

# SN54S124, SN74S124 DUAL VOLTAGE-CONTROLLED OSCILLATORS

SDLS201

DECEMBER 1983 — REVISED MARCH 1988

- Two Independent VCOs in a 16-Pin Package
- Output Frequency Set by Single External Component:  
Capacitor for Fixed- or Variable-Frequency Operation
- Separate Supply Voltage Pins for Isolation of Frequency Control Inputs and Oscillators from Output Circuitry
- Highly Stable Operation over Specified Temperature and/or Supply Voltage Ranges
- Typical  $f_{max}$  . . . . . 85 MHz  
Typical Power Dissipation . . . . . 525 mW
- Frequency Spectrum . . . 1 Hz to 60 MHz

## description

The 'S124 features two independent voltage-controlled oscillators (VCO) in a single monolithic chip. The output frequency of each VCO is established by an external capacitor in combination with two voltage-sensitive inputs, one for frequency range and one for frequency control. These inputs can be used to vary the output frequency as shown under typical characteristics. These highly stable oscillators can be set to operate at any frequency typically between 0.12 hertz and 85 megahertz. Under the conditions used in Figure 1, the output frequency can be approximated as follows:

$$f_o = \frac{5 \times 10^{-2}}{C_{ext}}$$

where:  $f_o$  = output frequency in hertz  
 $C_{ext}$  = external capacitance in farads.

## logic

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

These devices can operate from a single 5-volt supply. However, one set of supply-voltage and ground pins ( $V_{CC}$  and GND) is provided for the enable, synchronization-gating, and output sections, and a separate set ( $\ominus V_{CC}$  and  $\ominus GND$ ) is provided for the oscillator and associated frequency-control circuits so that effective isolation can be accomplished in the system.

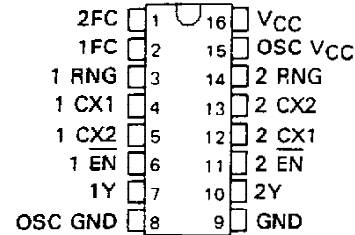
The enable input of these devices starts or stops the output pulses when it is low or high, respectively. The internal oscillator of the 'S124 is started and stopped by the enable input. The enable input is one standard load; it and the buffered output operate at standard Schottky-clamped TTL levels.

The pulse synchronization-gating section ensures that the first output pulse is neither clipped nor extended. Duty cycle of the square-wave output is fixed at approximately 50 percent.

The SN54S124 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; the SN74S124 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

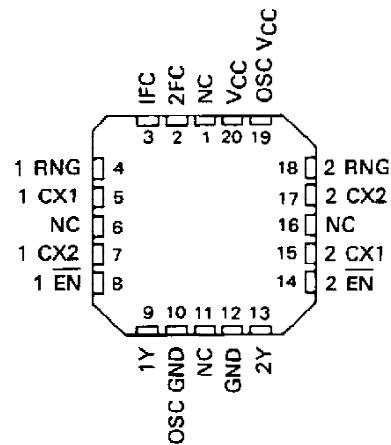
SN54S124 . . . J OR W PACKAGE  
SN74S124 . . . D OR N PACKAGE

(TOP VIEW)



SN54S124 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

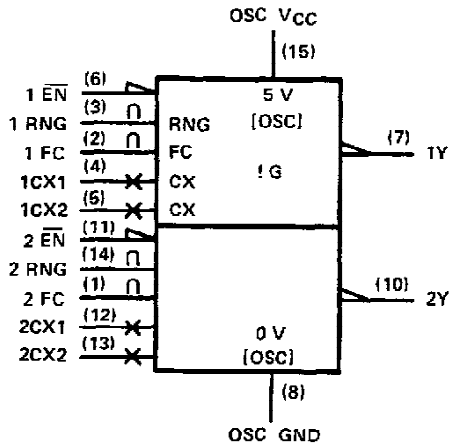
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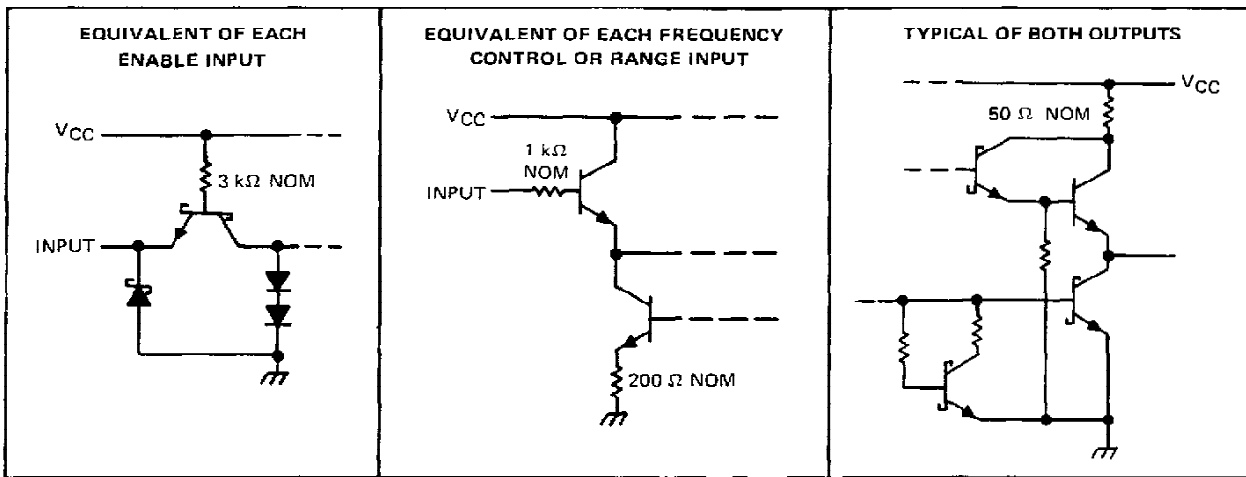
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logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

## schematics of inputs and outputs



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (See Notes 1 and 2)	7V
Input voltage	5.5 V
Operating free-air temperature range: SN54S124	-55°C to 125°C
SN74S124	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTES: 1. Voltage values are with respect to the appropriate ground terminal.  
2. Throughout this data sheet, the symbol  $V_{CC}$  is used for the voltage applied to both the  $V_{CC}$  and  $\ominus V_{CC}$  terminals, unless otherwise noted.

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## recommended operating conditions

	SN54S124			SN74S124			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$ (see Note 1)	4.5	5	5.5	4.75	5	6.25	V
Input voltage at frequency control or range input, $V_{I(freq)}$ or $V_{I(rng)}$	1		5	1		5	V
High-level output current, $I_{OH}$			-1			-1	mA
Low-level output current, $I_{OL}$			20			20	mA
Output frequency (enabled), $f_o$	1			1			Hz
	60			60			MHz
Operating free-air temperature, $T_A$	-55			125			$^{\circ}$ C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS <sup>†</sup>	MIN	TYP <sup>‡</sup>	MAX	UNIT	
$V_{IH}$	High-level input voltage at enable		2			V	
$V_{IL}$	Low-level input voltage at enable				0.8	V	
$V_{IK}$	Input clamp voltage at enable	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$			-1.2	V	
$V_{OH}$	High-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OH} = -1 \text{ mA}$	SN54S <sup>4</sup>	2.5	3.4	V	
			SN74S <sup>4</sup>	2.7	3.4		
$V_{OL}$	Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 20 \text{ mA}$			0.5	V	
$I_I$	Input current	Freq control or range	$V_{CC} = \text{MAX}$	$V_I = 5 \text{ V}$	10	50	$\mu$ A
				$V_I = 1 \text{ V}$	1	15	
$I_{II}$	Input current at maximum input voltage	Enable	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$	High-level input current	Enable	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$			50	$\mu$ A
$I_{IL}$	Low-level input current	Enable	$V_{CC} = \text{MAX}$ , $V_I = 0.5 \text{ V}$			-2	mA
$I_{OS}$	Short-circuit output current <sup>§</sup>	$V_{CC} = \text{MAX}$	-40		-100	mA	
$I_{CC}$	Supply current, total into $V_{CC}$ and $\ominus V_{CC}$	$V_{CC} = \text{MAX}$ , See Note 3		105	150	mA	
		$V_{CC} = \text{MAX}$ , $T_A = 125^{\circ}\text{C}$ , See Note 3	W package only		110		

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

NOTE 3:  $I_{CC}$  is measured with the outputs disabled and open.

## switching characteristics, $V_{CC} = 5 \text{ V}$ , $R_L = 280 \Omega$ , $C_L = 15 \text{ pF}$ , $T_A = 25^{\circ}\text{C}$ (see note 4)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_o$	Output frequency	$C_{ext} = 2 \text{ pF}$	$V_{I(freq)} = 4 \text{ V}$ , $V_{I(rng)} = 1 \text{ V}$	60	85	MHz
			$V_{I(freq)} = 1 \text{ V}$ , $V_{I(rng)} = 5 \text{ V}$	25	40	
	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	$f_o = 1 \text{ Hz}$ to $20 \text{ MHz}$		1.4		s
		$f_o > 20 \text{ MHz}$		70		ns

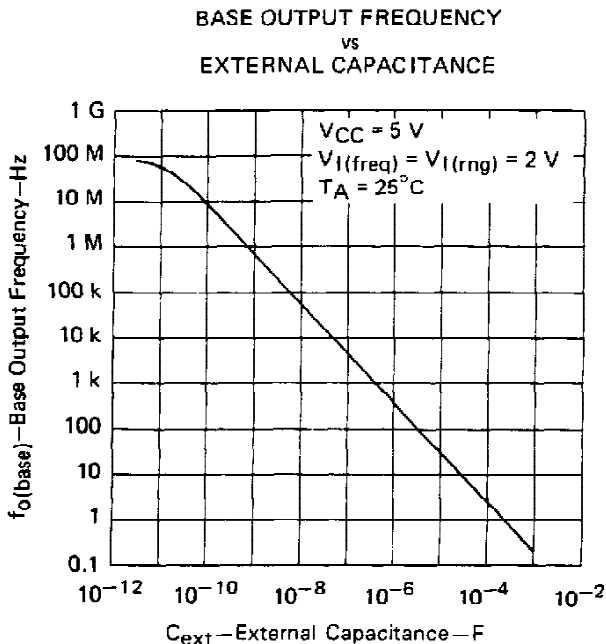
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

  
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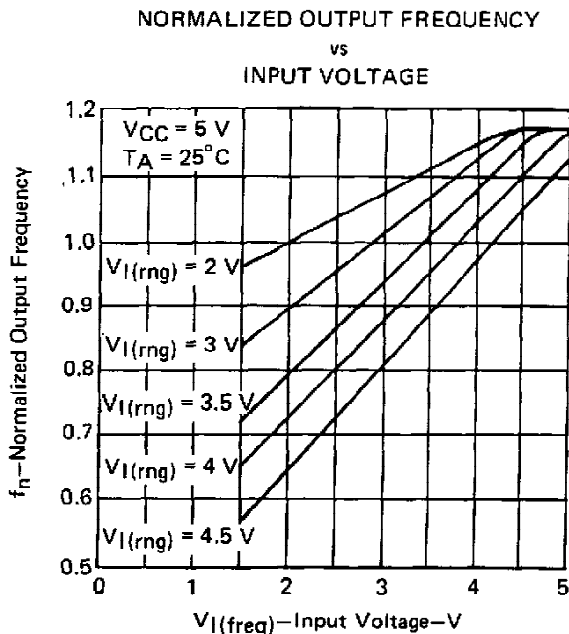
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**SN54S124, SN74S124**  
**DUAL VOLTAGE-CONTROLLED OSCILLATORS**

**TYPICAL CHARACTERISTICS**



**FIGURE 1**



**FIGURE 2**

NOTE:  $f_o = f_n \times f_o(\text{base})$



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