

## Dual Voltage Controlled Oscillators

## General Description

The DM54LS124/DM74LS124 features two fully independent voltage-controlled oscillators (VCO's) in a single monolithic chip. The output frequency of each is established by a single external component, either a capacitor or a crystal, in combination with two voltage-sensitive inputs, one for frequency range and one for frequency control. An enable input is provided that can be used to start or stop the output pulses when it is low or high, respectively. The internal oscillator runs continuously, even while the output is disabled. A pulse synchronizer ensures that the first output pulse is neither clipped nor extended. Duty cycle of the output pulses is fixed at approximately 50 percent.

The highly stable oscillator can be set to operate at any frequency between 0.12 Hz and 50 MHz typically. The output frequency can be approximated as follows:

$$f_o = \frac{500}{C_{EXT}}$$

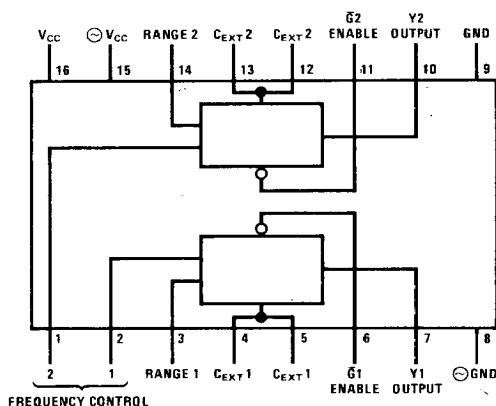
where:  $f_o$  = output frequency in MHz  
 $C_{EXT}$  = external capacitance in pF

The enable input and the buffered output operate at standard Schottky-clamped TTL levels. The enable input is one standard load in each series. Although these devices can operate from a single 5-volt supply, separate supply-voltage and ground pins are provided for the digital logic and for the oscillator/range control circuits so that effective isolation can be accomplished in the system.

## Features

- Two fully independent VCO's in a 16-pin package
- Output frequency set by single external component:
  - Crystal for high-stability fixed-frequency operation
  - Capacitor for fixed- or variable-frequency operation
- Separate supply voltage pins for isolation of inputs and oscillators from logic circuitry
- Stable operation over specified temperature and/or supply voltage ranges

## Connection Diagram



Note: While the enable input is low, the output is enabled. While the enable input is high, the output is high.

54LS124/74LS124(J), (N), (W)

## Electrical Characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER			CONDITIONS		DM54		DM74		UNITS
					LS124		LS124		
					MIN	TYP(1) MAX	MIN	TYP(1) MAX	
V <sub>IH</sub>	High Level Input Voltage at Enable				2		2		V
V <sub>IL</sub>	Low Level Input Voltage at Enable					0.7		0.8	V
V <sub>I</sub>	Input Clamp Voltage at Enable		V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA			-1.5		-1.5	V
I <sub>OH</sub>	High Level Output Current					-1.2		-1.2	mA
V <sub>OH</sub>	High Level Output Voltage		V <sub>CC</sub> = Min, V <sub>IH</sub> = 2V, I <sub>OH</sub> = -1.2 mA		2.5	3.4	2.7	3.4	V
I <sub>OL</sub>	Low Level Output Current					12		24	mA
V <sub>OL</sub>	Low Level Output Voltage		V <sub>CC</sub> = Min, V <sub>ENABLE</sub> = V <sub>IL</sub> Pins 4 and 13 = V <sub>CC</sub> (Min) - 2V	I <sub>OL</sub> = 12 mA	0.25	0.4	0.25	0.4	V
				I <sub>OL</sub> = 24 mA		0.35	0.5		
I <sub>I</sub>	Input Current	Freq Control or range	V <sub>CC</sub> = Max	V <sub>I</sub> = 5V	50	250	50	250	μA
				V <sub>I</sub> = 1V	10	50	10	50	
I <sub>I</sub>	Input Current at Maximum Input Voltage	Enable	V <sub>CC</sub> = Max, V <sub>I</sub> = 7V			0.1		0.1	mA
I <sub>IH</sub>	High Level Input Current	Enable	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V			20		20	μA
I <sub>IL</sub>	Low Level Input Current	Enable	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.5V			-0.4		-0.4	mA
I <sub>OS</sub>	Short Circuit Output Current		V <sub>CC</sub> = Max, V <sub>ENABLE</sub> = 4.5V(2)		-30	-150	-30	-150	mA
I <sub>CC</sub>	Supply Current, Total into Pins 15 and 16		V <sub>CC</sub> = Max(3)		22	37	22	37	mA
V <sub>I</sub>	Input Voltage at Frequency Control or Range Input				0	5	0	5	V

## Notes

- (1) All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ .  
 (2) Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.  
 (3)  $I_{CC}$  is measured with the outputs disabled and open.

Switching Characteristics  $V_{CC} = 5\text{V}$ ,  $R_L = 667\Omega$ ,  $C_L = 45 \text{ pF}$ ,  $T_A = 25^\circ\text{C}$ 

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
$f_o$	Output Frequency	$C_{EXT} = 2 \text{ pF}$	$V_{I(\text{FREQ})} = 5\text{V}, V_{I(\text{RNG})} = 0\text{V}$ $V_{I(\text{FREQ})} = 0\text{V}, V_{I(\text{RNG})} = 5\text{V}$	35	50		MHz
	Output Duty Cycle	$C_{EXT} = 8.3 \text{ pF}$ to $500\mu\text{F}$			50%		
$t_{PHL}$	Propagation Delay Time, High-to-Low Level Output From Enable	$f_o \geq 1 \text{ Hz}$			30+(4)		ns

## Notes

- (4) The delay will typically be 30 ns plus up to one half the period of one cycle (i.e.  $30 \text{ ns} + 5 \times 10^8 / f_o(\text{Hz})$ ) depending upon the timing of the enable pulse with respect to the signal generated by the internal oscillator.