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MOTOROLA

# 1.1 GHz Low-Voltage Dual Modulus Prescaler

The MC12022LVA 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 1.1 GHz in programmable frequency steps.

The MC12022LVB 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 2.7 to 5.0 V
- Low–Power 4.0 mA Typical at $V_{CC}$ = 2.7 V
- Operating Temperature Range of –40 to 85°C
- Short Setup Time ($t_{set}$) 16ns Maximum @ 1.1 GHz
- Modulus Control Input Level Is Compatible With Standard CMOS and TTL

**FUNCTIONAL TABLE**

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

**NOTES:** 1. SW: H = $V_{CC}$, L = Open. A logic L can also be applied by grouunding this pin, but this is not recommended due to increased power soncumption.
2. 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 |

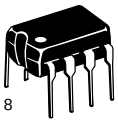
**NOTE:** * Equivalent to a two–input NAND gate

# MC12022LVA
# MC12022LVB

## MECL PLL COMPONENTS
## ÷64/65, ÷128/129
## DUAL MODULUS PRESCALER

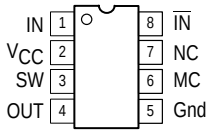
**SEMICONDUCTOR TECHNICAL DATA**


**D SUFFIX**
PLASTIC PACKAGE
CASE 751
(SO–8)




**P SUFFIX**
PLASTIC PACKAGE
CASE 626

**PIN CONNECTIONS**




(Top View)

**ORDERING INFORMATION**

| Device | Operating Temp Range | Package |
|---|---|---|
| MC12022LVAD | $T_A$ = – 40° to +85°C | SO–8 |
| MC12022LVAP | | Plastic |
| MC12022LVBD | | SO–8 |
| MC12022LVBP | | Plastic |

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Power Supply Voltage, Pin 2 | $V_{CC}$ | –0.5 to 7.0 | Vdc |
| Operating Temperature Range | $T_A$ | –40 to 85 | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to 150 | °C |
| Modulus Control Input, Pin 6 | MC | –0.5 to 6.5 | Vdc |

NOTE; ESD data available upon request.

**ELECTRICAL CHARACTERISTICS** ($V_{CC}$ = 4.5 to 5.5 V; $T_A$ = –40°C to 85°C, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Toggle Frequency (Sine Wave Input) | $f_t$ | 0.1 | 1.4 | 1.1 | GHz |
| Supply Current Output Unloaded (Pin 2) | $I_{CC}$ | – | 4.7 | 6.5 | mA |
| Supply Current Output Unloaded (Pin 2) at 5.0 Vdc | $I_{CCH}$ | | 5.8 | 8.0 | mA |
| Modulus Control Input High (MC) | $V_{IH1}$ | 2.0 | – | $V_{CC}$ | V |
| Modulus Control Input Low (MC) | $V_{IL1}$ | – | – | 0.8 | V |
| Divide Ratio Control Input High (SW) | $V_{IH2}$ | $V_{CC}$ | $V_{CC}$ | $V_{CC}$ | Vdc |
| Divide Ratio Control Input Low (SW) | $V_{IL2}$ | Open | Open | Open | – |
| Output Voltage Swing ($C_L$ = 12 pF; $R_L$ = 1.1 kΩ at 2.7 Vdc) | $V_{out}$ | 0.8 | 1.0 | – | $V_{pp}$ |
| Output Voltage Swing ($C_L$ = 12 pF; $R_L$ = 2.2 kΩ at 5.0 Vdc) | $V_{out}$ | 1.0 | 1.6 | – | $V_{pp}$ |
| Modulus Setup Time MC to Out | $t_{set}$ | – | 11 | 16 | ns |
| Input Voltage Sensitivity 250–1100 MHz<br>100–250 MHz | $V_{in(min)}$ | 100<br>400 | –<br>– | 1500<br>1500 | mVpp |
| Output Current ($C_L$ = 12 pF; $R_L$ = 2.2 kΩ at 2.7 Vdc) | $I_O$ | – | 1.2 | 4.0 | mA |
| Output Current ($C_L$ = 12 pF; $R_L$ = 2.2 kΩ at 5.0 Vdc) | $I_O$ | – | 1.2 | 4.0 | mA |

**Figure 1. Logic Diagram (MC12022LVA)**

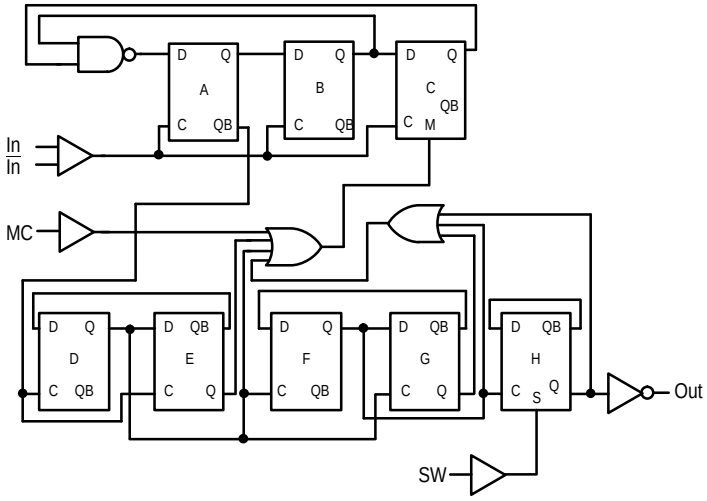
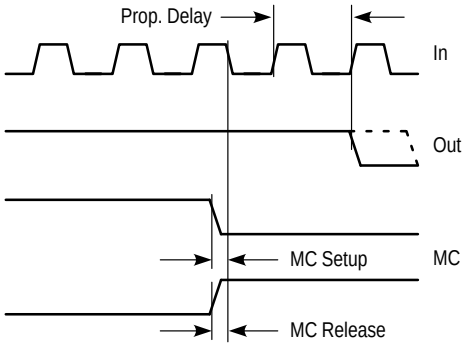
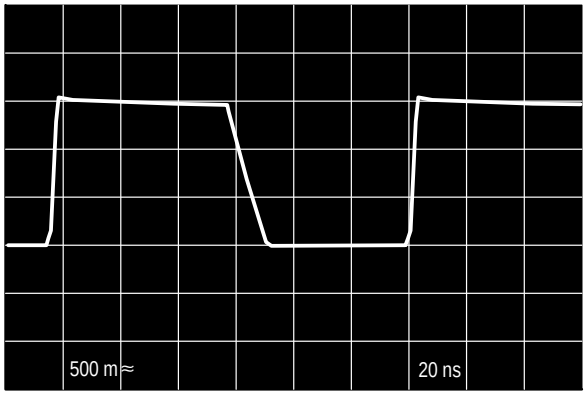



**Figure 2. Modulus Setup Time**

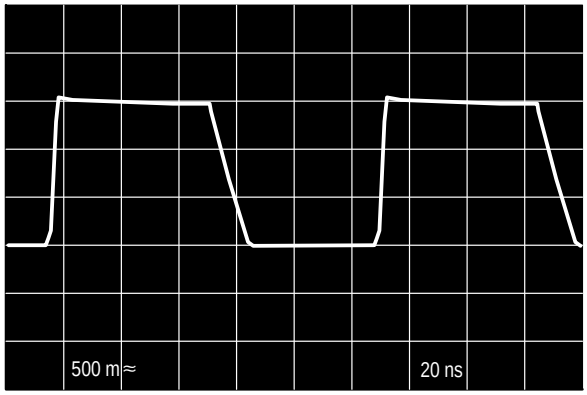



Modulus setup time MC to out is the MC setup or MC release plus the prop delay.

**Figure 3. Typical Output Waveforms**

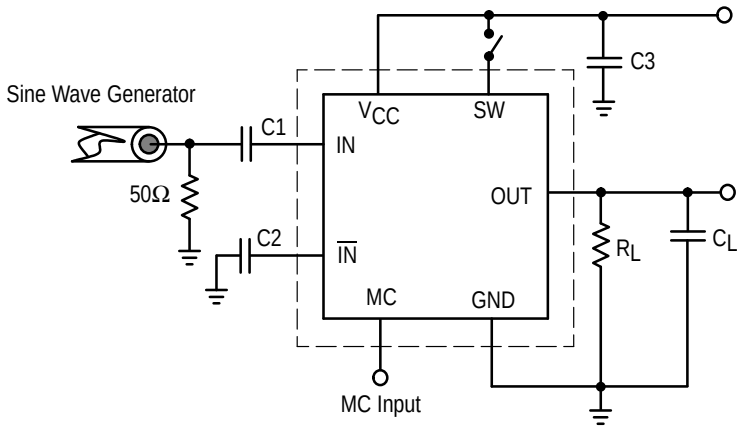



(÷64, 500MHz Input Frequency, $V_{CC}$ = 5.0V, $T_A$ = 25°C, Output Loaded)



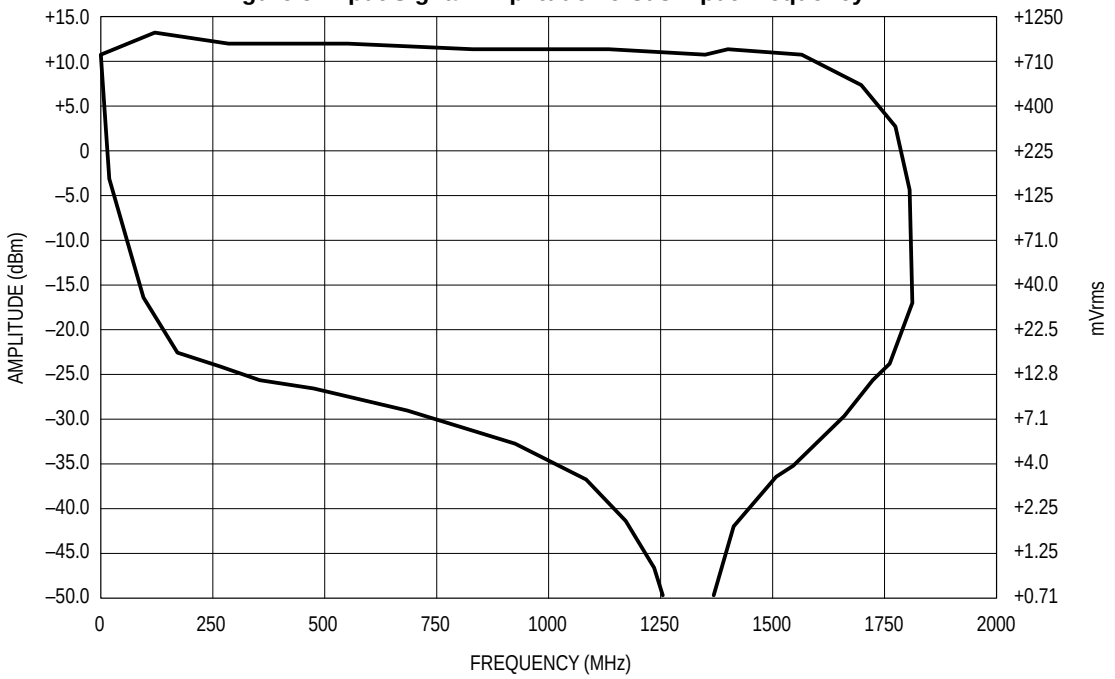

(÷128, 1.1GHz Input Frequency, $V_{CC}$ = 5.0V, $T_A$ = 25°C, Output Loaded)

**Figure 4. AC Test Circuit**




EXTERNAL COMPONENTS
C1 = C2 = 1000pF
C3 = 0.1µF
$C_L$ = 12pF (Including Scope and jig capacitance)
$R_L$ = 2.2kΩ (at +5.0Vdc)
$R_L$ = 1.1kΩ (at +2.7Vdc)

**Figure 5. Input Signal Amplitude versus Input Frequency**




Divide Ratio = 128; $V_{CC}$ = 5.0 V; $T_A$ = 25°C

**Figure 6. Output Amplitude versus Input Frequency**

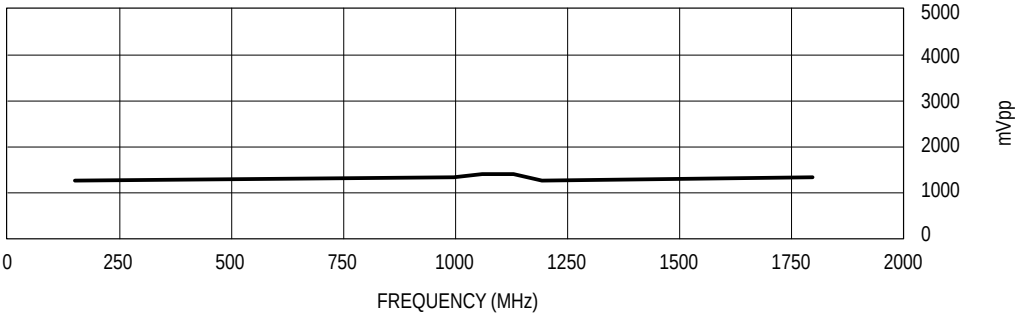
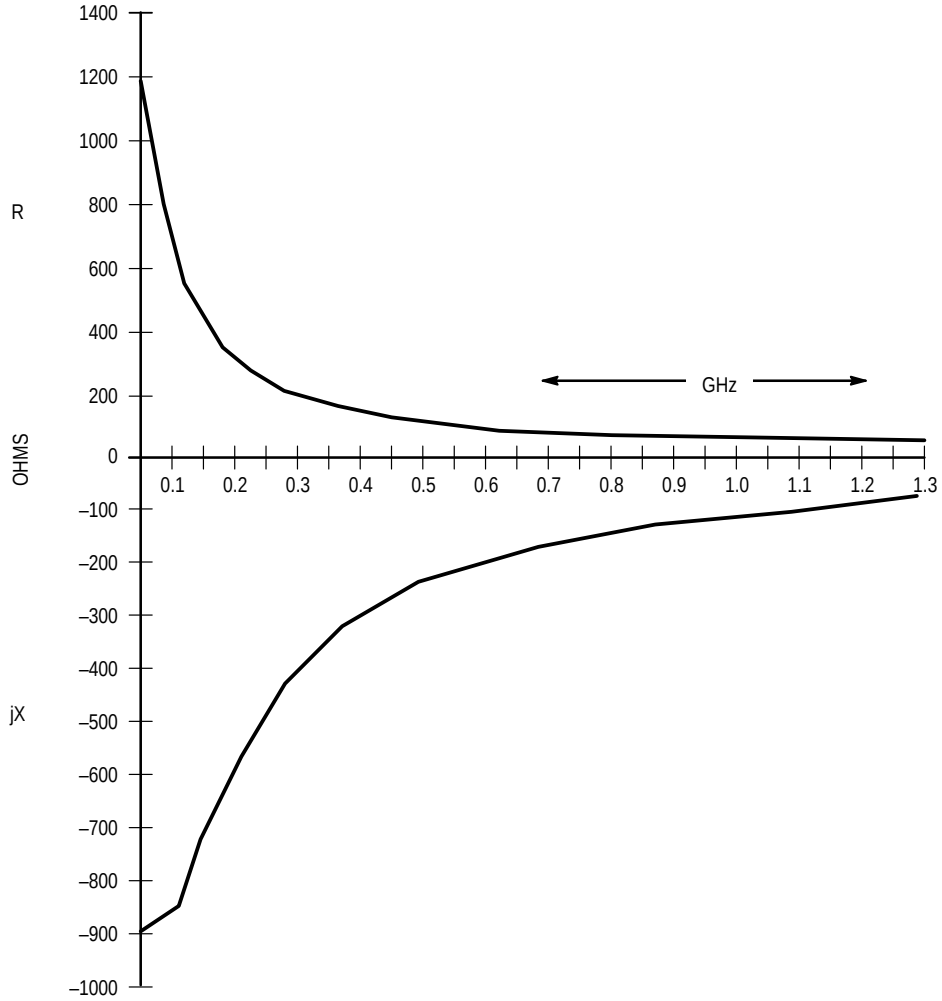
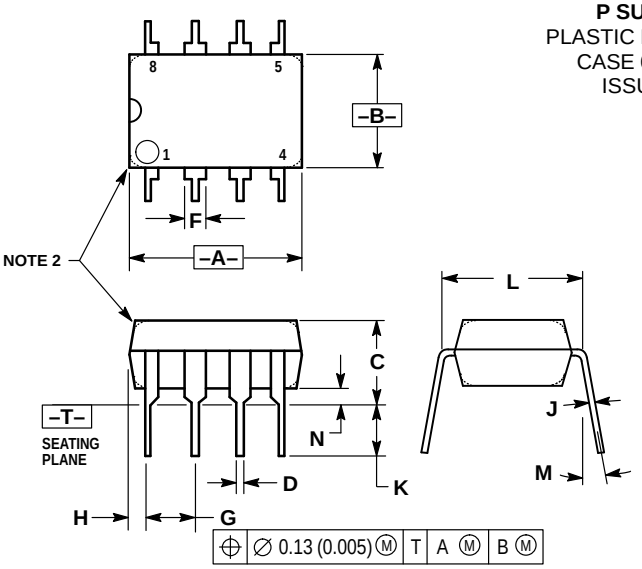


**Figure 7. Typical Input Impedance versus Input Frequency**



## OUTLINE DIMENSIONS

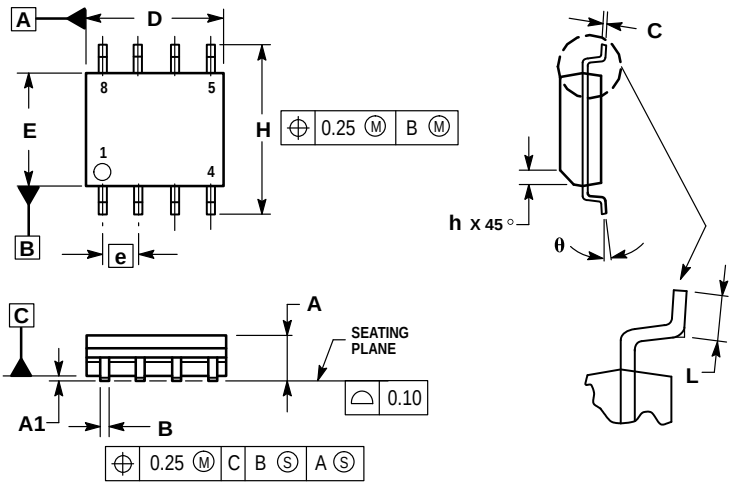
**P SUFFIX**
PLASTIC PACKAGE
CASE 626–05
ISSUE K




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 |
| F | 1.02 | 1.78 | 0.040 | 0.070 |
| G | 2.54 BSC | | 0.100 BSC | |
| H | 0.76 | 1.27 | 0.030 | 0.050 |
| J | 0.20 | 0.30 | 0.008 | 0.012 |
| K | 2.92 | 3.43 | 0.115 | 0.135 |
| L | 7.62 BSC | | 0.300 BSC | |
| M | — | 10° | — | 10° |
| N | 0.76 | 1.01 | 0.030 | 0.040 |

**D SUFFIX**
PLASTIC PACKAGE
CASE 751–06
(SO–8)
ISSUE T




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

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 1.35 | 1.75 |
| A1 | 0.10 | 0.25 |
| B | 0.35 | 0.49 |
| C | 0.19 | 0.25 |
| D | 4.80 | 5.00 |
| E | 3.80 | 4.00 |
| e | 1.27 BSC | |
| H | 5.80 | 6.20 |
| h | 0.25 | 0.50 |
| L | 0.40 | 1.25 |
| θ | 0° | 7° |

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