

# M51167BP, BFP

## SINGLE CHIP PREAMPLIFIER FOR DUAL CASSETTE RECORDER

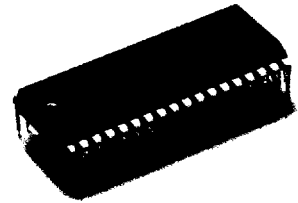
### DESCRIPTION

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.

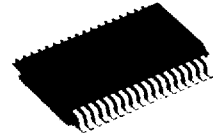
### FEATURES

- Built-in electronic switch for double cassette.
- Built-in equalizer switch for both modes.
- Low noise EQ amplifier..... 1.3 $\mu$ 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 x 31.5mm x 3.8mm)

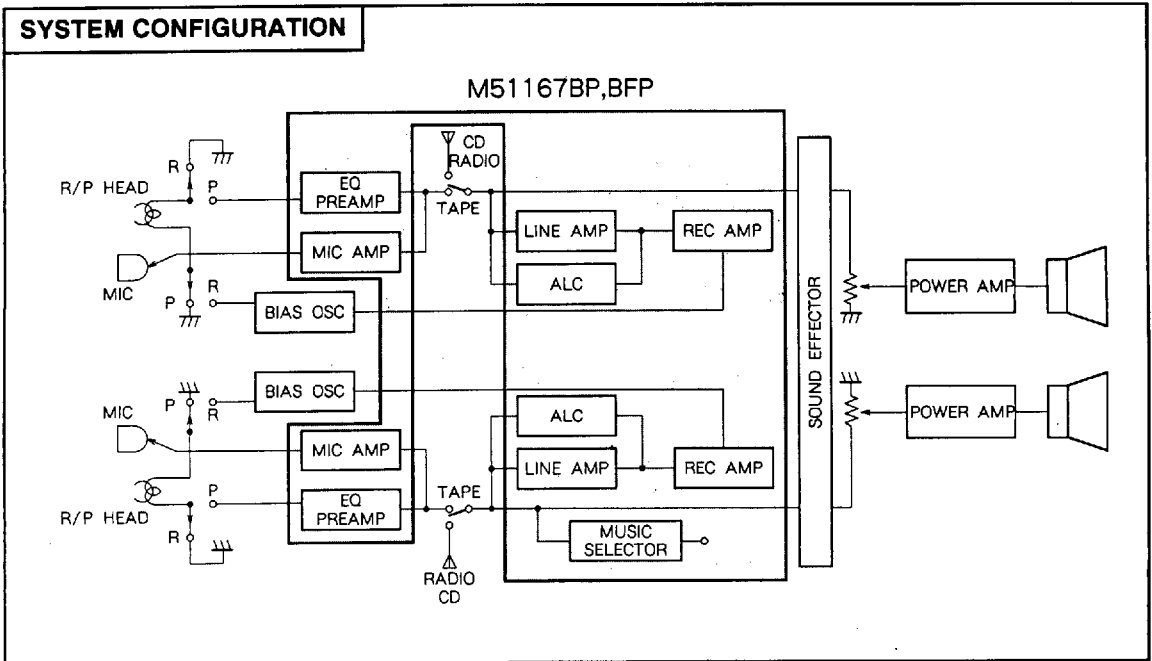


Outline 36P2R-A(BFP)

0.8mm pitch 450mil SSOP  
(8.4mm x 15.0mm x 2.0mm)

### RECOMMENDED OPERATING CONDITIONS

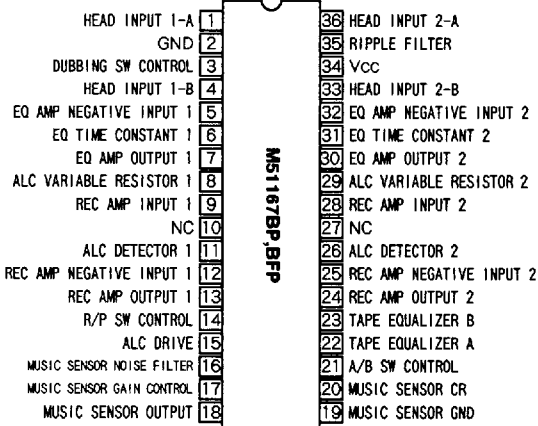
- Supply voltage range..... Vcc = 5.5~12V  
Rated supply voltage..... Vcc = 9V



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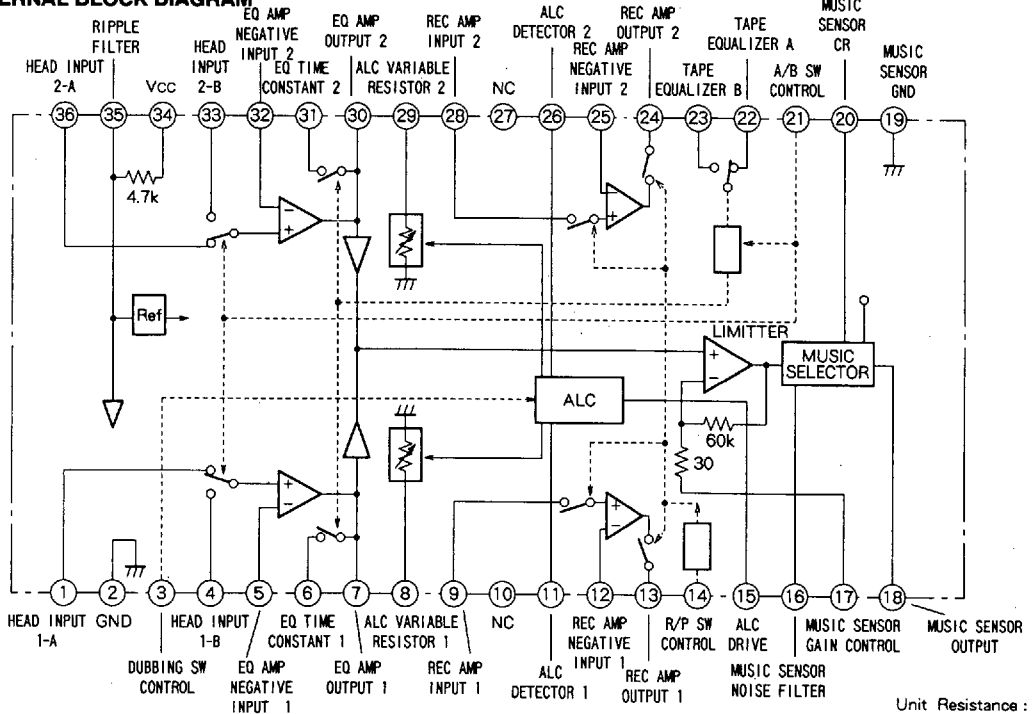
### PIN CONFIGURATION



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

NC: NO CONNECTION

### IC INTERNAL BLOCK DIAGRAM




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**ABSOLUTE MAXIMUM RATINGS** (Ta = 25 °C, unless otherwise noted, ( ) : M51167BP)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage	Quiescent	+ 16	V
Pd	Power dissipation		560(1100)	mW
Ke	Thermal derating	Ta ≥ 25 °C	5.6(11)	mW/°C
Topr	Operating temperature		-20~ + 75	°C
Tstg	Storage temperature		-40~ + 125	°C

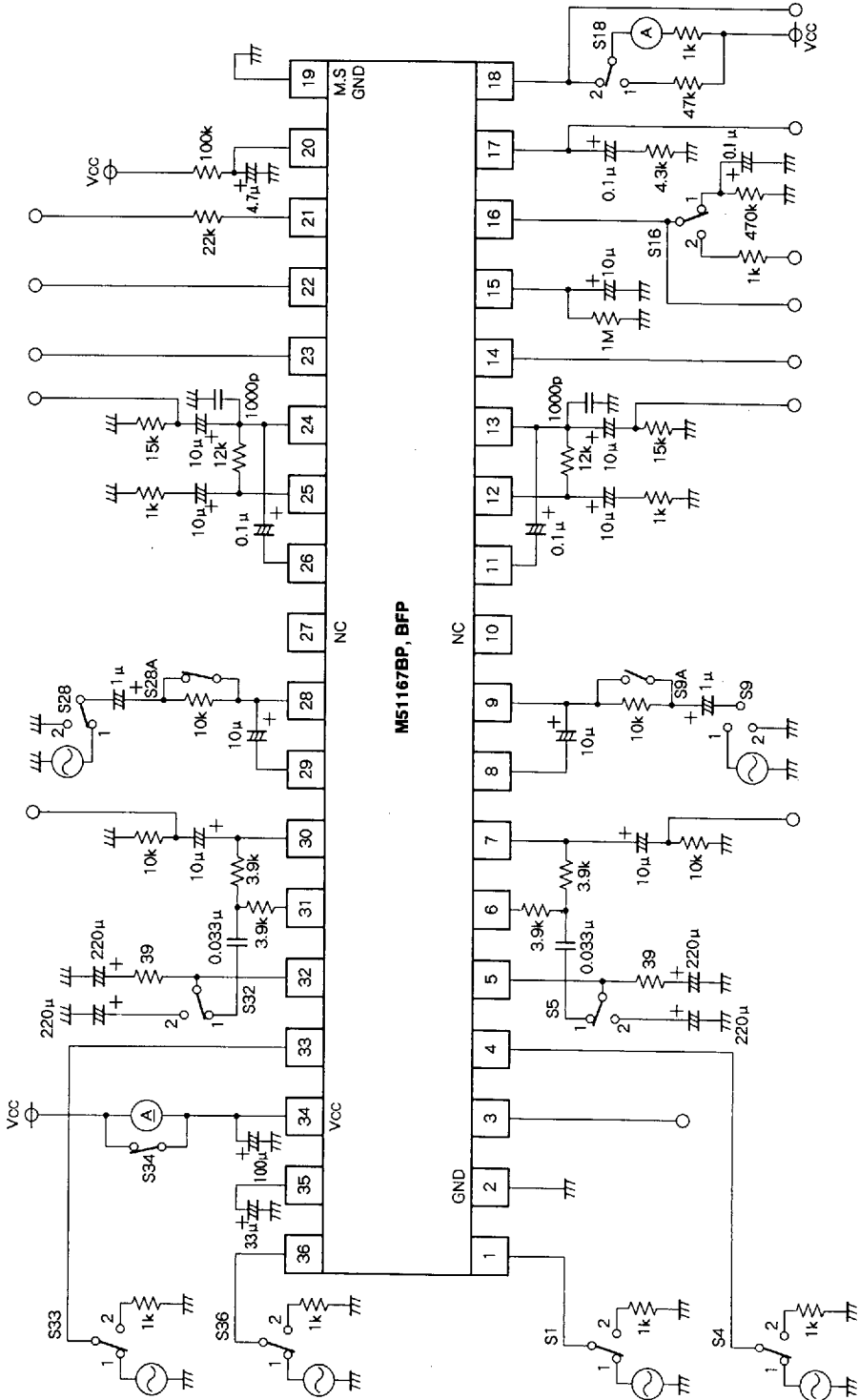
**ELECTRICAL CHARACTERISTICS** (Ta = 25 °C, Vcc = 9V, f = 1kHz, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
Icco	Quiescent circuit current	Quiescence	10	20	30	mA
GvoEQ	Open loop voltage gain	Vi = 0.05mVrms	68	80	-	dB
GvcEQ	Closed loop voltage gain	Vo = 0.5Vrms	40.0	43.0	46.0	dB
THDEQ	Total harmonic distortion	Vo = 0.5Vrms	-	0.05	0.4	%
Vomax	Maximum output voltage	THD = 3 %	1.15	1.50	-	Vrms
Ni	Equivalent input noise voltage	BW = 20Hz~20kHz, Rg = 1k Ω	-	1.3	1.9	μVrms
SepEQ	Channel separation	Vo = 0.5Vrms, BW = 20Hz~20kHz	40	65	-	dB
GvcRec	Closed loop voltage gain	Vo = 0.5Vrms	21.0	22.2	23.4	dB
THDRec	Total harmonic distortion	Vo = 0.5Vrms	-	0.01	0.1	%
VomaxR	Maximum output voltage	THD = 3 %	1.9	2.4	-	Vrms
NoRec	Output noise voltage	BW = 20Hz~20kHz, Rg = 10k Ω	-	35	70	μVrms
SepRec	Channel separation	Vo = 0.5Vrms, BW = 20Hz~20kHz	50	75	-	dB
VoALC	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
VoL	M.S. output voltage	M.S. Output voltage when output is Low	0.0	0.007	0.4	V
BVo	M.S. input current	Pin  input current	-	-	2.0	μA
SVo	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	

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TEST CIRCUIT



Units Resistance : Ω  
Capacitance : F

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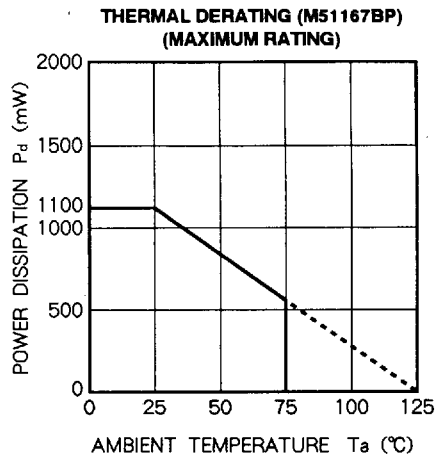
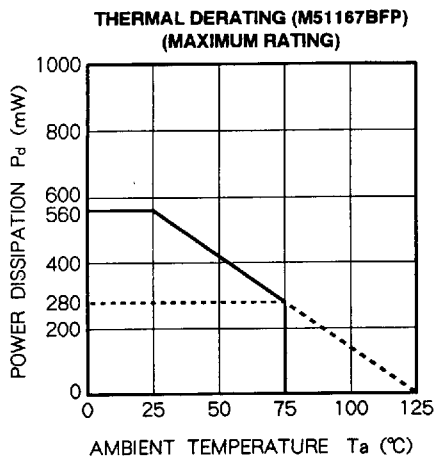
control voltage H = 5V  
L = 0V

### 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	$G_{vo} = 20 \log (V_o/V_i)$
GvcEQ	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7	$G_{vc} = 20 \log (V_o/V_i)$
THDEQ	1	1	2	OFF	1	1	ON	L	L	L	L	L	4	7	$V_o = 0.5V_{rms}$
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	$V_o(7) = 0.5V_{rms}$ BW = 20Hz~20kHz
GvcRec	2	1	1	ON	1	1	ON	H	H	L	L	L	9	13	$G_{vc} = 20 \log (V_o/V_i)$
THDRec	2	1	1	ON	1	1	ON	H	H	L	L	L	9	13	$V_o = 0.5V_{rms}$
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	$V_o(13) = 0.5V_{rms}$ 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 ④ at ② msec.  
 5. Measure current of pin ⑩ after preset pulse enters pin ④ 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 ⑩ is 4V, output is operating state and voltage of pin ④ is 1V, output is noise voltage level.  
 8. When voltage of pin ⑩ is 1V, output is operating state and voltage of pin ④ is 4V, output is noise voltage level.  
 9. The difference between voltage of pin ④ is 4V and 1V is 6dB.  
 10. When voltage of pin ⑩ is 4V, ALC is operating state and voltage of pin ③ is 1V, ALC is not operating.

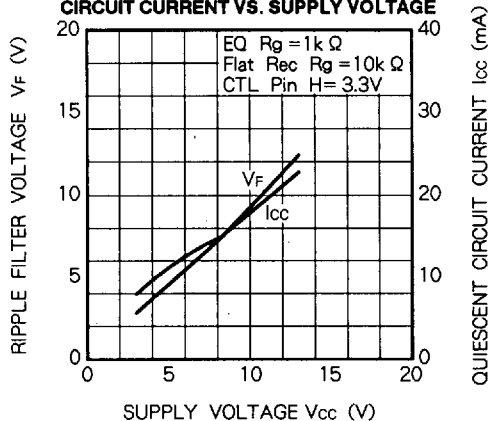
### TYPICAL CHARACTERISTICS



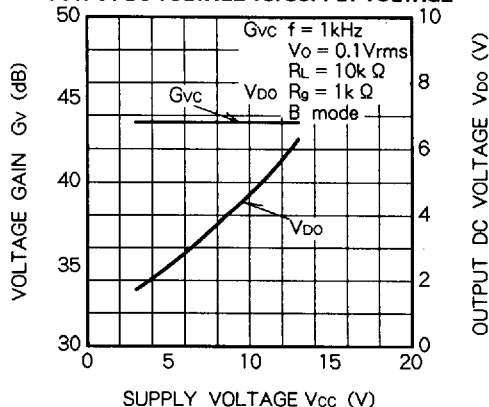
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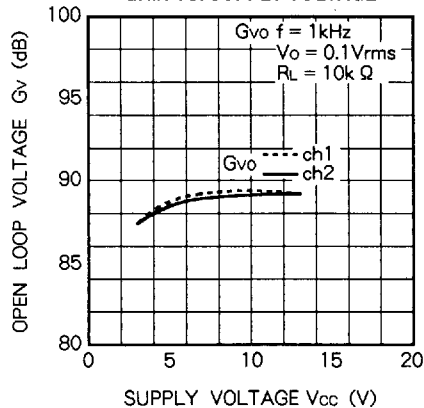
RIPPLE FILTER PIN  $\textcircled{6}$  VOLTAGE, QUIESCENT CIRCUIT CURRENT VS. SUPPLY VOLTAGE



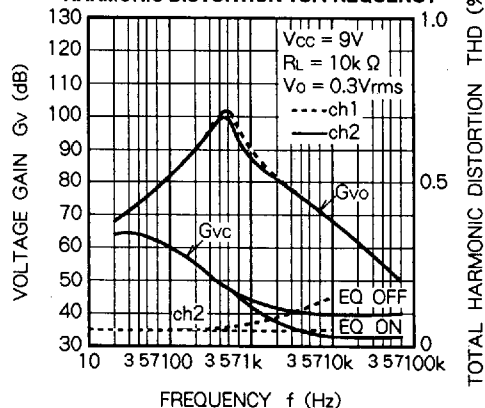
EQ AMPLIFIER CLOSED LOOP VOLTAGE GAIN, OUTPUT DC VOLTAGE VS. SUPPLY VOLTAGE



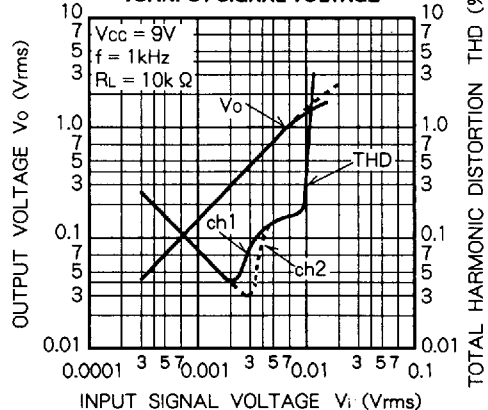
EQ AMPLIFIER OPEN LOOP VOLTAGE GAIN VS. SUPPLY VOLTAGE



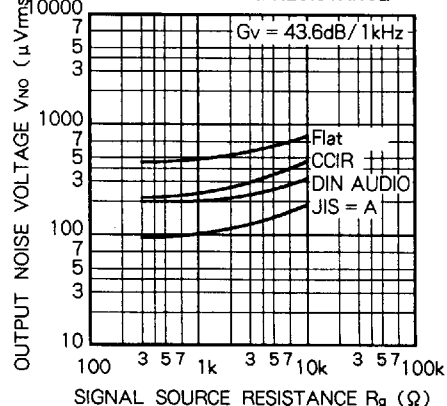
EQ AMPLIFIER VOLTAGE GAIN, TOTAL HARMONIC DISTORTION VS. FREQUENCY



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



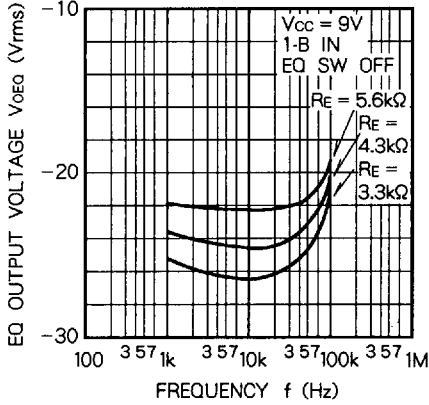
OUTPUT NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE



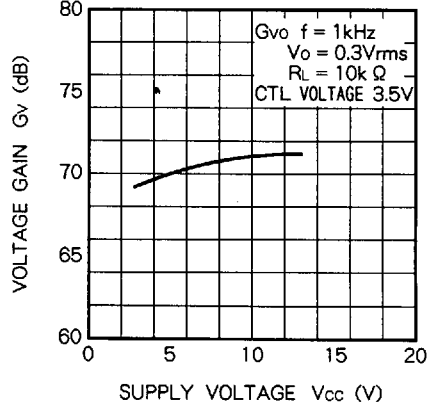
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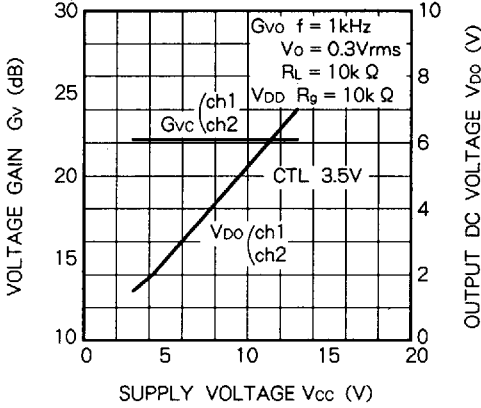
**M.S. LEVEL (EQ OUTPUT VOLTAGE) VS. FREQUENCY**



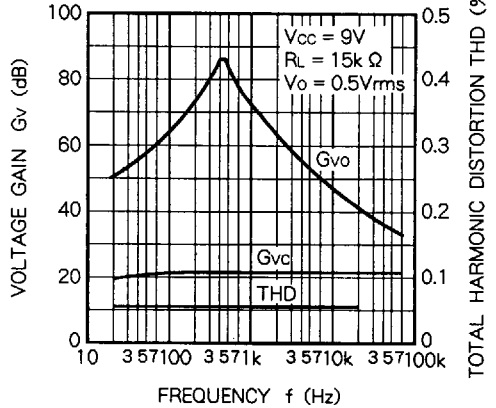
**REC AMPLIFIER OPEN VOLTAGE GAIN VS. SUPPLY VOLTAGE**



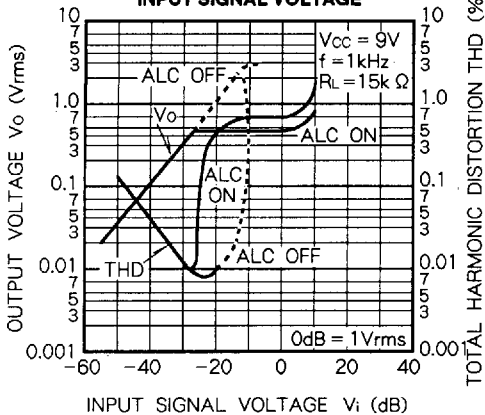
**REC AMPLIFIER CLOSED LOOP VOLTAGE GAIN, OUTPUT DC VOLTAGE VS. SUPPLY VOLTAGE**



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



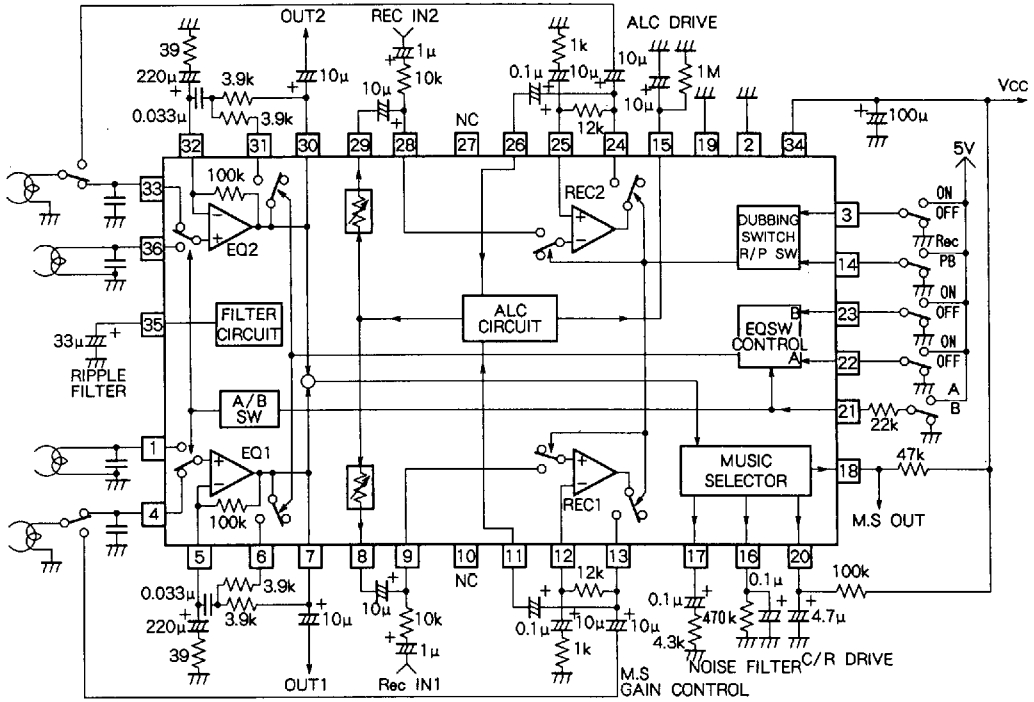
**REC AMPLIFIER OUTPUT VOLTAGE, TOTAL HARMONIC DISTORTION VS. INPUT SIGNAL VOLTAGE**



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## SINGLE CHIP PREAMPLIFIER FOR DUAL CASSETTE RECORDER

### APPLICATION EXAMPLE



Units Resistance :  $\Omega$   
Capacitance : F

### OPERATIONAL CHECK LIST

Pin③ (Dubbing control)	H	H	L	L
Pin④ (Rec/RB control)	H	L	H	L
EQ amplifier	○	○	○	○
Rec amplifier	○	x	○	x
ALC circuit	OFF	OFF	ON	OFF