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CXA1175M

HDD Equalizer (Pulse Slimming) IC

Description

CXA1175 is an IC for HDD read data equalizers (cosine equalization).

The delay circuit realized through the adoption of an active filter circuit dispenses from the expensive delay line so far in use. Delay time may be changed at will by altering the resistance value.

Features

- The delay circuit obtained through an active filter circuit dispenses from external delay lines. Delay time adjustment is possible by changing the external resistance value.
- Mix ratio adjustment is possible by changing the external resistance value.
- Variation of characteristics on both inner and outer tracks is possible through TTL signal. Minute adjustment is possible when necessary through the use of discrete devices.

16pin SOP (Plastic)

- Single power supply, 5V.
- Low power consumption.

Block Diagram and Pin Configuration
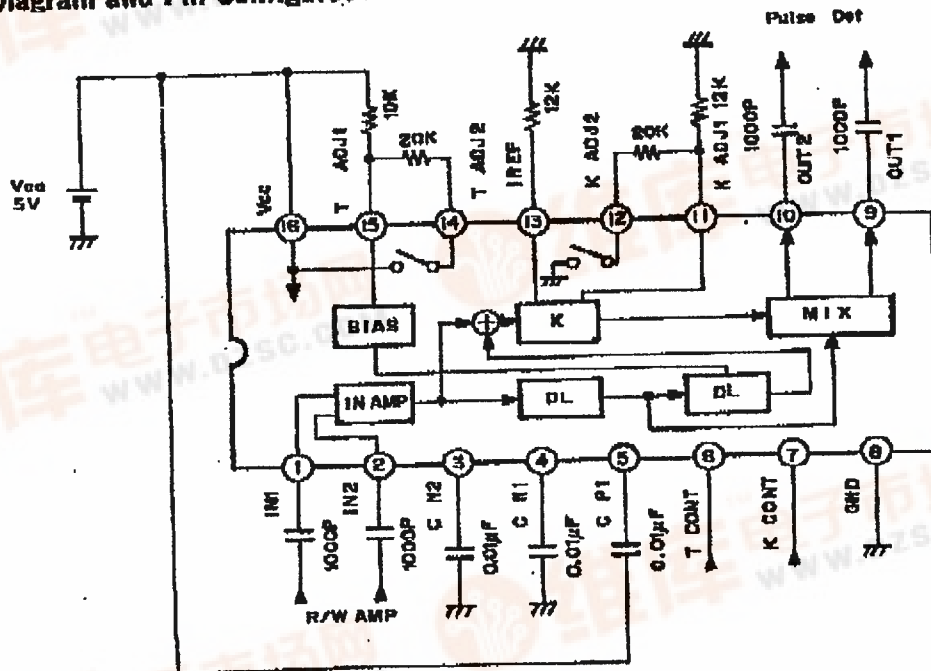
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Absolute Maximum Ratings (Ta=25°C)

• Supply voltage	V_{CC}	7	V
• Storage temperature	T_{stx}	−55 to +150	°C

Operating Conditions

• Supply voltage	V_{CC}	4.75 to 5.25	V
• Ambient temperature	T_{opr}	−20 to +75	°C

Pin Description

No.	Symbol	Voltage	Equivalent circuit	Description
1	IN1	2.0V		Inputs data signals from read amplifier as differential signals through a capacitor. Internal impedance is approx. 16kΩ.
2	IN2			
3	CN2	1.5V		Connects capacitor (0.01µF) between this pin and GND to control noise in the circuit.
4	CN1			
5	CP1	3.5V		Connects capacitor (0.01µF) between this pin and V_{CC} to control noise in the circuit.
6	T CONT	* 2.0V / * 0.8V		To vary characteristics on the inner or outer track, delay time is varied according to the signals (TTL level) input to this pin. When this pin is at Low, delay time is set according to the resistance connected to pin 15 (T ADJ1). When this pin is at High, delay time is set according to the parallel resistance value of the resistances connected to Pins 15 (T ADJ1) and 14 (T ADJ2).

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No.	Symbol	Voltage	Equivalent circuit	Description
7	K CONT	∓ 2.0V / ∓ 0.8V		To vary characteristics on the inner or outer track, Mix ratio K is varied according to the signals (TTL level) input to this pin. When this pin is at Low, Mix ratio is set according to the parallel resistance value of the resistances connected to pins 11 (K ADJ1) and 12 (K ADJ2). When this pin is at High, Mix ratio is set according to the resistance connected to Pin 11 (K ADJ1).
8	GND	0V		GND pin for all circuits.
9	OUT1	3.8V		Signal output pin. Equalized signal is output to pulse detector.
10	OUT2			
11	K ADJ1	1.2V		A resistor is connected to set Mix ratio. K≈approx.0.23 at 12kΩ (Typ.). Varying the resistance value from ∞ to 4KΩ varies K from 0 to 0.3.
12	K ADJ2			When Pin 7 (K CONT) is at Low, this pin is set to the parallel value of the resistances connected to this pin and to pin 11 (K ADJ1).
13	I REF	1.2V		12kΩ resistor is connected to obtain internal reference current.
14	T ADJ2			When Pin 6 (T CONT) is at High, delay time is set according to the parallel value of the resistances connected to this pin and to pin 15 (T ADJ1).

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No.	Symbol	Voltage	Equivalent circuit	Description
15	T ADJ1	4.0		A resistor is connected to set delay time. Set to 58ns at 10kΩ (Typ.). Varying from 5 to 25kΩ produces a change from 40 to 150ns.
				Connects 5V power supply.
16	V_{CC}	5V		

Electrical Characteristics

Item	Symbol	Conditions	Test point	Min.	Typ.	Max.	Unit
Consumption current	ICC	S1=ON	IM1	8	11	14	mA
Mix ratio accuracy ※	K	f=200kHz VIN=100mVp-p S1=ON	VM1	−10	0	+10	%
Delay time accuracy ※	T1	f=6MHz VIN=100mVp-p S1=ON	VM1	−13.0	0	+13.0	%
	T2	f=10MHz VIN=100mVp-p S1=ON	VM1	−22.0	0	+22.0	%
Frequency characteristics	FC	−3dB VIN=25mVp-p S1=OFF	VM1	15			MHz
Gain	GAIN	S1=OFF f=200kHz	VM1	7.5	9	10.5	dB
Maximum input voltage range	VINMAX	S1=OFF f=3MHz THD≦5%	VM1	300			mVp-p

※ With the center value of mix ratio and delay time taken as K=0.230 and T=58ns.
The testing methods of mix ratio and delay time can be defined as follows,

Equalizer frequency characteristics on cosine equalizer is shown below:

$$H(\omega) = 1 - 2K \times COS(\omega\Delta T)$$

Here S1 is OFF (Where K is set to 0), 200kHz and 6MHz gain are taken as G_0, G_2, (dB). When a certain K is set, 200kHz and 6MHz gain are taken as G_1, G_3, (dB).
K is Calculated through the following formula:

$$K = \frac{1 - 10^{(G1-G0)/20}}{2}$$

Delay time T1 is calculated through the following formula:

$$T1 = \frac{1}{\omega} COS^{-1} \left(\frac{1-10^{(G3-G2)/20}}{1-10^{(G1-G0)/20}} \right)$$

For T2 test and with 10MHz characteristics, as the equalizer frequency characteristics have exceeded the gain peak, delay time when 10MHz gain are taken as G_4, G_5, (dB) is expressed by the following formula

$$T2 = \frac{1}{\omega} \left\{ 2\pi - COS^{-1} \left(\frac{1-10^{(G3-G2)/20}}{1-10^{(G1-G0)/20}} \right) \right\}$$

The calculating method for this delay time is applied when it is set around 50ns. For setting to any other delay time, the frequency used to test the gain should be changed.

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Transfer Characteristics

The cosine equalizer transfer characteristics expressed by the transfer function is indicated as follows, where transfer function is taken as H (ω) and delay time as ΔT, then,

$$H(\omega) = 1 - 2K \times COS(\omega \times \Delta T)$$

Calculation of delay time

T ADJ1 Pin current is taken as I, while delay time is obtained through the following formula:

$$\Delta t = \frac{5.4 \times 10^{-11}}{I}$$

As T ADJ1 pin voltage is 4.0V, the resistance to be connected to T ADJ1 pin is taken as R. We have

$$I = \frac{1.0}{R}$$

T ADJ1 pin voltage changes slightly according to the connected resistance value. However, ignoring this fluctuation, the relation between the delay time and R is given through the following formula:

$$\Delta t = \frac{5.4 \times 10^{-11}}{1.0} \times R$$
$$= 5.4 \times 10^{-11} \times R$$

When R=10kΩ, We have

$$\Delta t = 5.4 \times 10^{-11} \times 10E3 = 54ns$$

Calculation of mix ratio K

Mix ratio calculation generally follows the following formula:

$$2K = \frac{I1}{I1 + I2}$$ Where   I1=11pin (K ADJ) current
I2=13pin (I REF) current

K ADJ1 pin, I REF pin voltage is approx. 1.2V.
As a 12kΩ is connected to I REF pin, I2=100μA. K ADJ1 pin voltage changes slightly according to the connected resistance value. However, ignoring this fluctuation, the relation between the mix ratio and R is given through the following formula:
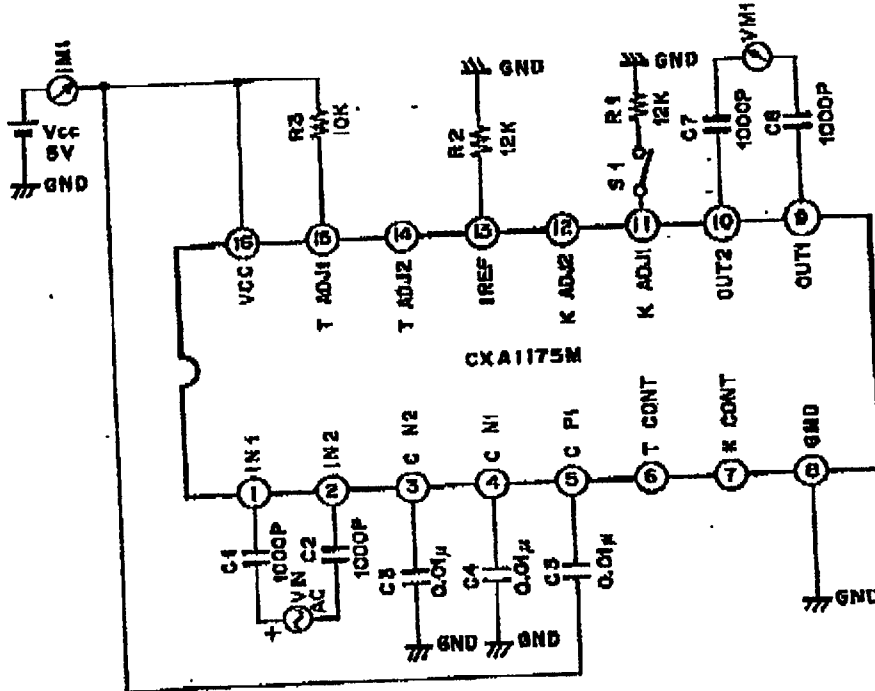
$$I1 = \frac{1.2}{R}$$

Therefore, the relation between K and R is as follows:
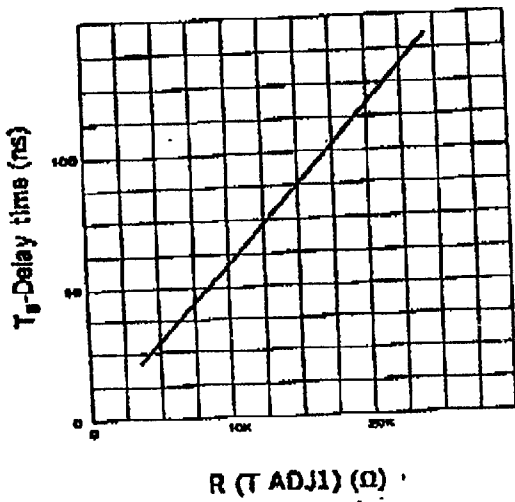
$$K = \frac{0.6}{1.2 + 100 \times 10^{-6} \times R}$$

For example, when R=12kΩ, We have

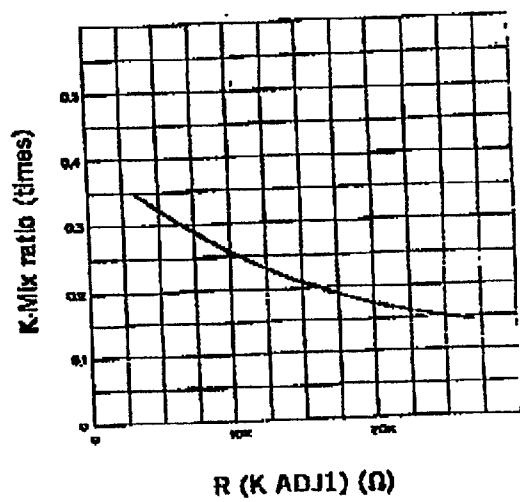$$K = \frac{0.6}{1.2 + 100 \times 10^{-6} \times 12 \times 10^3} = 0.25$$

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Electrical Characteristics Test Circuit

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Delay time vs. Setting resistance

T_D-Delay time (ns)

R (T ADJ1) (Ω)

Mix ratio vs. Setting resistance

K-Mix ratio (times)

R (K ADJ1) (Ω)

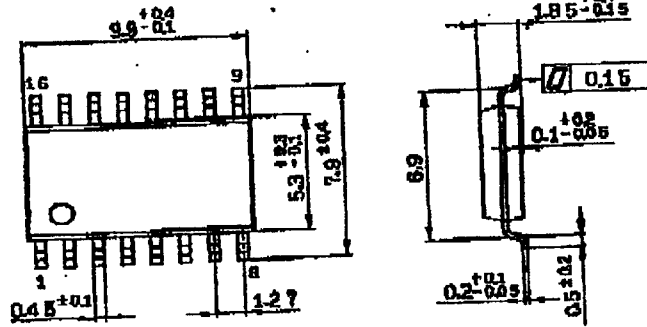# SONY®

Package Outline **Unit : mm**

16pin SOP (Plastic) 300mil 0.2g

SOP-16P-L01