

Recording amplifier with built-in ALC for headphone stereos

BA3641FV

The BA3641FV is an option IC developed for the purpose of adding a recording function to 1-chip playback system ICs (BA3612AKV, etc.) for headphone stereos.

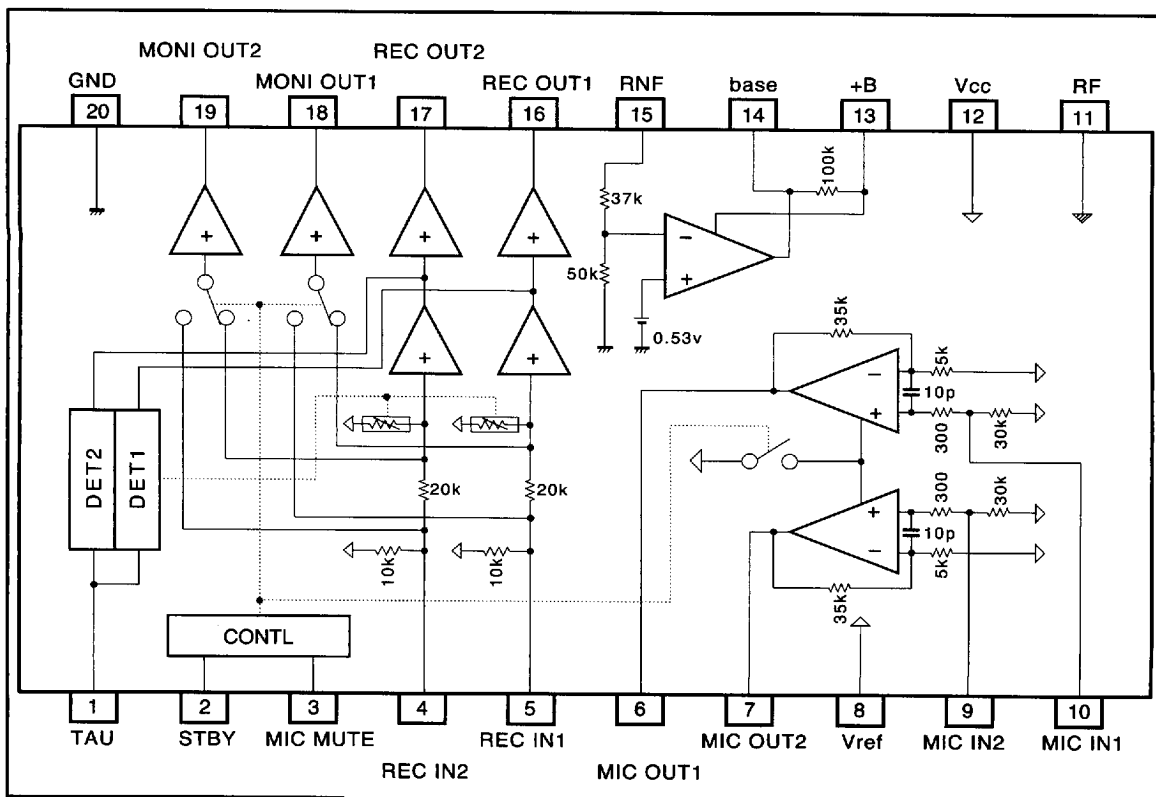
●Applications

Headphone stereos with recording function

●Features

- 1) Two built-in microphone amplifier channels.
- 2) Microphone mute function (radio / microphone switching).
- 3) Two built-in recording amplifier channels (with ALC).
- 4) Two built-in monitor output amplifier channels (radio / microphone switching).
- 5) Built-in regulators for the erase head and bias OSC circuit.

●Block diagram



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●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	V _{CC}	4.5	V
Power dissipation	P _d	400*	mW
Operating temperature	T _{opr}	-15~+75	°C
Storage temperature	T _{stg}	-55~+125	°C

* Reduced by 4.0mW for each increase in Ta of 1°C over 25°C.

●Recommended supply voltage ranges (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	V _{CC}	1.7~3.6	V
	RF	1.5~3.6	V
	+B	0.9~3.6	V
	V _{ref}	0.95~2.0	V

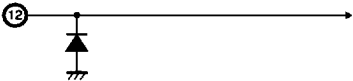
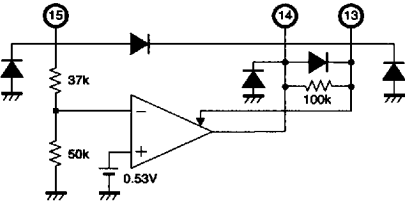
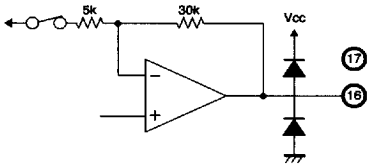
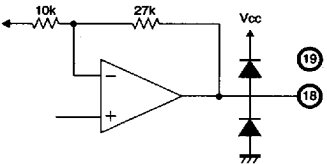
* RF voltage must be less than V_{CC} voltage.

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Headphone stereo recording ICs

Low-frequency amplifiers

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Pin No.	Pin symbol	I/O	DC voltage	Equivalent circuit	Function
12	Vcc	I	Vcc		Supply voltage input pin
13	+B	I	+B		Battery supply voltage input pin
14	base	O	+B-0.7V		Control pin for external regulator transistor
15	RNF	I	0.92V		Regulator output feedback pin
16	REC OUT1	I/O	Vref		Recording amp output pin STBY : When low Hi-Z
17	REC OUT2				
18	MONI OUT1	I/O	Vref		Monitor amp output pin
19	MONI OUT2				
20	GND	I	0V		Ground pin (SUB pin)

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●Electrical characteristics (unless otherwise indicated, $V_{cc} = 2.3V$, $R_F = 2.0V$, $+B = 1.2V$, $V_{ref} = 1.0V$, $R_L = 5k\Omega$, $f = 1kHz$, DIN-AUDIO, $T_a = 25^\circ C$)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current 1		IQV1	1.5	2.7	4.2	mA	<MIC—REC> $V_{ST} : Hi, V_{MUTE} : Lo$
		IQR1	0.84	1.40	2.10	mA	
Quiescent current 2		IQV2	1.5	2.7	4.2	mA	<Tuner—REC> $V_{ST} : Hi, V_{MUTE} : Hi$
		IQR2	0.7	1.1	1.6	mA	
Quiescent current 3		IQV3	—	0	5	μA	<Tuner—PLAY> $V_{ST} : Lo, V_{MUTE} : Hi$
		IQR3	270	450	675	μA	
Regulator supply current		ICCB	—	4.03	4.28	mA	$V_{ST} : Hi, I_{reg}=4.0mA$
Standby supply current		ISTV	—	0	5	μA	<TAPE—PLAY> $V_{ST} : Lo, V_{MUTE} : Lo$
		ISTR	—	0	5	μA	
		ISTB	—	0	5	μA	
Microphone amp	Closed loop voltage gain	GVC1	16	18	20	dB	$V_o = -15dBv$
	Maximum output voltage	VOM1	220	300	—	mVrms	$V_{cc}=1.7V, R_F=1.5V, THD=1\%$
	Total harmonic distortion	THD1	—	0.1	0.8	%	$V_{cc}=1.7V, R_F=1.5V, V_o = -15dBv$
	Output noise voltage	VNO1	—	14	30	$\mu Vrms$	$R_g=6.8k\Omega$
	Microphone mute attenuation	MUTE1	80	88	—	dB	$V_o = -15dBv, 1kHzBPF+DIN AUDIO$
	Channel crosstalk	CT1	60	75	—	dB	$V_o = -15dBv, 1kHzBPF+DIN AUDIO$ $R_g=6.8k\Omega$
	Ripple rejection rate	RR1	70	85	—	dB	$V_{cc}=1.7V (R=-20dBv), R_F=1.5V$ $130HzBPF+DIN AUDIO$ $R_g=6.8k\Omega$
	Input impedance	Rin1	20	30	40	k Ω	
	Output impedance for muting	Rout1 (z)	32	40	48	k Ω	$V_{MUTE} : Hi$
Monitor amp	Closed loop voltage gain	GVC2	10.0	11.5	13.0	dB	$V_o = -15dBv, ALC=OFF$
	Maximum output voltage	VOM2	220	300	—	mVrms	$ALC=OFF$ $V_{cc}=1.7V, R_F=1.5V, THD=1\%$
	Total harmonic distortion	THD2	—	0.1	0.8	%	$ALC=OFF$ $V_{cc}=1.7V, R_F=1.5V, V_o = -15dBv$
	Microphone noise voltage	VNO2M	—	18	40	$\mu Vrms$	$R_g=100k\Omega, V_{ST} : Hi, V_{MUTE} : Lo$
	Tuner noise voltage	VNO2T	—	12	30	$\mu Vrms$	$R_g=100k\Omega, V_{ST} : Hi, V_{MUTE} : Hi$
	Channel crosstalk	CT2	60	77	—	dB	$V_o = -15dBv, 1kHzBPF+DIN AUDIO$ $R_g=100k\Omega, ALC=OFF$
	Ripple rejection rate	RR2	75	85	—	dB	$V_{cc}=1.7V (R=-20dBv), R_F=1.5V$ $130HzBPF+DIN AUDIO$ $R_g=100k\Omega, ALC=OFF$
	Standby output impedance	Rout2 (z)	25	31	37	k Ω	$V_{ST} : Lo, V_{MUTE} : Lo$

Headphone stereo recording ICs

Low-frequency amplifiers

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Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions
Recording amp	Closed loop voltage gain	GVC3	34	36	38	dB	$V_o = -10\text{dBv}$, ALC=OFF
	Maximum output voltage	VOM3	400	450	—	mVrms	ALC=OFF $V_{cc}=1.75\text{V}$, $R_F=1.5\text{V}$, THD=1%
	Total harmonic distortion	THD3	—	0.2	0.8	%	ALC=OFF $V_{cc}=1.7\text{V}$, $R_F=1.5\text{V}$, $V_o = -10\text{dBv}$
	Output noise voltage	VNO3	—	350	500	μVrms	$R_g=100\text{k}\Omega$, $V_{MUTE} : \text{Hi}$
	Channel crosstalk	CT3	50	65	—	dB	$V_o = -15\text{dBv}$, 1kHzBPF+DIN AUDIO $R_g=100\text{k}\Omega$, ALC=OFF
	Ripple rejection rate	RR3	55	65	—	dB	$V_{cc}=1.7\text{V}$ ($R = -20\text{dBv}$), $R_F=1.5\text{V}$ 130HzBPF+DIN AUDIO $R_g=100\text{k}\Omega$, ALC=OFF
	Input impedance	Rin3	6.4	8.0	9.6	k Ω	ALC=OFF
	Output impedance for muting	Rout3(z)	1.0	—	—	M Ω	$V_{ST} : \text{Lo}$, $V_{MUTE} : \text{Lo}$
Microphone amp and recording amp	REC OUT ALC characteristics	VALC1	-18.0	-16.0	-14.0	dBv	$V_{in} = -70\text{dBv}$
		VALC2	-9.4	-7.8	-6.5	dBv	$V_{in} = -60\text{dBv}$
		VALC3	-10.2	-8.2	-6.7	dBv	$V_{in} = -30\text{dBv}$
	REC OUT total harmonic distortion	THD-R2	—	0.4	0.9	%	$V_{in} = -60\text{dBv}$
		THD-R3	—	0.4	0.9	%	$V_{in} = -30\text{dBv}$
	ALC channel balance	G _{CB}	-1.0	0.0	+1.0	dB	$V_{in} = -45\text{dBv}$
	Output noise voltage	VNO4	—	1000	1700	μVrms	$R_g=6.8\text{k}\Omega$
	Channel crosstalk	CT4	45	52	—	dB	$V_o = -15\text{dBv}$, 1kHzBPF+DIN AUDIO $R_g=6.8\text{k}\Omega$
	Ripple rejection rate A REC OUT	RR4	48	54	—	dB	$V_{cc}=1.7\text{V}$ ($R = -20\text{dBv}$), $R_F=1.5\text{V}$ 130HzBPF+DIN AUDIO $R_g=6.8\text{k}\Omega$
Regulator	Output voltage	V _{reg}	0.87	0.92	0.96	V	I _{reg} =50mA
	Load regulation	ΔV_{reg}	—	5	30	mV	I _{reg} =40mA~60mA
	Ripple leak	V _{RR}	—	-90	-70	dBv	$V_{cc}=1.7\text{V}$ ($R = -20\text{dBv}$), $R_F=1.5\text{V}$ +B=1.2V ($R = -30\text{dBv}$), I _{reg} =50mA 130HzBPF+DIN AUDIO
Switch	High level voltage conditions	VinH	0.77	—	6.00	V	
	Low level voltage conditions	VinL	-0.30	—	0.30	V	
	Input resistance	RINS	80	100	120	k Ω	$V_{in}=0.3\text{V}$

●Measurement circuit

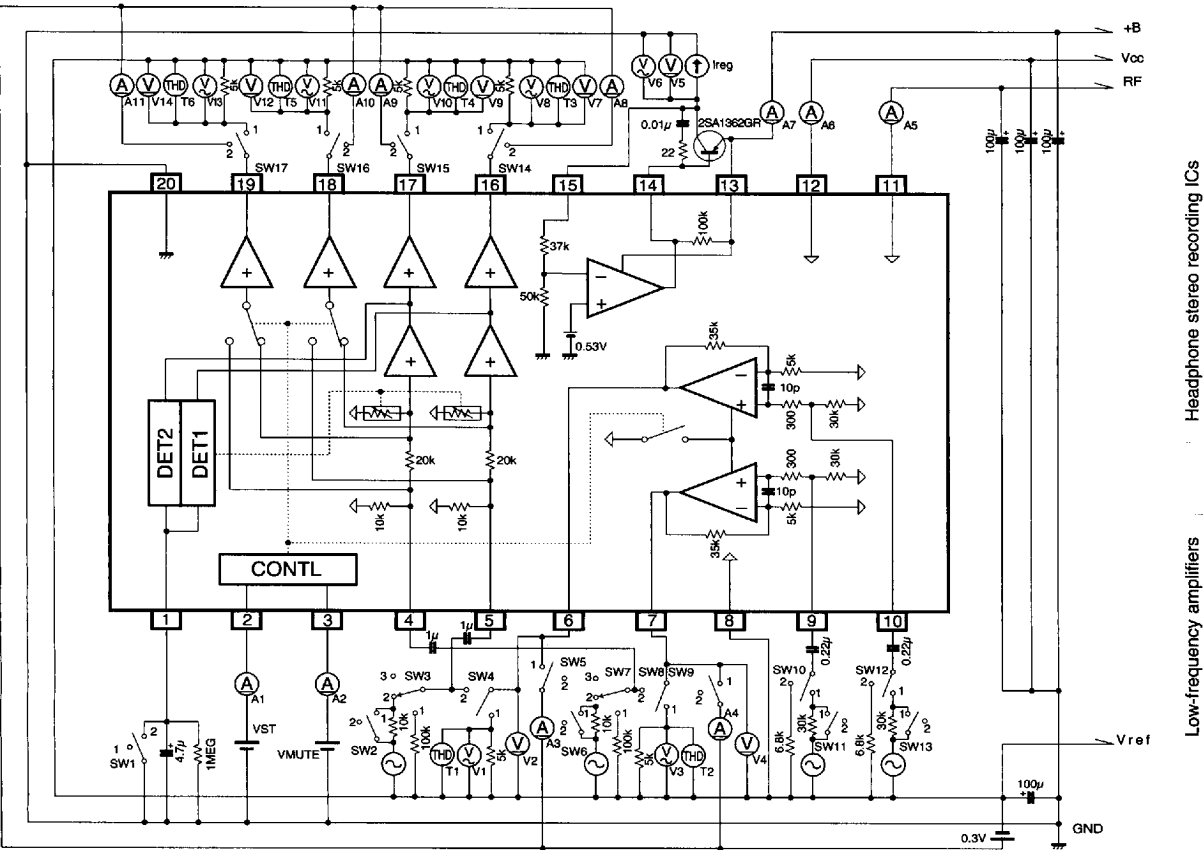


Fig. 1 Measurement circuit

- Unit
- Resistors : Ω ($\pm 1\%$)
- Ceramic capacitors : F ($\pm 1\%$)
- Electrolytic capacitors : F ($\pm 5\%$)

●Switch logic table

MIC MUTE	STBY			
	High		Low (open)	
High	<Tuner-REC>		<Tuner-PLAY>	
	MIC-AMP	OFF	MIC-AMP	OFF
	MONI-AMP	ON (ALC : OFF)	MONI-AMP	ON (ALC : OFF)
	REC-AMP	ON (ALC : ON)	REC-AMP	OFF (Hi-Zo)
Low (open)	<MIC-REC>		<TAPE-PLAY>	
	MIC-AMP	ON	MIC-AMP	OFF
	MONI-AMP	ON (ALC : ON)	MONI-AMP	OFF
	REC-AMP	ON (ALC : ON)	REC-AMP	OFF (Hi-Zo)
	Regulator		Regulator	
	ON		OFF	

●Application circuit

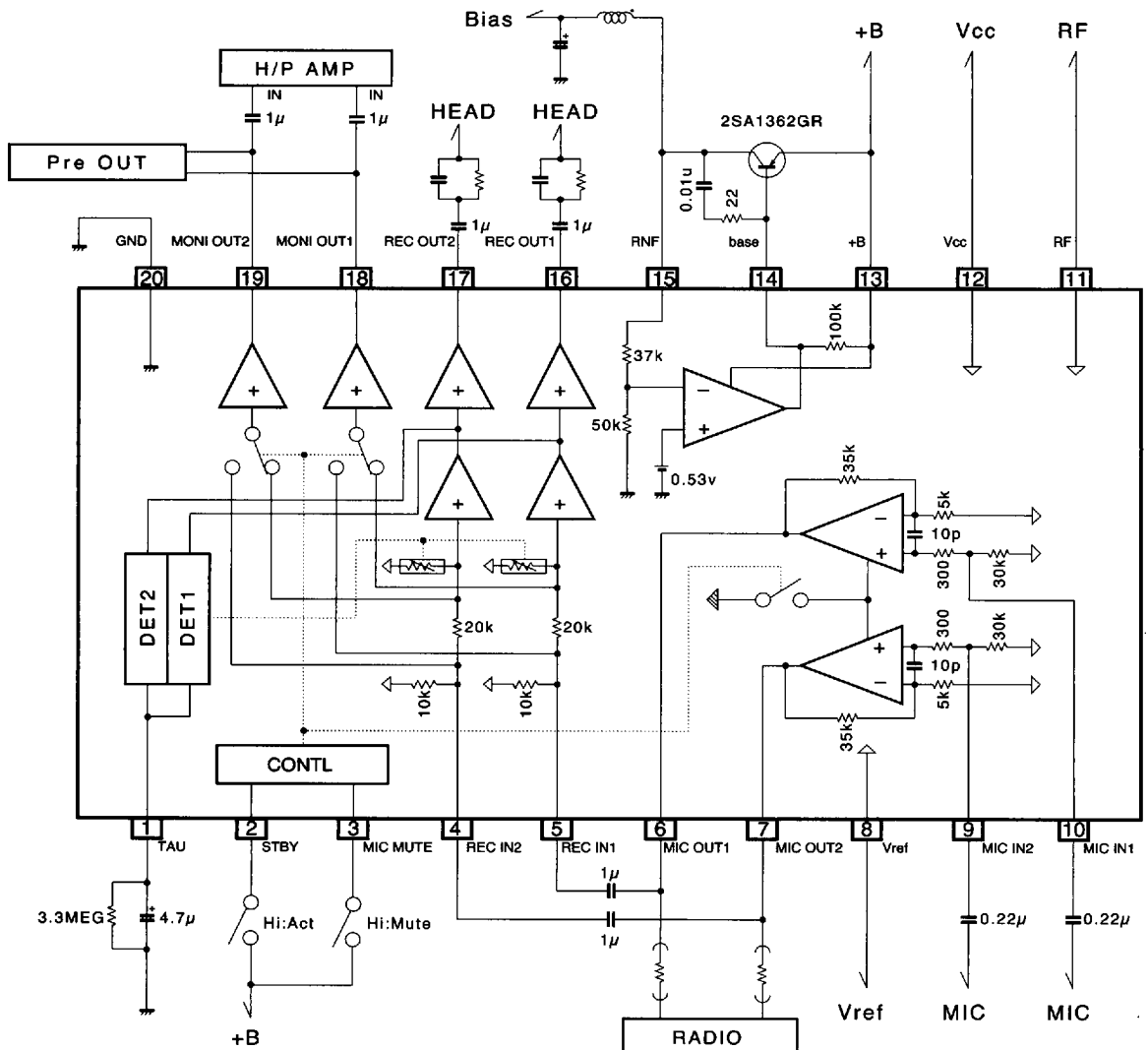


Fig. 2 Application circuit example

Unit
 Resistors : Ω ($\pm 5\%$)
 Ceramic capacitors : F ($\pm 10\%$)
 Electrolytic capacitors : F ($\pm 20\%$)

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●Electrical characteristic curves

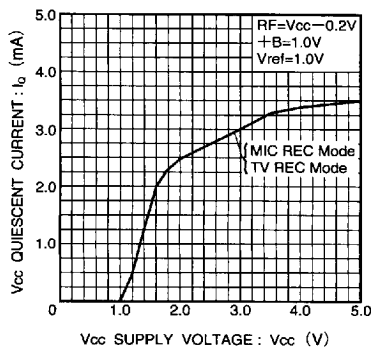


Fig. 3 VCC quiescent current vs. supply voltage

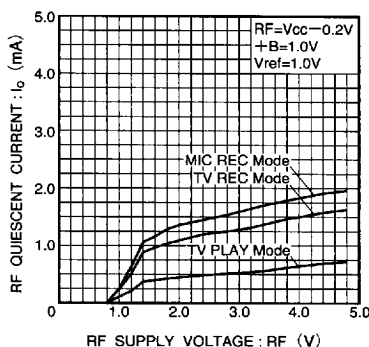


Fig. 4 RF quiescent current vs. supply voltage

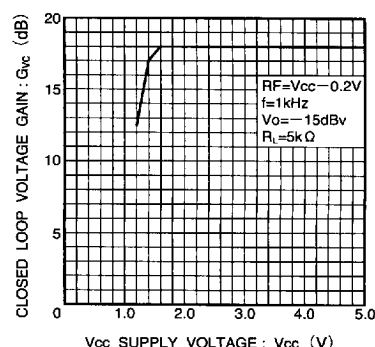


Fig. 5 Microphone amp voltage gain vs. supply voltage

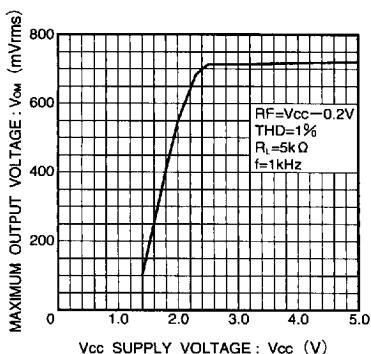


Fig. 6 Maximum microphone amp output voltage vs. supply voltage

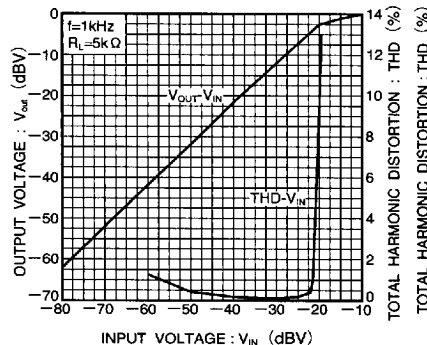


Fig. 7 Microphone amp input/output linearity

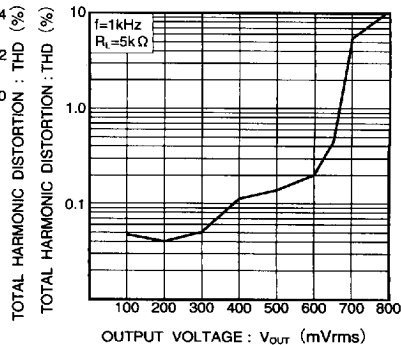


Fig. 8 Microphone amp total harmonic distortion vs. output voltage

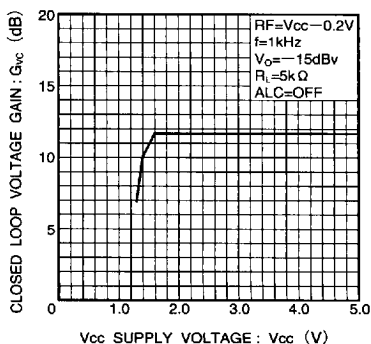


Fig. 9 Monitor amp voltage gain vs. supply voltage

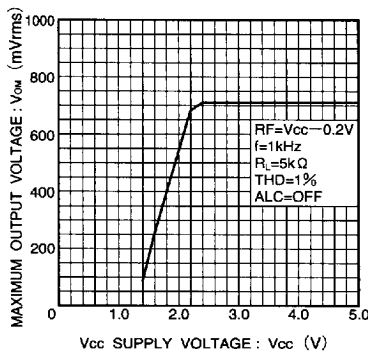


Fig. 10 Maximum monitor amp output voltage vs. supply voltage

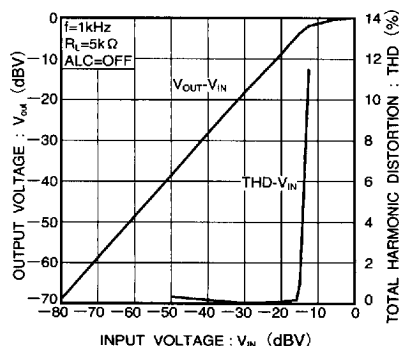


Fig. 11 Monitor amp input/output linearity

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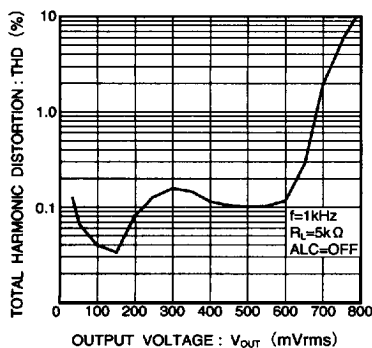


Fig. 12 Monitor amp total harmonic distortion vs. output voltage

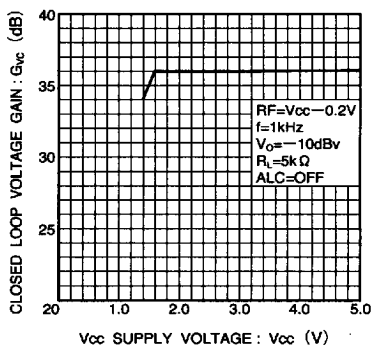


Fig. 13 Recording amp voltage gain vs. supply voltage

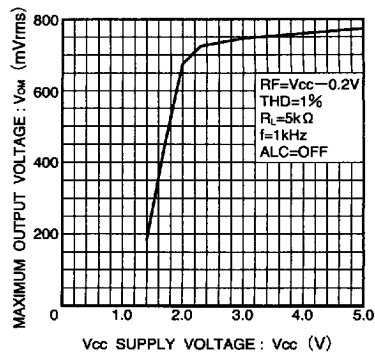


Fig. 14 Maximum recording amp output voltage vs. supply voltage

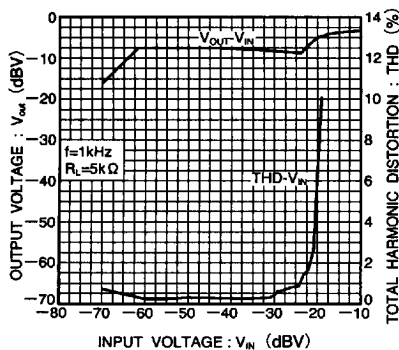


Fig. 15 ALC input/output characteristics of microphone and recording amps

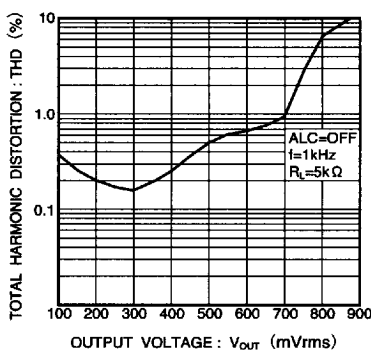


Fig. 16 Recording amp total harmonic distortion vs. output voltage

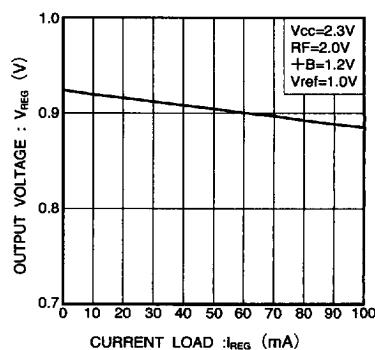


Fig. 17 Regulator output voltage vs. load current

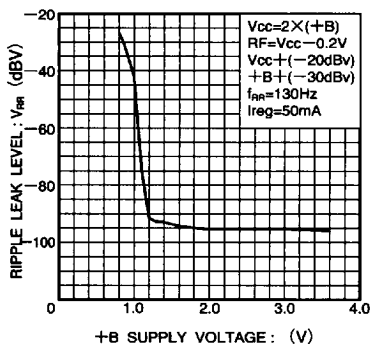
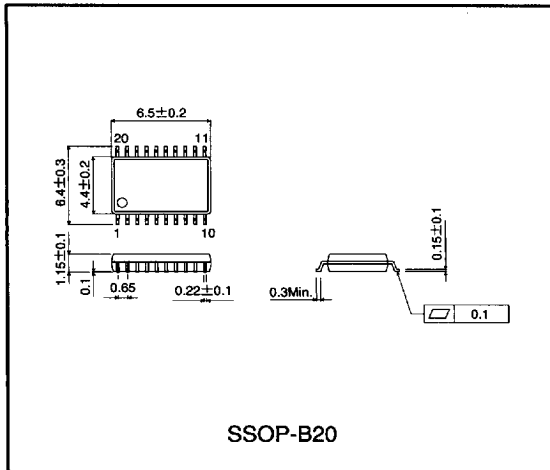


Fig. 18 Regulator ripple leak vs. supply voltage

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● External dimensions (Unit: mm)



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