



# LC89962, LC89962M

## NTSC Format Delay Line

### Overview

The LC89962 and LC89962M are delay line circuits that provide a delayed signal by a 1H period of NTSC format with an external low-pass filter.

### Features

- Requires only the input of a 3.58-MHz clock to produce a 1H delayed signal and the external low-pass filter.
- Uses a 5-V single-voltage power supply.
- Requires a minimal number of external components due to the peripheral components provided on chip.
- Output signal has the same phase as the input signal.
- Operation has a 4fsc clock synchronized with the input clock allows these products to be used as wide bandwidth delay lines.
- A 4fsc clock can be output from the 4FSC pin (pin 7).

### Functions

- 906-bit CCD shift register
- Timing generator and CCD driver circuits
- Auto-bias circuit
- Sync-tip clamp circuit
- Sample-and-hold and output amplifier circuits
- 4 × PLL circuit
- 4fsc output circuit

### Specifications

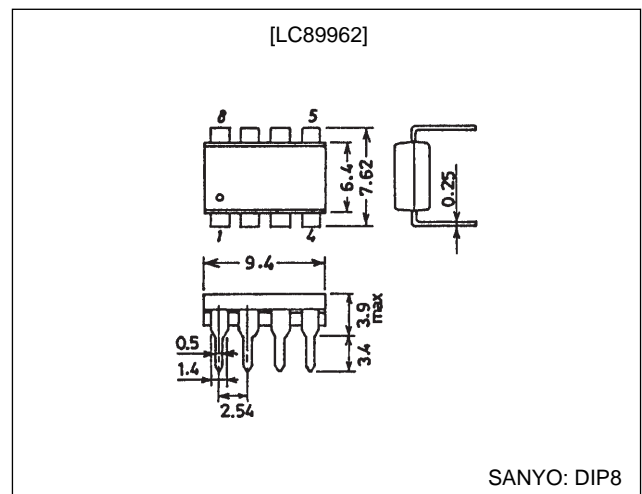
Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>DD</sub>		-0.3 to +6.0	V
Allowable power dissipation	Pd max	LC89962	400	mW
		LC89962M	140	mW
Operating temperature	T <sub>opr</sub>		-10 to +60	°C
Storage temperature	T <sub>stg</sub>		-55 to +125	°C

### Package Dimensions

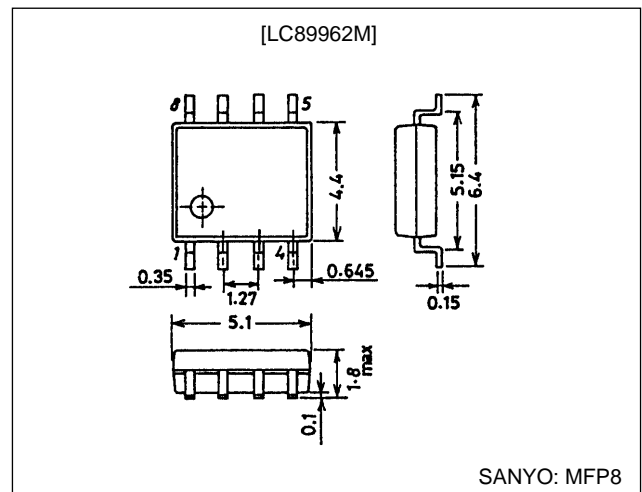
unit: mm

#### 3001B-DIP8



unit: mm

#### 3032B-MFP8



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### Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage	V <sub>DD</sub>		4.75	5.0	5.25	V
Clock input amplitude	V <sub>CLK</sub>	Sine wave	200	300	500	mVp-p
Clock frequency	F <sub>CLK</sub>			3.579545		MHz
Signal input amplitude	V <sub>IN</sub>	(*1)		500	572	mVp-p

Note 1. The input signal must be input with low impedance for correct operation of sync-tip clamping.

### Electrical Characteristics at Ta = 25°C, V<sub>DD</sub> = 5.0 V, CLK = 3.579545 MHz; 300 mV p-p

Parameter	Symbol	Switch states				min	typ	max	Unit
		SW1	SW2	SW3	Test conditions				
Supply current	I <sub>DD</sub>	a	a	a	*1	5	15	25	mA
Voltage gain	G <sub>V</sub>	a	b	a	*2	-2	0	+2	dB
Frequency characteristics	G <sub>f</sub>	b	b	a	*3	-2	-1	0	dB
Differential gain	DG	a	a	a	*4	0	5		%
Differential phase	DP	a	a	a	*4	0	5		deg
Linearity	LS	a	a	a	*5	37	40	43	%
Clock leakage	Lck	a	b	a	*6		5	50	mVrms
Noise	N <sub>O</sub>	a	b	a	*7		1	2	mVrms
Output impedance	Z <sub>O</sub>	a	b	a↔b	*8	220	370	520	Ω
Delay time	TD	a	b	a	*9		63.33		μs

### Test Conditions

- The supply current with no input signal
- The following formula is used to calculate the voltage gain (G<sub>V</sub>).

$$G_V = 20 \log \frac{V_{OUT} \text{ [mVp-p]}}{500 \text{ [mVp-p]}} \text{ [dB]}$$

Output signal symbol	Input signal
V <sub>OUT</sub>	Sine wave: 200 kHz, 500 mV p-p

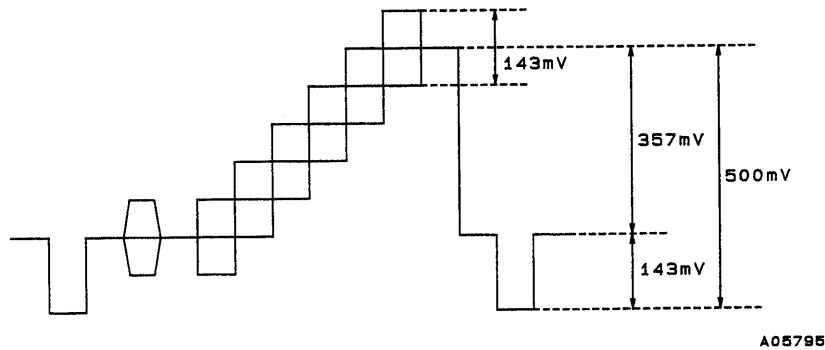
- The following formula is used to calculate the frequency characteristics (G<sub>f</sub>).

$$G_f = 20 \log \frac{V_2 \text{ [mVp-p]}}{V_1 \text{ [mVp-p]}} \text{ [dB]}$$

Output signal symbol	Input signal
V1	Sine wave: 200 kHz, 200 mV p-p
V2	Sine wave: 3.58 MHz, 200 mV p-p

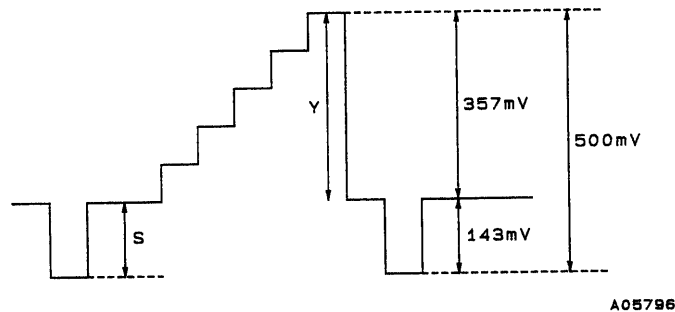
During this test, adjust V<sub>bias</sub> so that the input signal DC level is 250 mV higher than the clamp level.

4. Measure the differential gain (DG) and differential phase (DP) using a vector scope with a 5-step function wave input. (See the following figure.)



5. To measure LS, input a 5-step function wave and measure the ratio of the sync level (S) to the luminance level (Y).

$$LS = \frac{S \text{ [mV]}}{Y \text{ [mV]}} \times 100 \text{ [%]}$$



6. To measure clock leakage (Lck), measure the 4fsc (14.3 MHz) component in the output signal with a spectrum analyzer when no input signal is presented.
7. To measure the noise level (N<sub>O</sub>), measure the noise output in the OUT pin output when no input signal is present with a video noise meter. Set up the noise meter with a 200-kHz high-pass filter, a 4.2-MHz low-pass filter, and 3.58-MHz trap filter.
8. The following formula is used to calculate the output impedance (Z<sub>O</sub>).

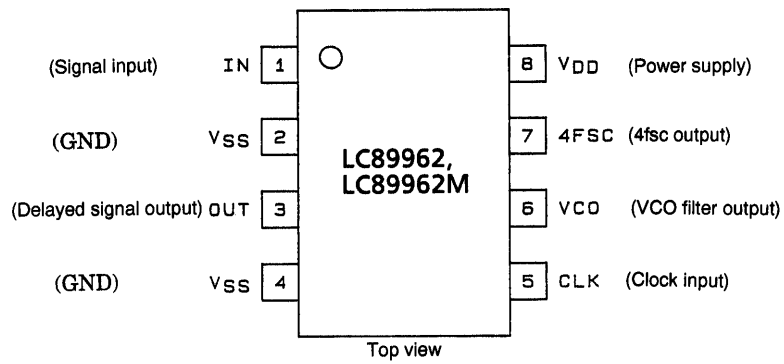
$$Z_O = \frac{V1 \text{ [mVp-p]} - V2 \text{ [mVp-p]}}{V2 \text{ [mVp-p]}} \times 500 \text{ [\Omega]}$$

Output signal symbol	SW3	Input signal
V1	a	Sine wave: 200 kHz, 500 mV p-p
V2	b	

9. To measure the delay time (TD), measure the delay time of the output signal to the input signal. In this measurement, the delay time associated with the low-pass filter must be excluded.

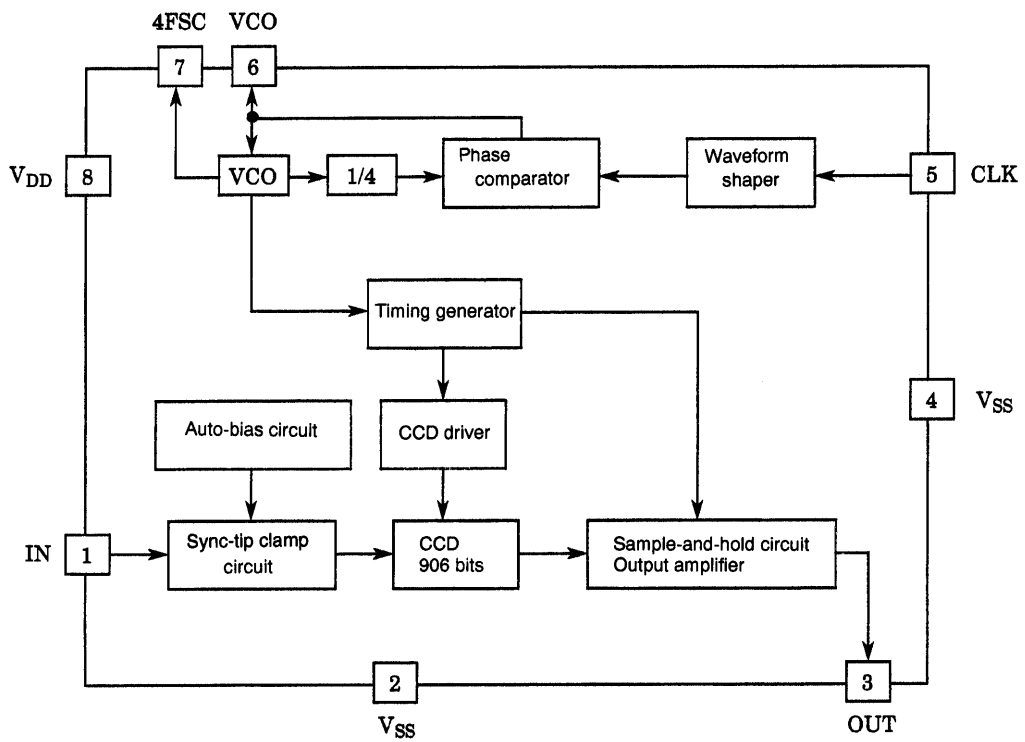
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### Pin Assignment



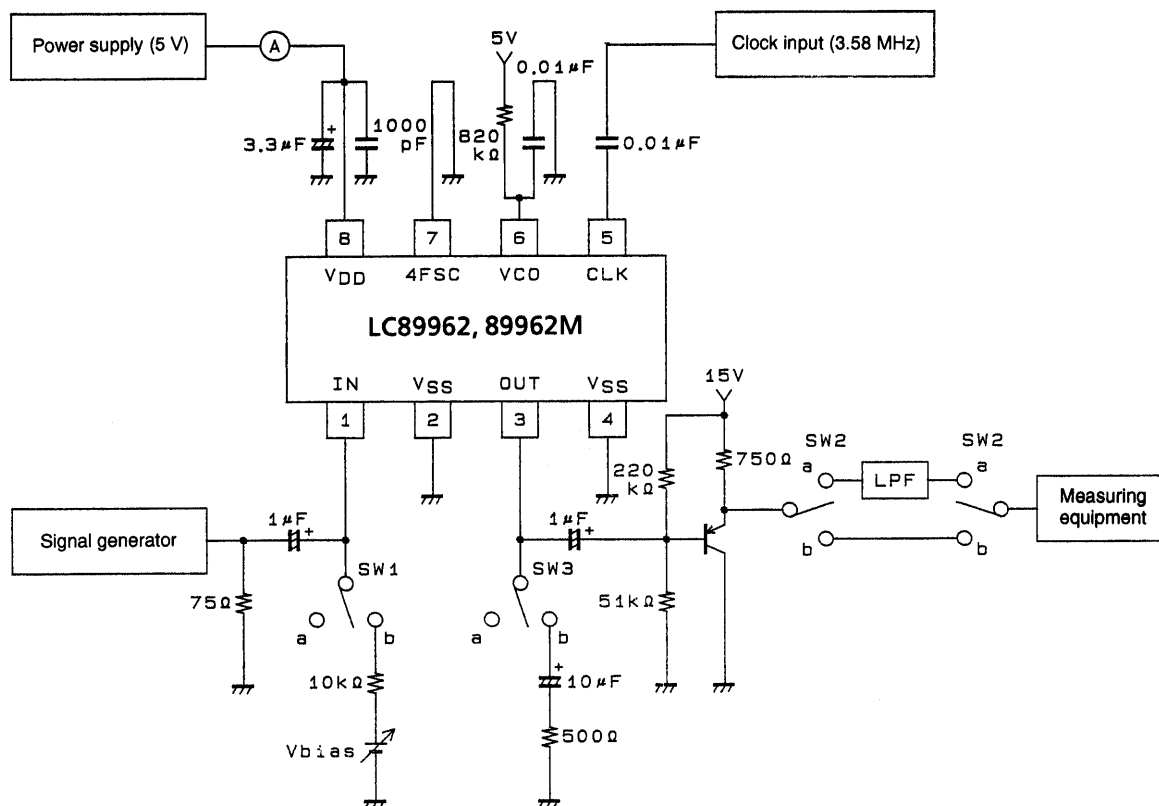
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### Block Diagram



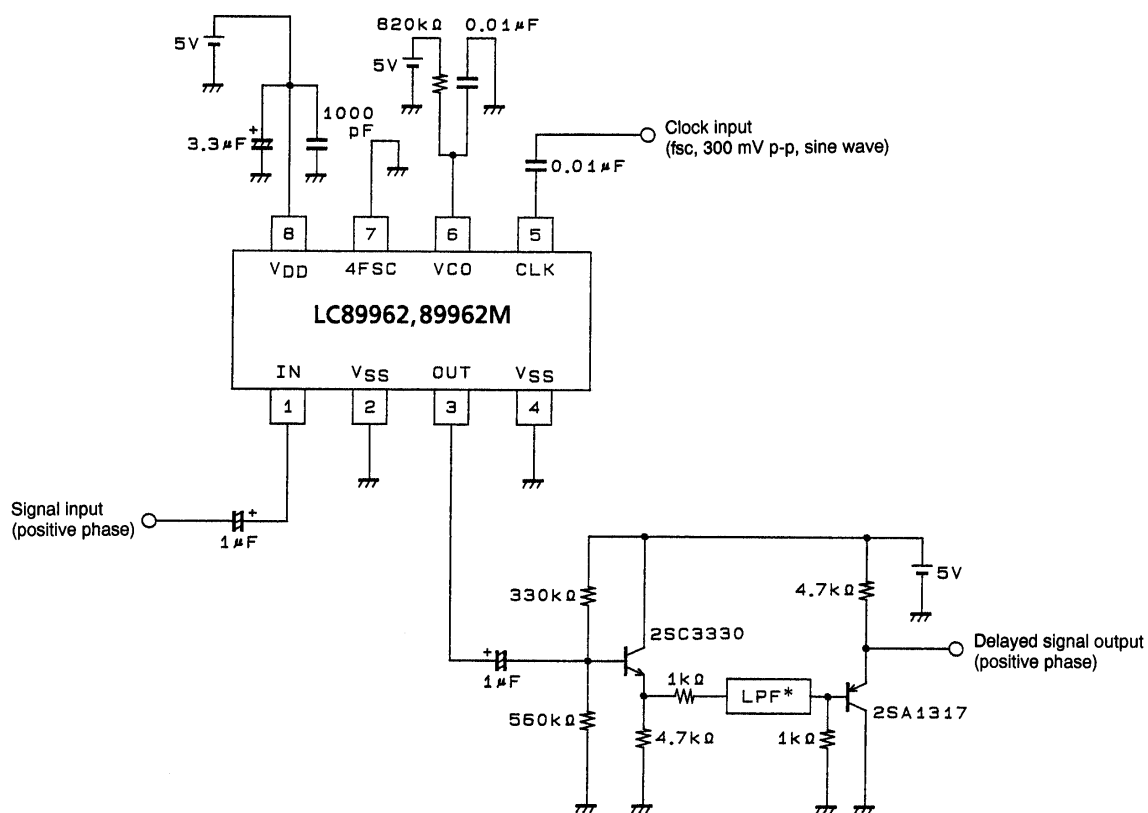
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### Test Circuit



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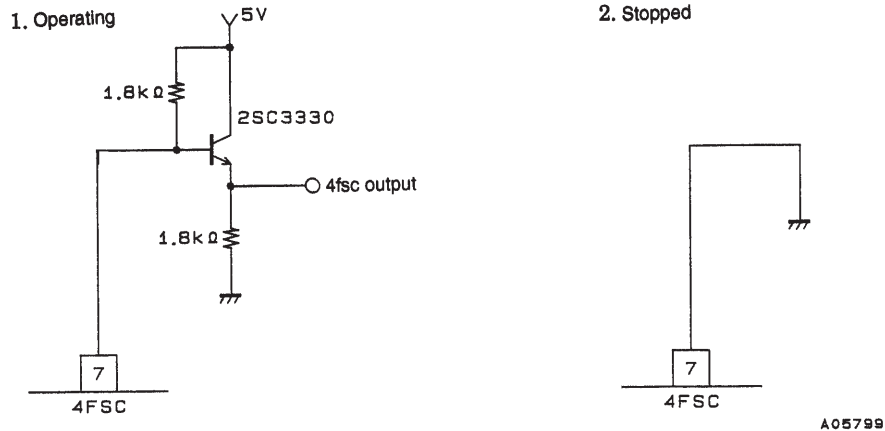
### Sample Application Circuit



\*The LPF delay time is 225 ns.

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4FSC (pin 7) Sample Application Circuit



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