SONY

CX20099/CX20148

Noise Reduction

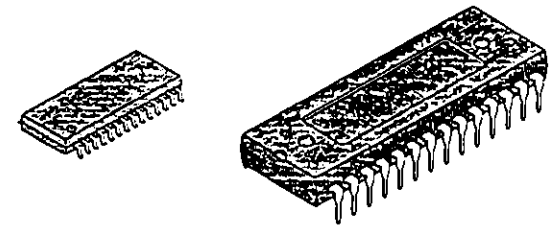
Description

The CX20099/CX20148 is a bipolar IC designed for the 8 mm VTR PCM audio noise reduction system.

Application in the PCM audio recording and playback system makes it possible to obtain about a 100 dB dynamic range.

CX20099
28 pin SOP (Plastic)

CX20148
28 pin DIP (Plastic)



Features

- 5V single power supply operation
- Low power consumption (70 mW typical in operation)
- Logarithmic compress/expand compandor is provided. (Compress/Expand ratio: 2)
- REC/PB electronic switching (Compatible with TTL)
- Noise modulation reduction with the fixed preemphasis
- Improvement in low band distortion with the holding recovery characteristics
- Built-in two channels

Structure

Bipolar silicon monolithic IC

Absolute Maximum Ratings (Ta = 25°C)

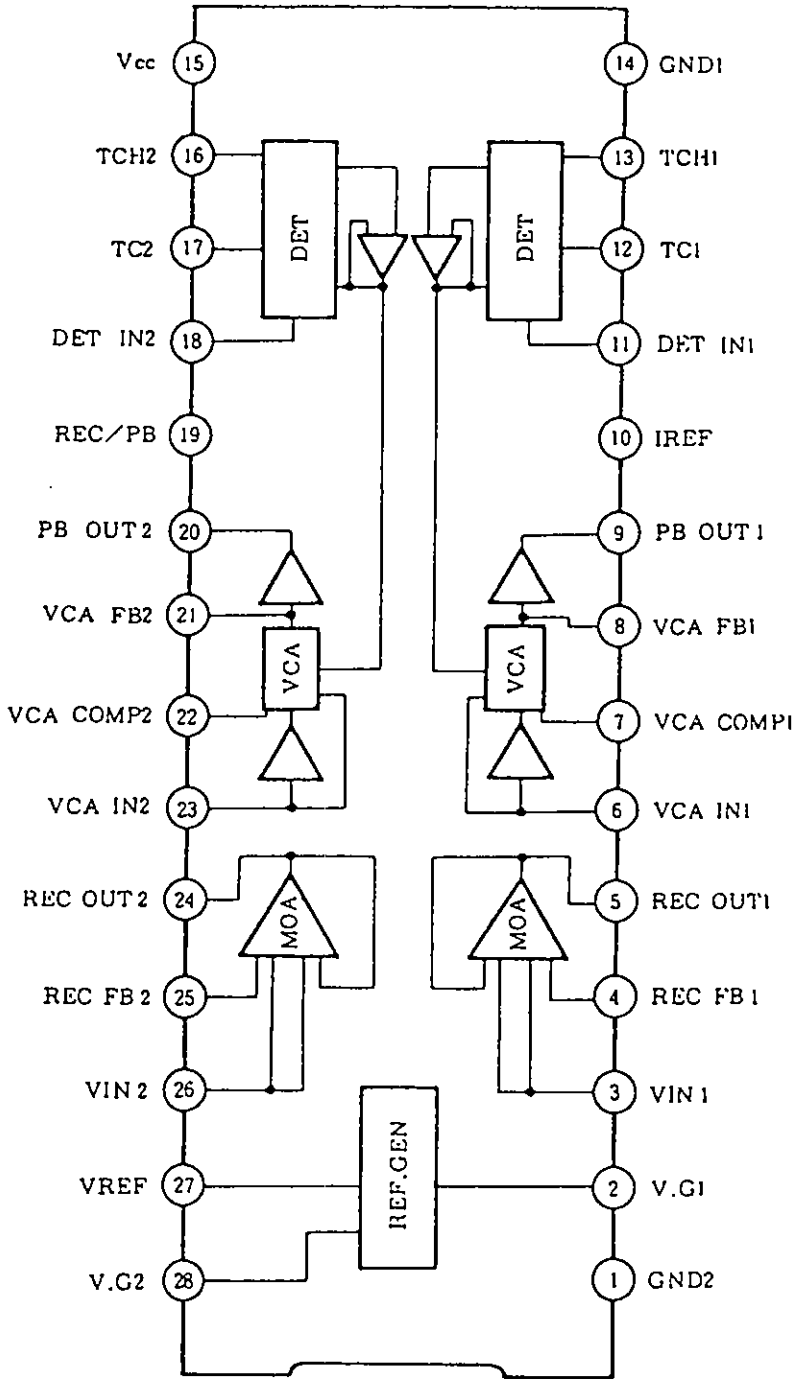
• Power supply voltage	Vcc	10	V
• Operating temperature	Topr	−20 to +75	°C
• Storage temperature	Tstg	−55 to +150	°C
• Allowable power dissipation	PD	CX20099 800	mW
		CX20148 1170	mW

Recommended Operating Condition

	Vcc	4.2 to 6.0	V (5.0V typical)

E51138B9Z – ST

Block Diagram



Pin Description

DC voltage (Ta = 25°C, Vcc = 5.0V, See Fig. 1.)

No.	Name	Function	DC voltage (V) (Typical)	Remark
1	GND2	Circuit GND for V_{REF} ·V.G (median point)	0.0	
2	V.G1	V.G signal reference for 1ch	2.50	Maximum current ≃ ±200μA Output impedance ≃ 260Ω typical
3	V_{IN1}	REC/PB common input terminal for 1ch	2.50	Bias current ≃ 150nA
4	REC_{FB1}	MOA inverter phase input terminal In REC, PB output for 1ch is feedback	2.50	Bias current ≃ 150nA
5	REC_{OUT1}	REC output for 1ch	2.50	Maximum output ≃ 2.8 Vp-p (R_L = 7KΩ) (2.1dBm)
6	VCA_{IN1}	VCA input terminal for 1ch to input current with the same voltage as V.G.	2.50	Bias current ≃ 100nA Max. current ≃ 1.7mAp-p (Iin + Iout) (at Vcc = 5.0V)
7	VCA_{COMP1}	1ch VCA phase compensation terminal	2.46	
8	VCA_{FB1}	1ch VCA output amp inverted phase input terminal to convert I to V	2.50	Bias current ≃ 150nA
9	PB_{OUT1}	1ch PB output terminal	2.50	Max. output ≃ 3.0Vp-p (R_L = 5kΩ)(3.7dBm)
10	I_{REF}	Reference current input terminal for both ch detectors	0.91	
11	DET_{IN1}	1ch detector input terminal to input current	1.36	
12	TC_1	For smoothing the 1ch detector full-wave rectified waveform. It also determines the attack and recovery time constants.	2.15	
13	TCH_1	It determines the 1ch detector hold time constant.	2.74	
14	GND_1	Signal and control GND for both channels	0.0	
15	Vcc	Power supply terminal for both channels	5.0	
16	TCH_2	It determines the 2ch detector hold time constant.	2.74	
17	TC_2	For smoothing the 2ch detector full-wave rectified waveform. It also determines the attack and recovery time constants.	2.15	
18	DET_{IN2}	2ch detector input terminal to input current	1.36	

No.	Name	Function	DC voltage (V) (Typical)	Remark
19	REC/PB	REC/PB mode switching terminal	0.50	In REC, 0 $\leqq V_L \leqq 0.5V$ $I_L \simeq 50\mu A$ max. In PB, 2.5V $\leqq V_H \leqq Vcc$ $I_H \simeq 0$
20	PBOUT2	2ch PB output terminal	2.50	Max. output $\simeq$ 3.0Vp-p (R_L = 5KΩ) (3.7dBm)
21	VCAFB2	2nd VCA output amp inverted phase input terminal to convert I to V.	2.50	Bias current $\simeq$ 150nA
22	VCACOMP2	2nd ch VCA phase compensation terminal	2.46	
23	VCAIN2	2ch VCA input terminal with the same voltage as V.G. to input current.	2.50	Bias current $\simeq$ 100nA. Max. current $\simeq$ 1.7mAp-p (Iin + Iout) (at Vcc = 5.0V)
24	RECOUT2	2ch REC output terminal	2.50	Max. output $\simeq$ 2.8Vp-p (R_L = 7KΩ) (2.1dBm)
25	RECFB2	MOA inverter phase input terminal In REC, PB output for 1ch is feedback	2.50	Bias current $\simeq$ 150nA
26	VIN2	REC/PB common input terminal for 2ch	2.50	Bias current $\simeq$ 150nA
27	VREF	Reference voltage for VCA gain	1.95	Max. current $\simeq$ 4mA typical Output impedance $\simeq$ 10Ω typical
28	V.G2	V.G signal reference for 2 ch	2.50	Max. current $\simeq \pm 200\mu A$ Output impedance $\simeq$ 260Ω typical

Electrical Characteristics

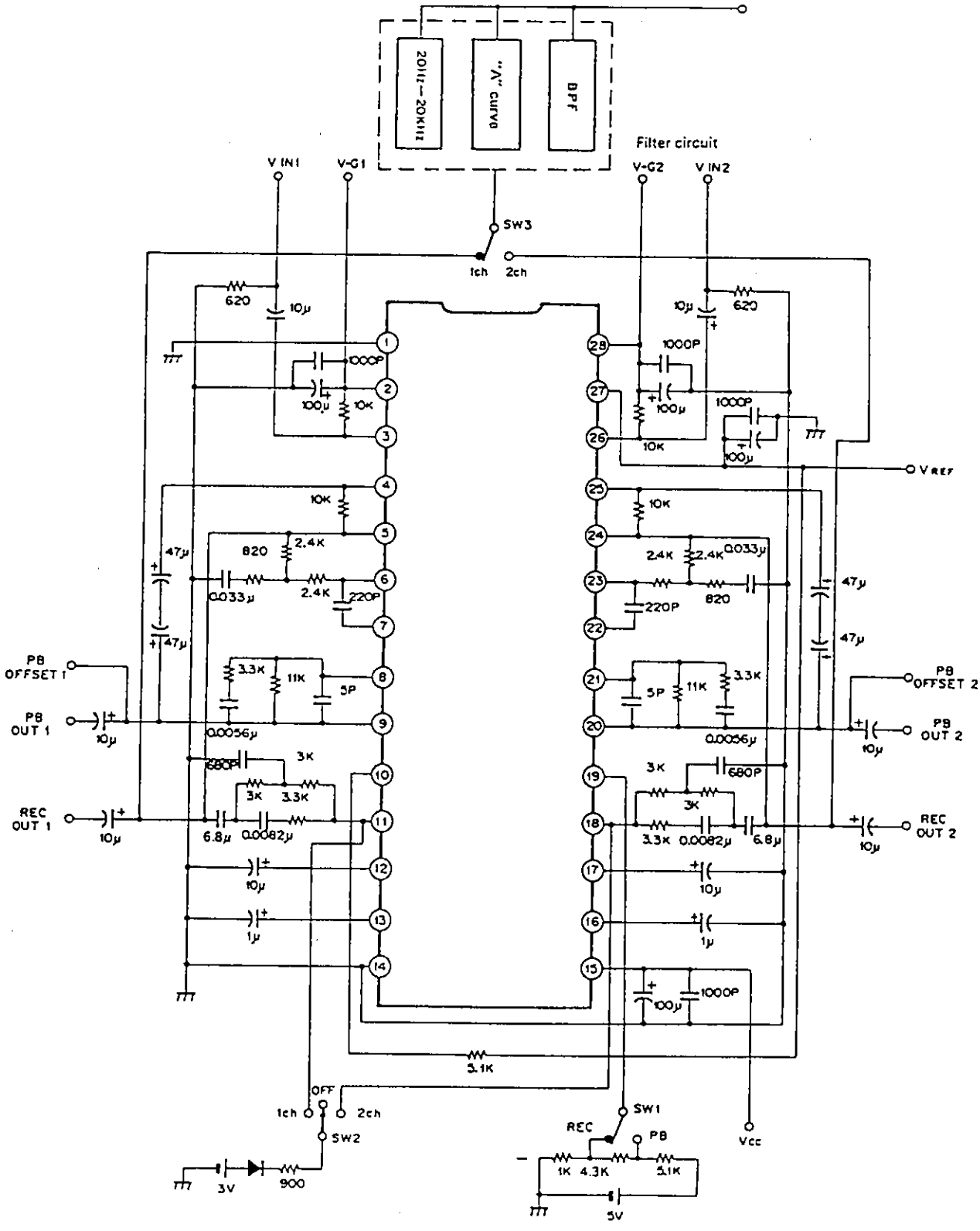
See the filter circuit of Electrical Characteristics Measuring Circuit

(Ta = 25°C, Vcc = 5V)

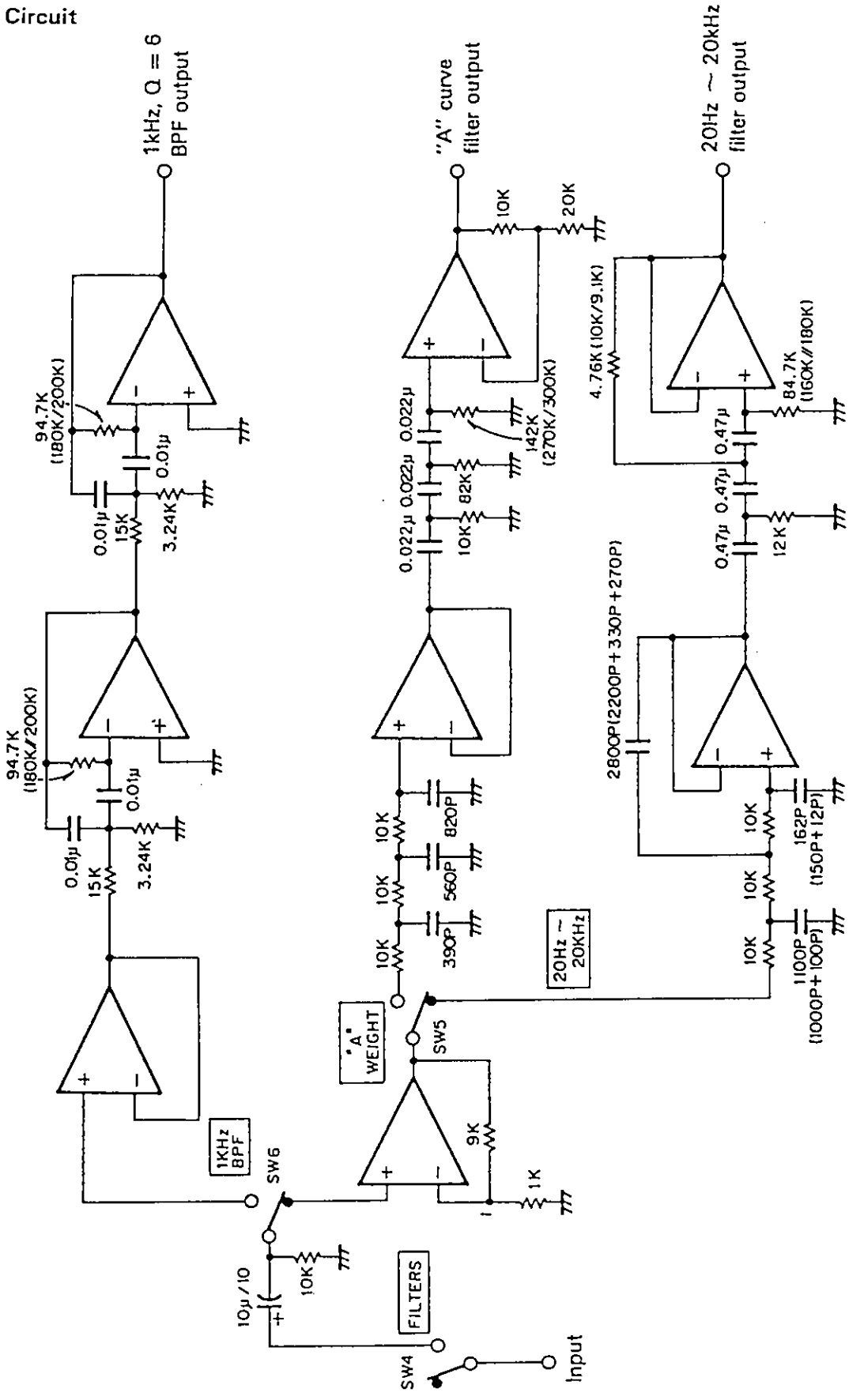
Measuring No.	Item	Symbol	SW · condition						Input condition		Measuring point	Description of output waveform and measuring method	Standard			
			SW1	SW2	SW3	SW4	SW5	SW6	f VIN (KHz)	VIN (dBm)			Min.	Typ.	Max.	Unit
1	Circuit current	Icc	OFF	OFF	OFF	OFF	OFF	OFF	No signal		Vcc		10.0	14.0	18.0	mA
2	Decoder offset voltage (1)	V_{OFF} (1)	ON	1ch					No signal		PB OFFSET 1	Measure DC centering on 2.5 V	−330	0	330	mV
3	Decoder offset voltage (2)	V_{OFF} (2)		2ch					No signal		PB OFFSET 2		−330	0	330	mV
4	Reference level (1)	E − F − R(1)	OFF	OFF					0.4	−10	REC OUT 1		−11.5	−10.0	−8.5	dBm
5	Reference level (2)	E − F − R(2)									REC OUT 2		−11.5	−10.0	−8.5	dBm
6	Frequency response 1-(1)	E − F − 1(1)							0.4	−50	REC OUT 1	Measure the difference with the reference level.	−21.5	−20.0	−18.5	dB
7	Frequency response 1-(2)	E − F − 1(2)									REC OUT 2		−21.5	−20.0	−18.5	dB
8	Frequency response 2-(1)	E − F − 2(1)							7.0	−50	REC OUT 1		−17.4	−15.9	−14.4	dB
9	Frequency response 2-(2)	E − F − 2(2)									REC OUT 2		−17.4	−15.9	−14.4	dB
10	Frequency response 3-(1)	E − F − 3(1)							0.4	−30	REC OUT 1		−11.5	−10.0	−8.5	dB
11	Frequency response 3-(2)	E − F − 3(2)									REC OUT 2		−11.5	−10.0	−8.5	dB
12	Frequency response 4-(1)	E − F − 4(1)							7.0	−30	REC OUT 1		−7.4	−5.9	−4.4	dB
13	Frequency response 4-(2)	E − F − 4(2)									REC OUT 2		−7.4	−5.9	−4.4	dB
14	Frequency response 5-(1)	E − F − 5(1)							14.0	−30	REC OUT 1		−6.2	−4.7	−3.2	dB
15	Frequency response 5-(2)	E − F − 5(2)									REC OUT 2		−6.2	−4.7	−3.2	dB

Mea-suring No.	Item	Symbol	SW · condition						Input condition		Measuring point	Description of output waveform and measuring method		Standard			
			SW1	SW2	SW3	SW4	SW5	SW6	f VIN (KHz)	VIN (dBm)				Min.	Typ.	Max.	Unit
16	Frequency response 6-(1)	E − F − 6 (1)	OFF	OFF	OFF	OFF	OFF	OFF	7.0	−10	REC OUT 1	Measure the difference with the reference level.		2.6	4.1	5.6	dB
17	Frequency response 6-(2)	E − F − 6 (2)									REC OUT 2			2.6	4.1	5.6	dB
18	REC output distortion factor (1)	T H D − R (1)							0.4	−10	REC OUT 1	Measure the distortion factor.		−	0.13	0.40	%
19	REC output distortion factor (2)	T H D − R (2)									REC OUT 2			−	0.13	0.40	%
20	Signal handling (1)	S − H (1)	ON						1.0	−3.0	PB OUT 1	Measure the distortion factor.		−	0.2	1.1	%
21	Signal handling (2)	S − H (2)									PB OUT 2			−	0.2	1.1	%
22	REC output SN ratio (F)(1)	S N − R − F(1)	OFF			ON			No signal		Filter OUT	20 Hz to 20 kHz Use filter (20 dB) Rg = 600 Ω		−	−40.0	−34.0	dBm
23	REC output SN ratio (F) (2)	S N − R − F(2)			ON				No signal		Filter OUT			−	−40.0	−34.0	dBm
24	REC output SN ratio (A) (1)	S N − R − A(1)			OFF		ON		No signal		Filter OUT	"A" curve Use filter (20 dB) Rg = 600 Ω		−	−40.0	−34.0	dBm
25	REC output SN ratio (A) (2)	S N − R − A(2)			ON				No signal		Filter OUT			−	−40.0	−34.0	dBm
26	Crosstalk 1—2 (REC)	C T (1 − 2)					OFF	ON	1.0	−10	Filter OUT	Use 1 kHz (20 dB) BPF	V_{IN1} input	−	−45.0	−39.0	dBm
27	Crosstalk 2—1 (REC)	C T (2 − 1)			OFF						Filter OUT		V_{IN2} input	−	−45.0	−39.0	dBm
28	Reference voltage	V_{REF}				OFF		OFF	No signal		V_{REF}			1.80	1.95	2.10	V
29	Median voltage 1	V.G1							No signal		V.G1			2.2	2.5	2.8	V
30	Median voltage 2	V.G2							No signal		V.G2			2.2	2.5	2.8	V

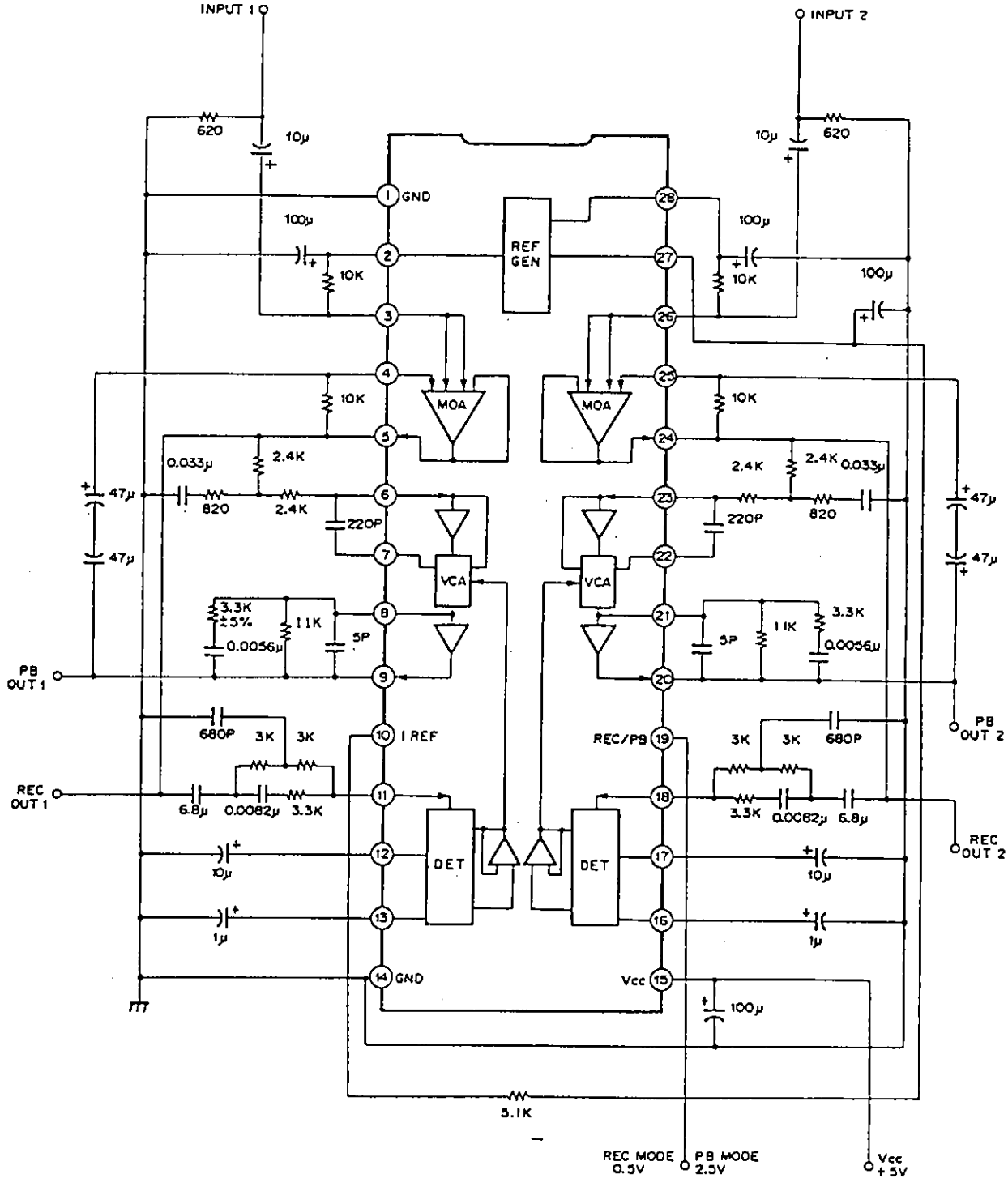
Electrical Characteristics Measuring Circuit



Filter Circuit



Example of Application Circuit



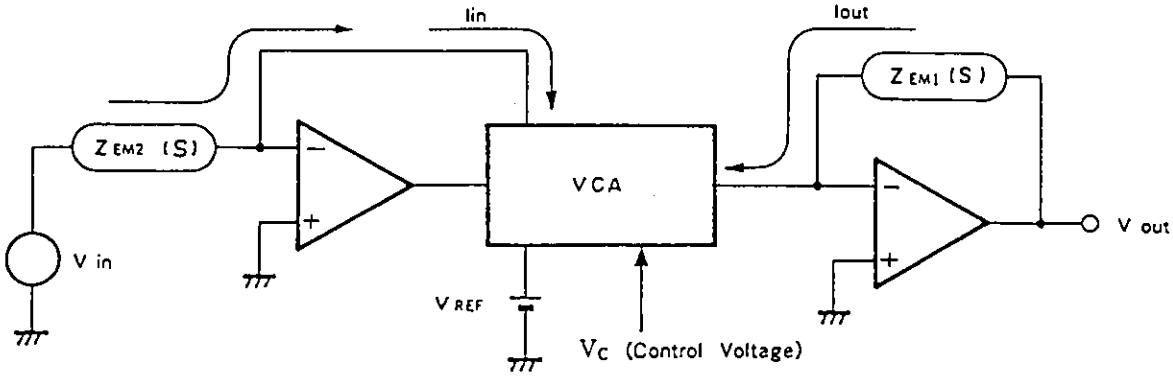
Description of Functions

(1) MOA (Main Op Amp)

With the internal switching, it operates as the voltage follower in PB and has the encoding characteristics in REC by inputting to the decoder circuit into the MOA feedback loop.

(2) VCA (Voltage Controlled Amp)

VCA is comprised of the current input and the power supply current divider. Before and after the VCA, the impedance elements (performing the emphasis as well) for the voltage — current and current — voltage conversions are connected.



The VCA control sensitivity is 0.33dB/mV and the VCA gain is determined based on the V_{REF} reference. When (V_{REF} — Vc) = 30 mV, the VCA gain becomes 10 dB; when the VCA gain is set as G_{VCA} in the above diagram,

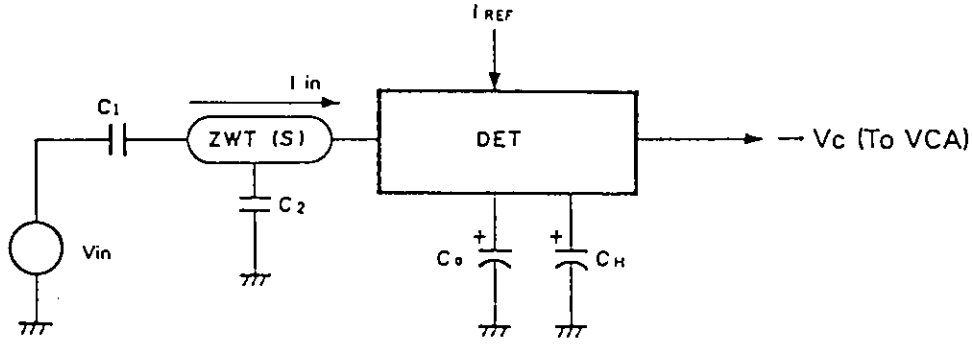
$$V_{OUT} = Vin \cdot G_{VCA} \cdot Z_{EM1}(S)/Z_{EM2}(s).$$

In this VCA, the maximum Io value depends on the power supply voltage when Io = Iin + Iout. That is, the maximum Io will be as follows:

Vcc = 5.0V — Io max. ≃ 1.7mAp—p.
Vcc = 4.2V — Io max. ≃ 1.4mAp—p.

(3) DET (Detector)

Current input is applied to the detector to cover a wide dynamic range with logarithm conversion.



The DC component in the detector input is eliminated by the capacitor (C1). Capacitor (C2) is also required to eliminate high frequency components as the $Z_{WT(S)}$ impedance is small.

In this case, the input current Iin will be,

$$I_{in} = V_{in}/Z_{WT(S)}.$$

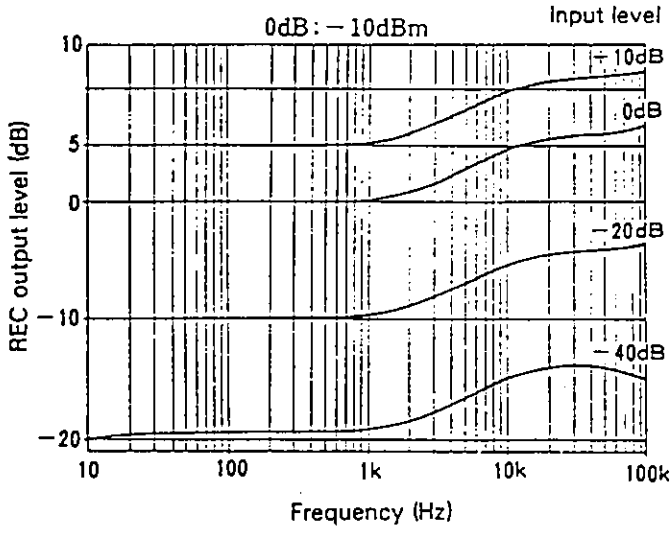
The VCA control voltage Vc will be a function of the ratio between Iin and Iref. When Iref = 100 μA, Iin will be 81.4 μArms and

$$V_c = V_{ref} \text{ (VCA gain} = 0\text{dB)}.$$

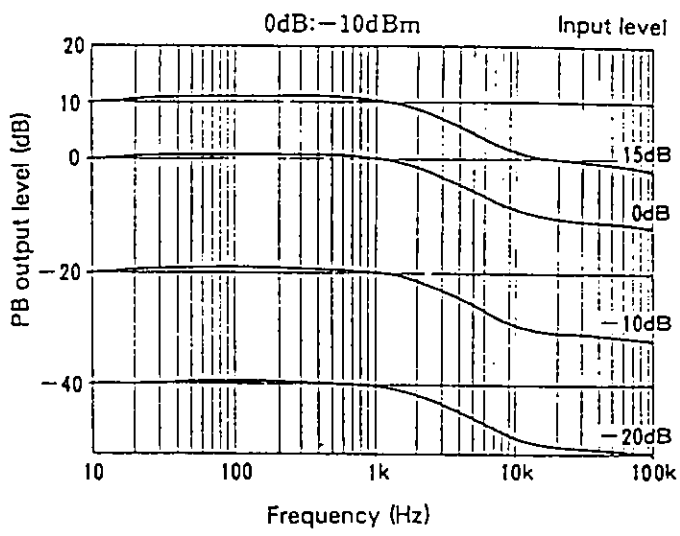
The recovery time constant is determined by Co. As it is set to be comparatively short, the detector output ripple component will increase causing low band distortion due to modulation from mixing.

Therefore, the distortion factor is corrected using a short recovery time constant by holding the full-wave rectified waveform peaks with CH.

Frequency Characteristics (Compression Mode)

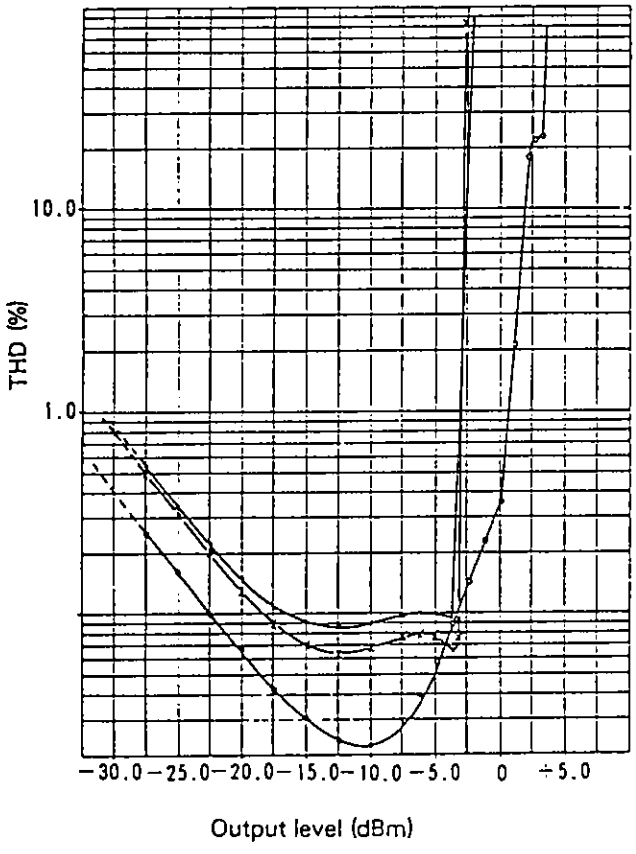


Frequency Characteristics (Expansion Mode)



Output Level
— THD Characteristics (Compression Mode)

● 400Hz(30kHz LPF)
× 1kHz(400Hz HPF, 30kHz LPF)
○ 10kHz(400Hz HPF, 30kHz LPF)



Output Level
— THD Characteristics (Expansion Mode)

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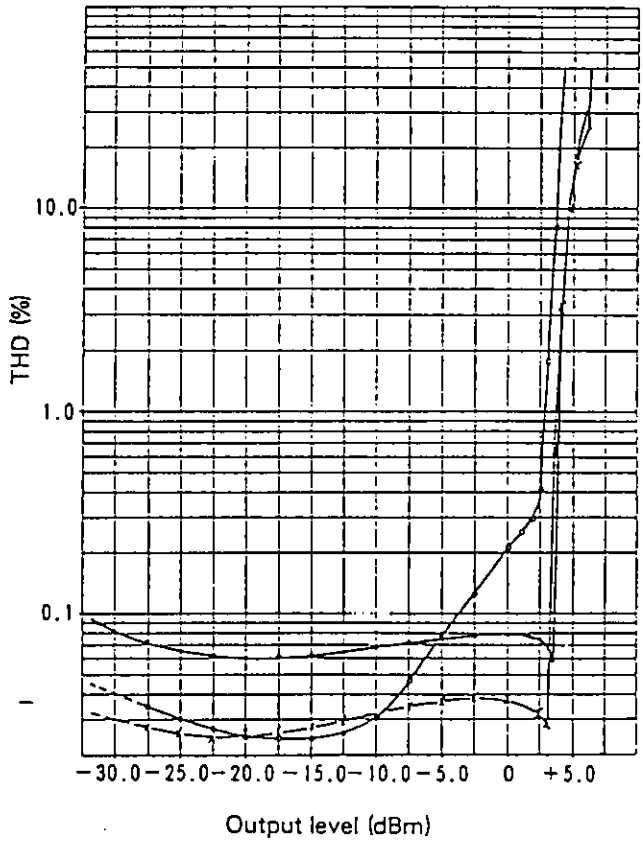
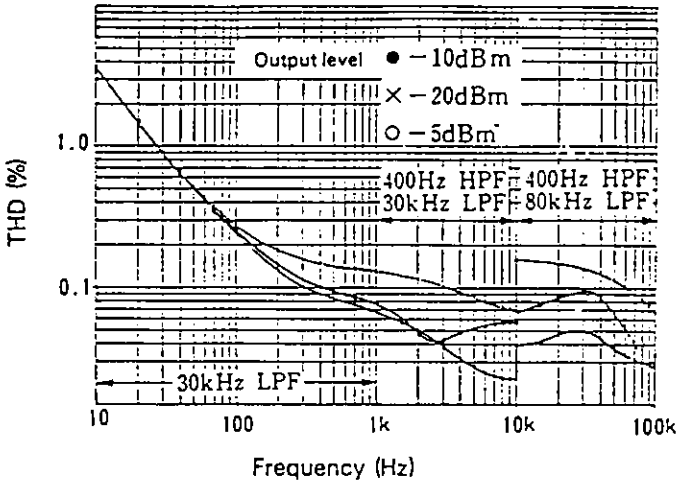
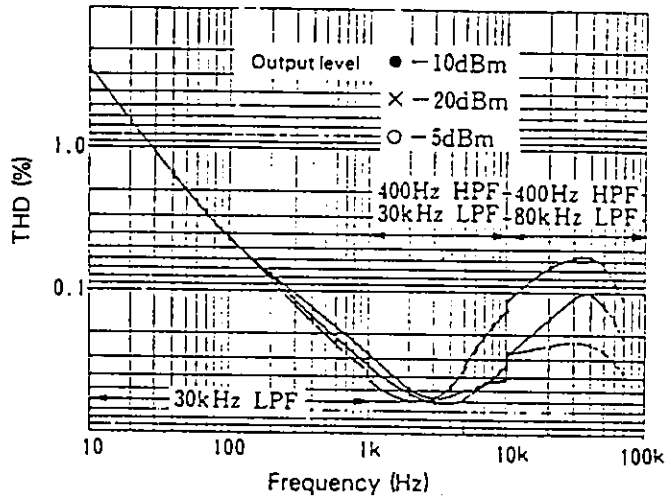


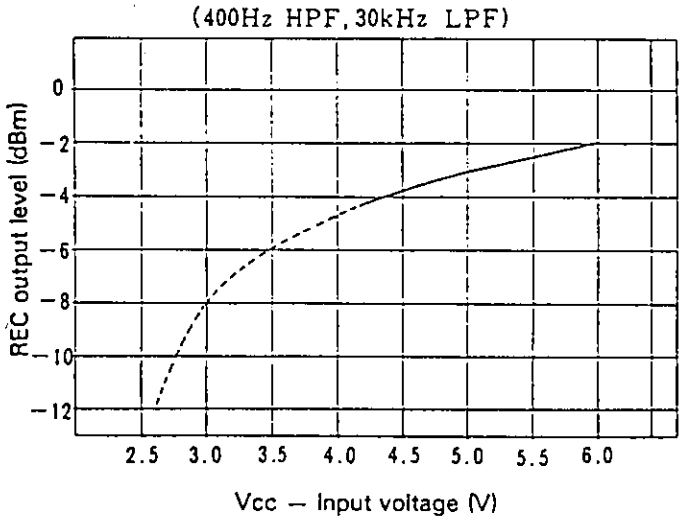
Frequency
— THD Characteristics (Compression Mode)



Frequency
— THD Characteristics (Expansion Mode)



Signal Handling (Compression Mode)
f = 1 kHz, 1% distortion



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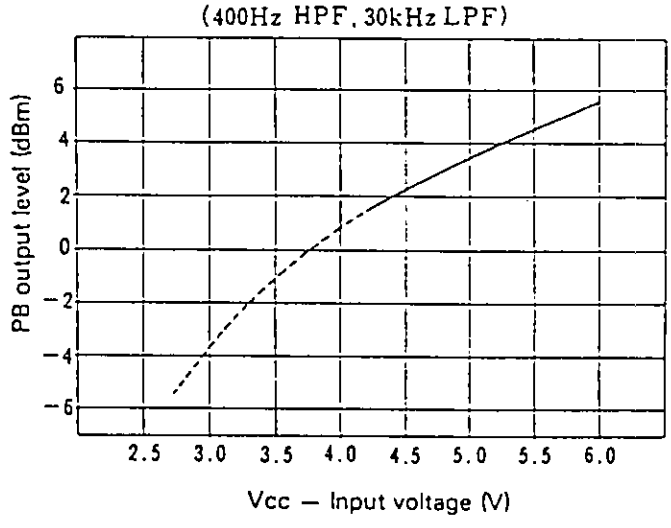
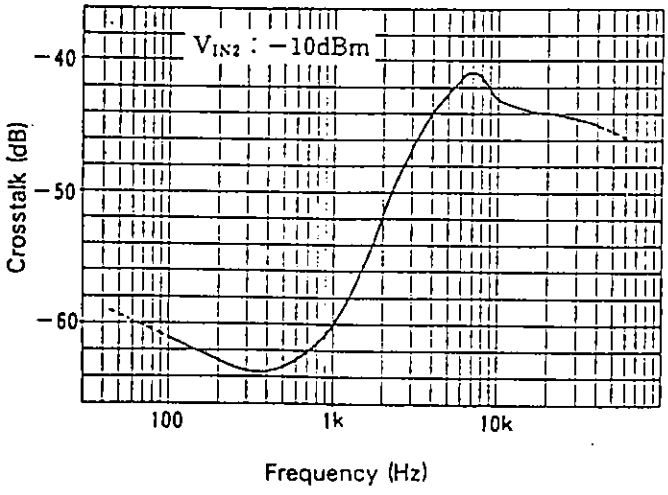


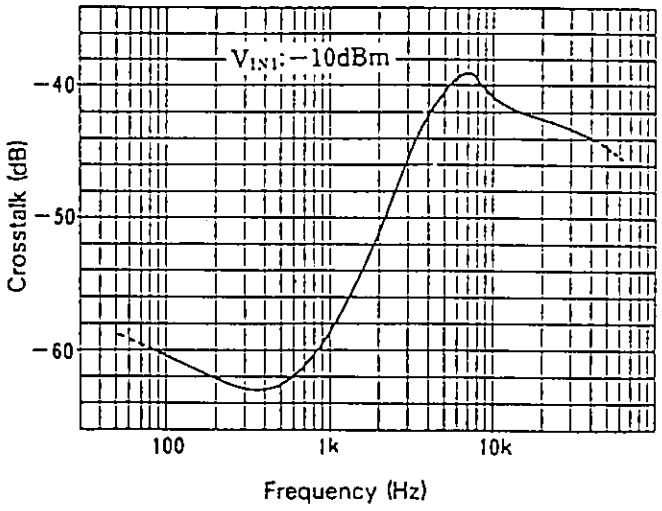
Crosstalk (between Channels)

2ch — 1ch (compression mode)
Crosstalk — Difference between input and REC output.



Crosstalk (between Channels)

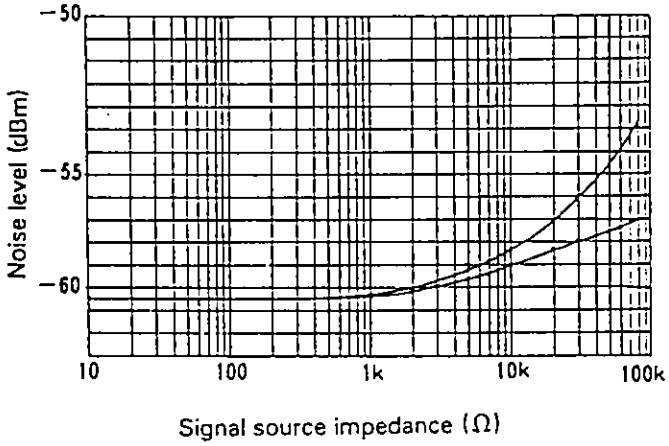
1ch — 2ch (compression mode)
Crosstalk — Difference between input and REC output.



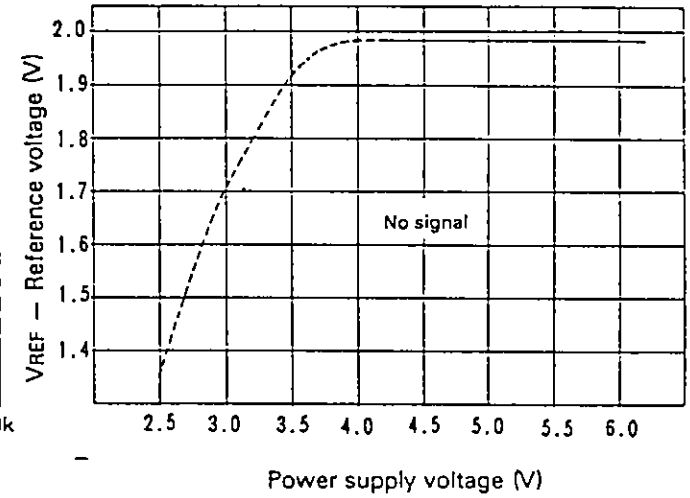
Signal Source Impedance
— Noise Level (S/N) Characteristics

Compression mode No signal

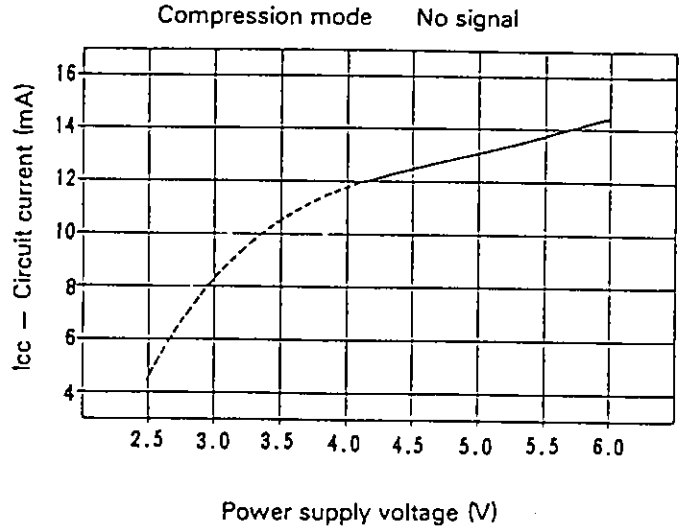
20Hz to 20kHz filter
"A" weighting filter



Reference Voltage
— Power Supply Voltage Characteristics

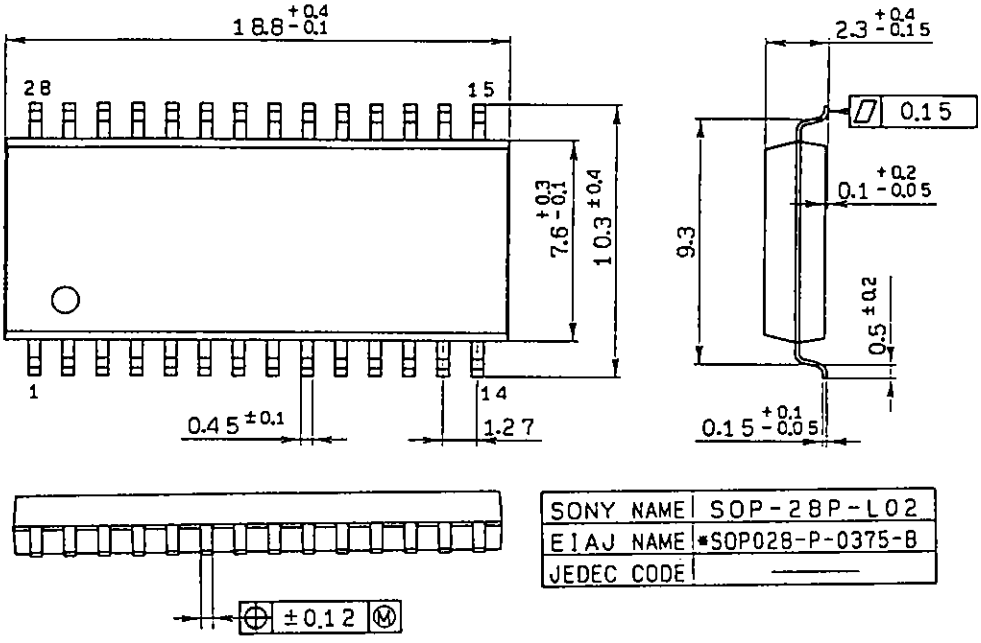


Circuit Current
— Power Supply Voltage Characteristics



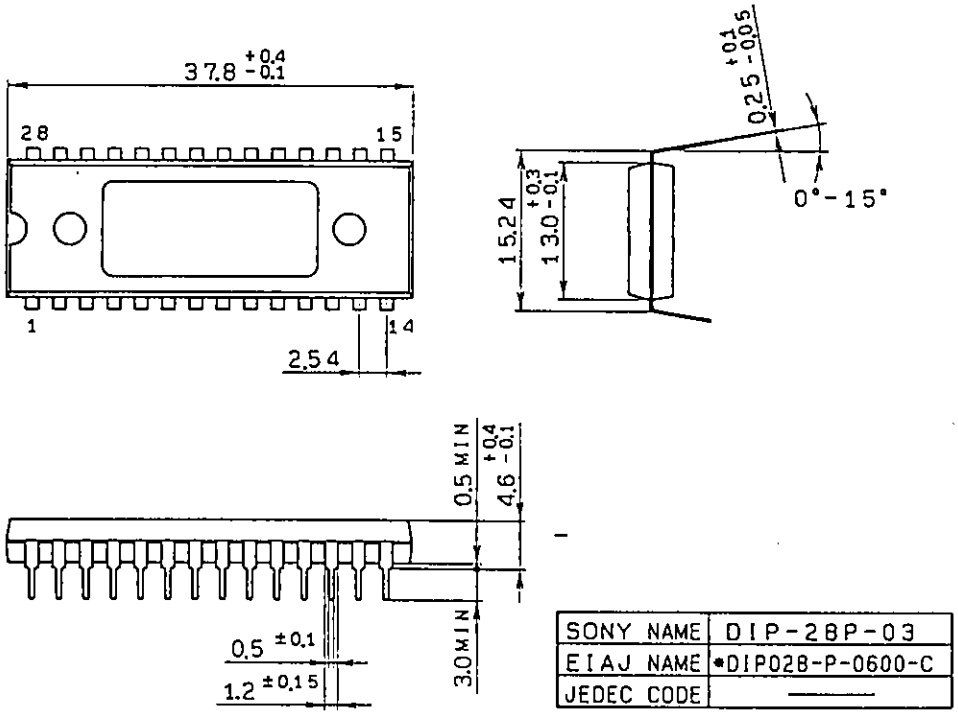
Package Outline Unit : mm

CX20099 28 pin SOP (Plastic)



SONY NAME	SOP-28P-L02
EIAJ NAME	*SOP028-P-0375-B
JEDEC CODE	———

CX20148 28 pin DIP (Plastic)



SONY NAME	DIP-28P-03
EIAJ NAME	*DIP028-P-0600-C
JEDEC CODE	———