

M51167BP,BFP

SINGLE CHIP PREAMPLIFIER FOR DUAL CASSETTE RECORDER

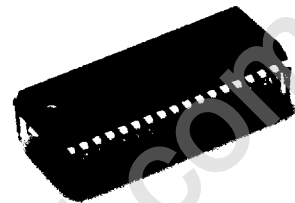
DESCRIPTION

The M51167 is an IC designed for radio CD/cassette tape players.

The IC, in addition to recording and playback preamplifiers (2 ch) for dual cassette, has equalizer selector, music selector, and ALC (automatic level controller) and is, with a single chip, capable of processing audio signals of cassette deck.

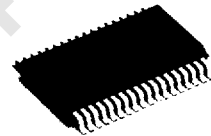
FEATURES

- Built-in electronic switch for double cassette.
- Built-in equalizer switch for both modes.
- Low noise EQ amplifier..... 1.3 μ Vrms (typ)
- Two built-in Rec amplifiers with ALC circuit for noise reduction system
- Built-in filter circuits for prevention of malfunctioning caused by tape pop up noise at music blank.
- Capable of setting timing for music blank by means of external CR combination.



Outline 36P4E(BP)

1.778mm pitch 500mil SDIP
(11.0mm $\times$ 31.5mm $\times$ 3.8mm)



Outline 36P2R-A(BFP)

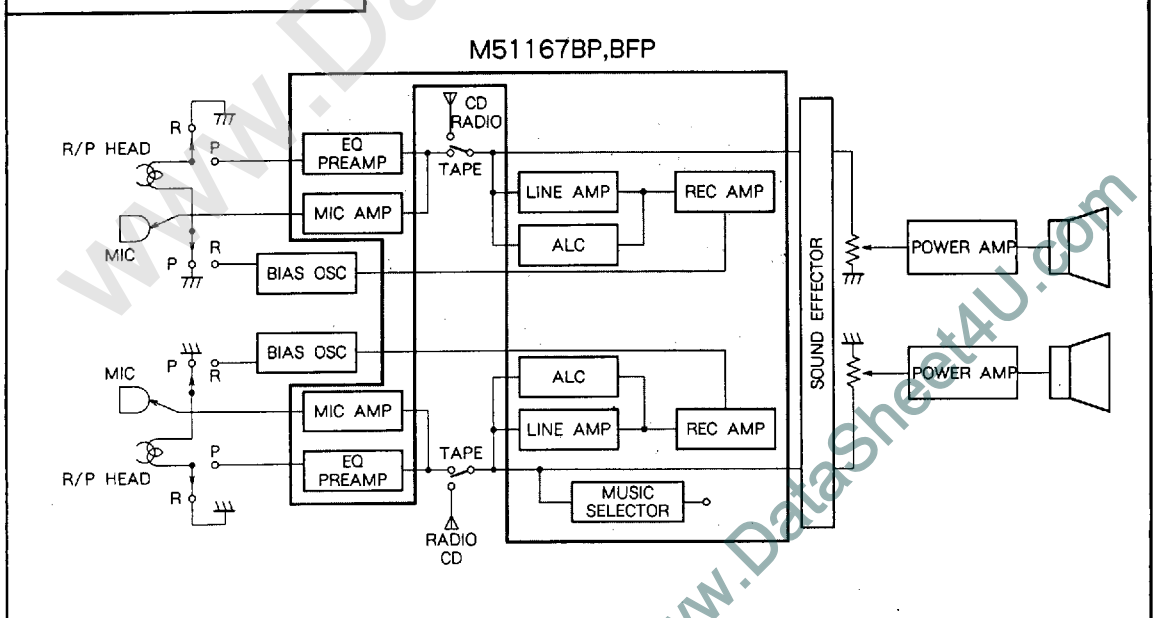
0.8mm pitch 450mil SSOP
(8.4mm $\times$ 15.0mm $\times$ 2.0mm)

RECOMMENDED OPERATING CONDITIONS

Supply voltage range..... $V_{CC} = 5.5 \sim 12V$

Rated supply voltage..... $V_{CC} = 9V$

SYSTEM CONFIGURATION



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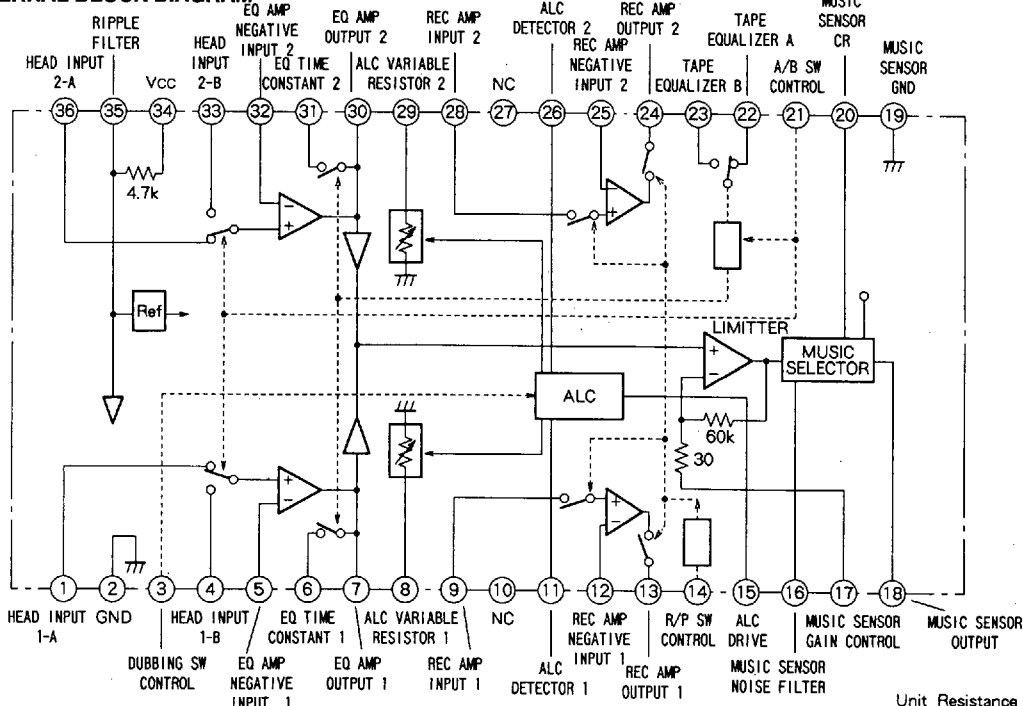
PIN CONFIGURATION

HEAD INPUT 1-A	1	36	HEAD INPUT 2-A
GND	2	35	RIPPLE FILTER
DUBBING SW CONTROL	3	34	VCC
HEAD INPUT 1-B	4	33	HEAD INPUT 2-B
EQ AMP NEGATIVE INPUT 1	5	32	EQ AMP NEGATIVE INPUT 2
EQ TIME CONSTANT 1	6	31	EQ TIME CONSTANT 2
EQ AMP OUTPUT 1	7	30	EQ AMP OUTPUT 2
ALC VARIABLE RESISTOR 1	8	29	ALC VARIABLE RESISTOR 2
REC AMP INPUT 1	9	28	REC AMP INPUT 2
NC	10	27	NC
ALC DETECTOR 1	11	26	ALC DETECTOR 2
REC AMP NEGATIVE INPUT 1	12	25	REC AMP NEGATIVE INPUT 2
REC AMP OUTPUT 1	13	24	REC AMP OUTPUT 2
R/P SW CONTROL	14	23	TAPE EQUALIZER B
ALC DRIVE	15	22	TAPE EQUALIZER A
MUSIC SENSOR NOISE FILTER	16	21	A/B SW CONTROL
MUSIC SENSOR GAIN CONTROL	17	20	MUSIC SENSOR CR
MUSIC SENSOR OUTPUT	18	19	MUSIC SENSOR GND

Outline 36P4E(BP)
36P2R-A(BFP)

NC : NO CONNECTION

IC INTERNAL BLOCK DIAGRAM



Unit Resistance : Ω

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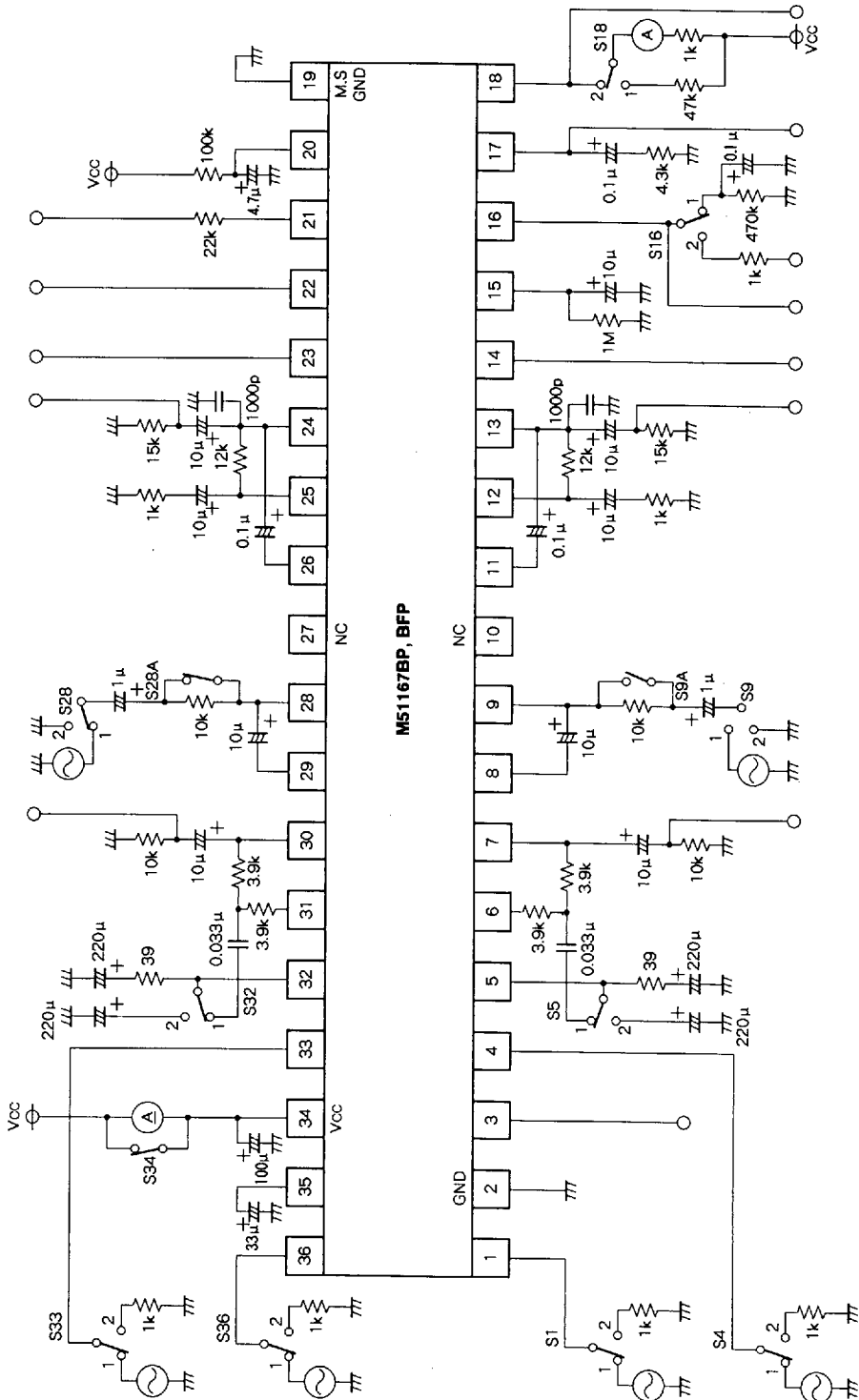
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$, unless otherwise noted, () : M51167BP)

Symbol	Parameter	Conditions	Ratings	Unit
V_{cc}	Supply voltage	Quiescent	+ 16	V
P_d	Power dissipation		560(1100)	mW
K_θ	Thermal derating	$T_a \geq 25^\circ\text{C}$	5.6(11)	mW/ $^\circ\text{C}$
T_{opr}	Operating temperature		-20 ~ + 75	$^\circ\text{C}$
T_{stg}	Storage temperature		-40 ~ +125	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{cc} = 9\text{V}$, $f = 1\text{kHz}$, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
I_{cco}	Quiescent circuit current	Quiescence	10	20	30	mA
G_{voEQ}	Open loop voltage gain	$V_i = 0.05\text{mVrms}$	68	80	—	dB
G_{vcEQ}	Closed loop voltage gain	$V_o = 0.5\text{Vrms}$	40.0	43.0	46.0	dB
$THDEQ$	Total harmonic distortion	$V_o = 0.5\text{Vrms}$	—	0.05	0.4	%
V_{omax}	Maximum output voltage	THD = 3 %	1.15	1.50	—	Vrms
N_i	Equivalent input noise voltage	$BW = 20\text{Hz} \sim 20\text{kHz}$, $R_g = 1\text{k}\Omega$	—	1.3	1.9	μVrms
SEP_{EQ}	Channel separation	$V_o = 0.5\text{Vrms}$, $BW = 20\text{Hz} \sim 20\text{kHz}$	40	65	—	dB
G_{vcRec}	Closed loop voltage gain	$V_o = 0.5\text{Vrms}$	21.0	22.2	23.4	dB
THD_{Rec}	Total harmonic distortion	$V_o = 0.5\text{Vrms}$	—	0.01	0.1	%
V_{omaxR}	Maximum output voltage	THD = 3 %	1.9	2.4	—	Vrms
N_{oRec}	Output noise voltage	$BW = 20\text{Hz} \sim 20\text{kHz}$, $R_g = 10\text{k}\Omega$	—	35	70	μVrms
SEP_{Rec}	Channel separation	$V_o = 0.5\text{Vrms}$, $BW = 20\text{Hz} \sim 20\text{kHz}$	50	75	—	dB
V_{oALC}	ALC output voltage	From the ALC inset point until input reaches +10dB	350	450	550	mVrms
$THDALC$	ALC distortion	Until input reaches +10dB	—	0.5	1.5	%
$AALC$	ALC range	Until output is 1dB UP	25	30	—	dB
V_{oL}	M.S. output voltage	M.S. Output voltage when output is Low	0.0	0.007	0.4	V
BV_o	M.S. input current	Pin ⑧ input current	—	—	2.0	μA
SV_o	M.S. level	EQ output voltage when M.S. output changes to Low from High	-19.5	-23.5	-27.5	dBV
$V_{R/P}$	R/P mode control voltage	High : Rec mode	3.5	—	5.0	V
		Low : PB mode	0.0	—	1.0	
$V_{A/B}$	A/B mode control voltage	High : A mode	3.5	—	5.0	V
		Low : B mode	0.0	—	1.0	
V_{EQ}	EQ SW control voltage	High : SW ON	3.5	—	5.0	V
		Low : SW OFF	0.0	—	1.0	
V_{DA}	Dubbing mode control voltage	High : Dubbing ON	3.5	—	5.0	V
		Low : Dubbing OFF	0.0	—	1.0	

TEST CIRCUIT

Units Resistance : Ω
Capacitance : F

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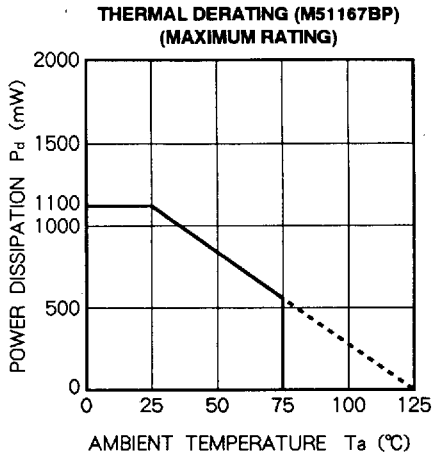
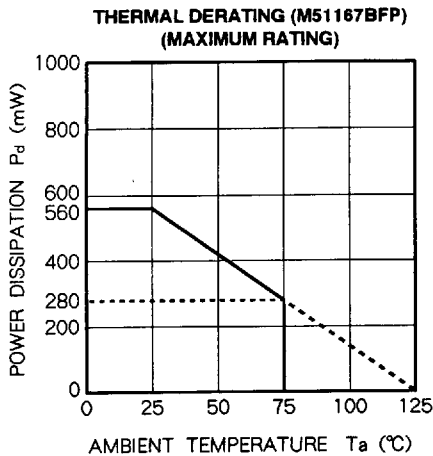
control voltage H = 5V
L = 0V

TEST METHODS

Symbol	Switch conditions							Control voltage					Input point	Output point	Test method
	S4 (S33)	S5 (S32)	S9 (S28)	S9A (S28A)	S16	S18	S34	3	14	21	22	23			
Icc	2	1	2	OFF	1	1	OFF	H	H	H	H	H		34	
GvoEQ	1	2	2	OFF	1	1	ON	L	L	L	L	L	4	7	Gvo = 20 log (Vo/Vi)
GvcEQ	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7	Gvc = 20 log (Vo/Vi)
THDEQ	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7	Vo = 0.5Vrms
VomaxE	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7	THD = 3%
Ni	2	1	2	OFF	1	1	ON	L	L	L	L	L		7	BW = 20Hz~20kHz
SepEQ	*	1	2	OFF	1	1	ON	L	L	L	L	L	4	30	Vo(7) = 0.5Vrms BW = 20Hz~20kHz
GvcRec	2	1	1	ON	1	1	ON	H	H	L	L	L	9	13	Gvc = 20 log (Vo/Vi)
THDRec	2	1	1	ON	1	1	ON	H	H	L	L	L	9	13	Vo = 0.5Vrms
VomaxR	2	1	1	ON	1	1	ON	H	H	L	L	L	9	13	THD = 3%
NoRec	2	1	2	OFF	1	1	ON	H	H	L	L	L		13	BW = 20Hz~20kHz
SepRec	2	1	*	ON	1	1	ON	H	H	L	L	L	9	24	Vo(13) = 0.5Vrms BW = 20Hz~20kHz
VoALC	2	1	1	OFF	1	1	ON	L	H	L	L	L	9	13	Note 1
THDALC	2	1	1	OFF	1	1	ON	L	H	L	L	L	9	13	Note 2
AALC	2	1	1	OFF	1	1	ON	L	H	L	L	L	9	13	Note 3
Vo L	2	1	2	OFF	2	1	ON	L	L	L	L	L		18	Note 4
BVo	2	1	2	OFF	2	2	ON	L	L	L	L	L		18	Note 5
SVo	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7,18	Note 6
VR/P	2	1	1	ON	1	1	ON	H	*	L	L	L	9	13	Note 7
VA/B	1	1	2	OFF	1	1	ON	L	L	*	L	L	4	7	Note 8
VEQ	1	1	2	OFF	1	1	ON	L	L	L	L	*	4	7	Note 9
VDA	2	1	1	OFF	1	1	ON	*	H	L	L	L	9	13	Note 10

- Note 1. Measure output voltage from the ALC inset point until input reaches +10dB.
 3. Input voltage range measured from the output voltage of the starting point to the point where the output voltage becomes 1dB higher.
 4. Measure voltage of pin ⑩ after preset pulse enters pin ⑩ at ② msec.
 5. Measure current of pin ⑩ after preset pulse enters pin ⑩ at ② msec.
 6. Measure output voltage of pin ⑦ when input voltage of pin ④ increases and output of pin ⑩ changes to Low from High.
 7. When voltage of pin ④ is 4V, output is operating state and voltage of pin ④ is 1V, output is noise voltage level.
 8. When voltage of pin ② is 1V, output is operating state and voltage of pin ② is 4V, output is noise voltage level.
 9. The difference between voltage of pin ② is 4V and 1V is 6dB.
 10. When voltage of pin ③ is 4V, ALC is operating state and voltage of pin ③ is 1V, ALC is not operating.

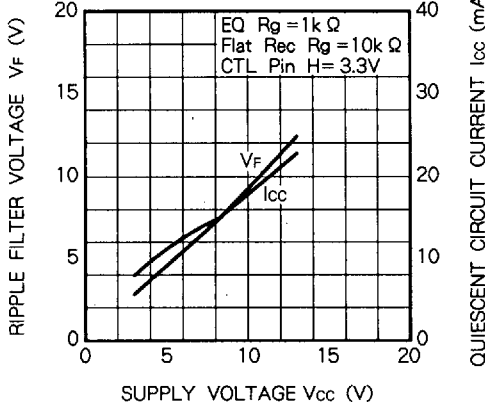
TYPICAL CHARACTERISTICS



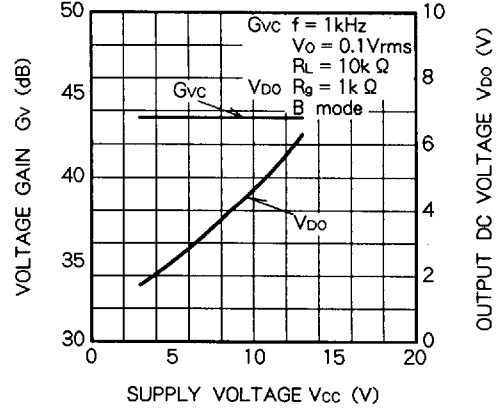
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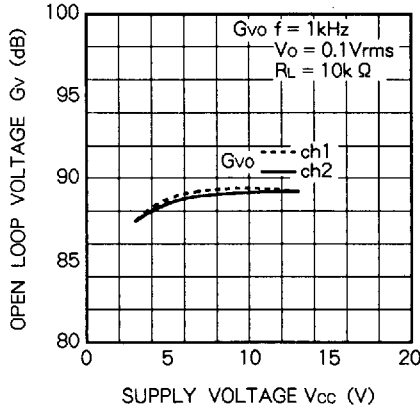
RIPPLE FILTER PIN[®] VOLTAGE, QUIESCENT CIRCUIT CURRENT VS. SUPPLY VOLTAGE



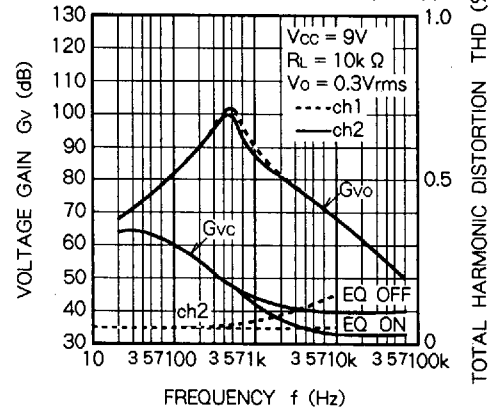
EQ AMPLIFIER CLOSED LOOP VOLTAGE GAIN, OUTPUT DC VOLTAGE VS. SUPPLY VOLTAGE



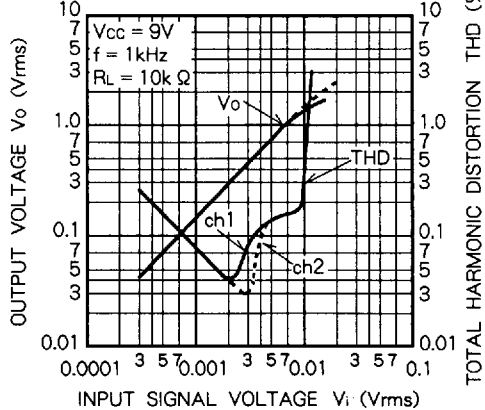
EQ AMPLIFIER OPEN LOOP VOLTAGE GAIN VS. SUPPLY VOLTAGE



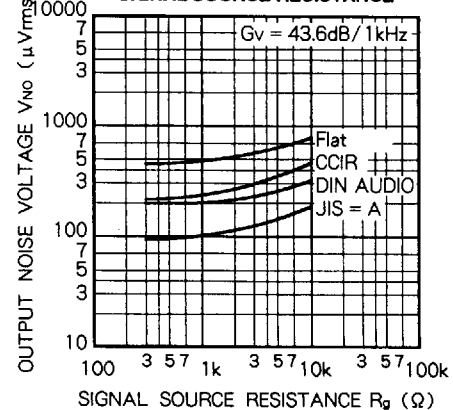
EQ AMPLIFIER VOLTAGE GAIN, TOTAL HARMONIC DISTORTION VS. FREQUENCY



EQ AMPLIFIER OUTPUT VOLTAGE, TOTAL HARMONIC DISTORTION VS. INPUT SIGNAL VOLTAGE



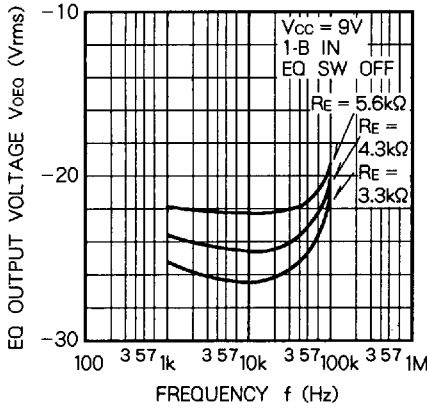
OUTPUT NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE



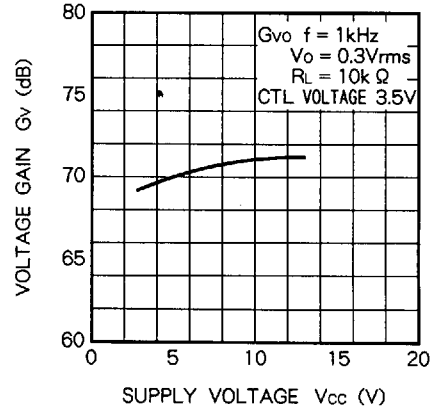
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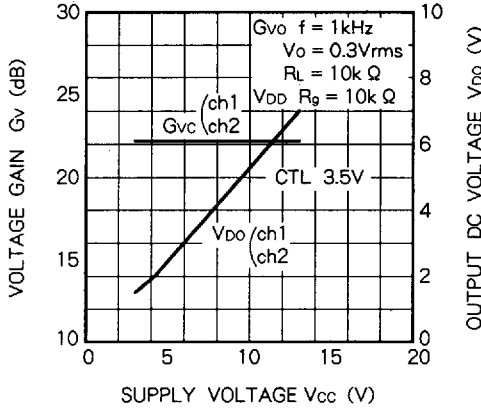
**M.S. LEVEL (EQ OUTPUT VOLTAGE)
VS. FREQUENCY**



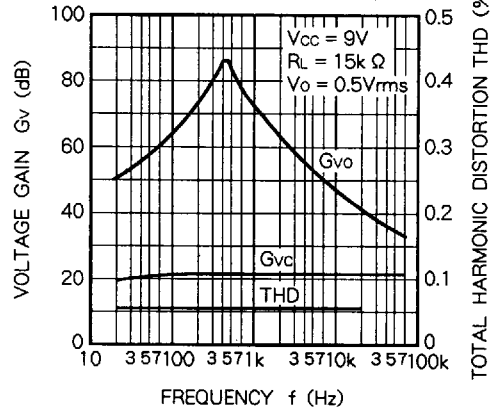
**REC AMPLIFIER OPEN VOLTAGE GAIN
VS. SUPPLY VOLTAGE**



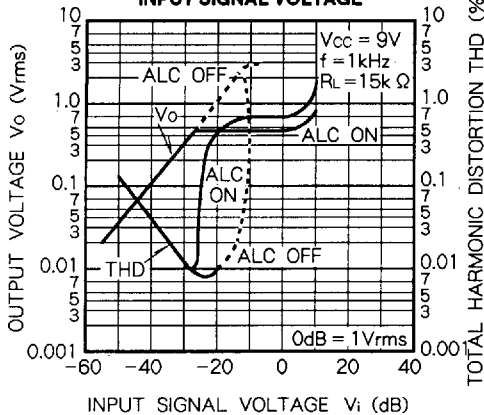
**REC AMPLIFIER CLOSED LOOP VOLTAGE GAIN,
OUTPUT DC VOLTAGE VS. SUPPLY VOLTAGE**



**REC AMPLIFIER VOLTAGE GAIN, TOTAL
HARMONIC DISTORTION VS. FREQUENCY**



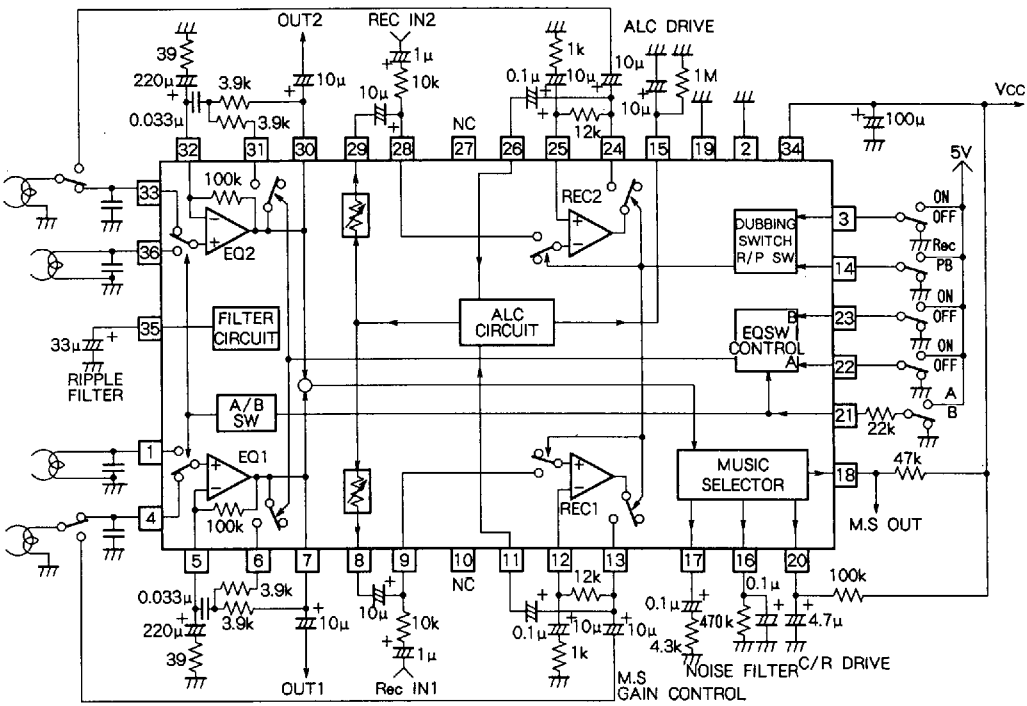
**REC AMPLIFIER OUTPUT VOLTAGE,
TOTAL HARMONIC DISTORTION VS.
INPUT SIGNAL VOLTAGE**



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APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F

OPERATIONAL CHECK LIST

Pin③ (Dubbing control)	H	H	L	L
Pin⑭ (Rec/RB control)	H	L	H	L
EQ amplifier	○	○	○	○
Rec amplifier	○	x	○	x
ALC circuit	OFF	OFF	ON	OFF