

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.

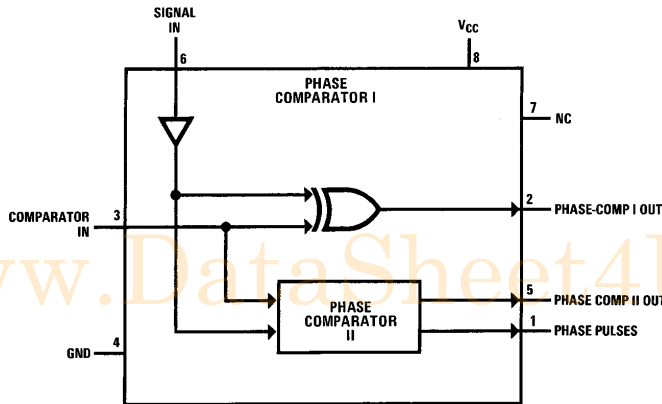
Phase comparator I, an exclusive-OR gate, provides a digital error signal (phase comp. I out) and maintains 90° phase shifts at the VCO center frequency. Between signal input and comparator input (both at 50% duty cycle), it may lock onto the signal input frequencies that are close to harmonics of the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

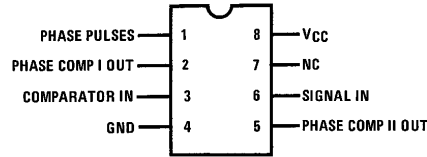
- Wide supply voltage range
- Convenient mini-DIP package
- TRI-STATE® phase-comparator output (comparator II)
- 200 mV input voltage (signal in) sensitivity (typical)

### Block and Connection Diagrams



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#### Dual-In-Line Package



TL/F/5921-2

#### Top View

Order Number MM54C932 or MM74C932

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MM54C932/MM74C932 Phase Comparator

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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	-55°C to +125°C
MM54C932	-40°C to +85°C
MM74C932	-65°C to +150°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**

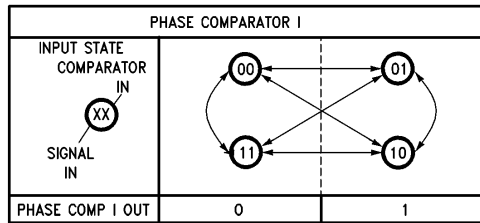
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$I_{CC}$	Quiescent Device Current	PIN 5 = $V_{CC}$ , PIN 8 = $V_{CC}$ , PIN 3 = 0V $V_{CC} = 5V$ $V_{CC} = 10V$ $V_{CC} = 15V$		0.005	150	$\mu A$
				0.01	300	$\mu A$
				0.015	600	$\mu A$
		PIN 6 = Open, PIN 3 = GND $V_{CC} = 5V$ $V_{CC} = 10V$ $V_{CC} = 15V$		5	205	$\mu A$
				20	710	$\mu A$
				50	1800	$\mu A$
$V_{OL}$	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	$\mu A$
		$V_{CC} = 15V, V_{IN} = 15V$		$10^{-5}$	1.0	$\mu A$
$C_{IN}$	Input Capacitance	Any Input			7.5	pF
$P_D$	Total Power Dissipation	$f_o = 10$ kHz, $R1 = 1$ M $\Omega$ $R2 = \infty$ , $V_{COIN} = V_{CC}/2$				
		$V_{CC} = 5V$		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.

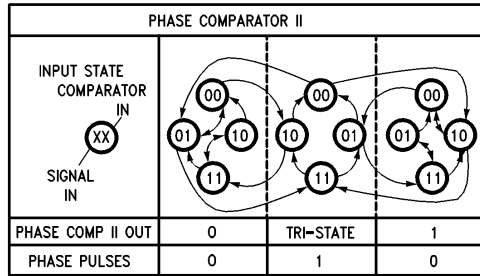
### Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
R <sub>IN</sub>	Phase Comparators Input Resistance Signal Input	V <sub>CC</sub> = 5V	1.0	3.0		MΩ
		V <sub>CC</sub> = 10V	0.2	0.7		MΩ
		V <sub>CC</sub> = 15V	0.1	0.3		MΩ
	Comparator Input	V <sub>CC</sub> = 5V V <sub>CC</sub> = 10V V <sub>CC</sub> = 15V		10 <sup>6</sup> 10 <sup>6</sup> 10 <sup>6</sup>		MΩ MΩ MΩ
	AC Coupled Signal Input Voltage Sensitivity	C <sub>SERIES</sub> = 1000 pF f = 50 kHz V <sub>CC</sub> = 5V V <sub>CC</sub> = 10V V <sub>CC</sub> = 15V		200 400 700	400 800 1400	mV mV mV

### Phase Comparator State Diagrams



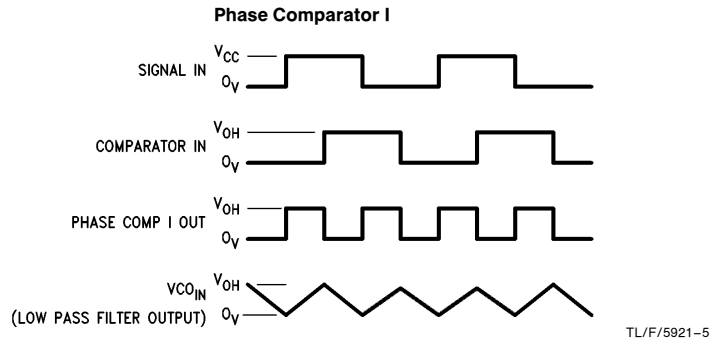
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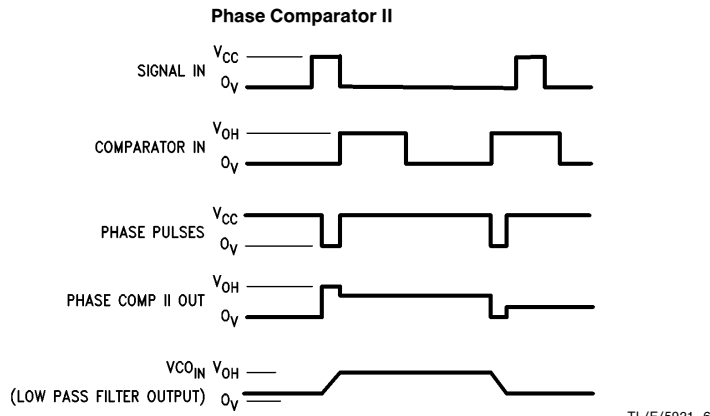
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**FIGURE 1**

### Typical Waveforms

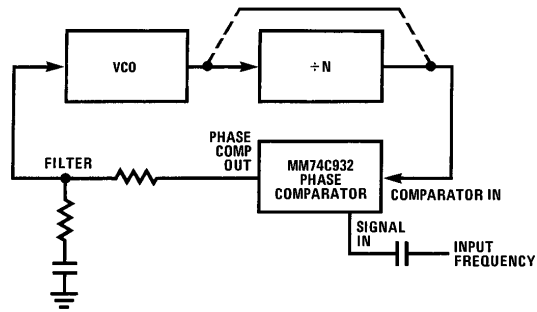


**FIGURE 2. Typical Waveform Employing Phase Comparator I in Locked Condition**

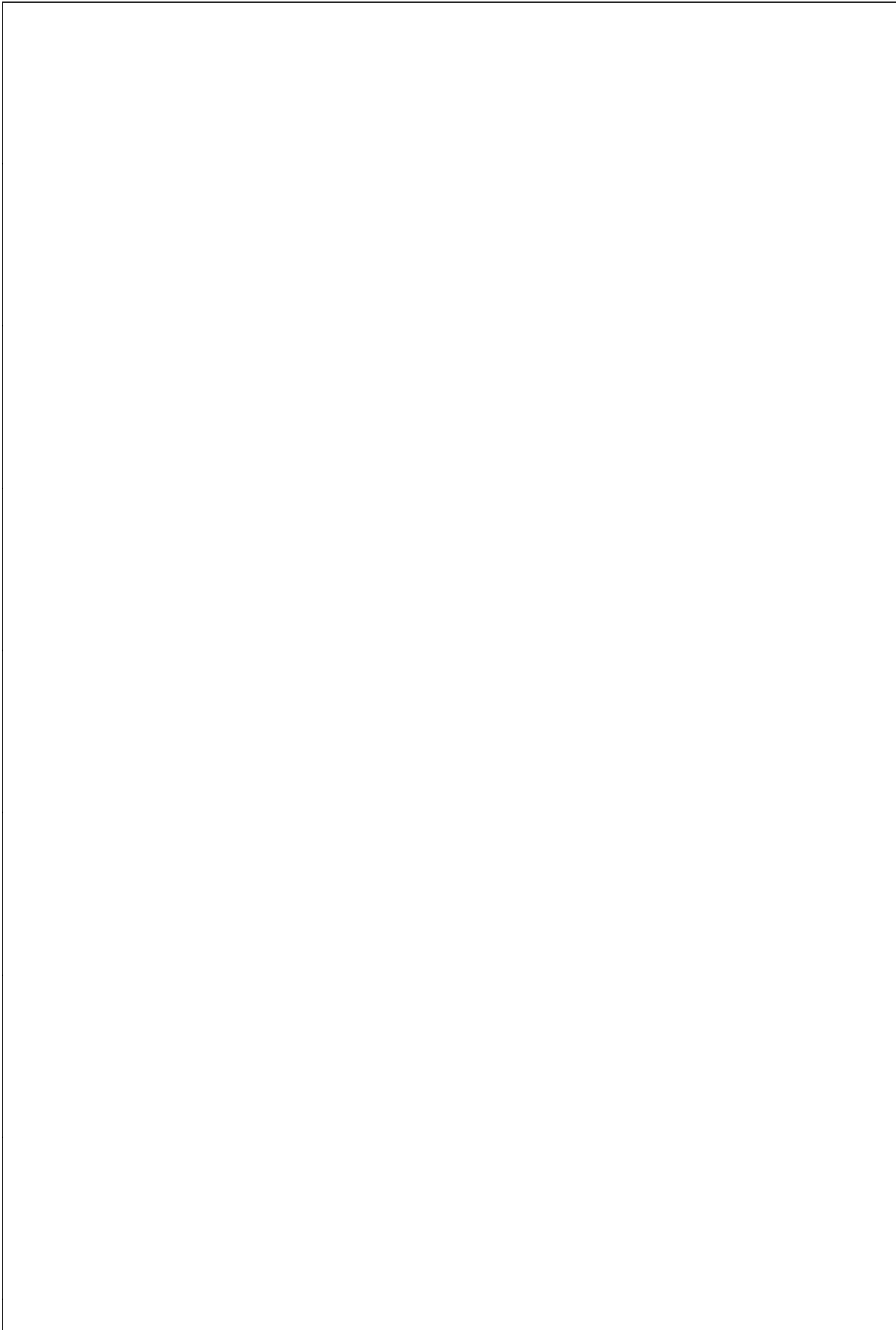


**FIGURE 3. Typical Waveform Employing Phase Comparator II in Locked Condition**

### Typical Phase Locked Loop

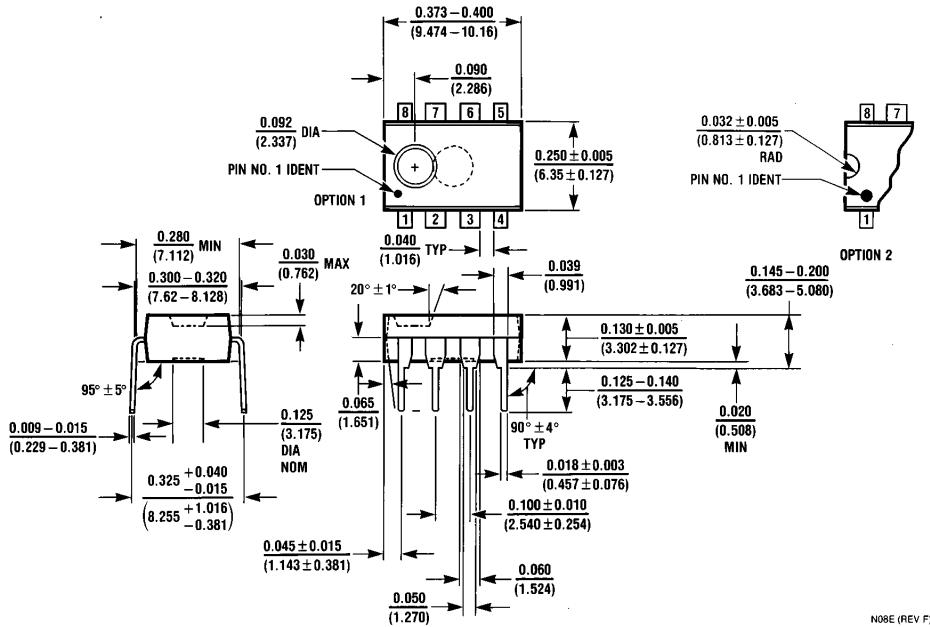


TL/F/5921-7



MM54C932/MM74C932 Phase Comparator

Physical Dimensions inches (millimeters)



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

N08E (REV F)

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