SONY

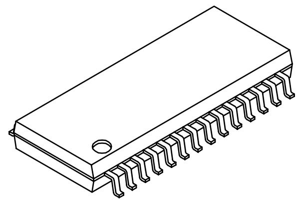
CXA2202M

EIAJ Sound Multiplexing Decoder

Description

The CXA2202M, is a bipolar IC designed as EIAJ TV sound multiplexing decoder, provides various functions including sound multiplexing demodulation, broadcast mode identification (stereo/bilingual discrimination display), mode display, and muting.

28 pin SOP (Plastic)



Features

- Adjustment free of filter
- High frequency stereo separation improved
- An internal active filter greatly reduces the external parts
- Use of the countdown method for broadcast mode identification eliminates the necessity of adjusting the identification system (Cue oscillator)
- Internal filter eliminates interference from digital facsimile signals
- The discrimination time needed to shift from multiplexing sound to monaural sound is reduced.
- Output level: 520mVrms (1kHz, monaural, 100%)
- Forced monaural mode can be set to operate only for stereo broadcasts or for stereo/bilingual broadcasts.

Applications

- Color TVs
- Hi-Fi VCRs

Structure

Bipolar silicon monolithic IC

Absolute Maximum Ratings (Ta = 25°C)

• Supply voltage	V_{CC}	10	V
• Input signal (Pin 7)	Vis	0.6	Vp-p
• Control voltage (Pins 6, 16, 17, 18)	Vic	V_{CC}	V
• Operating temperature	Topr	–20 to +75	°C
• Storage temperature	Tstg	–65 to +150	°C
• Allowable power dissipation	P_D	1000	mW
• LED drive current	I_{LED}	10	mA

Operating Supply Voltage Range 8.5 to 9.5 V

Pin Configuration

GND	1	28	SUBI
NC	2	27	NC
REFL	3	26	SC OUT
V_{CC}	4	25	SC IN
NC	5	24	NC
MO MODE	6	23	MC OUT
MPX IN	7	22	MC IN
NC	8	21	L OUT
CUBI	9	20	R OUT
NC	10	19	M OUT
LEDST	11	18	FOMO
LEDSU	12	17	MUTE
LEDM	13	16	MODE
NC	14	15	NC

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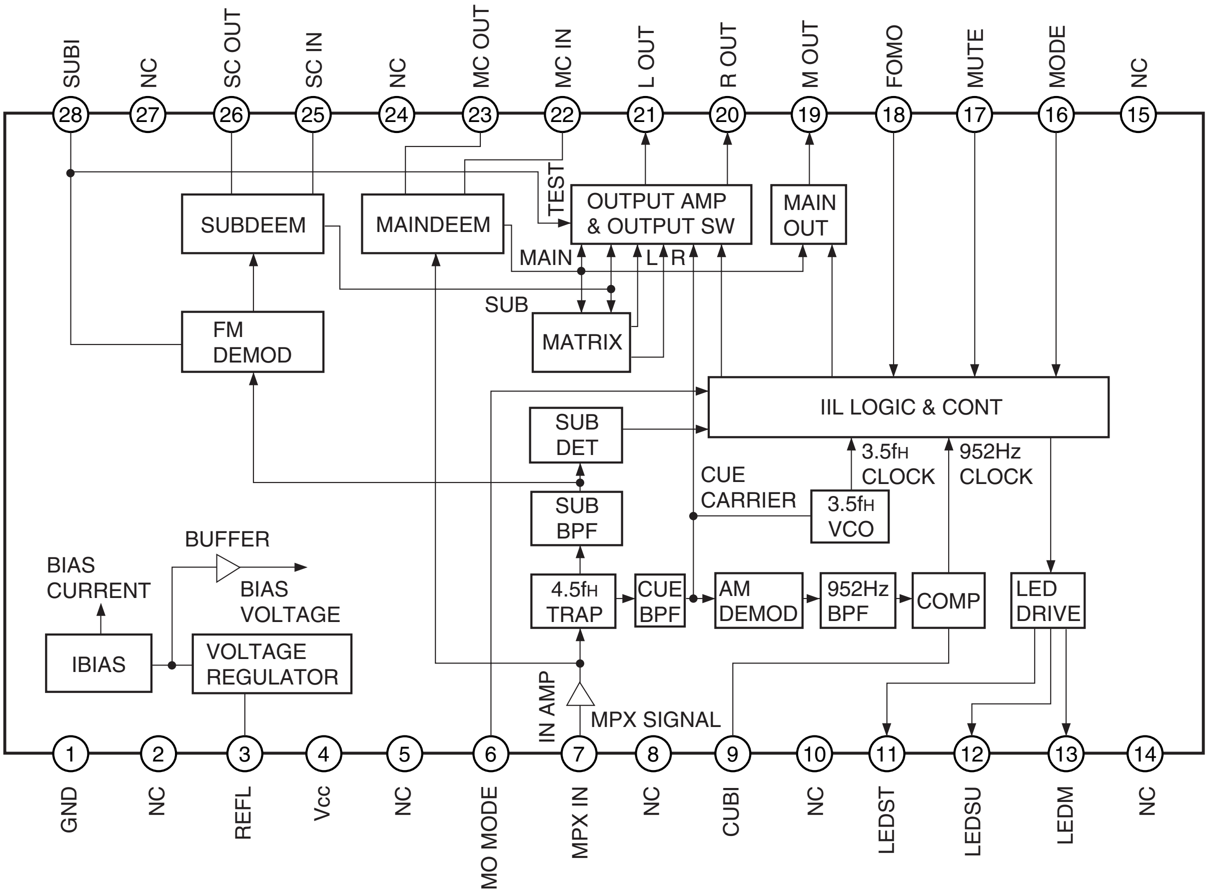
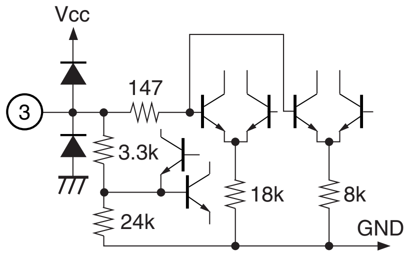
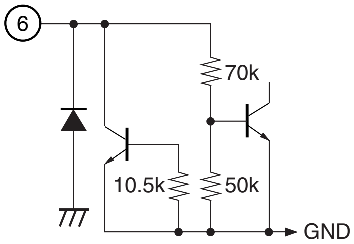
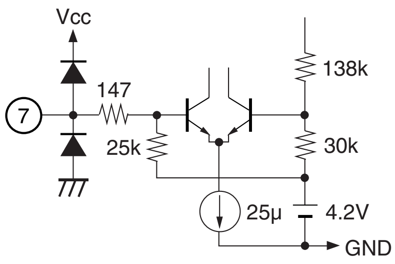
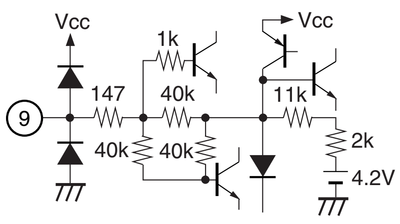
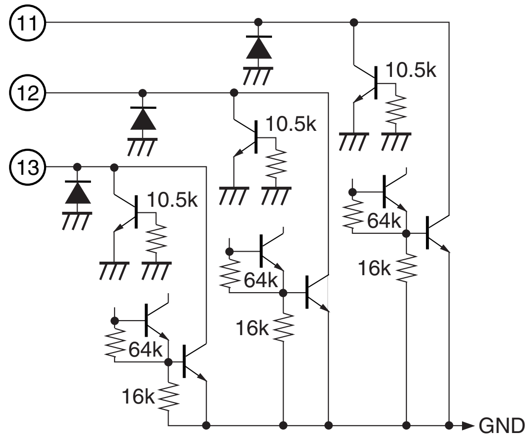
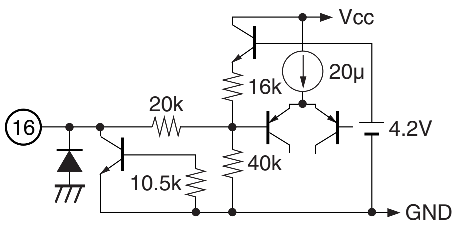
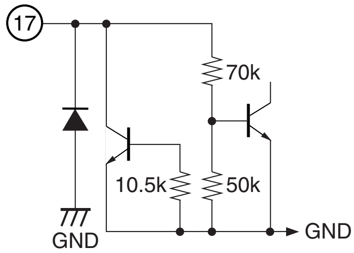
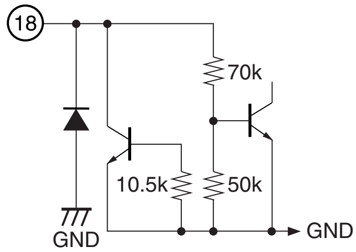
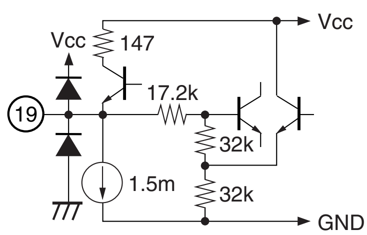
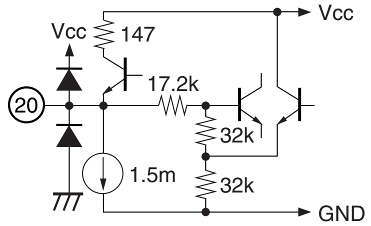
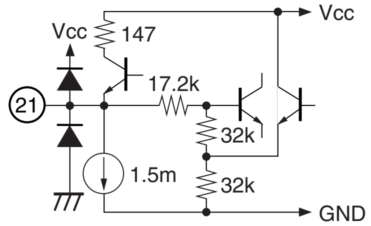
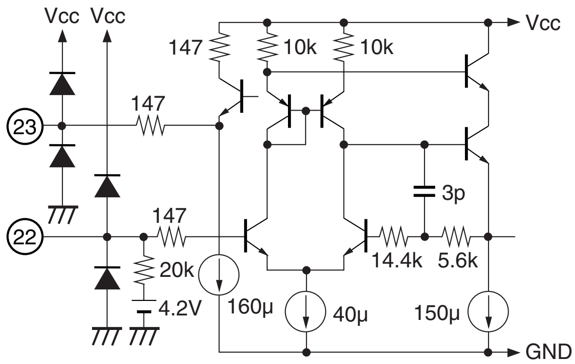
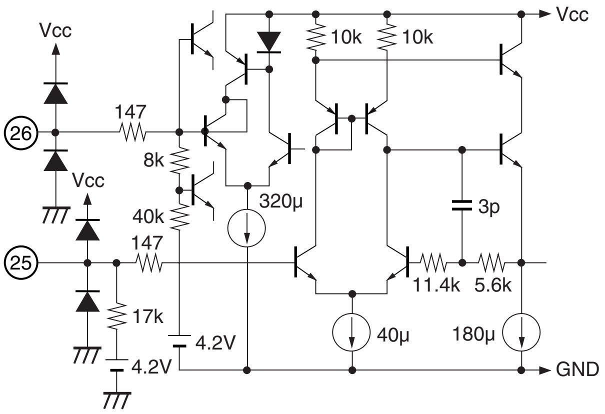
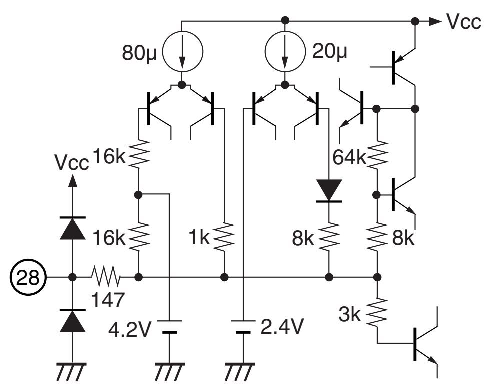
Block Diagram



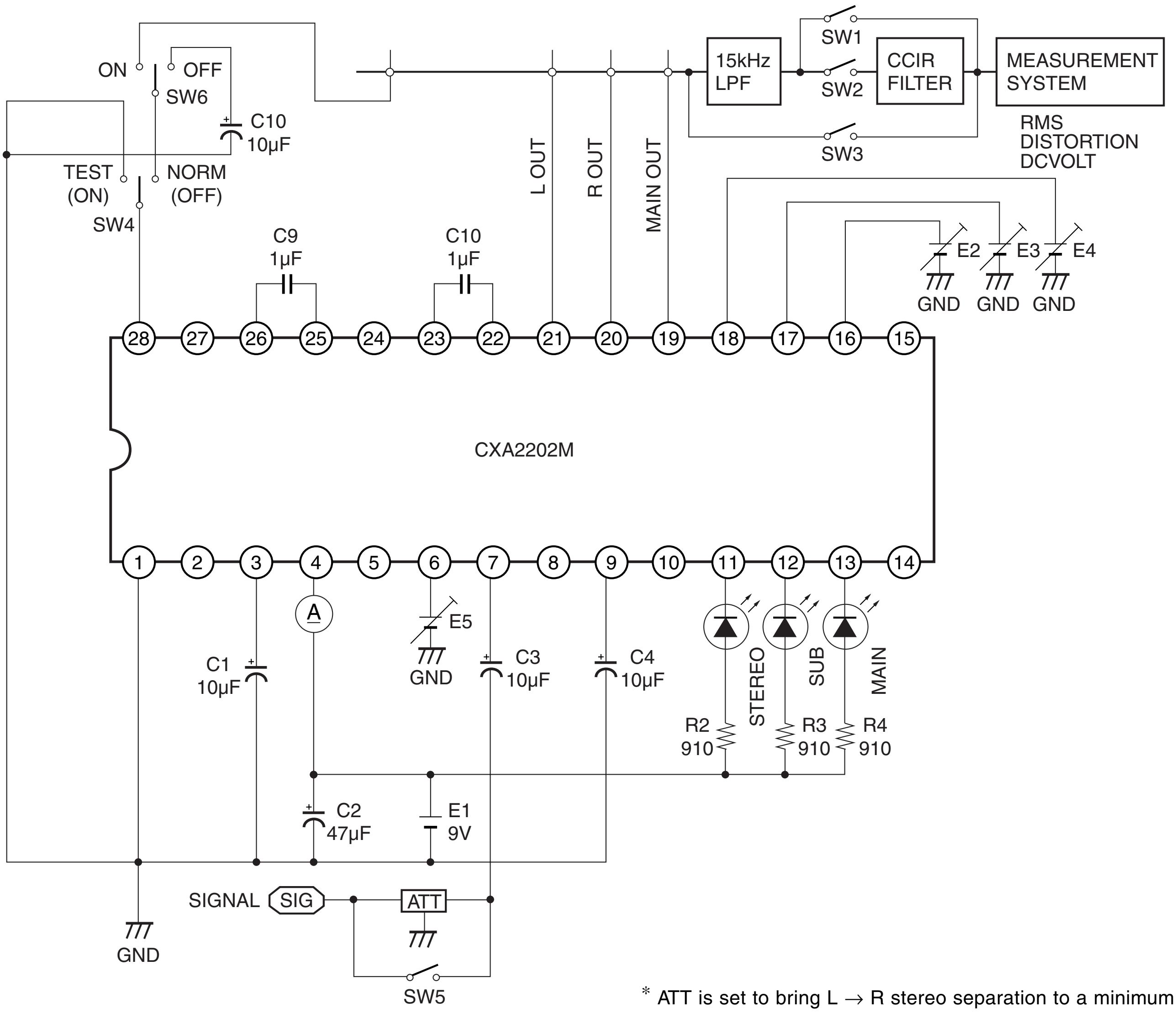
Pin Description (Ta = 25°C, Vcc = 9V)

Pin No.	Symbol	Pin voltage	Equivalent circuit	Description
1	GND	0		GND.
2 5 8 10 14 15 24 27	NC	—	—	Keep these pins open. (They are not connected to the chip.)
3	REFL	1.2V		The noise elimination filter connection of internal reference voltage.
4	Vcc	—		Power supply.
6	MO MODE	—		Forced monaural mode selection. When Low or open, the forced monaural mode operates for stereo broadcasts only; if High, the forced monaural mode operates for both stereo and bilingual broadcasts.
7	MPX IN	4.1V		Sound multiplexing signal input. Typical input level = 70mVrms (monaural, 100%)
9	CUBI	4.1V		Bias capacitor connection of Cue pulse generator.

Pin No.	Symbol	Pin voltage	Equivalent circuit	Description
11	LEDST	—		Mode indicator LED connection. Pin 11: stereo Pin 12: sub Pin 13: main
12	LEDSU			
13	LEDM			
16	MODE	—		DC voltage-based output mode switch for bilingual broadcasts.
17	MUTE	—		Output muting. When High, only DC is output from Pins 19, 20 and 21.
18	FOMO	—		Forced monaural. When High, forced monaural (main sound) mode is selected and the LED turns off.
19	M OUT	4.1V		Main signal output. Always outputs the main signal component, regardless of the broadcast mode.

Pin No.	Symbol	Pin voltage	Equivalent circuit	Description
20	R OUT	4.1V		R-ch output.
21	L OUT	4.1V		L-ch output. During "TEST", the Cue signal component passed through the Cue BPF is output.
22	MC IN	4.1V		DC cut capacitor connection of main signal.
23	MC OUT	3.4V		
25	SC IN	4.1V		DC cut capacitor connection of sub signal.
26	SC OUT	3.9V		
28	SUBI	4.1V		Bias capacitor connection of sub FM detector. "TEST" mode, used for filter adjustment, is activated by grounding this pin.

Electrical Characteristics Measurement Circuit



* ATT is set to bring L → R stereo separation to a minimum.

Electrical Characteristics (Ta = 25°C, Vcc = 9V)

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
1	Current consumption	Icc	1	1	Measure current input to Pin 4	Pin 4	17	25	36	mA
2	Sub output level 400Hz	Vs1	4	2 and 3	Input signal: SIG1 Measure output amplitude (400Hz, sine wave) of Pins 20 and 21: Vs1 (15kLPF)	Pins 20 and 21*1	480	580	690	mVrms
3	Sub frequency characteristics 1kHz	Fs1	4	2 and 3	Input signal: SIG2 Measure output amplitude (1kHz, sine wave) of Pins 20 and 21: Vs2 $Fs1 = 20 \log \frac{Vs2}{Vs1}$ (15kLPF)	Pins 20 and 21*1	–1.6	–0.6	0	dB
4	Sub frequency characteristics 10kHz	Fs2	4	2 and 3	Input signal: SIG3 Measure output amplitude (10kHz, sine wave) of Pins 20 and 21: Vs3 $Fs2 = 20 \log \frac{Vs3}{Vs1}$ (15kLPF)	Pins 20 and 21*1	–19.0	–16.5	–14.0	dB
5	Sub distortion	Ds	4	2 and 3	Input signal: SIG2 Measure distortion of output signal (1kHz, sine wave) of Pins 20 and 21 (15kLPF)	Pins 20 and 21*1	—	1	2	%
6	Sub S/N ratio	Ns	4	2 and 3	Input signal: SIG2 Measure S/N ratio of output (1kHz) of Pins 20 and 21 (15kLPF. RMS)	Pins 20 and 21*1	59	64	—	dB
7	Stereo distortion L-ch	Dstl	4	2	Input signal: SIG4 Measure distortion of output signal (1kHz, sine wave) of Pin 21 (15kLPF)	Pin 21	—	0.2	1.5	%
8	Stereo distortion R-ch	Dstr	4	2	Input signal: SIG5 Measure distortion of output signal (1kHz, sine wave) of Pin 20 (15kLPF)	Pin 20	—	0.2	1.5	%

*1 When bias condition is "3", measurement point is Pin 20 only.

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
9	Stereo output level L-ch 1kHz	Vstl	4	2	Input signal: SIG4 Measure output amplitude (1kHz, sine wave) of Pin 21 (15kLPF)	Pin 21	440	540	640	mVrms
10	Stereo output level R-ch 1kHz	Vstr	4	2	Input signal: SIG5 Measure output amplitude (1kHz, sine wave) of Pin 20 (15kLPF)	Pin 20	440	540	640	mVrms
11	Main output level MAIN OUT	Vm1	4	2	Input signal: SIG6 Measure output signal (400Hz, sine wave) of Pin 19 (15kLPF)	Pin 19	480	580	690	mVrms
12	Main output level	Vm2	4	2	Input signal: SIG6 Measure amplitude of output signal (400Hz, sine wave) of Pins 20 and 21 (15kLPF)	Pins 20 and 21	480	580	690	mVrms
13	Main frequency characteristics 1kHz	Fm1	4	2	Input signal: SIG7 Measure output amplitude (1kHz, sine wave) of Pins 20 and 21: Vm3 $Fm1 = 20 \log \frac{Vm3}{Vm2}$ (15kLPF)	Pins 20 and 21	–1.6	–0.6	0	dB
14	Main frequency characteristics 10kHz	Fm2	4	2	Input signal: SIG8 Measure output amplitude (10kHz, sine wave) of Pins 20 and 21: Vm4 $Fm2 = 20 \log \frac{Vm4}{Vm2}$ (15kLPF)	Pins 20 and 21	–16.0	–14.0	–12.0	dB
15	Main distortion MAIN OUT	Dm1	4	2	Input signal: SIG7 Measure distortion of output signal (1kHz, sine wave) of Pin 19 (15kLPF)	Pin 19	—	0.2	1	%
16	Main distortion	Dm2	4	2	Input signal: SIG7 Measure distortion of output signal (1kHz, sine wave) of Pins 20 and 21 (15kLPF)	Pins 20 and 21	—	0.2	1	%

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
17	Main distortion at maximum input	Dm3	4	2	Input signal: SIG9 Measure distortion of output signal (1kHz, sine wave) of Pins 20 and 21 (15kLPF)	Pins 20 and 21	—	0.3	2	%
18	Main S/N ratio	Nm	4	2	Input signal: SIG7 Measure S/N ratio of output signal (1kHz) of Pins 20 and 21 (15kLPF. RMS)	Pins 20 and 21	65	73	—	dB
19	Stereo separation L → R	Sstr	4	2	Input signal: SIG4 Sstr = $20 \log \frac{\text{Output amplitude Pin 21}}{\text{Output amplitude Pin 20}}$ (dB) (15kLPF)	Pins 20 and 21	35	45	—	dB
20	Stereo separation R → L	Sstl	4	2	Input signal: SIG5 Sstl = $20 \log \frac{\text{Output amplitude Pin 20}}{\text{Output amplitude Pin 21}}$ (dB) (15kLPF)	Pins 20 and 21	35	45	—	dB
21	Cross talk MAIN → SUB	Cms1	2	2	Input signal: SIG15 Calculate the level difference between the output amplitude of Pins 20 and 21 (Vms1) and the measured value (Vm3) in measurement No. 13 $Cms1 = 20 \log \frac{Vm3}{Vms1}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	55	58	—	dB
22	Cross talk SUB → MAIN	Csm1	2	1	Input signal: SIG2 Calculate the level difference between the output amplitude of Pins 20 and 21 (Vsm1) and the measured value (Vs2) in measurement No. 3. $Csm1 = 20 \log \frac{Vs2}{Vsm1}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	60	70	—	dB

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
23	Cross talk MAIN → SUB BOTH mode	Cms2	2	3	Input signal: SIG15 Calculate the level difference between the output amplitude of Pin 20 (Vms2) and the output amplitude of Pin 21 (Vms3). $Cms2 = 20 \log \frac{Vms3}{Vms2}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	55	58	—	dB
24	Cross talk SUB → MAIN BOTH mode	Csm2	2	3	Input signal: SIG2 Calculate the level difference between the output amplitude of Pin 21 (Vsm2) and the output amplitude of Pin 20 (Vsm3). $Csm2 = 20 \log \frac{Vsm3}{Vsm2}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	60	70	—	dB
25	Residual carrier SUB	Lcs	3	2	Input signal: SIG11 Measure subcarrier component amplitude of the output of Pins 20 and 21.	Pins 20 and 21	—	10	30	mVrms
26	Residual carrier MAIN	Lcm	3	1	Input signal: SIG11 Measure the subcarrier component amplitude of the output of Pins 20 and 21.	Pins 20 and 21	—	12	20	mVrms
27	Mute volume MAIN	Mm	4	4	Input signal: SIG7 Calculate the level difference between the output amplitude of Pins 20 and 21 (VMm) and the measured value (Vm3) in measurement No. 13. $Mm = 20 \log \frac{Vm3}{VMm}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	70	80	—	dB

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
28	Mute volume SUB	Ms	4	4	Input signal: SIG2 Caluculate the level difference between the output amplitude of Pins 20 and 21 (VMs) and the measured value (Vs2) in measurement No. 3. $Ms = 20 \log \frac{Vs2}{VMs}$ (dB) (15kLPF, 1kBPF)	Pins 20 and 21	70	80	—	dB
29	Mute volume stereo	Mst	4	2 and 4	Input signals: SIG4, 5 Measure the level difference between the output signals of Pins 20 and 21 under bias conditions 2 and 4. $Mst = 20 \log \frac{\text{Measured value under bias condition 2 (mVrms)}}{\text{Measured value under bias condition 4 (mVrms)}}$ (15kLPF, 1kBPF)	Pins 20 and 21*2	70	80	—	dB
30	DC offset stereo L-ch	Ostl	3	2 and 4	Input signal: SIG18 Measure the fluctuation in the output DC level of Pin 21 under bias conditions 2 and 4.	Pin 21	—	20	100	mV
31	DC offset stereo R-ch	Ostr	3	2 and 4	Input signal: SIG18 Measure the fluctuation in the output DC level of Pin 20 under bias conditions 2 and 4.	Pin 20	—	20	100	mV
32	DC offset MAIN OUT	Om	3	2 and 4	Input signal: No signal Measure the fluctuation in the output DC level of Pin 19 under bias conditions 2 and 4.	Pin 19	—	20	100	mV
33	Cue detection sensitivity	CD	4	2	Input signal: SIG12 Change SIG12 and measure amount of attenuation at the point "monaural" switches to "Sound multiplex".	—	9	14	17	dB

*2 Measure Pin 21 for SIG4 input; Pin 20 for SIG5 input.

No.	Item	Symbol	SW conditions	Bias conditions	Conditions	Measurement point	Min.	Typ.	Max.	Unit
34	SUB detection sensitivity	SD	4	2	Input signal: SIG13 Change SIG13 and measure amount of attenuation at the point "monaural" switches to "Sound multiplex".	—	10	13	18	dB
35	Cue BPF gain	CG	5	2	Input signal: SIG14 Measure the output amplitude of Pin 21.	Pin 21	410	600	760	mVrms
36	4.5fH trap attenuation level	TG	6	2	Input signal: SIG16, 17 Measure output amplitude of Pin 28 and then measure the level difference in the output signal for SIG16 input and SIG17 input. TG = $20 \log \frac{\text{Measured value for SIG16 (mVrms)}}{\text{Measured value for SIG17 (mVrms)}}$	Pin 28	20	38	—	dB

SW Condition Table

No. \ SW	1	2	3	4	5	6
1	off	off	off	off	off	off
2	off	on	off	off	off	off
3	off	off	on	off	off	off
4	on	off	off	off	off	off
5	off	off	on	on	on	off
6	off	off	on	off	on	on

BIAS Condition Table

No. \ BIAS	E1	E2	E3	E4	E5
1	9V	0.5V	0.5V	0.5V	0.5V
2	9V	4.5V	0.5V	0.5V	0.5V
3	9V	2.5V	0.5V	0.5V	0.5V
4	9V	4.5V	4.5V	0.5V	0.5V

Input Signal Definition

SIG1: Sound MPX signal
Main: 0%
Sub: 400Hz, 100% MOD
Cue: Bilingual

SIG2: Sound MPX signal
Main: 0%
Sub: 1kHz, 100% MOD
Cue: Bilingual

SIG3: Sound MPX signal
Main: 0%
Sub: 10kHz, 100% MOD
Cue: Bilingual

SIG4: Sound MPX signal
L-ch: 1kHz, 100%
R-ch: 0%
Cue: Stereo

SIG5: Sound MPX signal
L-ch: 0%
R-ch: 1kHz, 100%
Cue: Stereo

SIG6: Sound MPX signal
Main: 400Hz, 100%
Sub: Carrier off
Cue: Cue signal off

SIG7: Sound MPX signal
Main: 1kHz, 100%
Sub: Carrier off
Cue: Cue signal off

SIG8: Sound MPX signal
Main: 10kHz, 100%
Sub: Carrier off
Cue: Cue signal off

SIG9: Sound MPX signal
Main: 1kHz, 300%
Sub: Carrier off
Cue: Cue signal off

SIG10: Sound MPX signal
L-ch: 1kHz, 100%
R-ch: 0%
Cue: Cue signal off

SIG11: Sound MPX signal
Main: 0%
Sub: 0% (Carrier only)
Cue: Bilingual

SIG12: Sound MPX signal
Main: 0%
Sub: 0% (Carrier only)
Cue: Bilingual (level adjusted to minimum)

SIG13: Sound MPX signal
Main: 0%
Sub: 0% (level adjusted to minimum)
Cue: Bilingual

SIG14: 55.069kHz sine wave
5.6mVrms

SIG15: Sound MPX signal
Main: 1kHz, 100%
Sub: 0% (Carrier only)
Cue: Bilingual

SIG16: 31.47kHz sine wave
42mVrms

SIG17: 70.80kHz sine wave
42mVrms

SIG18: Sound MPX signal
L-ch: 0%
R-ch: 0%
Cue: Stereo

* Sound MPX signal level is defined as 100% MONO at 1Vp-p.

Output and LED On/Off Table

Broadcast condition	MODE SW SUB	MODE SW BOTH	MODE SW MAIN	Forced monaural MODE	Forced monaural	MUTE	Output condition L	Output condition R	Output condition MAIN	LED On/Off condition STEREO	LED On/Off condition SUB	LED On/Off condition MAIN
Stereo	×	×	×	×	OFF	OFF	L	R	L + R	ON	OFF	OFF
	×	×	×	×	ON	OFF	L+ R	L+ R	L+ R	OFF	OFF	OFF
	×	×	×	×	×	ON	DC	DC	DC	OFF	OFF	OFF
Bilingual	ON			F.MONO	×	OFF	SUB	SUB	MAIN	OFF	ON	OFF
		ON		F.MONO	×	OFF	MAIN	SUB	MAIN	OFF	ON	ON
			ON	F.MONO	×	OFF	MAIN	MAIN	MAIN	OFF	OFF	ON
	ON			F.MAIN	OFF	OFF	SUB	SUB	MAIN	OFF	ON	OFF
		ON		F.MAIN	OFF	OFF	MAIN	SUB	MAIN	OFF	ON	ON
			ON	F.MAIN	OFF	OFF	MAIN	MAIN	MAIN	OFF	OFF	ON
	×	×	×	F.MAIN	ON	OFF	MAIN	MAIN	MAIN	OFF	OFF	OFF
	×	×	×	×	×	ON	DC	DC	DC	OFF	OFF	OFF
Monaural	×	×	×	×	×	OFF	MONO	MONO	MONO	OFF	OFF	OFF
	×	×	×	×	×	ON	DC	DC	DC	OFF	OFF	OFF

×: No response

Control Voltage Range

		Voltage range
MODE SW Pin 16	SUB	4.5V to Vcc
	BOTH	2V to 3V (or open)
	MAIN	0V to 0.5V
Forced monaural Pin 18	on	3V to Vcc
	off	0V to 0.5V (or open)
MUTE Pin 17	on	3V to Vcc
	off	0V to 0.5V (or open)
Forced monaural mode Pin 6	F.MAIN	3V to Vcc
	F.MONO	0V to 0.5V (or open)

Description of Operation

The sound mutiplexing signal input from Pin 7 is passed through IN AMP and is applied to the Cue BPF, Sub BPF, and Main de-emphasis circuit.

1. Discrimination circuits
   Cue BPF passes only the Cue signal component from the multiplex signal. In the AM demodulator, the signal (AM wave) is AM detected and one of two sine waves is generated, either a 922.5Hz signal for bilingual broadcasts or a 982.5Hz signal for stereo broadcasts.
   In the 952Hz BPF, the $3.5f_H$ carrier component is eliminated from the Cue signal after AM wave detection. The Cue signal, from which the carrier component has been eliminated, is waveform shaped by COMP, with the resulting 922.5Hz or 982.5Hz pulse being applied to the Logic section.
   In the $3.5f_H$ VCO, a $3.5f_H$ pulse locked onto the Cue signal carrier ($3.5f_H$) is created and sent to the Logic section.
   In the Logic section, the broadcast mode is identified using the countdown method. Depending on this result as well as the presence of a SUB signal from SUB detector and the MUTE ON/OFF, MODE switching, and FOMO ON/OFF instructions from CONT, the output switching control signal is created. This signal is used to control the output condition of OUTPUT SW and MAIN OUT.

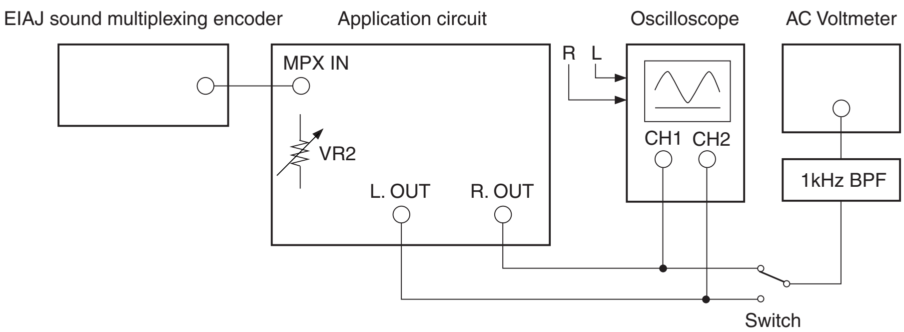
2. Main circuits
   In MAIN DEEM, de-emphasis is applied to the Main signal component and the Sub and Cue components are removed.
   After passing through the MAIN DEEM, the Main signal is applied to MATRIX, OUTPUT AMP, and MAINOUT.

3. Sub circuits
   In SUB BPF, only the SUB signal component out of multiplex signals is passed through. In the $4.5f_H$ trap, the digital facsimile signal component is removed.
   In FM Demod, the SUB signal is FM demodulated.
   In SUB DEEM, the FM demodulated Sub signal is de-emphasized and the carrier component is removed.
   After passing through SUB DEEM, the Sub signal is applied to MATRIX and OUTPUT AMP.

4. MATRIX and output circuits
   In MATRIX, the L and R signals are created by adding and subtracting the Main signal from MAIN DEEM and the Sub signal from SUB DEEM in stereo broadcast.
   In OUTPUT AMP and OUTPUT SW, the output signal is switched under the control of Logic.
   In addition, MAIN OUT always outputs the MAIN signal component, regardless of the broadcast mode.

Adjustment

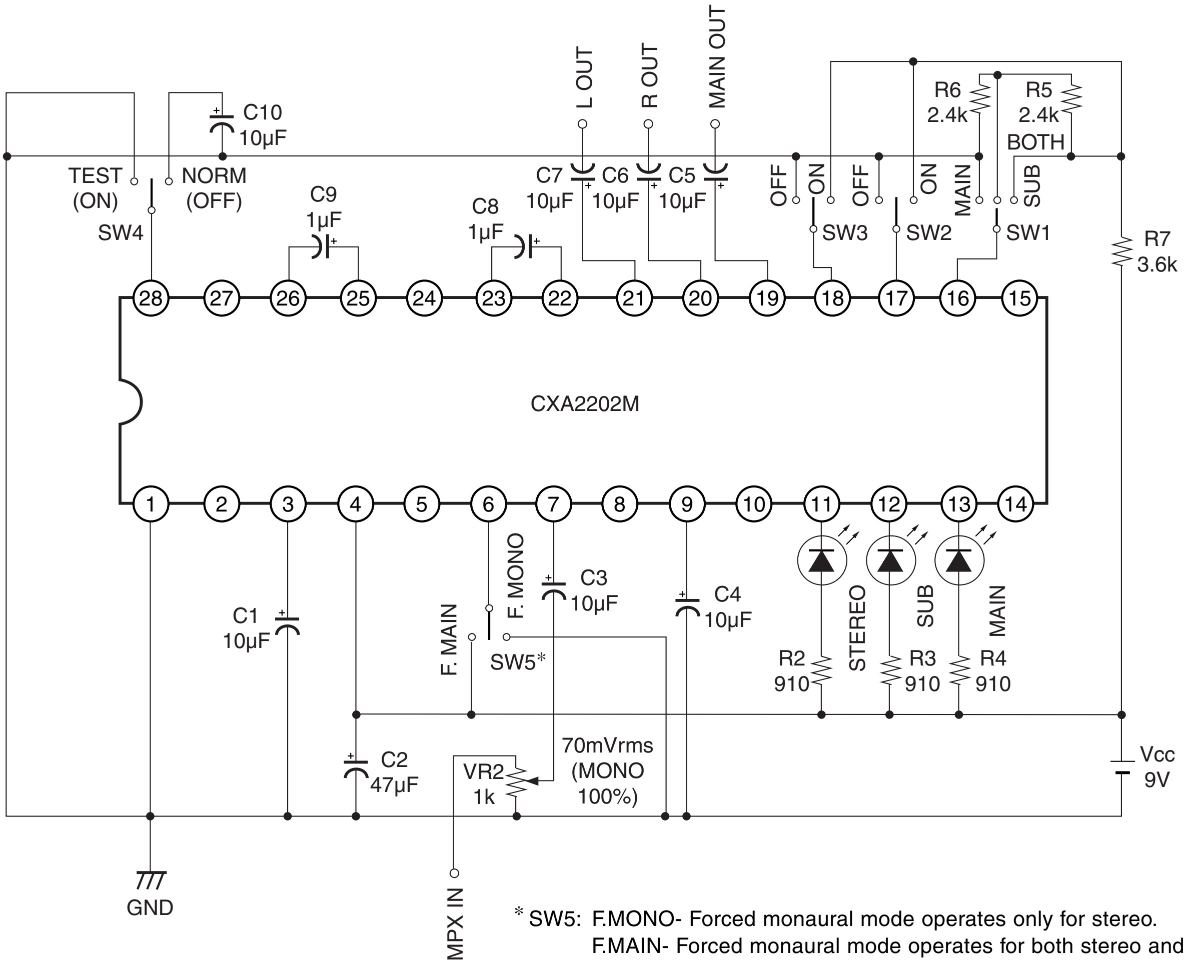
Separation adjustment



Procedure

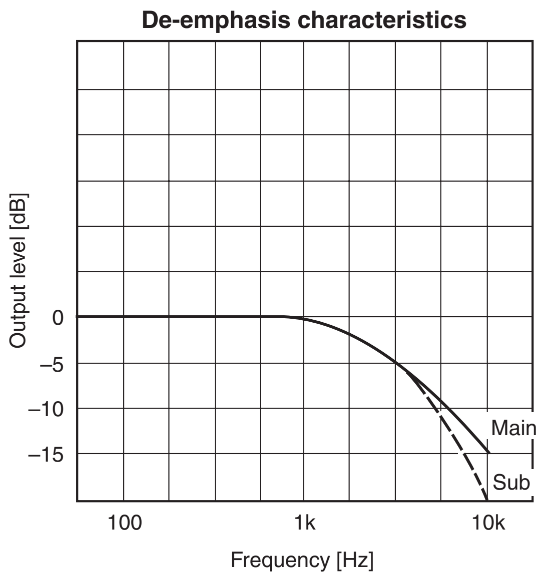
1) Connect components as shown in figure above. (Set SW4 to NORM.)
2) Set the encoder to stereo mode, and input a 100% modulated 1kHz signal; also set the encoder so that only the L-ch is output.
3) Monitor the oscilloscope and AC voltmeter and adjust VR2 so that the R-ch is at a minimum.
   (Separation standard: 35dB or more)

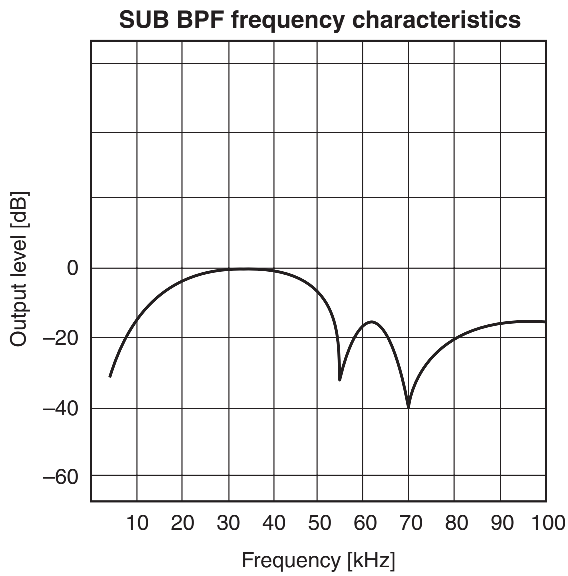
Application Circuit

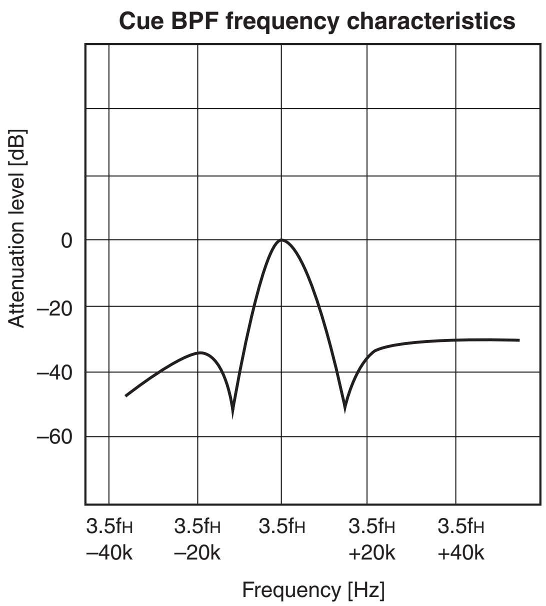


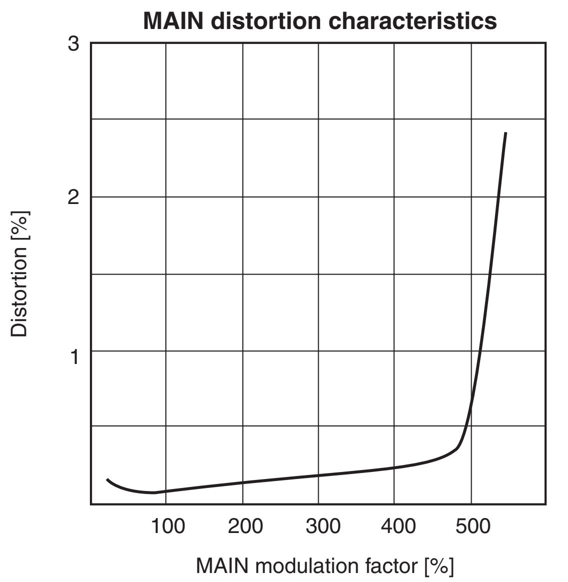
* SW5: F.MONO- Forced monaural mode operates only for stereo.
F.MAIN- Forced monaural mode operates for both stereo and bilingual.

Example of Representative Characteristics



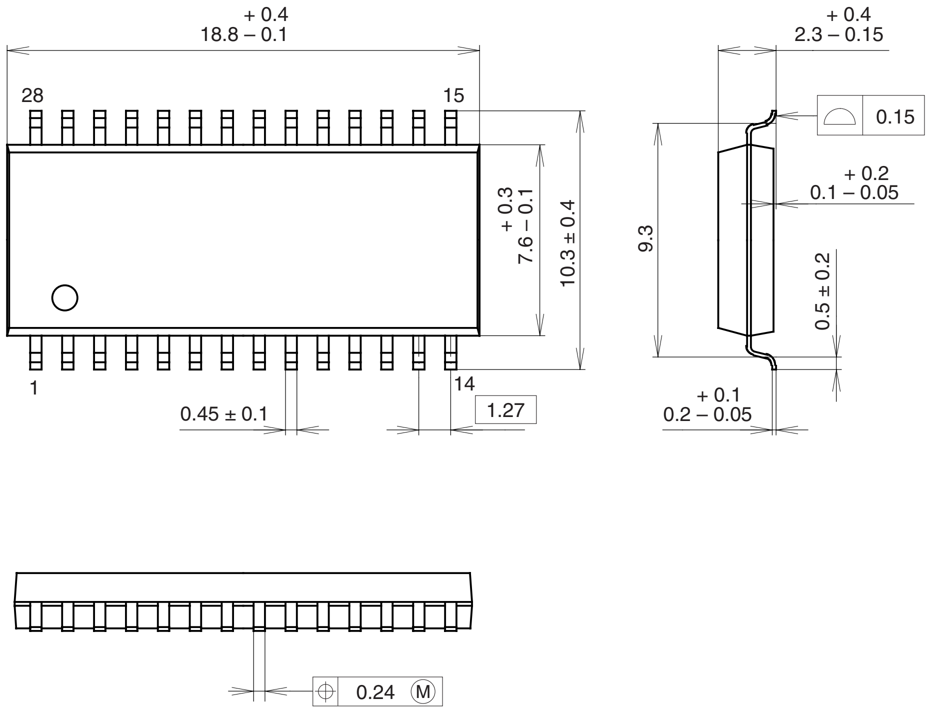






Package Outline Unit: mm

28PIN SOP (PLASTIC)



PACKAGE STRUCTURE

SONY CODE	SOP-28P-L04
EIAJ CODE	SOP028-P-0375
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.7g

LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi Bi:1-4wt%
PLATING THICKNESS	5-18µm