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MOTOROLA

MC12009
MC12011
MC12013

Dual Modulus Prescaler

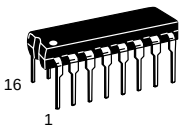
These devices are two–modulus prescalers which will divide by 5 and 6, 8 and 9, and 10 and 11, respectively. A MECL–to–MTTL translator is provided to interface directly with the MC12014 Counter Control Logic. In addition, there is a buffered clock input and MECL bias voltage source.

- MC12009 480 MHz (÷5/6), MC12011 550 MHz (÷8/9), MC12013 550 MHz (÷10/11)
- MECL to MTTL Translator on Chip
- MECL and MTTL Enable Inputs
- 5.0 or –5.2 V Operation*
- Buffered Clock Input — Series Input RC Typ, 20 Ohms and 4 pF
- V_{BB} Reference Voltage
- 310 Milliwatts (Typ)

* When using a 5.0 V supply, apply 5.0 V to Pin 1 (V_{CCO}), Pin 6 (MTTL V_{CC}), Pin 16 (V_{CC}), and ground Pin 8 (V_{EE}). When using –5.2 V supply, ground Pin 1 (V_{CCO}), Pin 6 (MTTL V_{CC}), and Pin 16 (V_{CC}) and apply –5.2 V to Pin 8 (V_{EE}). If the translator is not required, Pin 6 may be left open to conserve dc power drain.

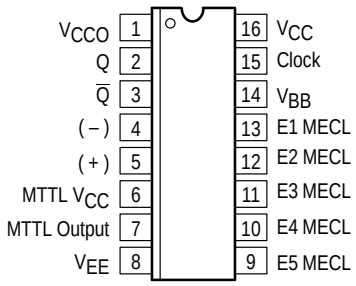
MECL PLL COMPONENTS
DUAL MODULUS PRESCALER

SEMICONDUCTOR
TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 648

PIN CONNECTIONS



(Top View)

MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
(Ratings above which device life may be impaired)			
Power Supply Voltage (V_{CC} = 0)	V_{EE}	–8.0	Vdc
Input Voltage (V_{CC} = 0)	V_{in}	0 to V_{EE}	Vdc
Output Source Current Continuous Surge	I_O	 < 50 < 100	mAdc
Storage Temperature Range	T_{stg}	–65 to +175	°C
(Recommended Maximum Ratings above which performance may be degraded)			
Operating Temperature Range MC12009, MC12011, MC12013	T_A	–30 to +85	°C
DC Fan–Out (Note 1) (Gates and Flip–Flops)	n	70	—

NOTES: 1. AC fan–out is limited by desired system performance.
2. ESD data available upon request.

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC12009P	T_A = – 35° to +85°C	Plastic
MC12011P		
MC12013P		

Figure 1. Logic Diagrams

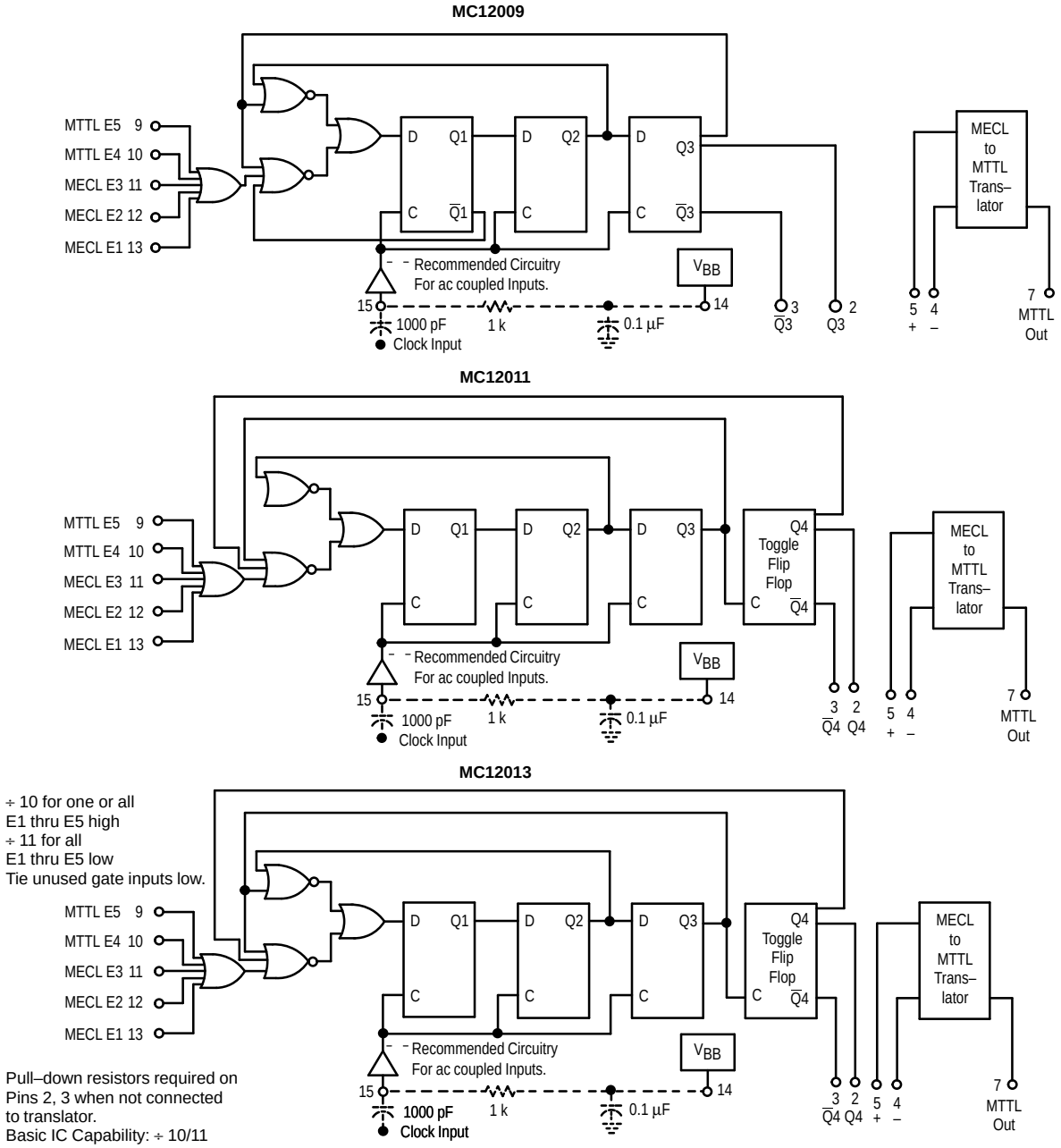
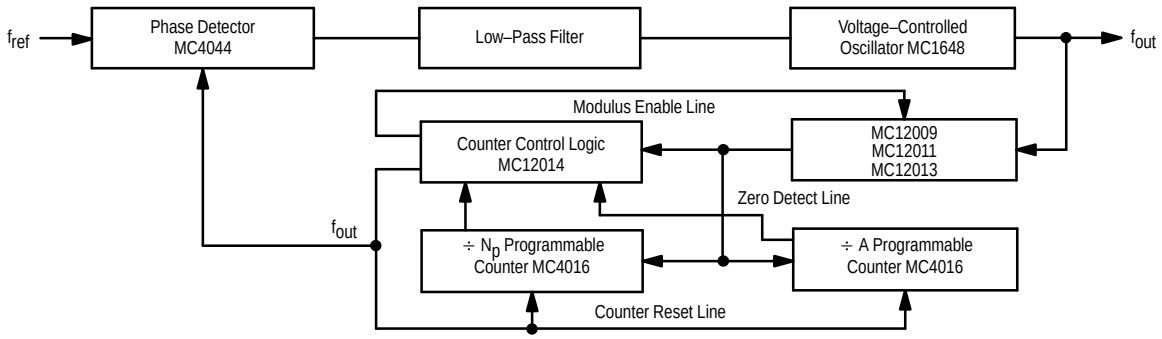


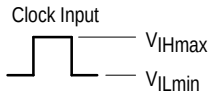
Figure 2. Typical Frequency Synthesizer Application



ELECTRICAL CHARACTERISTICS (Supply Voltage = –5.2 V, unless otherwise noted.)

Characteristic	Symbol	Pin Under Test	Test Limits						Unit
			–30°C		+25°C		+85°C		
			Min	Max	Min	Max	Min	Max	
Power Supply Drain Current	I_{CC1}	8	–88		–80		–80		mAdc
	I_{CC2}	6		5.2		5.2		5.2	mAdc
Input Current	I_{inH1}	15 11 12 13		375 375 375 375		250 250 250 250		250 250 250 250	µAdc
	I_{inH2}	4 5	1.7 1.7	6.0 6.0	2.0 2.0	6.0 6.0	2.0 2.0	6.4 6.4	mAdc
	I_{inH3}	5	0.7	3.0	1.0	3.0	1.0	3.6	
	I_{inH4}	9 10		100 100		100 100		100 100	µAdc
Leakage Current	I_{inL1}	15 11 12 13	–10 –10 –10 –10		–10 –10 –10 –10		–10 –10 –10 –10		µAdc
	I_{inL2}	9 10	–1.6 –1.6		–1.6 –1.6		–1.6 –1.6		mAdc
Reference Voltage	V_{BB}	14			–1.360	–1.160			Vdc
Logic ‘1’ Output Voltage	V_{OH1} (Note 1)	2 3	–1.100 –1.100	–0.890 –0.890	–1.000 –1.000	–0.810 –0.810	–0.930 –0.930	–0.700 –0.700	Vdc
	V_{OH2}	7	–2.8		–2.6		–2.4		
Logic ‘0’ Output Voltage	V_{OL1} (Note 1)	2 3	–1.990 –1.990	–1.675 –1.675	–1.950 –1.950	–1.650 –1.650	–1.925 –1.925	–1.615 –1.615	Vdc
	V_{OL2}	7		–4.26		–4.40		–4.48	
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 2)	2 3	–1.120 –1.120		–1.020 –1.020		–0.950 –0.950		Vdc
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 3)	2 3		–1.655 –1.655		–1.630 –1.630		–1.595 –1.595	Vdc
Short Circuit Current	I_{OS}	7	–65	–20	–65	–20	–65	–20	mAdc

1. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
2. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
3. In addition to meeting the output levels specified, the device must divide by 6, 9 or 11 during this test. The clock input is the waveform shown.



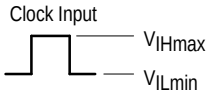
Each MECL 10,000 series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are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

ELECTRICAL CHARACTERISTICS (Supply Voltage = –5.2 V, unless otherwise noted.) (continued)

@ Test Temperature	TEST VOLTAGE/CURRENT VALUES (Volts) V_{IHmax}	V_{ILmin}	V_{IHAmin}	V_{ILAmax}	V_{IH}	V_{ILH}
–30°C	–0.890	–1.990	–1.205	–1.500	–2.8	–4.7
+25°C	–0.810	–1.950	–1.105	–1.475	–2.8	–4.7
+85°C	–0.700	–1.925	–1.035	–1.440	–2.8	–4.7

Characteristic	Symbol	Pin Under Test	TEST VOLTAGE APPLIED TO PINS LISTED BELOW V_{IHmax}	V_{ILmin}	V_{IHAmin}	V_{ILAmax}	V_{IH}	V_{IL}	Gnd
Power Supply Drain Current	I_{CC1}	8							1,16
	I_{CC2}	6	4	5					6
Input Current	I_{inH1}	15 11 12 13	15 11 12 13						1,16 1,16 1,16 1,16
	I_{inH2}	4 5	5 5	4 4					6 6
	I_{inH3}	5	4	5					6
	I_{inH4}	9 10					9 10		1,16 1,16
Leakage Current	I_{inL1}	15 11 12 13							1,16 1,16 1,16 1,16
	I_{inL2}	9 10						9 10	1,16 1,16
Reference Voltage	V_{BB}	14							1,16
Logic ‘1’ Output Voltage	V_{OH1} (Note 1.)	2 3		11,12,13 11,12,13				9,10 9,10	1,16 1,16
	V_{OH2}	7	5	4					6
Logic ‘0’ Output Voltage	V_{OL1} (Note 1.)	2 3		11,12,13 11,12,13				9,10 9,10	1,16 1,16
	V_{OL2}	7	4	5					6
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 2.)	2 3			11,12,13 11,12,13				1,16 1,16
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 3.)	2 3				11,12,13 11,12,13			1,16 1,16
Short Circuit Current	I_{OS}	7	5	4				7	6

1. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
2. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
3. In addition to meeting the output levels specified, the device must divide by 6, 9 or 11 during this test. The clock input is the waveform shown.



ELECTRICAL CHARACTERISTICS (Supply Voltage = –5.2 V, unless otherwise noted.) (continued)

			TEST VOLTAGE/CURRENT VALUES						
			Volts			mA			
@ Test Temperature			V_{IHT}	V_{ILT}	V_{EE}	I_L	I_{OL}	I_{OH}	
–30°C			–3.2	–4.4	–5.2	–0.25	16	–0.40	
+25°C			–3.2	–4.4	–5.2	–0.25	16	–0.40	
+85°C			–3.2	–4.4	–5.2	–0.25	16	–0.40	
Characteristic	**Symbol**	**Pin Under Test**	**TEST VOLTAGE APPLIED TO PINS LISTED BELOW**						**Gnd**
			V_{IHT}	V_{ILT}	V_{EE}	I_L	I_{OL}	I_{OH}	
Power Supply Drain Current	I_{CC1}	8			8				1,16
	I_{CC2}	6			8				6
Input Current	I_{inH1}	15 11 12 13	 9,10 9,10 9,10		8 8 8 8				1,16 1,16 1,16 1,16
	I_{inH2}	4 5			8 8				6 6
	I_{inH3}	5			8				6
	I_{inH4}	9 10			8 8				1,16 1,16
Leakage Current	I_{inL1}	15 11 12 13			8,15 8,11 8,12 8,13				1,16 1,16 1,16 1,16
	I_{inL2}	9 10			8 8				1,16 1,16
Reference Voltage	V_{BB}	14			8	14			1,16
Logic ‘1’ Output Voltage	V_{OH1} (Note 1.)	2 3			8 8				1,16 1,16
	V_{OH2}	7			8			7	6
Logic ‘0’ Output Voltage	V_{OL1} (Note 1.)	2 3			8 8				1,16 1,16
	V_{OL2}	7			8		7		6
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 2.)	2 3	9,10 9,10		8 8				1,16 1,16
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 3.)	2 3		9,10 9,10	8 8				1,16 1,16
Short Circuit Current	I_{OS}	7			8				6

1. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
2. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
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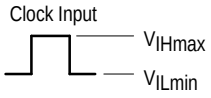
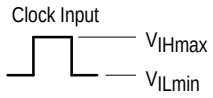


ELECTRICAL CHARACTERISTICS (Supply Voltage = 5.0 V, unless otherwise noted.)

Characteristic	Symbol	Pin Under Test	Test Limits						Unit
			–30°C		+25°C		+85°C		
			Min	Max	Min	Max	Min	Max	
Power Supply Drain Current	I_{CC1}	8	–88		–80		–80		mAdc
	I_{CC2}	6		5.2		5.2		5.2	mAdc
Input Current	I_{inH1}	15 11 12 13		375 375 375 375		250 250 250 250		250 250 250 250	µAdc
	I_{inH2}	4 5	1.7 1.7	6.0 6.0	2.0 2.0	6.0 6.0	2.0 2.0	6.4 6.4	mAdc
	I_{inH3}	5	0.7	3.0	1.0	3.0	1.0	3.6	
	I_{inH4}	9 10			100 100	100 100		100 100	µAdc
Leakage Current	I_{inL1}	15 11 12 13	–10 –10 –10 –10		–10 –10 –10 –10		–10 –10 –10 –10		µAdc
	I_{inL2}	9 10	–1.6 –1.6		–1.6 –1.6		–1.6 –1.6		mAdc
Reference Voltage	V_{BB}	14			3.67	3.87			Vdc
Logic ‘1’ Output Voltage	V_{OH1} (Note 4.)	2 3	3.900 3.900	4.110 4.110	4.000 4.000	4.190 4.190	4.070 4.070	4.300 4.300	Vdc
	V_{OH2}	7	2.4		2.6		2.8		
Logic ‘0’ Output Voltage	V_{OL1} (Note 4.)	2 3	3.070 3.070	3.385 3.385	3.110 3.110	3.410 3.410	3.135 3.135	3.445 3.445	Vdc
	V_{OL2}	7		0.94		0.80		0.72	
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 5.)	2 3	3.880 3.880		3.980 3.980		4.050 4.050		Vdc
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 6.)	2 3		3.405 3.405		3.430 3.430		3.465 3.465	Vdc
Short Circuit Current	I_{OS}	7	–65	–20	–65	–20	–65	–20	mAdc

4. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
5. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
6. In addition to meeting the output levels specified, the device must divide by 6, 9 or 11 during this test. The clock input is the waveform shown.



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 Ω resistor to –2.0 V. Test procedures are shown for only one gate. The other gates are tested in the same manner.

ELECTRICAL CHARACTERISTICS (Supply Voltage = 5.0 V, unless otherwise noted.) (continued)

@ Test Temperature	TEST VOLTAGE/CURRENT VALUES (Volts) V_{IHmax}	V_{ILmin}	V_{IHAmin}	V_{ILAmax}	V_{IH}	V_{ILH}
–30°C	+4.110	+3.070	+3.795	+3.500	+2.4	+0.5
+25°C	+4.190	+3.110	+3.895	+3.525	+2.4	+0.5
+85°C	+4.300	+3.135	+3.965	+3.560	+2.4	+0.5

Characteristic	Symbol	Pin Under Test	TEST VOLTAGE APPLIED TO PINS LISTED BELOW V_{IHmax}	V_{ILmin}	V_{IHAmin}	V_{ILAmax}	V_{IH}	V_{IL}	(V_{EE}) Gnd
Power Supply Drain Current	I_{CC1}	8							8
	I_{CC2}	6	4	5					8
Input Current	I_{inH1}	15 11 12 13	15 11 12 13						8 8 8 8
	I_{inH2}	4 5	5 5	4 4					8 8
	I_{inH3}	5	4	5					8
	I_{inH4}	9 10					9 10		8 8
Leakage Current	I_{inL1}	15 11 12 13							8,15 8,11 8,12 8,13
	I_{inL2}	9 10						9 10	8 8
Reference Voltage	V_{BB}	14							8
Logic ‘1’ Output Voltage	V_{OH1} (Note 4.)	2 3		11,12,13 11,12,13				9,10 9,10	8 8
	V_{OH2}	7	5	4					8
Logic ‘0’ Output Voltage	V_{OL1} (Note 4.)	2 3		11,12,13 11,12,13				9,10 9,10	8 8
	V_{OL2}	7	4	5					8
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 5.)	2 3			11,12,13 11,12,13				8 8
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 6.)	2 3				11,12,13 11,12,13			8 8
Short Circuit Current	I_{OS}	7	5	4				7	8

4. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
5. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
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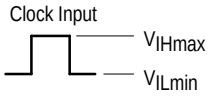
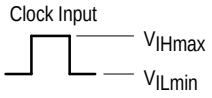


ELECTRICAL CHARACTERISTICS (Supply Voltage = 5.0 V, unless otherwise noted.) (continued)

			TEST VOLTAGE/CURRENT VALUES						
			Volts			mA			
@ Test Temperature			V_{IHT}	V_{ILT}	V_{CC}	I_L	I_{OL}	I_{OH}	
–30°C			+2.0	+0.8	+5.0	–0.25	16	–0.40	
+25°C			+2.0	+0.8	+5.0	–0.25	16	–0.40	
+85°C			+2.0	+0.8	+5.0	–0.25	16	–0.40	
Characteristic	**Symbol**	**Pin Under Test**	**TEST VOLTAGE APPLIED TO PINS LISTED BELOW**						**(V_{EE}) Gnd**
			V_{IHT}	V_{ILT}	V_{CC}	I_L	I_{OL}	I_{OH}	
Power Supply Drain Current	I_{CC1}	8			1,16				8
	I_{CC2}	6			6				8
Input Current	I_{inH1}	15 11 12 13	 9,10 9,10 9,10		1,16 1,16 1,16 1,16				8 8 8 8
	I_{inH2}	4 5			6 6				8 8
	I_{inH3}	5			6				8
	I_{inH4}	9 10			1,16 1,16				8 8
Leakage Current	I_{inL1}	15 11 12 13			1,16 1,16 1,16 1,16				8,15 8,11 8,12 8,13
	I_{inL2}	9 10			1,16 1,16				8 8
Reference Voltage	V_{BB}	14			1,16	14			8
Logic ‘1’ Output Voltage	V_{OH1} (Note 4.)	2 3			1,16 1,16				8 8
	V_{OH2}	7			6			7	8
Logic ‘0’ Output Voltage	V_{OL1} (Note 4.)	2 3			1,16 1,16				8 8
	V_{OL2}	7			6		7		8
Logic ‘1’ Threshold Voltage	V_{OHA} (Note 5.)	2 3	9,10 9,10		1,16 1,16				8 8
Logic ‘0’ Threshold Voltage	V_{OLA} (Note 6.)	2 3		9,10 9,10	1,16 1,16				8 8
Short Circuit Current	I_{OS}	7			6				8

4. Test outputs of the device must be tested by sequencing through the truth table. All input, power supply and ground voltages must be maintained between tests. The clock input is the waveform shown.
5. In addition to meeting the output levels specified, the device must divide by 5, 8 or 10 during this test. The clock input is the waveform shown.
6. In addition to meeting the output levels specified, the device must divide by 6, 9 or 11 during this test. The clock input is the waveform shown.



SWITCHING CHARACTERISTICS

Characteristic	Symbol	Pin Under Test	MC12009, MC12011, MC12013									TEST VOLTAGES/WAVEFORMS APPLIED TO PINS LISTED BELOW:								
			–30°C			+25°C			+85°C											
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit	Pulse Gen.1	Pulse Gen.2	Pulse Gen.3	V_{IHmin} †	V_{ILmin} †	V_F –3.0 V	V_{EE} –3.0 V	V_{CC} +2.0
Propagation Delay (See Figures 3 and 5)	$t_{15+\ 2+}$	2	—	—	8.1	—	—	8.1	—	—	8.9	ns	15	—	—	—	11,12,13	9,10	8	1,6,16
	$t_{15+\ 2-}$	2	—	—	7.5	—	—	7.5	—	—	8 2		15	—	—	—	11,12,13	9,10	8	1,6,16
	$t_{5+\ 7+}$	7	—	—	8.4	—	—	8.1	—	—	8.9	↓	A	—	—	—	—	—	8	1,6,16
	$t_{5-\ 7-}$	7	—	—	6.5	—	—	6.5	—	—	7.1		A	—	—	—	—	—	8	1,6,16
Setup Time (See Figures 4 and 5)	t_{setup1}	11	5.0	—	—	5.0	—	—	5.0	—	—	ns	15	*	—	—	*	9,10	8	1,6,16
	t_{setup2}	9	5.0	—	—	5.0	—	—	5.0	—	—	ns	15	—	*	—	11,12,13	*	8	1,6,16
Release Time (See Figures 4 and 5)	t_{rel1}	11	5.0	—	—	5.0	—	—	5.0	—	—	ns	15	*	—	—	*	9.10	8	1,6,16
	t_{rel2}	9	5.0	—	—	5.0	—	—	5.0	—	—	ns	15	—	*	—	11,12,13	*	8	1,6,16
Toggle Frequency (See Figure 6)	f_{max}	2										MHz								
MC12009 : 5/6			440	—	—	480	—	—	440	—	—		—	—	—	11	—	—	8	16
MC12011 : 8/9			500	—	—	550	—	—	500	—	—		—	—	—	11	—	—	8	16
MC12013 : 10/11			500	—	—	550	—	—	500	—	—		—	—	—	11	—	—	8	16

*Test inputs sequentially, with Pulse Generator 2 or 3 as indicated connected to input under test, and the voltage indicated applied to the other input(s) of the same type (i.e., MECL or MTTL).

	–30°C	+ 25°C	+ 85°C	
†V_{IHmin}	+ 1.03	+ 1.115	+ 1.20	Vdc
†V_{ILmin}	+ 0.175	+ 0.200	+ 0.235	Vdc

Figure 3. AC Voltage Waveforms

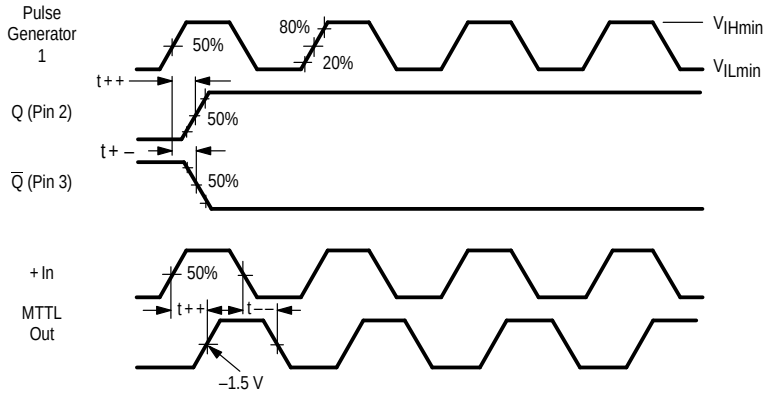
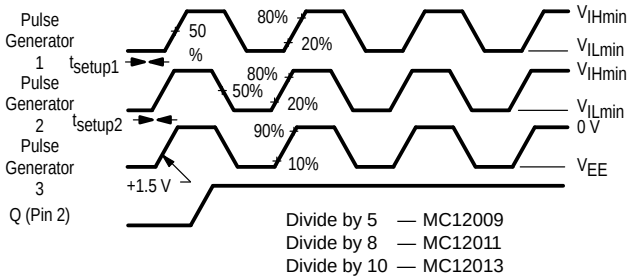


Figure 4. Setup and Release Time Waveforms



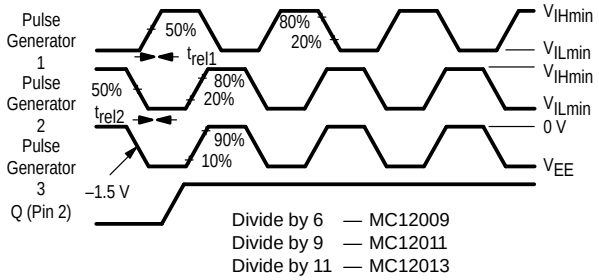
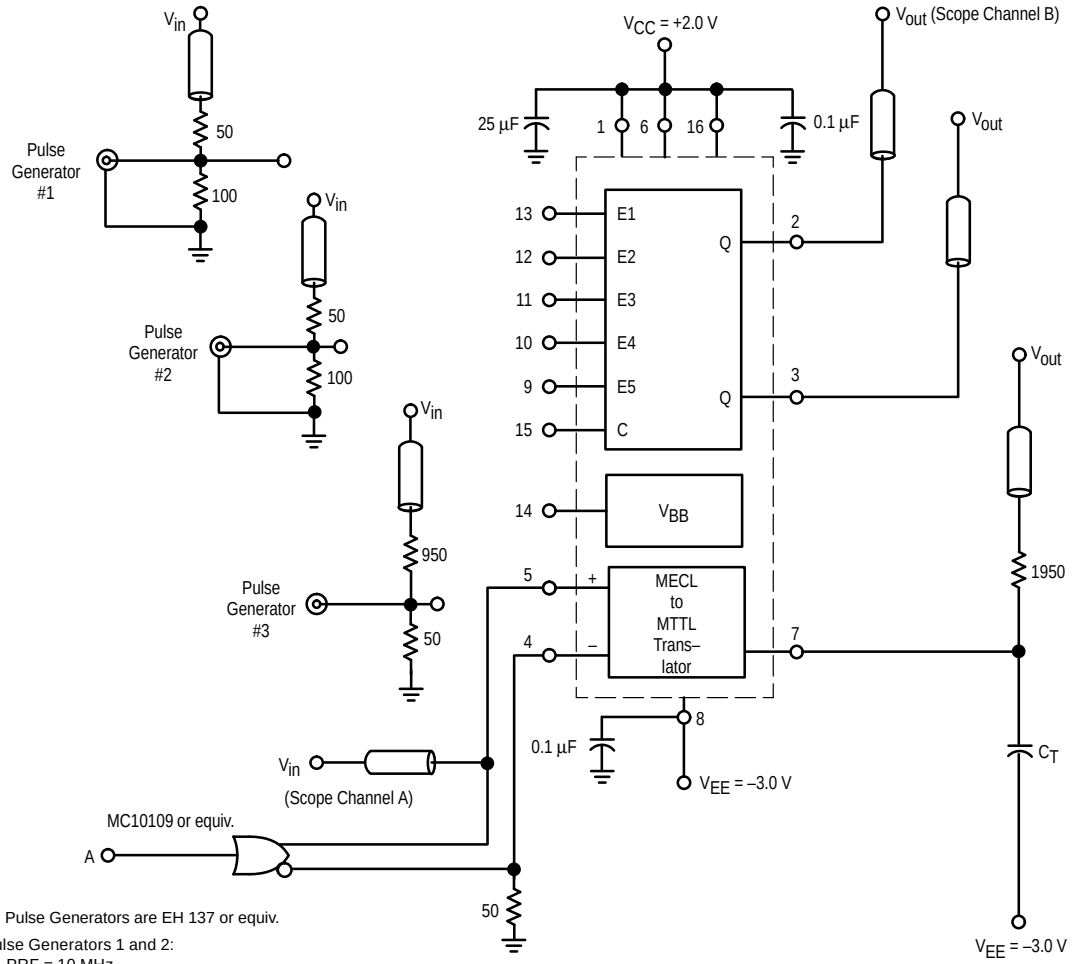


Figure 5. AC Test Circuit



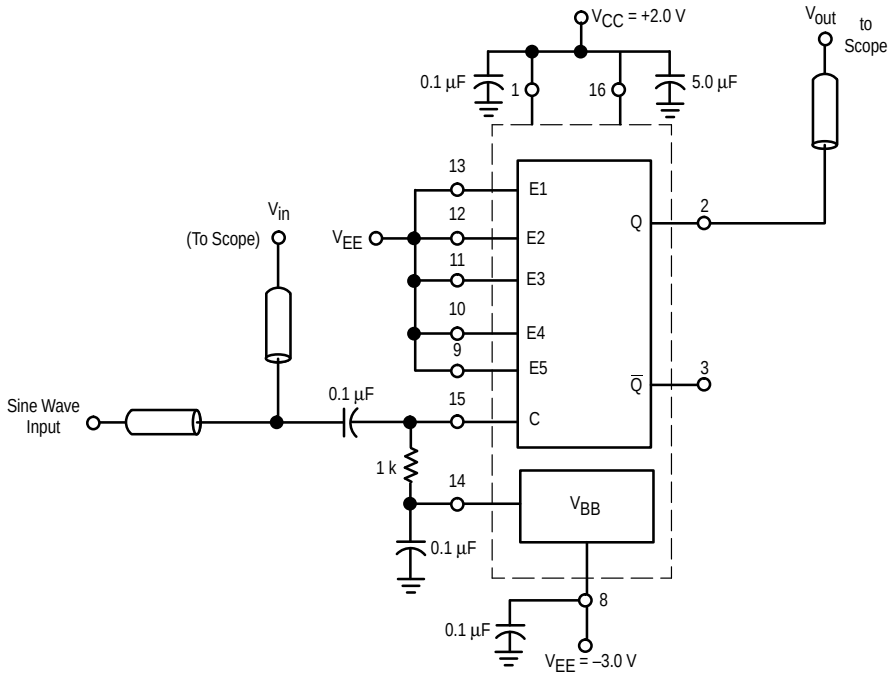
All Pulse Generators are EH 137 or equiv.

Pulse Generators 1 and 2:
PRF = 10 MHz
PW = 50% Duty Cycle
t + = t – = 2.0 ± 0.2 ns

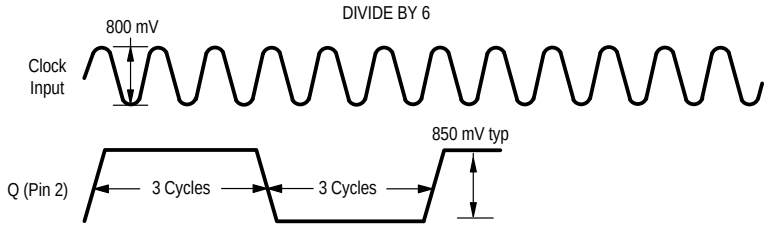
Pulse Generator 3:
PRF = 2.0 MHz
PW = 50% Duty Cycle
t + = t – = 5.0 ± 0.5 ns

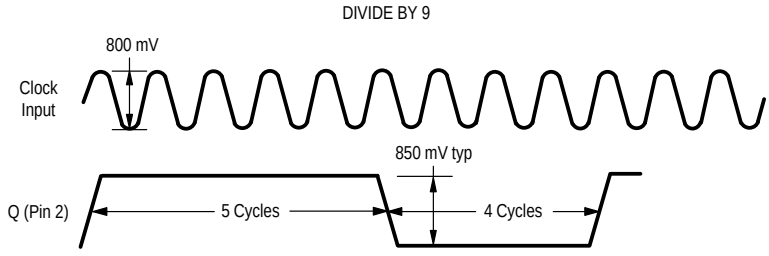
All resistors are + 1%.
All input and output cables to the scope are equal lengths of 50–ohm coaxial cable.
The 1950–ohm resistor at Pin 7 and the scope termination impedance constitute a 40 : 1 attenuator probe.
C_T = 15 pF = total parasitic capacitance which includes probe, wiring, and load capacitance.
Unused output connected to a 50–ohm resistor to ground.

Figure 6. Maximum Frequency Test Circuit



Unused output connected to a 50 Ω resistor to ground





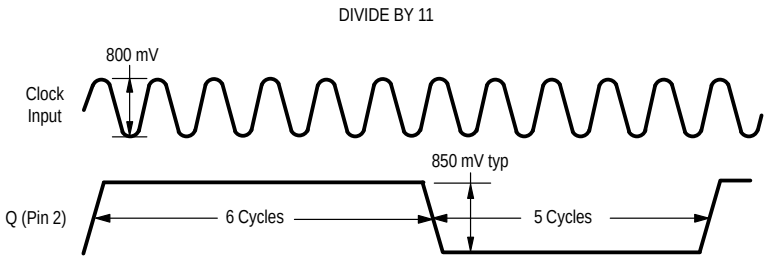


Figure 7. State Diagram

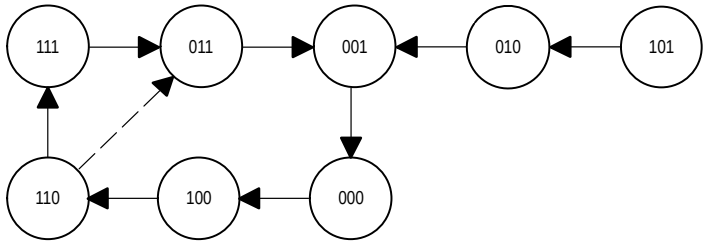
DIVIDE BY 5/6 (MC12009/MC12509)

Q1	Q2	Q3
1	1	1
0	1	1
0	0	1
0	0	0
1	0	0
1	1	0

Enable = 0

Enable = 1

— — — Enable = 1



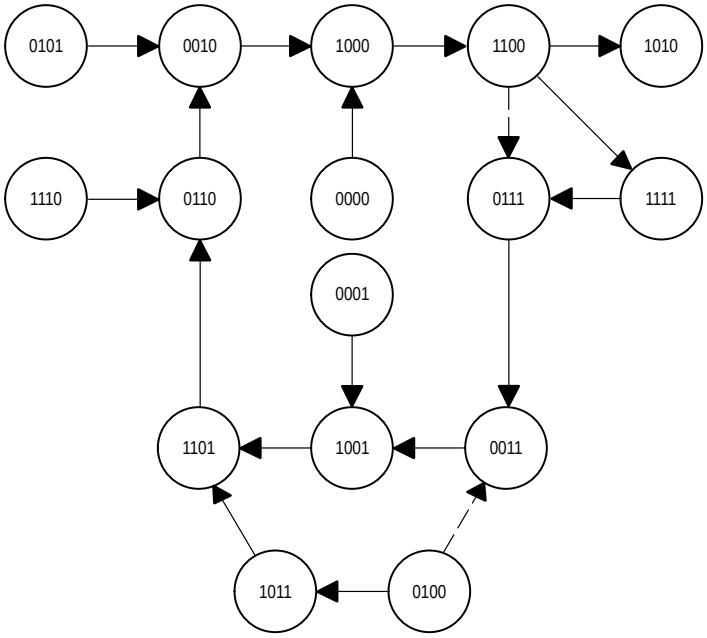
DIVIDE BY 8/9 (MC12011)

Q1	Q2	Q3	Q4
1	1	1	1
0	1	1	1
0	0	1	1
1	0	0	1
1	1	0	1
0	1	1	0
0	0	1	0
1	0	0	0
1	1	0	0

Enable = 0

Enable = 1

— — — Enable = 1.



DIVIDE BY 10/11 (MC12013)

Q1	Q2	Q3	Q4
1	1	1	1
0	1	1	1
0	0	1	1
0	0	0	1
1	0	0	1
1	1	0	1
0	1	1	0
0	0	1	0
0	0	0	0
1	0	0	0
1	1	0	0

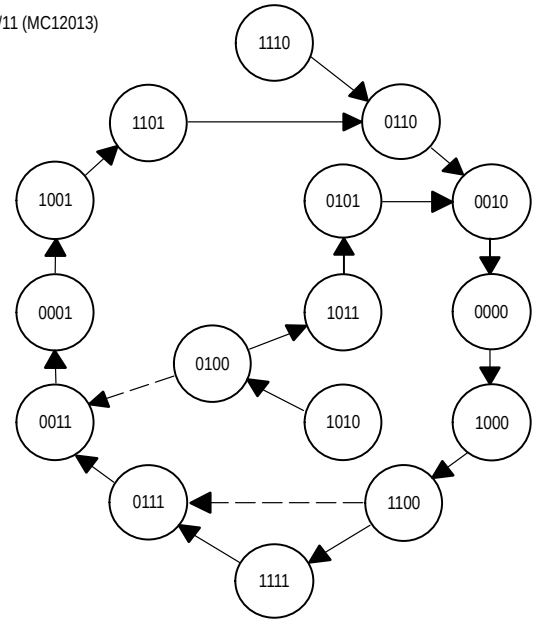
Enable = 0

Enable = 1

NOTES:

— — — Enable = 1.

The State of the Enable is important only for the positive Clock Transition when the counter is in state 1100.



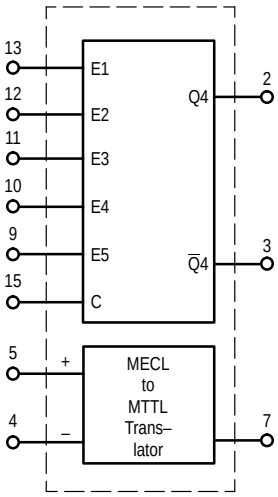
APPLICATIONS INFORMATION

The primary application of these devices is as a high–speed variable modulus prescaler in the divide by N section of a phase–locked loop synthesizer used as the local oscillator of two–way radios.

Proper VHF termination techniques should be followed when the clock is separated from the prescaler by any appreciable distance.

In their basic form, these devices will divide by 5/6, 8/9, or 10/11. Division by 5, 8, or 10 occurs when any one or all of the five gate inputs E1 through E5 are high. Division by 6, 9, or 11 occurs when all inputs E1 through E5 are low. (Unconnected MTTL inputs are normally high, unconnected MECL inputs are normally low). With the addition of extra parts, many different division configurations may be obtained (20/21, 40/41, 50/51, 100/101, etc.) A few of the many configurations are shown below, only for the MC12013.

Figure 8. Divide By 10/11 (MC12013)



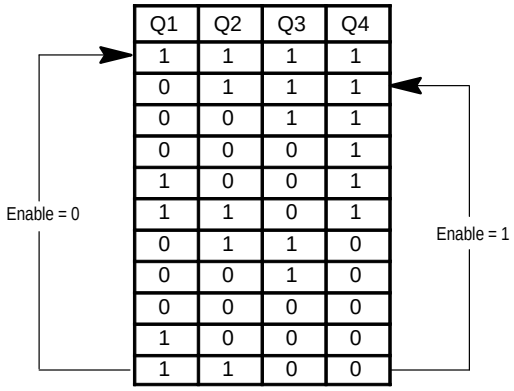
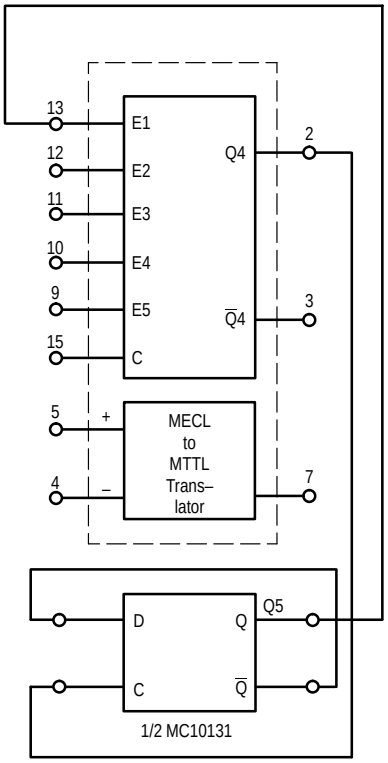


Figure 9. Divide By 20/21 (MC12013)



COUNT	Q1	Q2	Q3	Q4	Q4
31	1	1	1	1	1
30	0	1	1	1	1
28	0	0	1	1	1
24	0	0	0	1	1
25	1	0	0	1	1
27	1	1	0	1	1
22	0	1	1	0	1
20	0	0	1	0	1
16	0	0	0	0	1
17	1	0	0	0	1
19	1	1	0	0	1
14	0	1	1	1	0
12	0	0	1	1	0
8	0	0	0	1	0
9	1	0	0	1	0
11	1	1	0	1	0
6	0	1	1	0	0
4	0	0	1	0	0
0	0	0	0	0	0
1	1	0	0	0	0
3	1	1	0	0	0

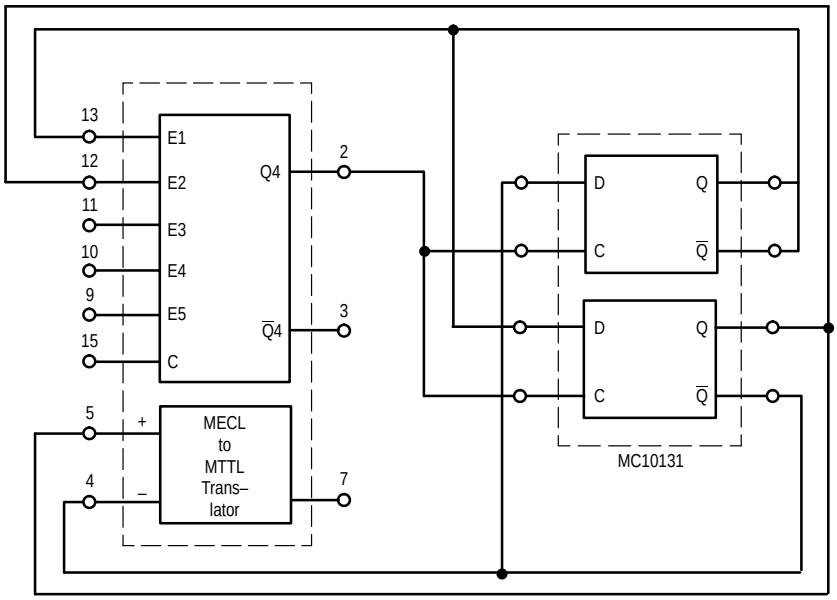
E2 + E3 + E4 + E5 = 0

E2 + E3 + E4 + E5 = 1

To obtain an MTTL output, connect Pins 5 and 4 to Pins 2 and 3 respectively. Termination resistors for the MECL outputs are not shown, but are required except for the flip–flop driving the translator section.

The ÷ 20/21 counter may also be built using an MTTL flip–flop by connecting Pins 5 and 4 to Pins 2 and 3 respectively, and driving the MTTL flip–flop with Pin 7. MC12013 inputs E4 and E5 are used rather than E1. With E1 + E2 + E3 = 0, operation remains as shown.

Figure 10. Divide By 40/41 (MC12013)

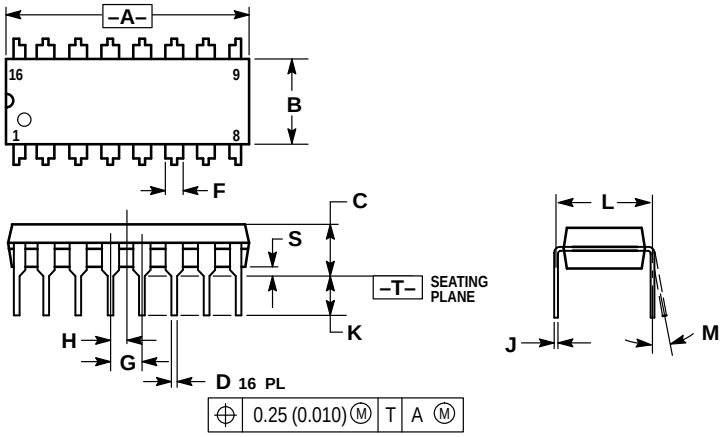


For ÷ 40 : E4 + E5 = 1
For ÷ 41 : E4 + E5 = 0

Termination resistors for MECL outputs are not shown, but are required except for the flip–flop driving the translator section.

OUTLINE DIMENSIONS

P SUFFIX
PLASTIC 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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