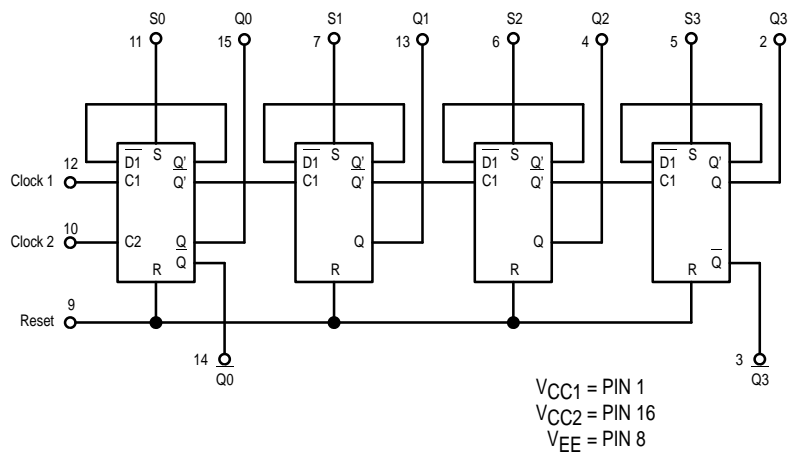


Binary Counter

The MC10178 is a four-bit counter capable of divide-by-two, divide-by-four, divide-by-eight or a divide-by-sixteen function. Clock inputs trigger on the positive going edge of the clock pulse. Set and Reset inputs override the clock, allowing asynchronous "set" or "clear." Individual Set and common Reset inputs are provided, as well as complementary outputs for the first and fourth bits. True outputs are available at all bits.

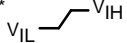
$P_D = 370 \text{ mW typ/pkg (No Load)}$
 $f_{\text{toggle}} = 150 \text{ MHz (typ)}$
 $t_r, t_f = 2.7 \text{ ns typ (20\%–80\%)}$

LOGIC DIAGRAM

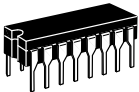


TRUTH TABLE

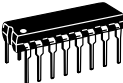
| INPUTS | | | | | | | OUTPUTS | | | |
|--------|----|----|----|----|----|----|----------|----|----|----|
| R | S0 | S1 | S2 | S3 | C1 | C2 | Q0 | Q1 | Q2 | Q3 |
| H | L | L | L | L | X | X | L | L | L | L |
| L | H | H | H | H | X | X | H | H | H | H |
| L | L | L | L | L | H | X | No Count | | | |
| L | L | L | L | L | X | H | | | | |
| L | L | L | L | L | ** | | L | L | L | L |
| L | L | L | L | L | | | H | L | L | L |
| L | L | L | L | L | | | L | H | L | L |
| L | L | L | L | L | | | H | H | L | L |
| L | L | L | L | L | | | L | L | H | L |
| L | L | L | L | L | | | H | L | H | L |
| L | L | L | L | L | | | L | H | H | L |
| L | L | L | L | L | | | H | H | H | L |
| L | L | L | L | L | | | L | L | L | H |
| L | L | L | L | L | | | H | L | L | H |
| L | L | L | L | L | | | L | H | L | H |
| L | L | L | L | L | | | H | H | L | H |
| L | L | L | L | L | | | L | L | H | H |
| L | L | L | L | L | | | H | L | H | H |
| L | L | L | L | L | | | L | H | H | H |
| L | L | L | L | L | | | H | H | H | H |

**  V_{IH} Clock transition from V_{IL} to V_{IH} may be applied to C₁ or C₂ or both for same effect.

MC10178



L SUFFIX
CERAMIC PACKAGE
CASE 620-10

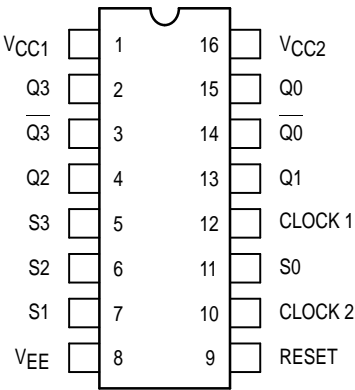


P SUFFIX
PLASTIC PACKAGE
CASE 648-08



FN SUFFIX
PLCC
CASE 775-02

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).



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 _E | 8 | | 97 | | | 88 | | 97 | mAdc | |
| Input Current | I _{inH} | 12 | | 390 | | | 245 | | 245 | μAdc | |
| | | 11 | | 350 | | | 220 | | 220 | | |
| | | 9 | | 650 | | | 410 | | 410 | | |
| | I _{inL} | * | 0.5 | | 0.5 | | | 0.3 | | μAdc | |
| Output Voltage Logic 1 | V _{OH} | 14 15 | −1.060 −1.060 | −0.890 −0.890 | −0.960 −0.960 | | −0.810 −0.810 | −0.890 −0.890 | −0.700 −0.700 | Vdc | |
| Output Voltage Logic 0 | V _{OL} | 14 15 | −1.890 −1.890 | −1.675 −1.675 | −1.850 −1.850 | | −1.650 −1.650 | −1.825 −1.825 | −1.615 −1.615 | Vdc | |
| Threshold Voltage Logic 1 | V _{OHA} | 3 14 15 | −1.080 −1.080 −1.080 | | −0.980 −0.980 −0.980 | | | −0.910 −0.910 −0.910 | | Vdc | |
| Threshold Voltage Logic 0 | V _{OLA} | 3 14 15 | | −1.655 −1.655 −1.655 | | | −1.630 −1.630 −1.630 | | −1.595 −1.595 −1.595 | Vdc | |
| Switching Times (50Ω Load) | | | | | | | | | | ns | |
| Propagation Clock Input Delay | t ₁₂₊₁₅₊ | 15 | 1.4 | 5.0 | 1.5 | 3.5 | 4.8 | 1.5 | 5.3 | | |
| | t _{12−13−} | 13 | 1.9 | 9.4 | 2.0 | 6.0 | 9.2 | 2.0 | 9.8 | | |
| | t _{12+4−} | 4 | 2.9 | 12.3 | 3.0 | 8.5 | 12.0 | 3.0 | 12.8 | | |
| | t _{12−3+} | 3 | 3.9 | 14.9 | 4.0 | 11.0 | 14.5 | 4.0 | 15.5 | | |
| Rise Time (20 to 80%) | t ₁₅₊ | 15 | 1.1 | 4.7 | 1.1 | 2.5 | 4.5 | 1.1 | 5.0 | | MHz |
| Fall Time (20 to 80%) | t _{15−} | 15 | 1.1 | 4.7 | 1.1 | 2.5 | 4.5 | 1.1 | 5.0 | | |
| Set Input | t _{11−15+} | 15 | 1.4 | 5.2 | 1.5 | | 5.0 | 1.5 | 5.5 | | |
| Reset Input | t _{9−15+} | 15 | 1.4 | 5.2 | 1.5 | | 5.0 | 1.5 | 5.5 | | |
| Counting Frequency | f _{count} | 15 | 125 | | 125 | 150 | | 125 | | | |

* Individually test each input applying V_{IL} to input under test.

ELECTRICAL CHARACTERISTICS (continued)

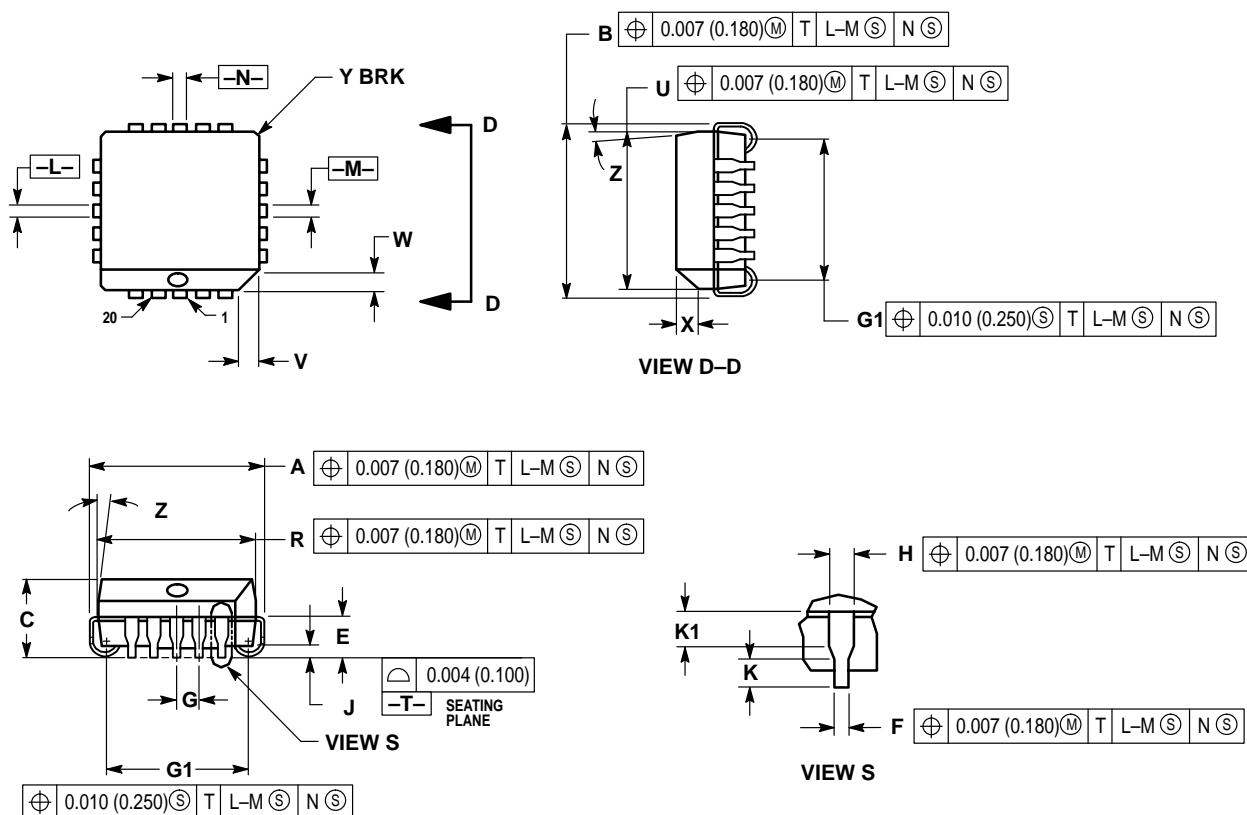
| @ Test Temperature | | | TEST VOLTAGE VALUES (Volts) | | | | | (V _{CC}) Gnd |
|----------------------------|---------------------|---------------------|---|--------------------|---------------------|---------------------|-----------------|---------------------------|
| | | | V _{IHmax} | V _{ILmin} | V _{IHAmin} | V _{ILAmax} | V _{EE} | |
| | | | −0.890 | −1.890 | −1.205 | −1.500 | −5.2 | |
| | | | +25°C | −0.810 | −1.850 | −1.105 | −1.475 | −5.2 |
| | | | +85°C | −0.700 | −1.825 | −1.035 | −1.440 | −5.2 |
| Characteristic | Symbol | Pin Under Test | TEST VOLTAGE APPLIED TO PINS LISTED BELOW | | | | | (V _{CC}) Gnd |
| | | | V _{IHmax} | V _{ILmin} | V _{IHAmin} | V _{ILAmax} | V _{EE} | |
| Power Supply Drain Current | I _E | 8 | 9 | | | | 8 | 1, 16 |
| Input Current | I _{inH} | 12 | 12 | | | | 8 | 1, 16 |
| | | 11 | 11 | | | | 8 | 1, 16 |
| | | 9 | 9 | | | | 8 | 1, 16 |
| Output Voltage | V _{OH} | * | | * | | | 8 | 1, 16 |
| | | | | | | | | |
| Output Voltage | V _{OL} | 14 | 9 | | | | 8 | 1, 16 |
| | | 15 | 11 | | | | 8 | 1, 16 |
| Threshold Voltage | V _{OHA} | 14 | | | 5 | | 8 | 1, 16 |
| | | 15 | | | 11 | | 8 | 1, 16 |
| | | | | | 9 | | 8 | 1, 16 |
| Threshold Voltage | V _{OLA} | 3 | | | | 5 | 8 | 1, 16 |
| | | 14 | | | | 11 | 8 | 1, 16 |
| | | 15 | | | | 9 | 8 | 1, 16 |
| Switching Times (50Ω Load) | | | | | Pulse In | Pulse Out | −3.2 V | +2.0 V |
| Propagation Delay | Data Input | t ₁₂₊₁₅₊ | 15 | | 12 | 15 | 8 | 1, 16 |
| | | t _{12−13−} | 13 | | 12 | 13 | 8 | 1, 16 |
| | | t _{12+4−} | 4 | | 12 | 4 | 8 | 1, 16 |
| | | t _{12−3+} | 3 | | 12 | 3 | 8 | 1, 16 |
| Rise Time (20 to 80%) | t ₊ | 15 | | | 12 | 15 | 8 | 1, 16 |
| Fall Time (20 to 80%) | t _− | 15 | | | 12 | 15 | 8 | 1, 16 |
| Set Input | t _{11−15+} | 15 | | | 11 | 15 | 8 | 1, 16 |
| Reset Input | t _{9−15+} | 15 | | | 9 | 15 | 8 | 1, 16 |
| Counting Frequency | f _{count} | 15 | | | 12 | 15 | 8 | 1, 16 |

* Individually test each input applying V_{IL} to input under test.

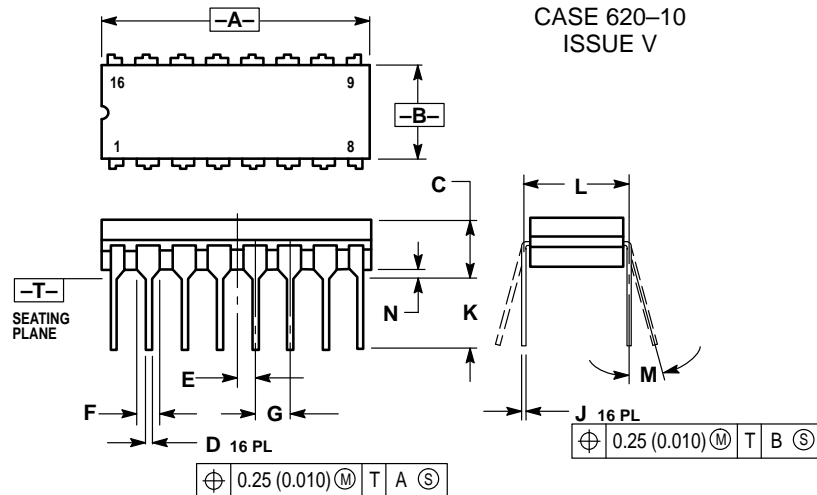
Each MECL 10,000 series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are 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



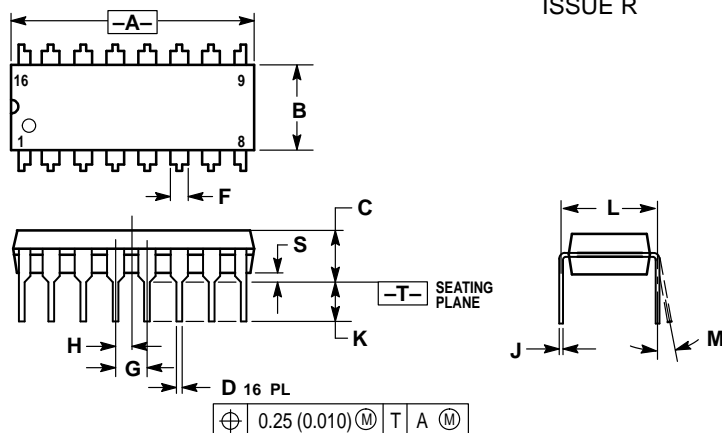
OUTLINE DIMENSIONS

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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