

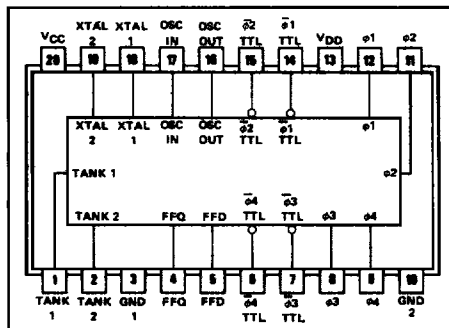
**TTL  
MSI**

# TYPE SN74LS362 (TIM9904) FOUR-PHASE CLOCK GENERATOR/DRIVER

BULLETIN NO. DL-S 7712476, OCTOBER 1976—REVISED AUGUST 1977

- Clock Generator/Driver for The TMS 9900 or Other Microprocessors
- High-Level 4-Phase Outputs
- Complementary TTL 4-Phase Outputs
- Self-Contained Oscillator Can be Crystal or Capacitor Controlled
- External Oscillator Can Be Used
- Clocked D-Type Flip-Flop With Schmitt-Trigger Input For Reset Signal Synchronization

SN74LS362 ... J OR N PACKAGE  
(TOP VIEW)

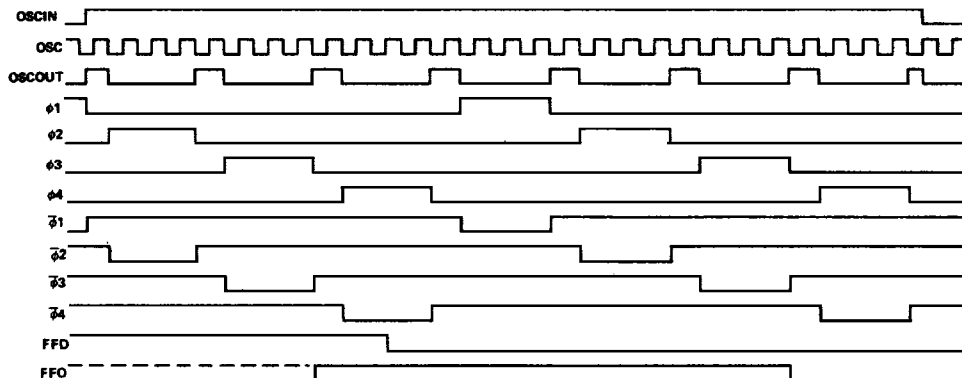


## description

The 'LS362 consists of an oscillator, divide-by-four counter, a second divide-by-four counter with gating to generate four clock phases, high-level (12-volt) output drivers, low-level (5-volt) complementary output drivers, and a D-type flip-flop controlled by an external signal and the  $\phi 3$  clock. The four high-level clock phases provide clock inputs to a TMS 9900 microprocessor. The four complementary TTL-level clocks can be used to time memory or other logic functions in a TMS 9900 computer system. The D-type flip-flop can be used to provide (for example) a reset signal to a TMS 9900, timed by  $\phi 3$ , on receipt of an input to the FFD input from power turn-on or a manual switch closure. Other applications are possible. A safety feature has been incorporated in the  $\phi$  outputs such that if an open occurs in the VCC supply common to 'LS362 and TMS 9900, the  $\phi$  outputs will go low thus protecting the TMS 9900.

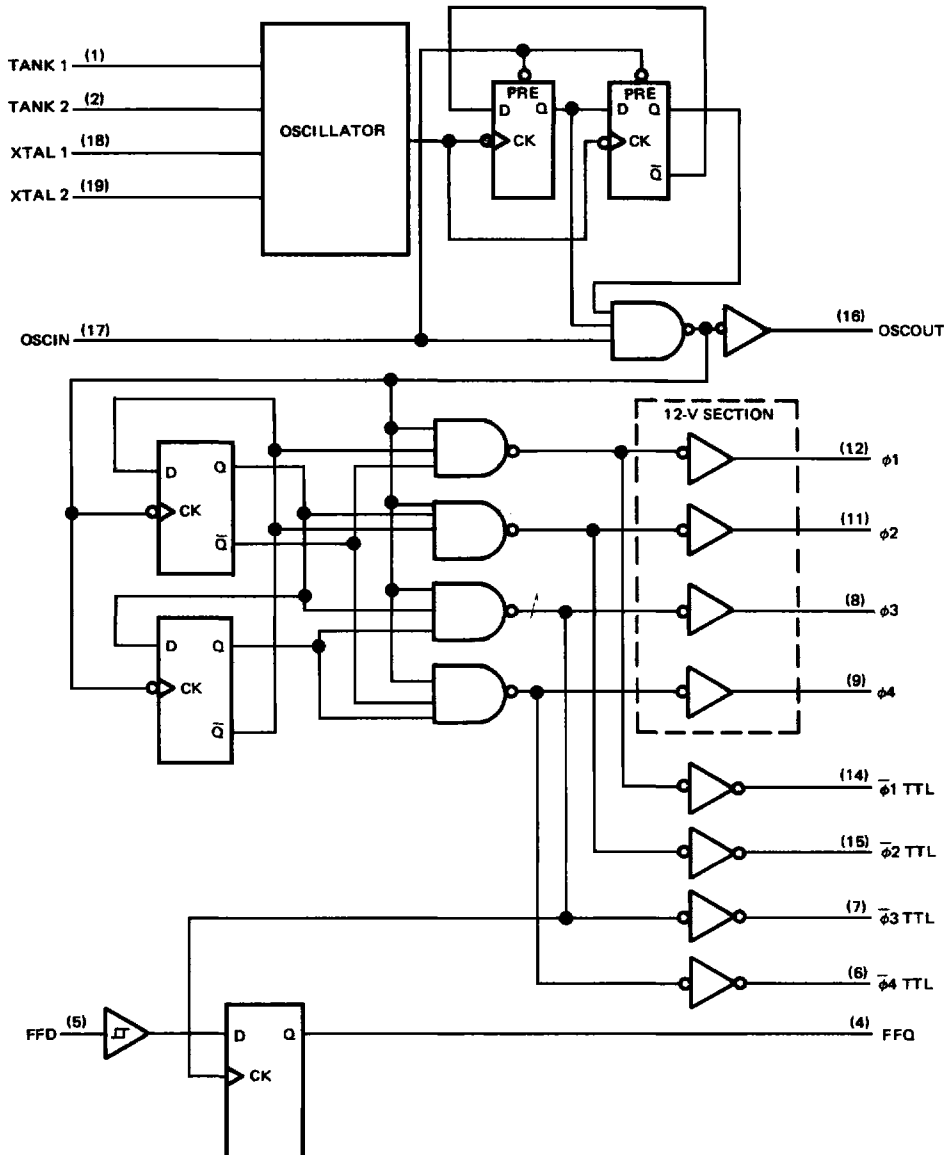
The frequency of the internal oscillator can be established by a quartz crystal or capacitor and LC circuit. Either a fundamental or overtone crystal may be used. The LC circuit connected to the tank inputs selects the desired crystal overtone or establishes the internal oscillator frequency when a capacitor is used instead of a crystal. An LC circuit must always be used at the tank inputs when using the internal oscillator. An external oscillator can be used, if desired, see "Applications Information" for details.

## typical phase relationships of inputs and outputs (OSC is internal)



# **TYPE SN74LS362 (TIM9904)** **FOUR-PHASE CLOCK GENERATOR/DRIVER**

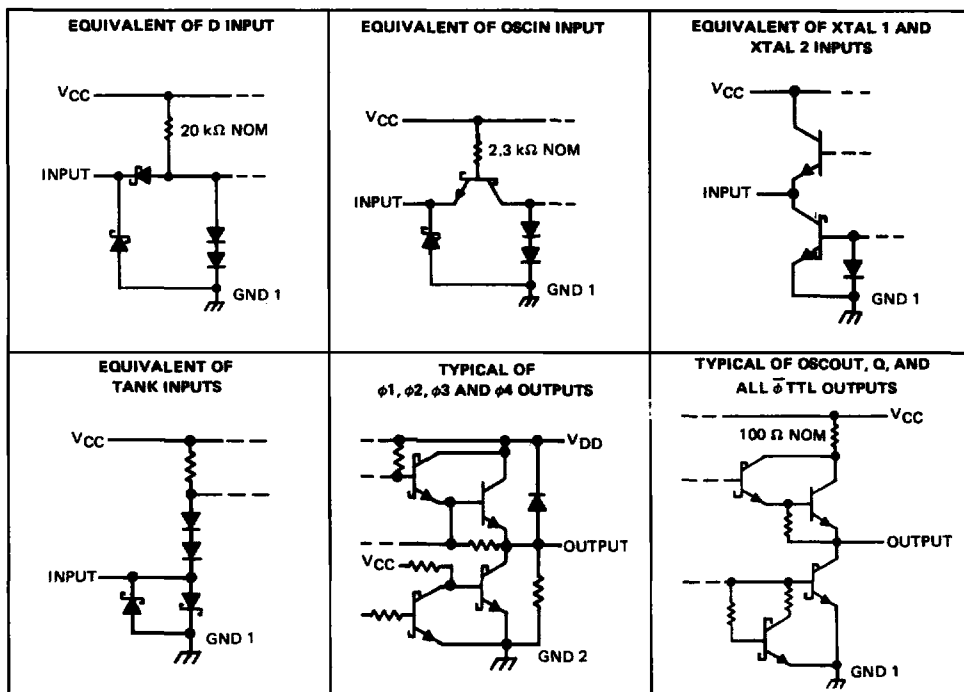
**functional block diagram**



# TYPE SN74LS362 (TIM9904)

## FOUR-PHASE CLOCK GENERATOR/DRIVER

schematics of inputs and outputs



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

Supply voltage: $V_{CC}$ (see Note 1)	7 V
$V_{DD}$ (see Note 1)	13 V
Input voltage: OSCIN	5.5 V
FFD	-0.5 V to 7 V
Operating free-air temperature range	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to the network ground terminals connected together.

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltages	$V_{CC}$	4.75	5	5.25	V
	$V_{DD}$	11.4	12	12.6	V
High-level output current, $I_{OH}$	$\phi 1, \phi 2, \phi 3, \phi 4$			-100	$\mu A$
	All others			-400	$\mu A$
Low-level output current, $I_{OL}$	$\phi 1, \phi 2, \phi 3, \phi 4$			4	mA
	All others			8	mA
Internal oscillator frequency, $f_{osc}$			48	54	MHz
External oscillator pulse width, $t_{w(osc)}$		25			ns
Setup time, FFD input (with respect to falling edge of $\phi 3$ ), $t_{su}$		50			ns
Hold time, FFD input (with respect to falling edge of $\phi 3$ ), $t_h$		-30			ns
Operating free-air temperature, $T_A$		0		70	°C





# TYPE SN74LS362 (TIM9904) FOUR-PHASE CLOCK GENERATOR/DRIVER

## APPLICATION INFORMATION

Figure 2 shows the 'LS362 connected to a TMS9900. The oscillator is shown operating with a quartz crystal and an LC circuit connected to the tank terminals.

For operation of the TMS 9900 microprocessor at 3 MHz, the frequency reference will need a resonant frequency of 48 MHz ( $16 \times 3$  MHz). A quartz crystal used as a frequency reference should be made for series-mode operation with a resistance in the 20- to 75-ohm range and be capable of a minimum of 2 mW power dissipation. Typical frequency tolerance is  $\pm 0.005\%$ . For 48-MHz operation a third-overtone crystal is used. The inductance L connected across the tank terminals should be  $0.47 \mu\text{H} \pm 10\%$ , and the capacitance C (including board capacity) should be  $22 \text{ pF} \pm 5\%$ . The LC circuit should be tuned to the third-overtone crystal frequency for best results. A  $0.1\text{-}\mu\text{F}$  capacitor can be substituted for the quartz crystal. With a capacitor rather than a crystal, the LC tuned circuit establishes the operating frequencies. LC component values for operation at any frequency can be computed from  $f_{\text{osc}} = 1/(2\pi\sqrt{LC})$  where  $f_{\text{osc}}$  is the oscillator frequency, L is the inductance value in henries, and C is the capacitance value in farads.

When the internal oscillator is being used, OSCIN should be connected to  $V_{\text{CC}}$  through a resistor ( $1 \text{ k}\Omega$  nominal) and an LC tank circuit must be connected to the tank inputs. An external oscillator can be used by connecting it to OSCIN and disabling the internal oscillator by connecting the crystal terminals to  $V_{\text{CC}}$  and leaving the tank inputs open. An external oscillator must have a frequency four times the desired output clock frequency and a 25% duty cycle. See Figure 3.

The first low-level external clock pulse will preset the divide-by-four counter, allowing the external oscillator signal to directly drive the phase generator. Figure 3 is a timing diagram illustrating operation with an external oscillator.

Resistors between  $\phi 1$ ,  $\phi 2$ ,  $\phi 3$ , and  $\phi 4$  outputs of the 'LS362 and the corresponding clock input terminals of the TMS 9900 should be in the 10- to 20-ohm range (See Figure 2). Their purpose is to minimize overshoot and undershoot. The required resistance value is dependent on circuit layout. Clock signal interconnections should be as short as possible.

The D-type flip-flop associated with pins FFD and FFQ can be used to provide a power-on reset and a manual reset to the TMS 9900 as shown in Figure 4. A Schmitt-trigger circuit driving the D input generates a fast-rising waveform when the input voltage rises to a specific value. At power turn-on, voltage across the  $0.1 \mu\text{F}$  capacitor in Figure 4 will rise towards  $V_{\text{CC}}$ . This circuit provides a delay that resets the TMS 9900 after  $V_{\text{CC}}$  has stabilized. An optional manual reset switch can be connected to the delay circuit for resetting the TMS 9900 at any time. The TMS 9900 HOLD signal could alternately be actuated by FFD.

The ground terminals GND1 and GND2 should be connected together and to system ground.

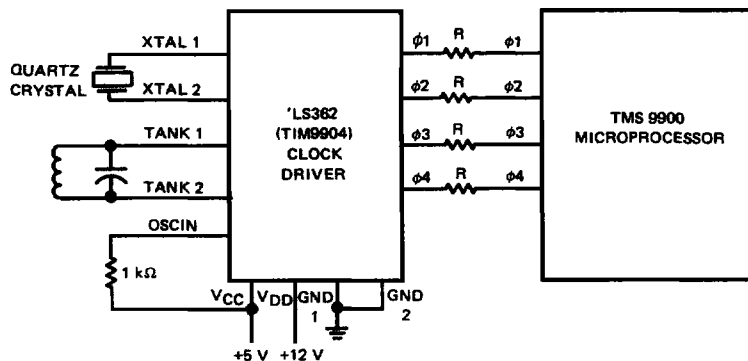


FIGURE 2—'LS362 CRYSTAL-CONTROLLED OPERATION

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## APPLICATION INFORMATION

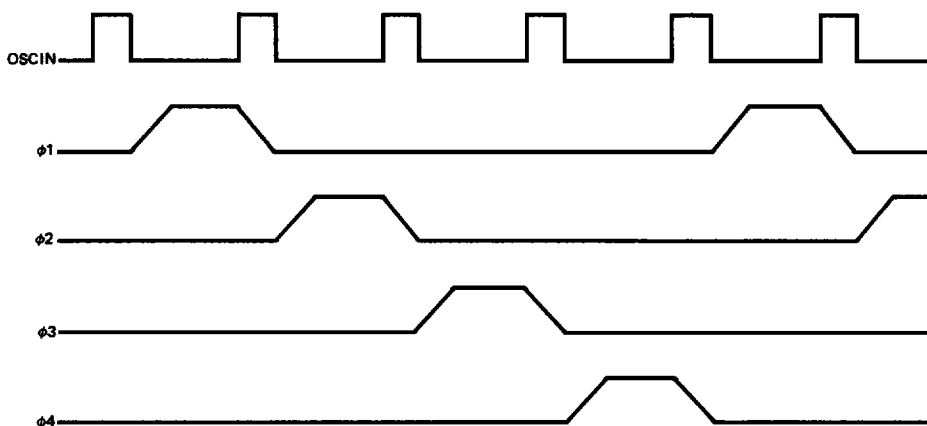


FIGURE 3—EXTERNAL OSCILLATOR TIMING

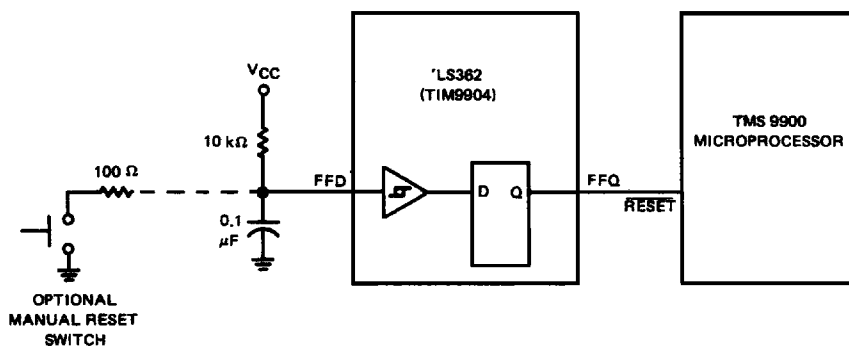


FIGURE 4—POWER-ON RESET