SONY

CXA1445M

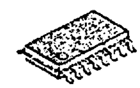
HDD Equalizer (Pulse Slimming) IC

Description

The CXA1445M 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.

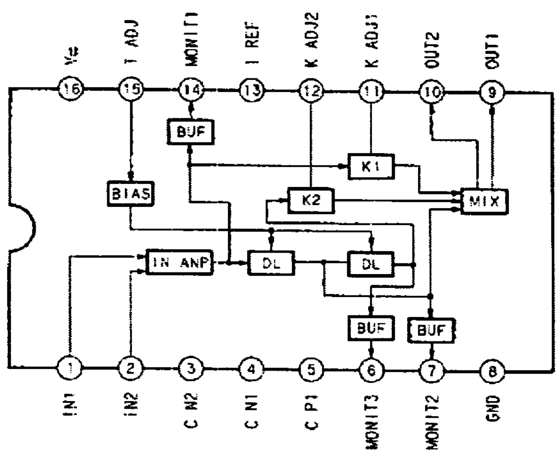
16pin SOP (Plastic)



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 of K1 and K2 is possible by changing the external resistance value.
- 5V single power supply

Block Diagram and Pin Configuration



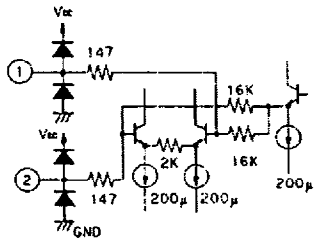
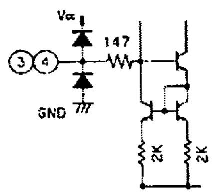
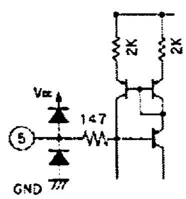
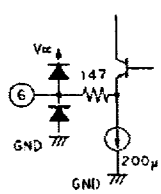
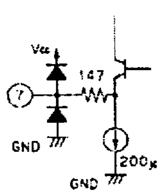
Absolute Maximum Ratings (Ta=25°C)

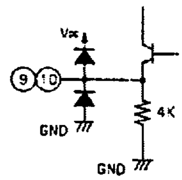
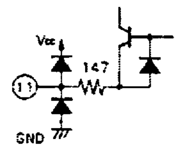
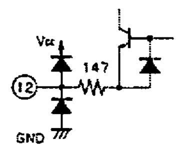
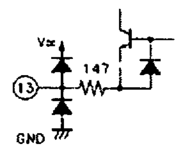
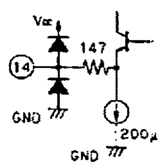
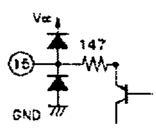
• Supply voltage	V_{CC}	7	V
• Storage temperature	T_{stg}	−55 to +150	°C

Operating Conditions

• Supply voltage	V_{CC}	4.5 to 5.5	V
• Operating 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	1.7V		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	MONIT3	2.4V		Monitor pin output through buffer after input signal passing two delay lines.
7	MONIT2	2.4V		Monitor pin output through buffer after input signal passing the first delay line.

No.	Symbol	Voltage	Equivalent circuit	Description
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 K_1. K_1=approx. 0.25 at 12kΩ (Typ.) Varying the resistance value from ∞ to 4kΩ varies K_1 from 0 to 0.3.
12	K ADJ2	1.2V		A resistor is connected to set K_2. K_2=approx. 0.25 at 12kΩ (Typ.) Varying the resistance value from ∞ to 4kΩ varies K_2 from 0 to 0.3.
13	I REF	1.2V		12kΩ resistor is connected to obtain internal reference current
14	MONIT1	2.4V		Output monitor pin of IN AMP
15	T ADJ	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.
16	V_{CC}	5V		Connects 5V power supply.

Electrical Characteristics

S3 and S4 taken as "a" side unless specified especially. (Ta=25°C, V_{CC}=5V)

Item	Symbol	Conditions	Test point	Min.	Typ.	Max.	Unit
Current consumption	I_{CC}	S1=ON, S2=ON	IM1	8	11	14	mA
Mix ratio accuracy *	K_1	f=200kHz V_{IN}=100mVp-p S1=ON, S2=OFF	VM1	−10	0	+10	%
	K_2	f=200kHz V_{IN}=100mVp-p S1=OFF, S2=ON	VM1	−10	0	+10	%
Delay time accuracy *	T_L	f=6MHz V_{IN}=100mVp-p	VM1	−13	0	+13	%
	T_H	f=10MHz V_{IN}=100mVp-p	VM1	−22	0	+22	%
Frequency characteristics	FC	−3dB V_{IN}=25mVp-p S1=OFF, S2=OFF	VM1	15			MHz
Gain	GAIN	f=200kHz S1=OFF, S2=OFF	VM1	7.5	9	10.5	dB
Maximum input voltage range	V_{INMAX}	f=3MHz THD≦5% S1=OFF, S2=OFF	VM1	300			mVp-p
Output noise voltage	V_{NOISE}	S1=OFF, S2=OFF S3=b, S4=b	VM2			630	μVrms

*With the center value of mix ratio and delay time taken as $K_{1,2}$=0.255 and T=58ns.

The testing methods of mix ratio and delay time can be defined as follows: Equalizer frequency characteristics taken as H (W). To find K_1, suppose $K_2=0$ (S2=OFF), then,

$$|H(W)|^2=1+K_1^2-2K_1\cos\omega\tau$$

Here $K_1=0$ (S1=OFF), 200kHz gain is taken as G_0 (dB). When a certain K_1 is set, 200kHz gain is taken as G_1 (dB). K_1 is calculated through the following formula:

$$K_1=1-10^{\frac{G_1-G_0}{20}}$$

K_2 is solved in a similar way by supposing $K_1=0$ (S1=OFF)

Delay time T_L is calculated through the following formula:
S1 and S2 are OFF (where K_1 and K_2 are set to 0), 200kHz and 6MHz gain are taken as G_0, G_2 (dB). When a certain K_1 and K_2 (S1 and S2=ON, $K_1=K_2$) are set, 200kHz and 6MHz gain are taken as G_1', G_3' (dB). T_L is calculated through the following foumula:

$$T_L=\frac{1}{\omega}\cos^{-1}\left(\frac{1-10^{\frac{G_3'-G_2}{20}}}{2K}\right)$$

K is caluculated through the following formula:

$$K=\frac{1-10^{\frac{G_1'-G_0}{20}}}{2}$$

As the equalizer frequency characteristics have exceeded the gain peak at f=10MHz, delay time T_H when 10MHz gain are taken as G_3', G_2 (dB) is expressed by the following formula:

$$T_H=\frac{1}{\omega}\left\{2\pi-\cos^{-1}\left(\frac{1-10^{\frac{G_3'-G_2}{20}}}{2K}\right)\right\}$$

The calculating method for this delay time is applied when it is set around 60ns. For setting to any other delay time, the frequency used to test the gain should be changed.

Calculation of delay time

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

$$\Delta t=\frac{5.4\times10^{-12}}{I}$$

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

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

T ADJ 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:

$$\Delta t=\frac{5.4\times10^{-12}}{1.0}\times R$$
$$=5.4\times10^{-12}\times R$$

When R=10kΩ, we have

$$\Delta t=5.4\times10^{-12}\times10\times10^{3}=54\text{ns}$$

Calculation of mix ratio K_1, K_2

Mix ratio calculation K_1 generally follows the following formula:

$$2K_1=\frac{I1}{I1+I2}$$

I1 : 11 pin (K ADJ1) current

I2 : 13 pin (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_1 and R is as follows:

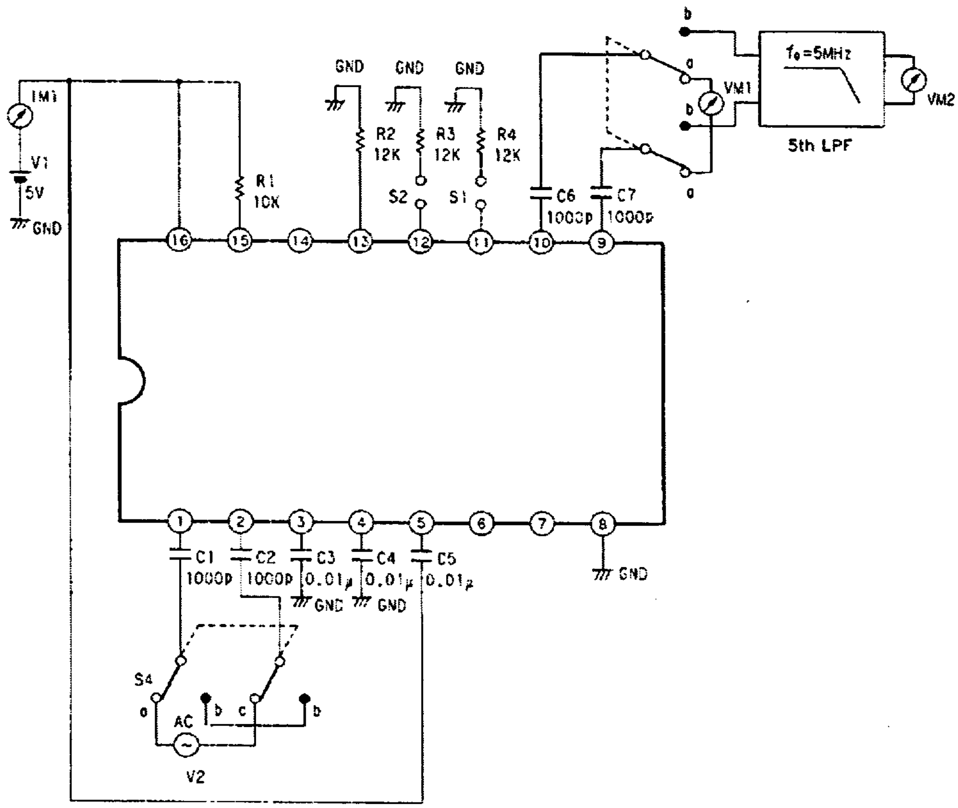
$$K_1=\frac{0.6}{1.2+100\times10^{-6}\times R}$$

For example, when R=12kΩ, we have

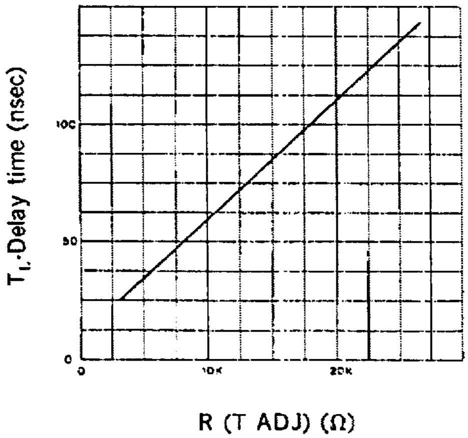
$$K_1=\frac{0.6}{1.2+100\times10^{-6}\times12\times10^{3}}=0.25$$

K_2 is solved in a similar way as being 12 pin K ADJ2 current.

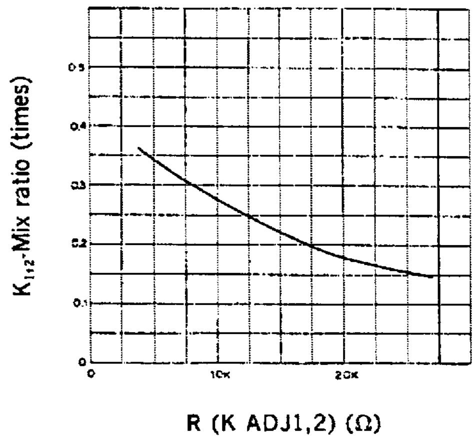
Electrical Characteristics Test Circuit



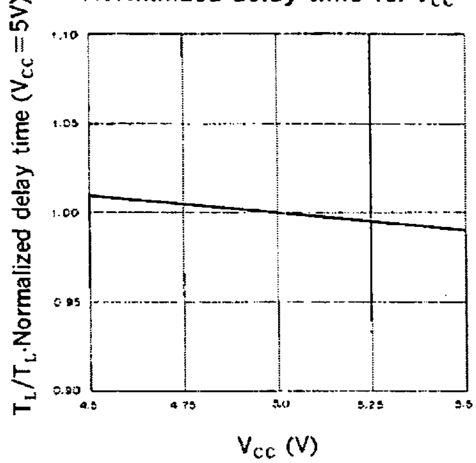
Delay time vs. Setting resistance



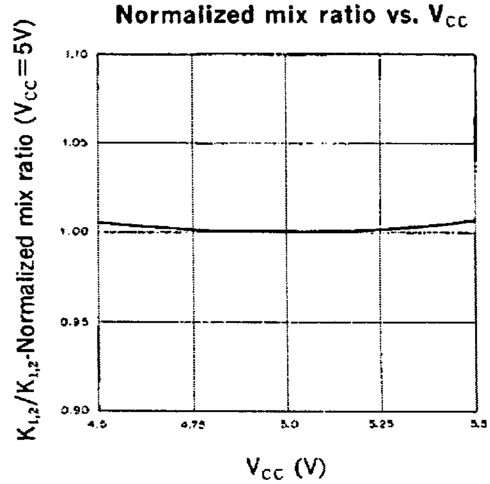
Mix ratio vs. Setting resistance



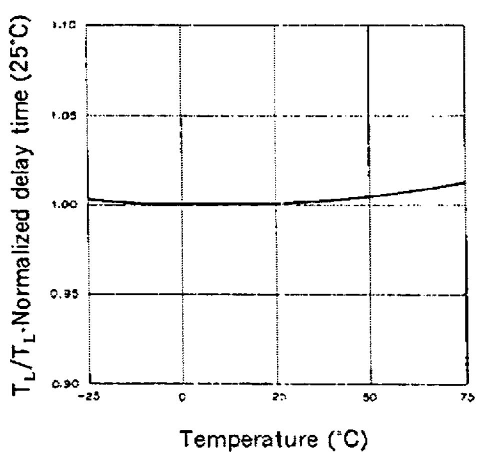
Normalized delay time vs. V_{CC}



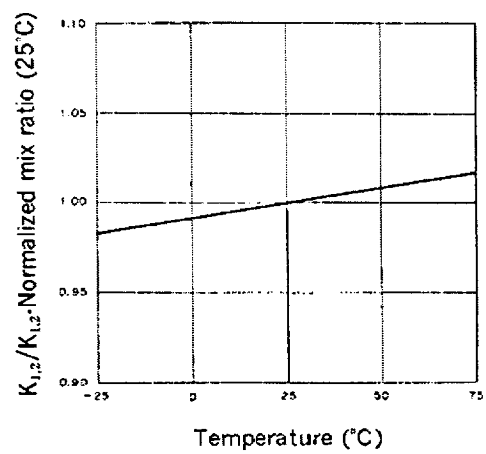
Normalized mix ratio vs. V_{CC}



Normalized delay time vs. Temperature

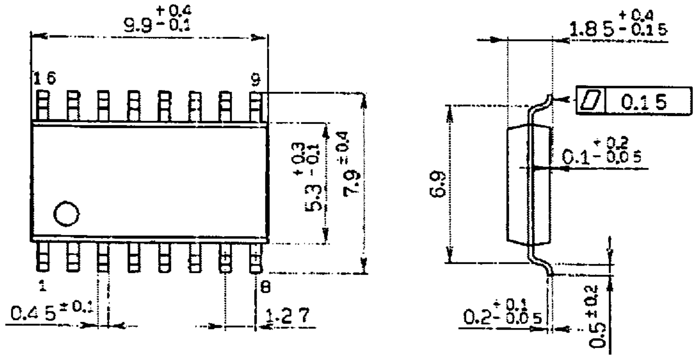


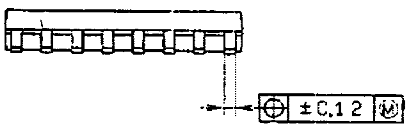
Normalized mix ratio vs. Temperature



Package Outline **Unit : mm**

16pin SOP (Plastic) 300mil 0.2g





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