

# 1.1GHz Low Power Dual Modulus Prescaler With On-Chip Output Termination

The MC12022TSA can be used with CMOS synthesizers requiring positive edges to trigger internal counters such as Motorola's MC145XXX series in a PLL to provide tuning signals up to 1.1GHz in programmable frequency steps. This device is a reduced current drain version of the MC12022A/B with the addition of on-chip output termination.

The MC12022TSB can be used with CMOS synthesizers requiring negative edges to trigger internal counters.

A Divide Ratio Control (SW) permits selection of a 64/65 or 128/129 divide ratio as desired.

The Modulus Control (MC) selects the proper divide number after SW has been biased to select the desired divide ratio.

**NOTE: The "B" Version Is Not Recommended for New Designs**

- 1.1 GHz Toggle Frequency
- Supply Voltage of 4.5 to 5.5V
- Low-Power 4.0mA Typical
- Operating Temperature Range of -40 to +85°C
- Short Setup Time ( $t_{set}$ ) 16ns Maximum @ 1.1GHz
- Modulus Control Input Level Is Compatible With Standard CMOS and TTL
- Output Load Resistor on Die

## FUNCTIONAL TABLE

SW	MC	Divide Ratio
H	H	64
H	L	65
L	H	128
L	L	129

Note: SW: H =  $V_{CC}$ , L = Open

MC: H = 2.0 V to  $V_{CC}$ , L = GND to 0.8 V

## DESIGN GUIDE

Criteria	Value	Unit
Internal Gate Count*	67	ea
Internal Gate Propagation Delay	200	ps
Internal Gate Power Dissipation	0.75	mW
Speed Power Product	0.15	pJ

\* Equivalent to a two-input NAND gate

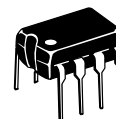
## MAXIMUM RATINGS

Symbol	Characteristic	Range	Unit
$V_{CC}$	Power Supply Voltage, Pin 2	-0.5 to + 7.0	Vdc
$T_A$	Operating Temperature Range	-40 to + 85	°C
$T_{stg}$	Storage Temperature Range	-65 to + 150	°C

**MC12022TSA  
MC12022TSB**

## MECL PLL COMPONENTS

**÷64/65, ÷128/129  
DUAL MODULUS  
PRESCALER**

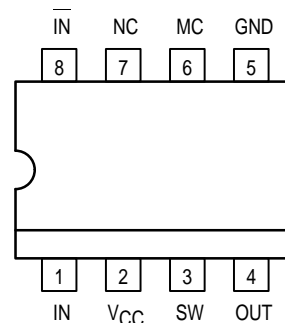


**P SUFFIX**  
8-LEAD PLASTIC PACKAGE  
CASE 626-05



**D SUFFIX**  
8-LEAD PLASTIC SOIC PACKAGE  
CASE 751-05

## Pinout: 8-Lead Plastic (Top View)



ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 4.5 to 5.5V; T<sub>A</sub> = -40°C to +85°C)

Symbol	Characteristic	Min	Typ	Max	Unit
f <sub>t</sub>	Toggle Frequency (Sine Wave Input)	0.1	1.4	1.1	GHz
I <sub>CC</sub>	Supply Current (Pin 2)		4.6	6.5	mA
V <sub>IH1</sub>	Modulus Control Input High (MC)	2.0		V <sub>CC</sub>	V
V <sub>IL1</sub>	Modulus Control Input Low (MC)			0.8	V
V <sub>IH2</sub>	Divide Ratio Control Input High (SW)	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>dC</sub>
V <sub>IL2</sub>	Divide Ratio Control Input Low (SW)	Open	Open	Open	—
V <sub>out</sub>	Output Voltage Swing (C <sub>L</sub> = 8pF)	1.0	1.4		V <sub>p-p</sub>
t <sub>set</sub>	Modulus Setup Time MC to Out		11	16	ns
V <sub>in</sub>	Input Voltage Sensitivity 250–1100 MHz 100–250 MHz	100 400		1500 1500	mV <sub>pp</sub>

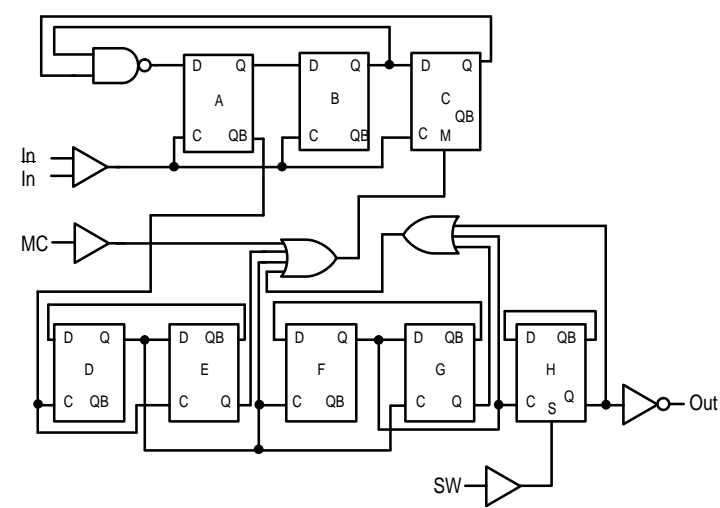
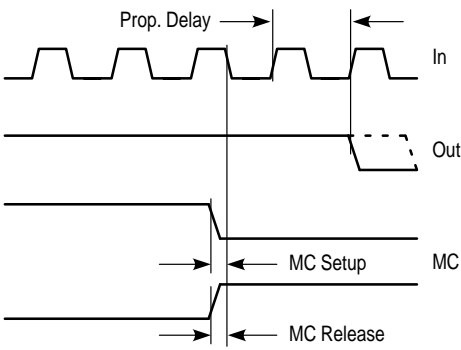
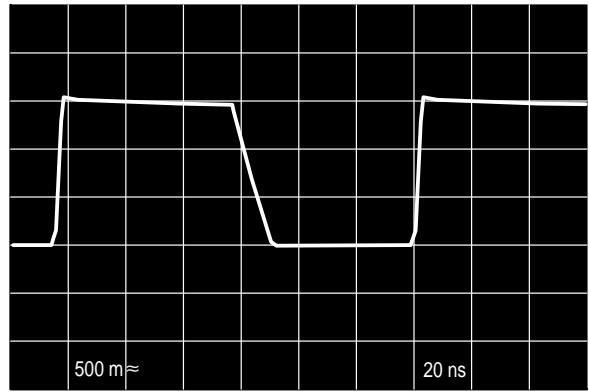


Figure 1. Logic Diagram (MC12022TSA)

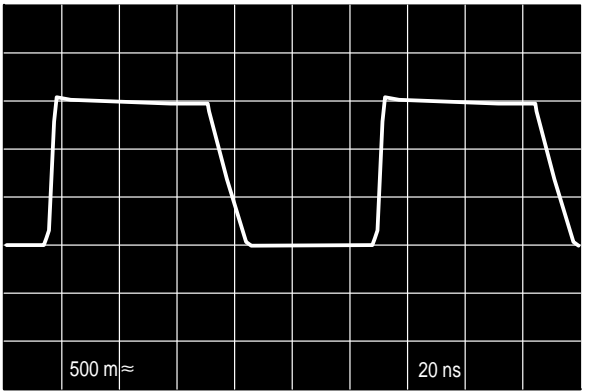


Modulus setup time MC to out is the MC setup or MC release plus the prop delay.

Figure 2. Modulus Setup Time



(÷64, 500MHz Input Frequency, V<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C, Output Loaded)



(÷128, 1.1GHz Input Frequency, V<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C, Output Loaded)

Figure 3. Typical Output Waveforms

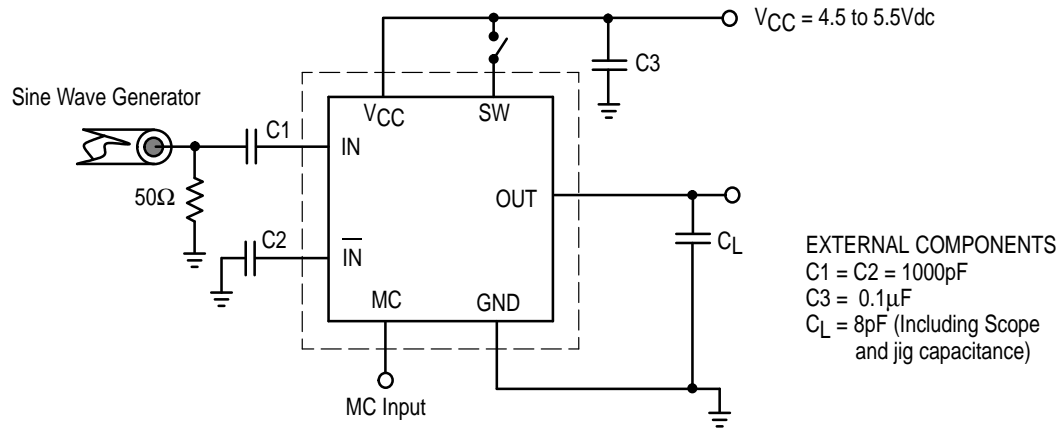


Figure 4. AC Test Circuit

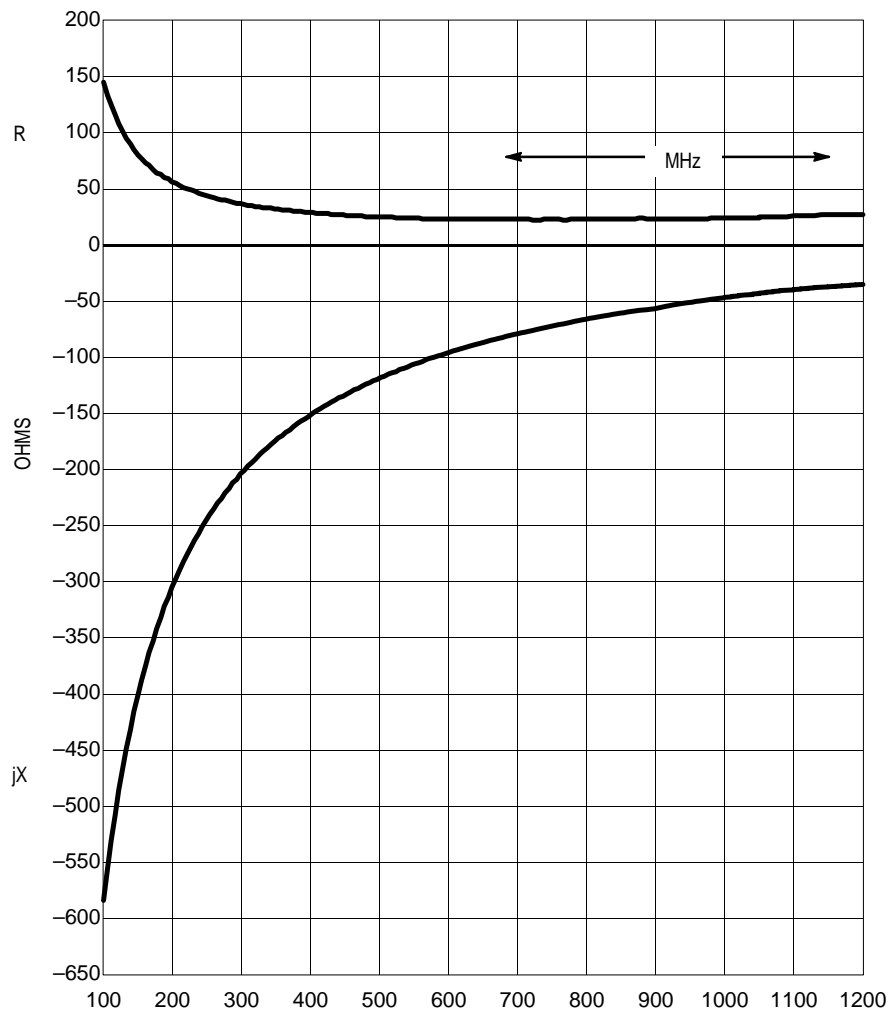
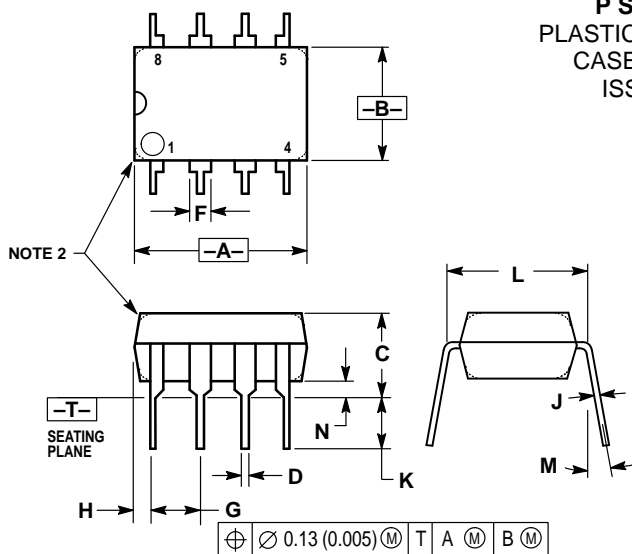


Figure 5. Typical Input Impedance versus Input Frequency

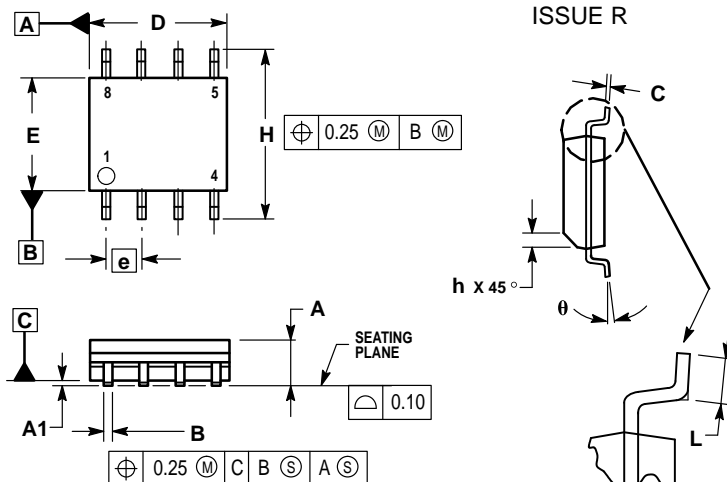
## OUTLINE DIMENSIONS

**P SUFFIX**  
**PLASTIC PACKAGE**  
**CASE 626-05**  
**ISSUE K**


## NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
E	1.02	1.78	0.040	0.070
F	2.54 BSC	0.100 BSC		
G	0.76	1.27	0.030	0.050
H	0.20	0.30	0.008	0.012
I	2.92	3.43	0.115	0.135
J	7.62 BSC	0.300 BSC		
K	—	10°	—	10°
L	0.76	1.01	0.030	0.040

**D SUFFIX**  
**PLASTIC SOIC PACKAGE**  
**CASE 751-05**  
**ISSUE R**


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
F	1.27 BSC	
G	5.80	6.20
H	0.25	0.50
I	0.40	1.25
J	0°	7°

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