National Semiconductor

February 1988

MM54C932/MM74C932 Phase Comparator

General Description

The MM74C932/MM54C932 consists of two independent output phase comparator circuits. The two phase comparators have a common signal input and a common comparator input. The signal input can be directly coupled for a large voltage signal, or capacitively coupled to the self-biasing amplifier at the signal input for a small voltage signal.

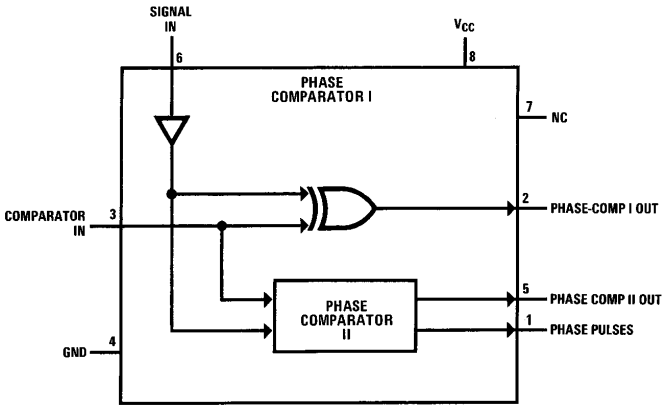
Phase comparator I, an exclusive-OR gate, provides a digital error signal (phase comp. I out) and maintains 90° phase shifts at the VCO center frequency. Between signal input and comparator input (both at 50% duty cycle), it may lock onto the signal input frequencies that are close to harmonics of the VCO center frequency.

Phase comparator II is an edge-controlled digital memory network. It provides a digital error signal (phase comp. II out) and lock in signal (phase pulses) to indicate a locked condition and maintains a 0° phase shift between signal input and comparator input.

Features

- Wide supply voltage range
- Convenient mini-DIP package
- TRI-STATE® phase-comparator output (comparator II)
- 200 mV input voltage (signal in) sensitivity (typical)

Block and Connection Diagrams



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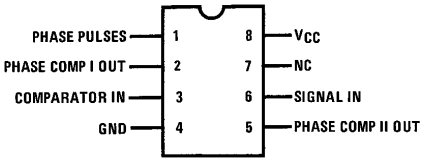
Dual-In-Line Package



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Top View

Order Number MM54C932 or MM74C932

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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Pin	−0.3V to V_{CC} + 0.3V
Operating Temperature Range	
MM54C932	−55°C to +125°C
MM74C932	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3V to 15V
Absolute Maximum V_{CC}	18V
Lead Temperature (Soldering, 10 seconds)	260°C

DC Electrical Characteristics

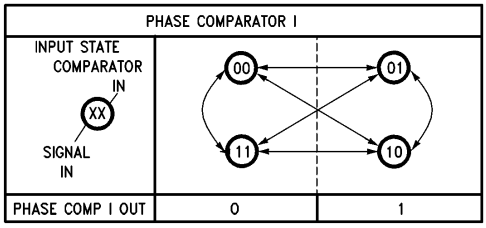
Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{CC}	Quiescent Device Current	PIN 5 = V_{CC}, PIN 8 = V_{CC}, PIN 3 = 0V				
		V_{CC} = 5V		0.005	150	μA
		V_{CC} = 10V		0.01	300	μA
		V_{CC} = 15V		0.015	600	μA
		PIN 6 = Open, PIN 3 = GND				
		V_{CC} = 5V		5	205	μA
		V_{CC} = 10V		20	710	μA
		V_{CC} = 15V		50	1800	μA
V_{OL}	Low Level Output Voltage	V_{CC} = 5V		0	0.05	V
		V_{CC} = 10V		0	0.05	V
		V_{CC} = 15V		0	0.05	V
V_{OH}	High Level Output Voltage	V_{CC} = 5V	4.95	5		V
		V_{CC} = 10V	9.95	10		V
		V_{CC} = 15V	14.95	15		V
V_{IL}	Low Level Input Voltage Comparator and Signal	V_{CC} = 5V, V_O = 0.5V or 4.5V			1.5	V
		V_{CC} = 10V, V_O = 1V or 9V			3.0	V
		V_{CC} = 15V, V_O = 1.5V or 13.5V			4.0	V
V_{IH}	High Level Input Voltage Comparator and Signal	V_{CC} = 5V, V_O = 0.5V or 4.5V	3.5			V
		V_{CC} = 10V, V_O = 1V or 9V	7.0			V
		V_{CC} = 15V, V_O = 1.5V or 13.5V	11.0			V
I_{OL}	Low Level Output Current	V_{CC} = 5V, V_O = 0.4V	0.36	0.88		mA
		V_{CC} = 10V, V_O = 0.5V	0.9	2.25		mA
		V_{CC} = 15V, V_O = 1.5V	2.4	8.8		mA
I_{OH}	High Level Output Current	V_{CC} = 5V, V_O = 4.6V	−0.36	−0.88		mA
		V_{CC} = 10V, V_O = 9.5V	−0.9	−2.25		mA
		V_{CC} = 15V, V_O = 13.5V	−2.4	−8.8		mA
I_{IN}	Input Current	All Inputs except Signal Input				
		V_{CC} = 15V, V_{IN} = 0V		-10^{-5}	−1.0	μA
		V_{CC} = 15V, V_{IN} = 15V		10^{-5}	1.0	μA
C_{IN}	Input Capacitance	Any Input			7.5	pF
P_D	Total Power Dissipation	f_o = 10 kHz, R1 = 1 MΩ R2 = ∞, VCO_{IN} = V_{CC}/2				
		V_{CC} = 5V		0.07		mW
		V_{CC} = 10V		0.6		mW
		V_{CC} = 15V		2.4		mW

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
R_{IN}	Phase Comparators					
	Input Resistance Signal Input	V_{CC} = 5V	1.0	3.0		MΩ
		V_{CC} = 10V	0.2	0.7		MΩ
		V_{CC} = 15V	0.1	0.3		MΩ
	Comparator Input	V_{CC} = 5V		10^6		MΩ
		V_{CC} = 10V		10^6		MΩ
		V_{CC} = 15V		10^6		MΩ
	AC Coupled Signal Input	C_{SERIES} = 1000 pF				
	Voltage Sensitivity	f = 50 kHz				
		V_{CC} = 5V		200	400	mV
		V_{CC} = 10V		400	800	mV
		V_{CC} = 15V		700	1400	mV

Phase Comparator State Diagrams



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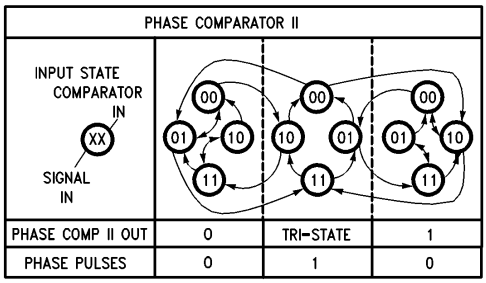

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FIGURE 1

Typical Waveforms

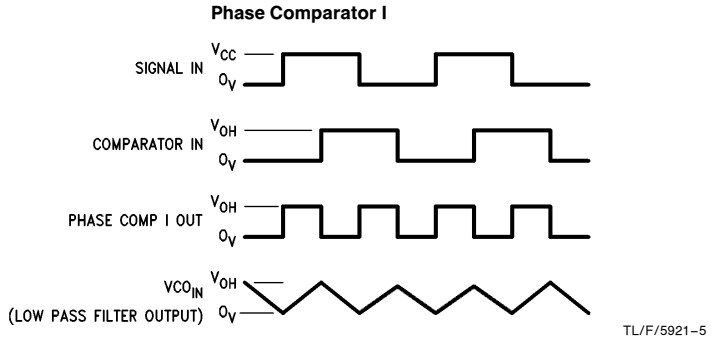


FIGURE 2. Typical Waveform Employing Phase Comparator I in Locked Condition

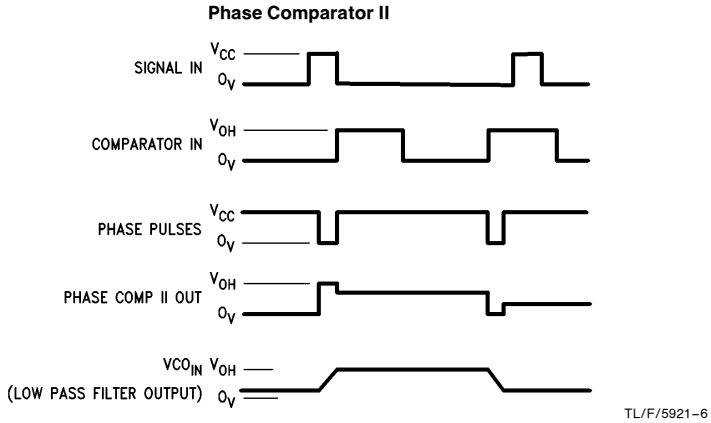
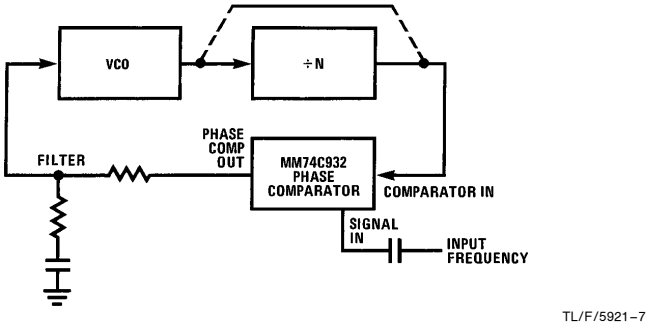
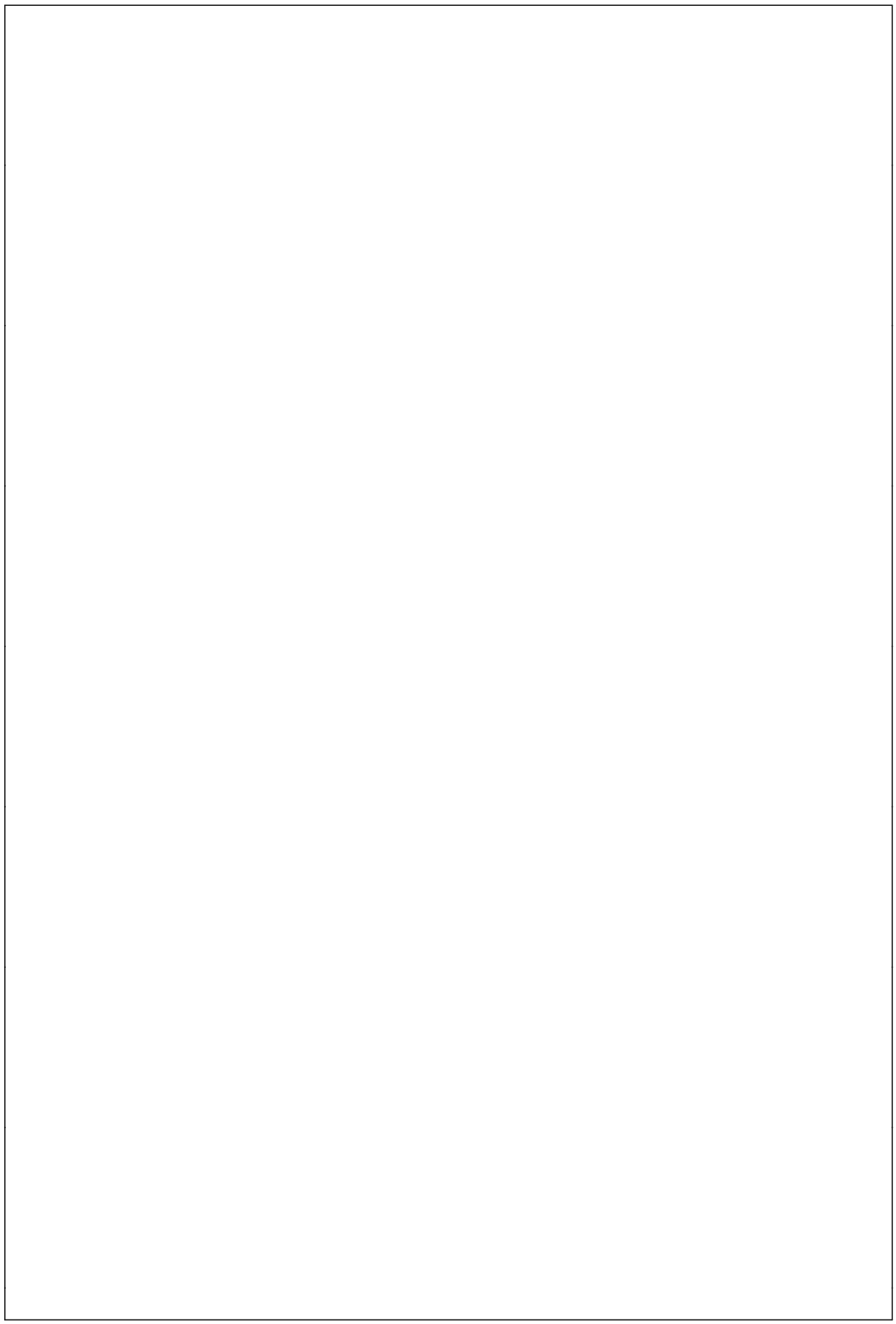


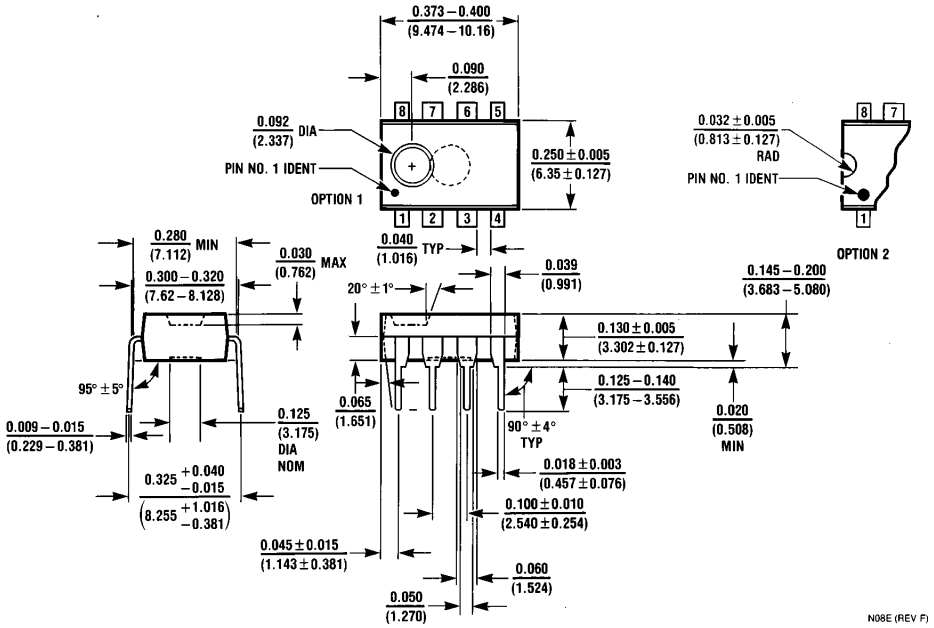
FIGURE 3. Typical Waveform Employing Phase Comparator II in Locked Condition

Typical Phase Locked Loop





Physical Dimensions inches (millimeters)



Molded Dual-In-Line Package (N)
Order Number MM54C932N or MM74C932N
NS Package Number N08E

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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