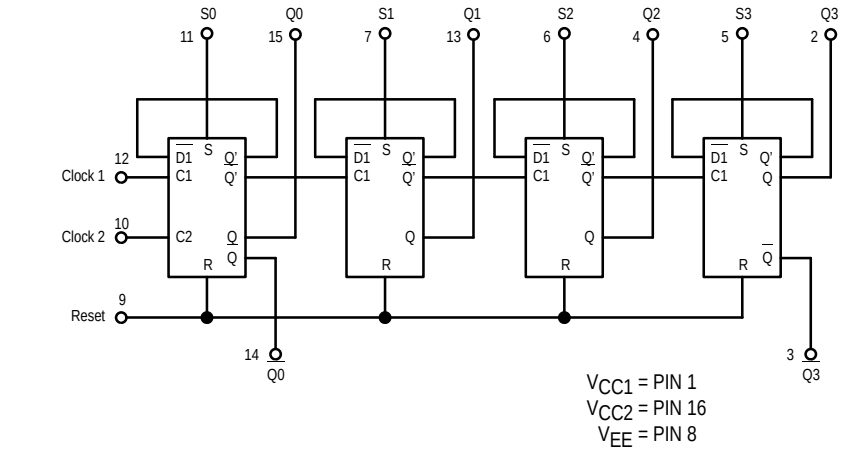
Binary Counter

MC10178

The MC10178 is a four–bit counter capable of divide–by–two, divide–by–four, divide–by–eight or a divide–by–sixteen function.

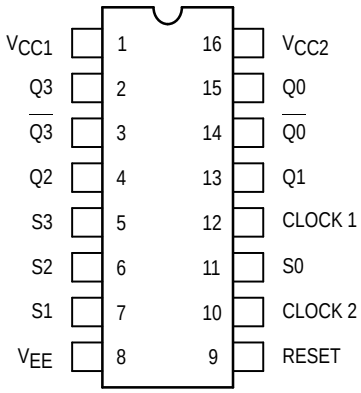
Clock inputs trigger on the positive going edge of the clock pulse. Set and Reset inputs override the clock, allowing asynchronous “set” or “clear.” Individual Set and common Reset inputs are provided, as well as complementary outputs for the first and fourth bits. True outputs are available at all bits.

P_D = 370 mW typ/pkg (No Load)
f_{toggle} = 150 MHz (typ)
t_r, t_f = 2.7 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).

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	No Count			
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_{IL} → V_{IH} Clock transition from V_{IL} to V_{IH} may be applied to C_1 or C_2 or both for same effect.

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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 11 9		390 350 650			245 220 410		245 220 410	µAdc
	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+} t_{12-13-} t_{12+4-} t_{12-3+}	15 13 4 3	1.4 1.9 2.9 3.9	5.0 9.4 12.3 14.9	1.5 2.0 3.0 4.0	3.5 6.0 8.5 11.0	4.8 9.2 12.0 14.5	1.5 2.0 3.0 4.0	5.3 9.8 12.8 15.5	
Rise Time (20 to 80%)	t_{15+}	15	1.1	4.7	1.1	2.5	4.5	1.1	5.0	
Fall Time (20 to 80%)	t_{15-}	15	1.1	4.7	1.1	2.5	4.5	1.1	5.0	
Set Input Reset Input	t_{11-15+} t_{9-15+}	15 15	1.4 1.4	5.2 5.2	1.5 1.5		5.0 5.0	1.5 1.5	5.5 5.5	
Counting Frequency	f_{count}	15	125		125	150		125		MHz

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

ELECTRICAL CHARACTERISTICS (continued)

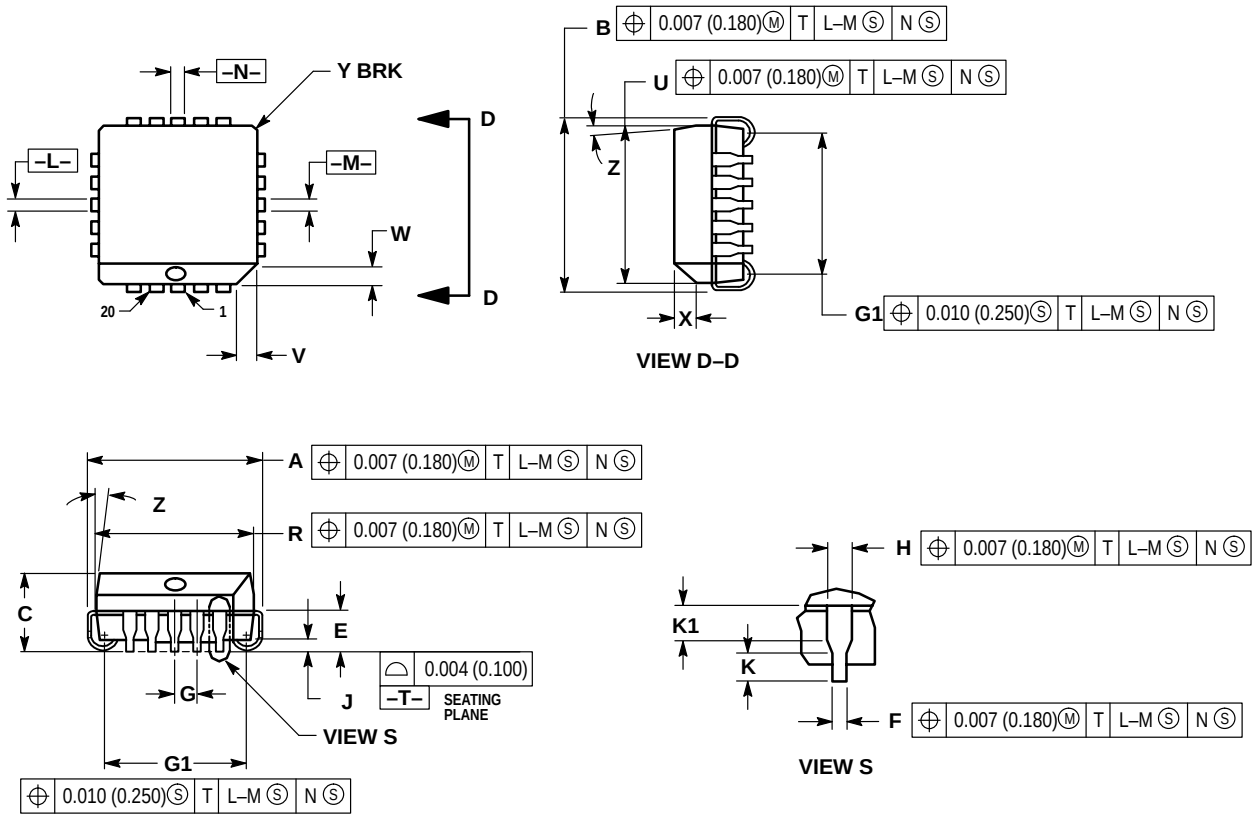
@ Test Temperature			TEST VOLTAGE VALUES (Volts)					
			V_{IHmax}	V_{ILmin}	V_{IHAmin}	V_{ILAmax}	V_{EE}	
–30°C			–0.890	–1.890	–1.205	–1.500	–5.2	
+25°C			–0.810	–1.850	–1.105	–1.475	–5.2	
+85°C			–0.700	–1.825	–1.035	–1.440	–5.2	
Characteristic		**Symbol**	**Pin Under Test**	**TEST VOLTAGE APPLIED 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 11 9	12 11 9				8 8 8	1, 16 1, 16 1, 16
		I_{inL}	*		*			8	1, 16
Output Voltage	Logic 1	V_{OH}	14 15	9 11				8 8	1, 16 1, 16
Output Voltage	Logic 0	V_{OL}	14 15	11 9				8 8	1, 16 1, 16
Threshold Voltage	Logic 1	V_{OHA}	3 14 15			5 11 9		8 8 8	1, 16 1, 16 1, 16
Threshold Voltage	Logic 0	V_{OLA}	3 14 15				5 11 9	8 8 8	1, 16 1, 16 1, 16
Switching Times	(50Ω Load)					**Pulse In**	**Pulse Out**	**–3.2 V**	**+2.0 V**
Propagation Delay	Data Input	t_{12+15+} t_{12-13-} t_{12+4-} t_{12-3+}	15 13 4 3			12 12 12 12	15 13 4 3	8 8 8 8	1, 16 1, 16 1, 16 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 Reset Input		t_{11-15+} t_{9-15+}	15 15			11 9	15 15	8 8	1, 16 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

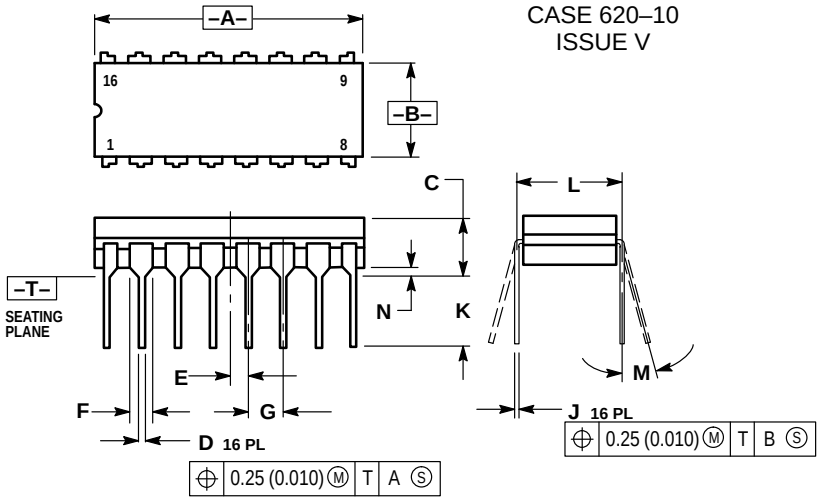


NOTES:
1. DATUMS –L–, –M–, AND –N– DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
2. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM –T–, SEATING PLANE.
3. DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. 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.
7. 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).

	INCHES		MILLIMETERS	
DIM	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

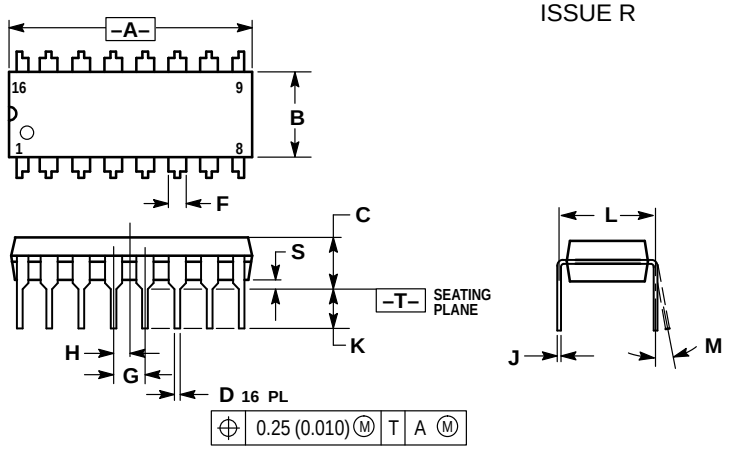
L SUFFIX
CERAMIC DIP PACKAGE
CASE 620–10
ISSUE V



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.

	INCHES		MILLIMETERS	
DIM	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.

	INCHES		MILLIMETERS	
DIM	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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