | 650              |                  |     | 410              |                  | 410              |      |
|                                              |                                                                                      | 6                 |                  | 350              |                  |     | 220              |                  | 220              |      |
|                                              |                                                                                      | 7                 |                  | 350              |                  |     | 220              |                  | 220              |      |
|                                              |                                                                                      | 9                 |                  | 460              |                  |     | 290              |                  | 290              |      |
|                                              | I <sub>inL</sub>                                                                     | 4, 5*<br>6, 7, 9* |                  |                  | 0.5<br>0.5       |     |                  |                  |                  | μAdc |
| Output Voltage      Logic 1                  | V <sub>OH</sub>                                                                      | 2<br>2†           | −1.060<br>−1.060 | −0.890<br>−0.890 | −0.960<br>−0.960 |     | −0.810<br>−0.810 | −0.890<br>−0.890 | −0.700<br>−0.700 | Vdc  |
| Output Voltage      Logic 0                  | V <sub>OL</sub>                                                                      | 3<br>3†           | −1.890<br>−1.890 | −1.675<br>−1.675 | −1.850<br>−1.850 |     | −1.650<br>−1.650 | −1.825<br>−1.825 | −1.615<br>−1.615 | Vdc  |
| Threshold Voltage    Logic 1                 | V <sub>OHA</sub>                                                                     | 2<br>2†           | −1.080<br>−1.080 |                  | −0.980<br>−0.980 |     |                  | −0.910<br>−0.910 |                  | Vdc  |
| Threshold Voltage    Logic 0                 | V <sub>OLA</sub>                                                                     | 3<br>3†           |                  | −1.655<br>−1.655 |                  |     | −1.630<br>−1.630 |                  | −1.595<br>−1.595 | Vdc  |
| Switching Times    (50Ω Load)<br>Clock Input |                                                                                      |                   |                  |                  |                  |     |                  |                  |                  | ns   |
| Propagation Delay                            | t <sub>9+2−</sub><br>t <sub>6+2+</sub>                                               | 2                 | 1.5              | 3.4              | 1.5              | 2.0 | 3.3              | 1.6              | 3.7              |      |
|                                              |                                                                                      | 2                 | 1.5              | 3.4              | 1.5              | 2.0 | 3.3              | 1.6              | 3.7              |      |
| Rise Time            (20 to 80%)             | t <sub>2+</sub>                                                                      | 2                 | 0.9              | 3.3              | 1.0              | 1.3 | 3.1              | 1.0              | 3.6              |      |
| Fall Time            (20 to 80%)             | t <sub>2−</sub>                                                                      | 2                 | 0.9              | 3.3              | 1.0              | 1.3 | 3.1              | 1.0              | 3.6              |      |
| Set Input                                    |                                                                                      |                   |                  |                  |                  |     |                  |                  |                  | ns   |
| Propagation Delay                            | t <sub>5+2+</sub><br>t <sub>12+15+</sub><br>t <sub>5+3−</sub><br>t <sub>12+14−</sub> | 2                 | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 15                | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 3                 | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 14                | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
| Reset Input                                  |                                                                                      |                   |                  |                  |                  |     |                  |                  |                  | ns   |
| Propagation Delay                            | t <sub>4+2−</sub><br>t <sub>13+15−</sub><br>t <sub>4+3−</sub><br>t <sub>13+14+</sub> | 2                 | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 15                | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 3                 | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
|                                              |                                                                                      | 14                | 1.1              | 3.4              | 1.1              | 2.0 | 3.3              | 1.2              | 3.7              |      |
| Setup Time                                   | t <sub>setup</sub>                                                                   | 7                 | 1.5              |                  | 1.0              |     |                  | 1.5              |                  | ns   |
| Hold Time                                    | t <sub>hold</sub>                                                                    | 7                 | 0.9              |                  | 0.75             |     |                  | 0.9              |                  | ns   |
| Toggle Frequency (Max)                       | f <sub>tog</sub>                                                                     | 2                 | 200              |                  | 200              | 225 |                  | 200              |                  | MHz  |

\* Individually test each input; apply  $V_{ILmin}$  to pin under test.

† Output level to be measured after a clock pulse has been applied to the  $\overline{C_E}$  Input (Pin 6)



**ELECTRICAL CHARACTERISTICS** (continued)

| <div> <div>@ Test Temperature</div> <div> <div>–30°C</div> <div>+25°C</div> <div>+85°C</div> </div> </div> |                          |                   | TEST VOLTAGE VALUES (Volts)               |             |             |             |          | $V_{CC}$<br>Gnd |
|------------------------------------------------------------------------------------------------------------|--------------------------|-------------------|-------------------------------------------|-------------|-------------|-------------|----------|-----------------|
|                                                                                                            |                          |                   | $V_{IHmax}$                               | $V_{ILmin}$ | $V_{IHmin}$ | $V_{ILmax}$ | $V_{EE}$ |                 |
|                                                                                                            |                          |                   | –0.890                                    | –1.890      | –1.205      | –1.500      | –5.2     |                 |
|                                                                                                            |                          |                   | –0.810                                    | –1.850      | –1.105      | –1.475      | –5.2     |                 |
|                                                                                                            |                          |                   | –0.700                                    | –1.825      | –1.035      | –1.440      | –5.2     |                 |
| Characteristic                                                                                             | Symbol                   | Pin Under Test    | TEST VOLTAGE APPLIED TO PINS LISTED BELOW |             |             |             |          | $V_{CC}$<br>Gnd |
|                                                                                                            |                          |                   | $V_{IHmax}$                               | $V_{ILmin}$ | $V_{IHmin}$ | $V_{ILmax}$ | $V_{EE}$ |                 |
| Power Supply Drain Current                                                                                 | $I_E$                    | 8                 |                                           |             |             |             | 8        | 1, 16           |
| Input Current                                                                                              | $I_{inH}$                | 4                 | 4                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 5                 | 5                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 6                 | 6                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 7                 | 7                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 9                 | 9                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            | $I_{inL}$                | 4, 5*<br>6, 7, 9* |                                           | *           |             |             | 8<br>8   | 1, 16<br>1, 16  |
| Output Voltage Logic 1                                                                                     | $V_{OH}$                 | 2                 | 5                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 2†                | 7                                         |             |             |             | 8        | 1, 16           |
| Output Voltage Logic 0                                                                                     | $V_{OL}$                 | 3                 | 5                                         |             |             |             | 8        | 1, 16           |
|                                                                                                            |                          | 3†                | 7                                         |             |             |             | 8        | 1, 16           |
| Threshold Voltage Logic 1                                                                                  | $V_{OHA}$                | 2                 |                                           |             | 5           |             | 8        | 1, 16           |
|                                                                                                            |                          | 2†                |                                           |             | 7           | 9           | 8        | 1, 16           |
| Threshold Voltage Logic 0                                                                                  | $V_{OLA}$                | 3                 |                                           |             | 5           |             | 8        | 1, 16           |
|                                                                                                            |                          | 3†                |                                           |             | 7           | 9           | 8        | 1, 16           |
| Switching Times (50Ω Load)<br>Clock Input                                                                  |                          |                   | +1.11Vdc                                  |             | Pulse In    | Pulse Out   | –3.2 V   | +2.0 V          |
| Propagation Delay                                                                                          | $t_{9+2-}$<br>$t_{6+2+}$ | 2                 |                                           |             | 9           | 2           | 8        | 1, 16           |
|                                                                                                            |                          | 2                 | 7                                         |             | 6           | 2           | 8        | 1, 16           |
| Rise Time (20 to 80%)                                                                                      | $t_{2+}$                 | 2                 | 7                                         |             | 9           | 2           | 8        | 1, 16           |
| Fall Time (20 to 80%)                                                                                      | $t_{2-}$                 | 2                 |                                           |             | 9           | 2           | 8        | 1, 16           |
| Set Input                                                                                                  | Propagation Delay        | $t_{5+2+}$        |                                           |             | 5           | 2           | 8        | 1, 16           |
|                                                                                                            |                          | $t_{12+15+}$      |                                           |             | 12          | 15          | 8        | 1, 16           |
|                                                                                                            |                          | $t_{5+3-}$        | 6                                         |             | 5           | 3           | 8        | 1, 16           |
|                                                                                                            |                          | $t_{12+14-}$      | 9                                         |             | 12          | 14          | 8        | 1, 16           |
| Reset Input                                                                                                | Propagation Delay        | $t_{4+2-}$        |                                           |             | 4           | 2           | 8        | 1, 16           |
|                                                                                                            |                          | $t_{13+15-}$      |                                           |             | 13          | 15          | 8        | 1, 16           |
|                                                                                                            |                          | $t_{4+3-}$        | 6                                         |             | 4           | 3           | 8        | 1, 16           |
|                                                                                                            |                          | $t_{13+14+}$      | 9                                         |             | 13          | 14          | 8        | 1, 16           |
| Setup Time                                                                                                 | $t_{setup}$              | 7                 |                                           |             | 6, 7        | 2           | 8        | 1, 16           |
| Hold Time                                                                                                  | $t_{hold}$               | 7                 |                                           |             | 6, 7        | 2           | 8        | 1, 16           |
| Toggle Frequency (Max)                                                                                     | $f_{tog}$                | 2                 | * *                                       |             | 6           | 2           | 8        | 1, 16           |

\* Individually test each input applying  $V_{IH}$  or  $V_{IL}$  to input under test.

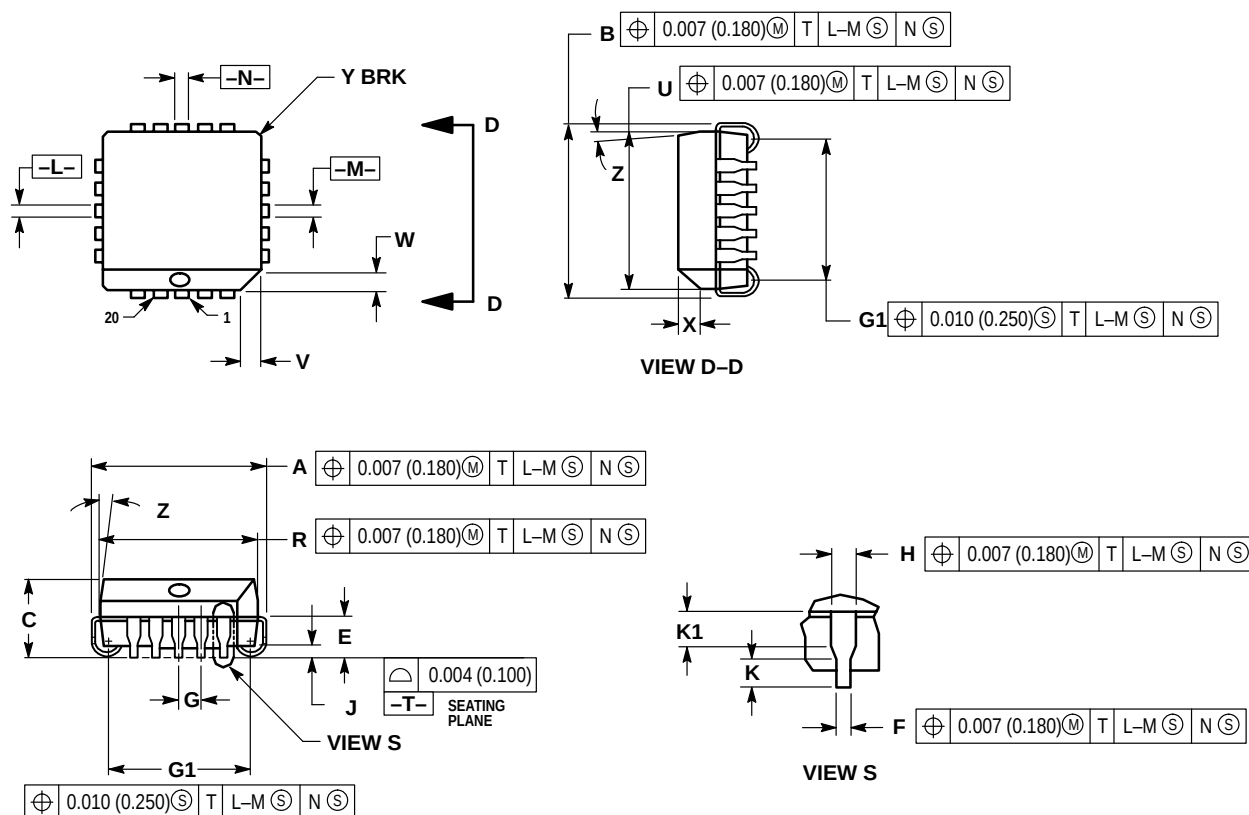
† Output level to be measured after a clock pulse has been applied to the  $\overline{C_E}$  Input (Pin 6)



Each MECL 10,000 series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are terminated through a 50-ohm resistor to –2.0 volts. Test procedures are shown for only one gate. The other gates are tested in the same manner.

## OUTLINE DIMENSIONS

FN SUFFIX  
PLASTIC PLCC PACKAGE  
CASE 775-02  
ISSUE C



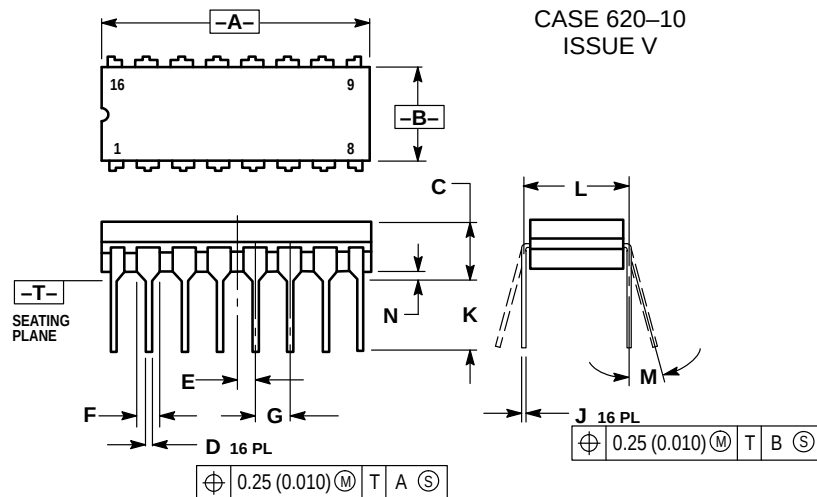
## NOTES:

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.385     | 0.395 | 9.78        | 10.03 |
| B   | 0.385     | 0.395 | 9.78        | 10.03 |
| C   | 0.165     | 0.180 | 4.20        | 4.57  |
| E   | 0.090     | 0.110 | 2.29        | 2.79  |
| F   | 0.013     | 0.019 | 0.33        | 0.48  |
| G   | 0.050 BSC |       | 1.27 BSC    |       |
| H   | 0.026     | 0.032 | 0.66        | 0.81  |
| J   | 0.020     | —     | 0.51        | —     |
| K   | 0.025     | —     | 0.64        | —     |
| R   | 0.350     | 0.356 | 8.89        | 9.04  |
| U   | 0.350     | 0.356 | 8.89        | 9.04  |
| V   | 0.042     | 0.048 | 1.07        | 1.21  |
| W   | 0.042     | 0.048 | 1.07        | 1.21  |
| X   | 0.042     | 0.056 | 1.07        | 1.42  |
| Y   | —         | 0.020 | —           | 0.50  |
| Z   | 2°        | 10°   | 2°          | 10°   |
| G1  | 0.310     | 0.330 | 7.88        | 8.38  |
| K1  | 0.040     | —     | 1.02        | —     |

## OUTLINE DIMENSIONS

**L SUFFIX**  
**CERAMIC DIP PACKAGE**  
**CASE 620-10**  
**ISSUE V**

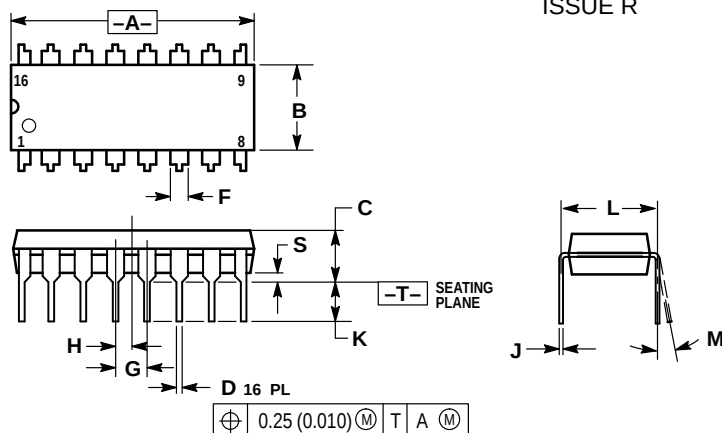


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.750     | 0.785 | 19.05       | 19.93 |
| B   | 0.240     | 0.295 | 6.10        | 7.49  |
| C   | —         | 0.200 | —           | 5.08  |
| D   | 0.015     | 0.020 | 0.39        | 0.50  |
| E   | 0.050 BSC |       | 1.27 BSC    |       |
| F   | 0.055     | 0.065 | 1.40        | 1.65  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.125     | 0.170 | 3.18        | 4.31  |
| L   | 0.300 BSC |       | 7.62 BSC    |       |
| M   | 0°        | 15°   | 0°          | 15°   |
| N   | 0.020     | 0.040 | 0.51        | 1.01  |

**P 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  |

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**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,  
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

