M51168AP

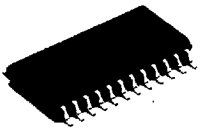
3V SINGLE CHIP, RECORD/PLAYBACK AMPLIFIER •POWER AMPLIFIER

DESCRIPTION

The M51168AP is a recording/playback preamplifier for portable audio systems. It has a built-in headphone power amplifier capable of operating at a low voltage. The IC can form a complete audio amplifier section.

FEATURES

- Built-in playback amplifier, microphone amplifier, line amplifier, ALC amplifier, ripple filter, power amplifier, and earphone amplifier.
- Internal ALC rectifier and LED driver
- Capable of making selection from playback amplifier, power amplifier, and microphone line amplifier, by means of electronic switch.
- Power amplifier and earphone amplifier selectable by electronic switch.
- Built-in battery check circuit (for recording)



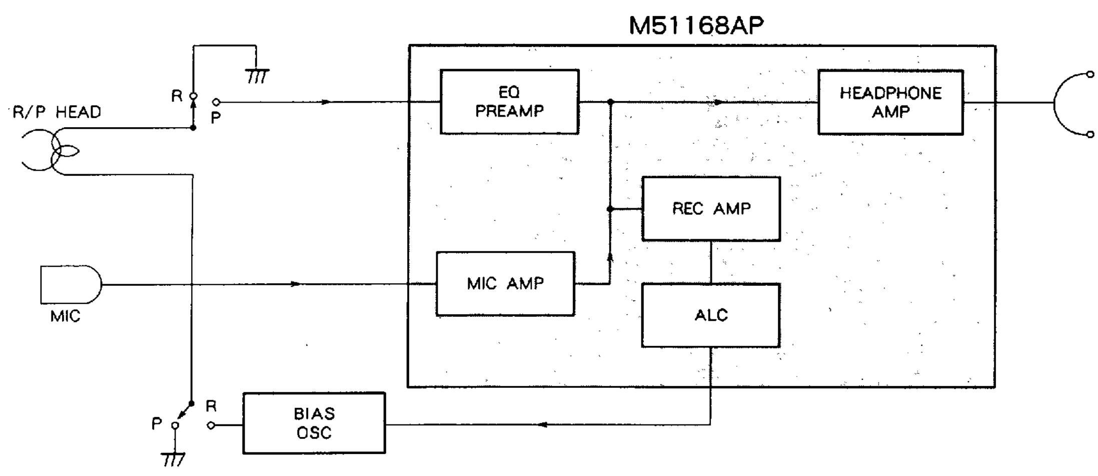
Outline 24P2N-B

1.27mm pitch 300mil SOP
(5.3mm × 15.02mm × 1.8mm)

RECOMMENDED OPERATING CONDITIONS

Supply voltage range ···································· Vcc = 1.8~4V
Rated supply voltage ··Vcc = 3V

SYSTEM CONFIGURATION



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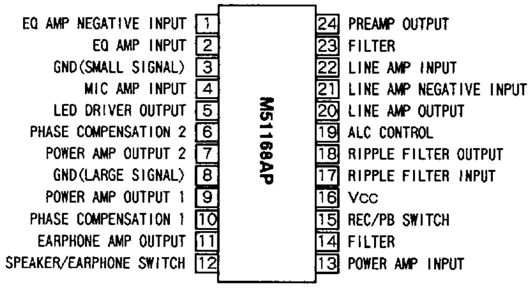
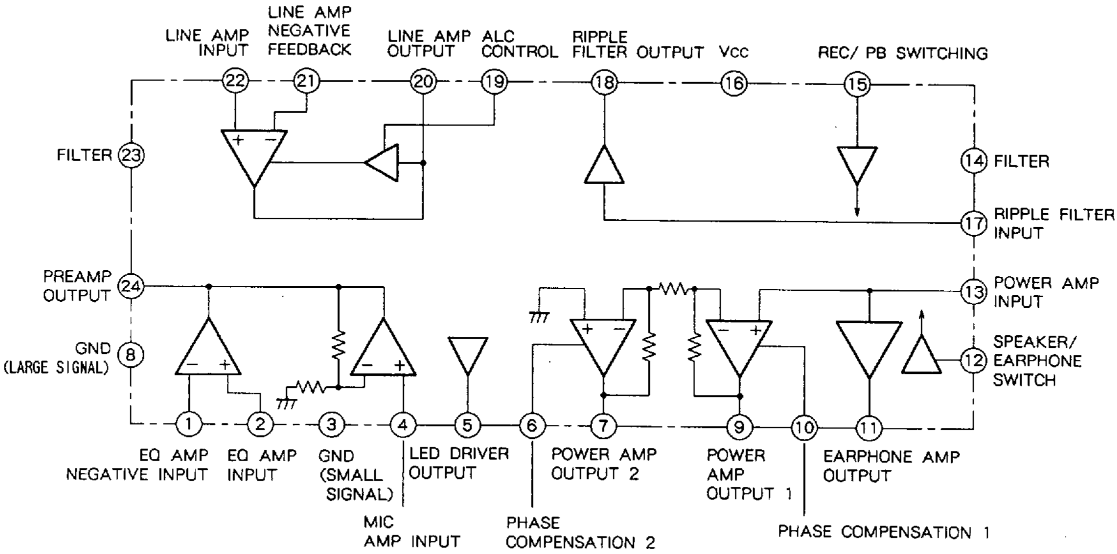
PIN CONFIGURATION



Outline 24P2N-B

IC INTERNAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherwise noted)

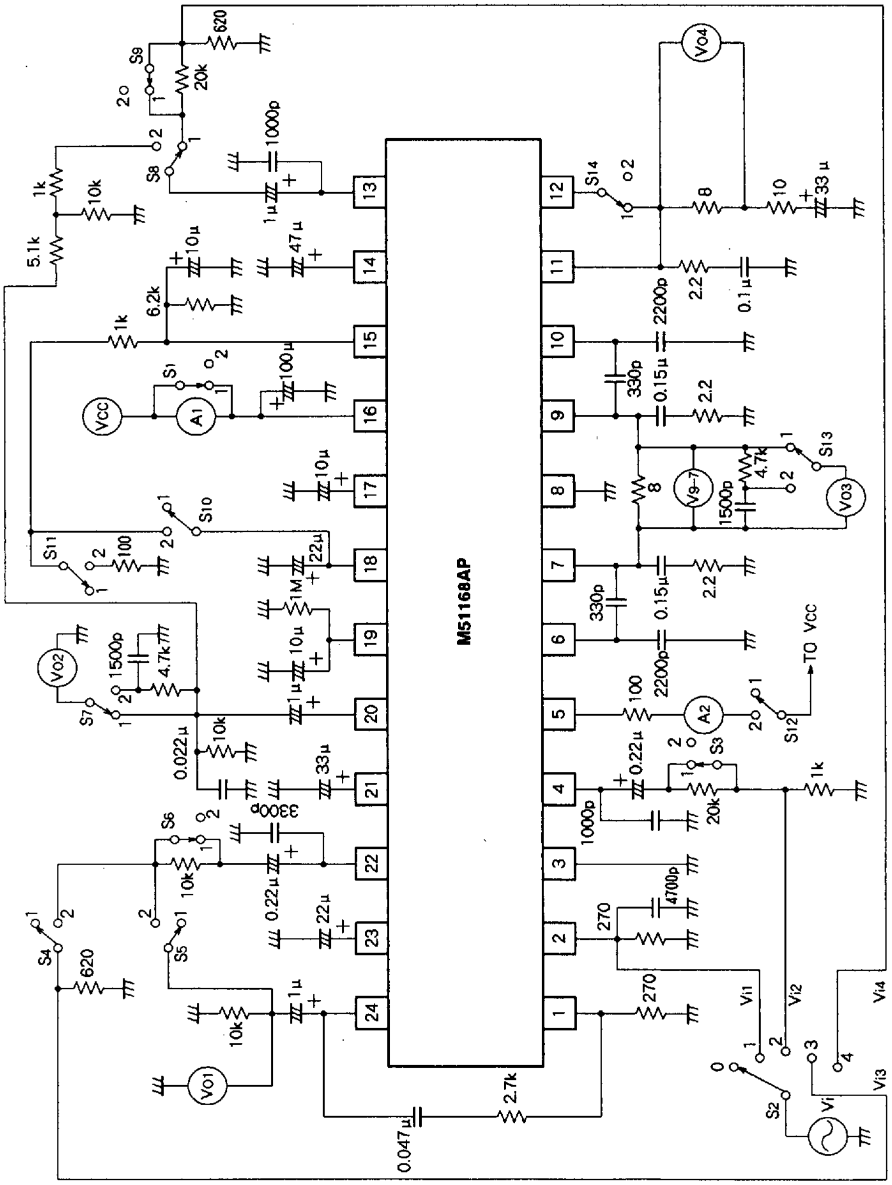
Symbol	Parameter	Ratings	Unit
V_{CC}	Supply voltage	4.5	V
I_{CC}	Circuit current	300	mA
P_d	Power dissipation	600	mW
K_θ	Thermal derating(Ta ≧ 25℃)	6	mW/℃
T_{opr}	Operating temperature	−20～+60	℃
T_{stg}	Storage temperature	−40～+125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, f = 1kHz, unless otherwise noted)

Symbol	Parameter	Test conditions					Limits			Unit
		Vcc	Input	Test point	PB/REC		Min	Typ	Max	
I_{CC1}	Circuit current (1)	3		A_1	PB	Quiescence	–	21	32	mA
I_{CC2}	Circuit current (2)	3		A_1	REC	Quiescence	–	15	23	mA
G_{a1}	Equalizer + line voltage gain	3	V_{i1}	V_{O2}	PB	V_{O2} = 0.3Vrms	62	65	67.5	dB
G_{a2}	Equalizer + line voltage attenuation	2	V_{i1}	V_{O2}	PB	V_{O2} = 0.3Vrms Comparison between G_{a2}/G_{a1}	−2	−0.5	+1	dB
THD_1	Equalizer + line total harmonic distortion	3	V_{i1}	V_{O2}	PB	V_{O2} = 0.3Vrms	–	0.7	1.5	%
G_{b1}	Microphone + line voltage gain	3	V_{i2}	V_{O2}	REC	V_{O2} = 0.1Vrms	59	62	64.5	dB
G_{b2}	Microphone + line voltage attenuation	2	V_{i2}	V_{O2}	REC	V_{O2} = 0.1Vrms Comparison between G_{b2}/G_{b1}	−2	−0.5	+1	dB
THD_2	ALC distortion	3	V_{i2}	V_{O2}	REC	V_{i2} = −50dBv	–	0.3	1.2	%
ALC	ALC range	3	V_{i2}	V_{O2}	REC		40	46	–	dB
Z_{iM}	Microphone input impedance	3	V_{i2}	V_{O1}	REC	V_{O1} = 0.1Vrms	13	20	–	kΩ
Z_{iL}	Line input impedance	3	V_{i3}	V_{O2}	PB	V_{O2} = 0.3Vrms	20	30	–	kΩ
V_{OML}	Maximum line output voltage	3	V_{i3}	V_{O2}	PB	THD = 3%	0.65	0.85	–	V_{P-P}
G_{c1}	Power voltage gain	3	V_{i4}	V_{O3}	PB	V_{O3} = 0.3Vrms	22.5	25	27	dB
G_{c2}	Power voltage attenuation	2	V_{i4}	V_{O3}	PB	V_{O3} = 0.3Vrms Comparison between G_{c2}/G_{c1}	−1.5	0	+1.5	dB
THD_3	Power total harmonic distortion	3	V_{i4}	V_{O3}	PB	V_{O3} = 0.3Vrms	–	0.6	2.0	%
P_{OM1}	Maximum power output	3	V_{i4}	V_{O3}	PB	THD = 10%	150	250	–	mW
Z_{iP}	Power input impedance	3	V_{i4}	V_{O3}	PB	V_{O3} = 0.3Vrms	13	20	–	kΩ
V_{OFF}	Output offset voltage	3		V_{9-7}	PB	Quiescence	−60	0	+60	mV
G_{d1}	Earphone voltage gain	3	V_{i4}	V_{O4}	REC	V_{O4} = 0.1Vrms	5	7	9	dB
G_{d2}	Earphone voltage attenuation	2	V_{i4}	V_{O4}	REC	V_{O4} = 0.1Vrms Comparison between G_{d2}/G_{d1}	−1.5	0	+1.5	dB
THD_4	Earphone total harmonic distortion	3	V_{i4}	V_{O4}	REC	V_{O4} = 0.2Vrms	–	0.4	1.0	%
P_{OM2}	Maximum earphone output	3	V_{i4}	V_{O4}	REC	THD = 10%	10	14	–	mW
N_{O1}	Equalizer + line + power output noise voltage	3		V_{O3}	PB	BW=20Hz～20kHz	–	12	22	mVrms
N_{O2}	Microphone + line output noise voltage	3		V_{O2}	REC	BW=20Hz～20kHz	–	1.0	1.8	mVrms
I_5	Pin ⑤ current	3		A_2	REC	Quiescence	2	–	–	mA
B.C	Battery checker voltage			Vcc	REC	Quiescence	1.9	2.1	2.3	V

Note : PB : playback, REC : recording

TEST CIRCUIT



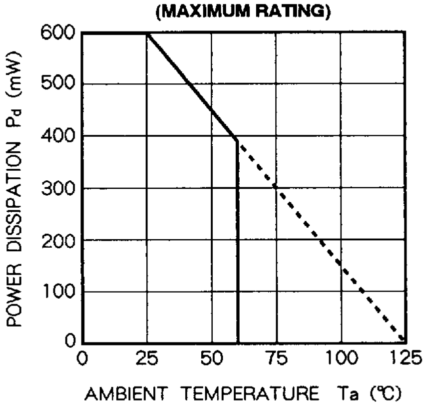
Units Resistance : Ω
Capacitance : F

TEST METHODS

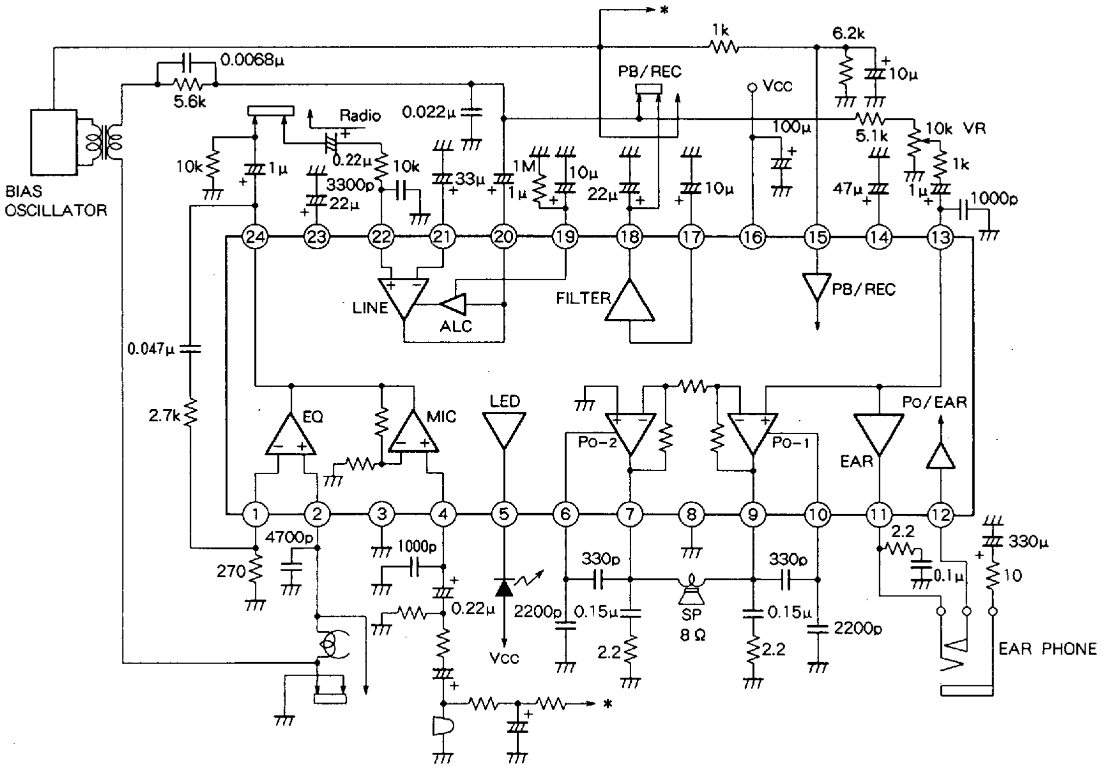
Parameter	State of switch														Method
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	
Circuit current (1)	2	0	1	2	1	2	1	1	1	1	2	1	1	1	Read off value for total circuit current for playback on ammeter A_1.
Circuit current (2)	2	0	1	2	1	2	1	1	1	2	1	1	1	2	Read off value for total circuit current for recording on ammeter A_1.
Equalizer + line voltage gain	1	1	1	1	2	2	1	1	1	1	2	1	1	2	$G_{a1} = 20\log(V_{o2}/V_{i1})$ [dB]
Equalizer + line voltage attenuation	1	1	1	1	2	2	1	1	1	1	2	1	1	2	Measure the difference in gain $(G_{a2} - G_{a1})$ [dB] when Vcc is 3V and 2V.
Equalizer + line total harmonic distortion rate	1	1	1	1	2	2	1	1	1	1	2	1	1	2	
Microphone + line voltage gain	1	2	1	1	2	2	1	1	1	2	2	1	1	2	$G_{b1} = 20\log(V_{o2}/V_{i2})$ [dB]
Microphone + line voltage attenuation	1	2	1	1	2	2	1	1	1	2	2	1	1	2	Measure the difference in gain $(G_{b2} - G_{b1})$ [dB] when Vcc is 3V and 2V.
ALC distortion	1	2	1	1	2	2	1	1	1	2	2	1	1	2	Measure the output distortion when $V_{i2} = -50$dBv
ALC range	1	2	1	1	2	2	1	1	1	2	2	1	1	2	ALC = $20\log(V_3/V_1)$, where the input and output voltages at the rise of ALC are V_1 and V_2 respectively, and the input for $V_{o2} = V_2 + 3$[dB] is V_3.
Microphone input impedance	1	2	1/2	2	1	2	1	1	1	2	2	1	1	2	$Z_{iM} = 20V_2/(V_1 - V_2)$[kΩ], where V_{o1} for S_3 = 1 and 2 are V_1 and V_2 respectively.
Line input impedance	1	3	1	2	1	1/2	1	1	1	1	2	1	1	2	$Z_{iL} = 10V_2/(V_1 - V_2)$[kΩ], where V_{o2} for S_6 = 1 and 2 are is V_1 and V_2 respectively.
Maximum line output voltage	1	3	1	2	1	1	1	1	1	1	2	1	1	2	Measure the value of V_{o2} when distortion is 3%.
Power voltage gain	1	4	1	2	1	2	1	1	1	1	2	1	1	1	$G_{c1} = 20\log(V_{o3}/V_{i4})$ [dB]
Power voltage attenuation	1	4	1	2	1	2	1	1	1	1	2	1	1	1	Find the difference in gain $(G_{c2} - G_{c1})$ [dB] when Vcc is 3V and 2V
Power total harmonic distortion	1	4	1	2	1	2	1	1	1	1	2	1	1	1	
Maximum power output	1	4	1	2	1	2	1	1	1	1	2	1	1	1	$P_{OM1} = \frac{(V_{o3})^2}{8}$ when distortion is 10%
Power input impedance	1	4	1	2	1	2	1	1	1/2	1	2	1	1	1	$Z_{iP} = 20V_2/(V_1 - V_2)$[kΩ], where V_{o3} for S_9 = 1 and 2 are V_1 and V_2 prespectively.
Output offset voltage	1	4	1	2	1	2	1	1	1	1	2	1	1	1	Measure DC voltage difference between terminal ⑨ and terminal ⑦.(terminal ⑦ is the standard)
Earphone voltage gain	1	4	1	2	1	2	1	1	1	2	2	1	1	2	$G_{d1} = 20\log(V_{o4}/V_{i4})$ [dB]
Earphone voltage attenuation	1	4	1	2	1	2	1	1	1	2	2	1	1	2	Measure the difference in gain $(G_{d2} - G_{d1})$ [dB] when Vcc is 3V and 2V
Earphone total harmonic distortion	1	4	1	2	1	2	1	1	1	2	2	1	1	2	
Maximum earphone output	1	4	1	2	1	2	1	1	1	2	2	1	1	2	$P_{OM2} = \frac{(V_{o4})^2}{8}$ when distortion is 10%
Equalizer + line + power output noise characteristics	1	0	1	1	2	2	1	2	1	1	2	1	2	1	BW = 20Hz~20kHz
Microphone + line output noise voltage	1	0	1	1	2	2	2	1	1	2	2	1	1	2	BW = 20Hz~20kHz
pin⑤ current	1	0	1	2	1	2	1	1	1	2	2	2	1	2	Read off value on ammeter A_2
Battery checker voltage	1	0	1	2	1	2	1	1	1	2	2	2	1	2	Measure the value of Vcc when the value of A_2 becomes 10μA or below, by gradually lowering Vcc from 3V.

TYPICAL CHARACTERISTICS

THERMAL DERATING (MAXIMUM RATING)



APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F