Ordering number: EN3535A

Monolithic Linear IC

LA4581MB

Preamplifier + Power Amplifier for 3V Headphone Stereos

Overview

The LA4581MB is an auto reverse-supported preamplifier + power amplifier IC that is intended for use in 3V headphone stereos.

Features

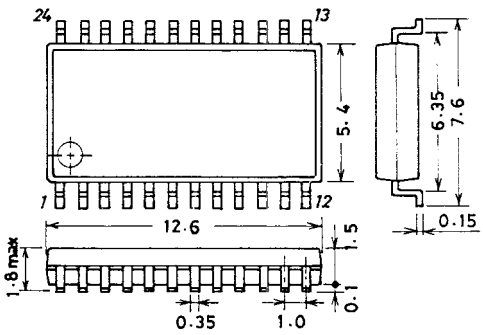
- Preamplifier muting and preamplifier output on/off can be implemented with one pin. This IC can easily be used to construct a set with a radio.
- The power amplifier needs no input/output coupling capacitor.
- A high-frequency cut capacitor is connected to the preamplifier input pin and the power amplifier input pin. (Anti-buzz provision)
- Because V_{ref} AMP (r_0 = 10 Ω) is built in, the virtual grounding impedance is about 10 Ω. This eliminates the need for a large capacitor.
- 8 Ω speaker drivable.

Package Dimensions

unit : mm

3112-MFP24S

[LA4581MB]



SANYO : MFP24S

Specifications

Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		4.5	V
Allowable power dissipation	Pd max		530	mW
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–40 to +125	°C

Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.0	V
Operating supply voltage range	V_{CC} op		1.8 to 3.6	V

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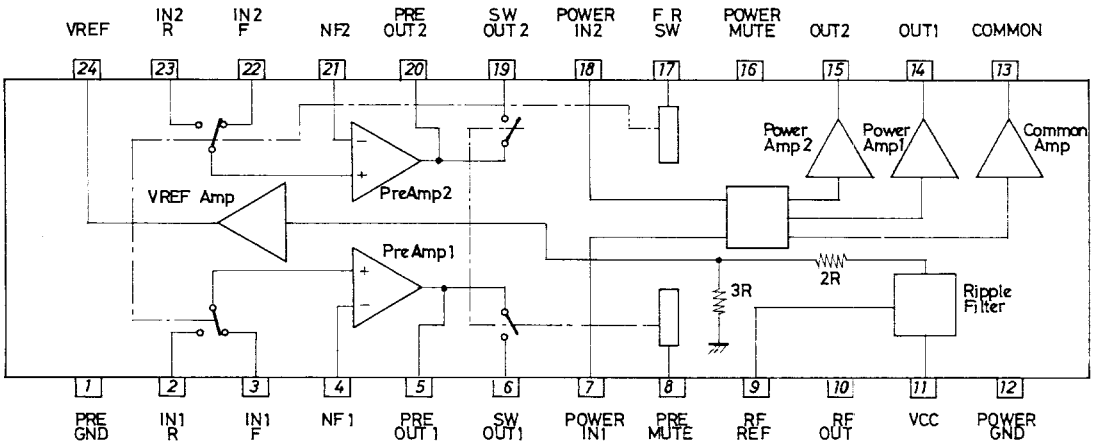
Operating Characteristics at Ta = 25 °C, V_{CC} = 3.0 V, f = 1 kHz, 0.775 V = 0 dBm, R_L = 10 kΩ (preamplifier), R_L = 16 Ω (power amplifier)

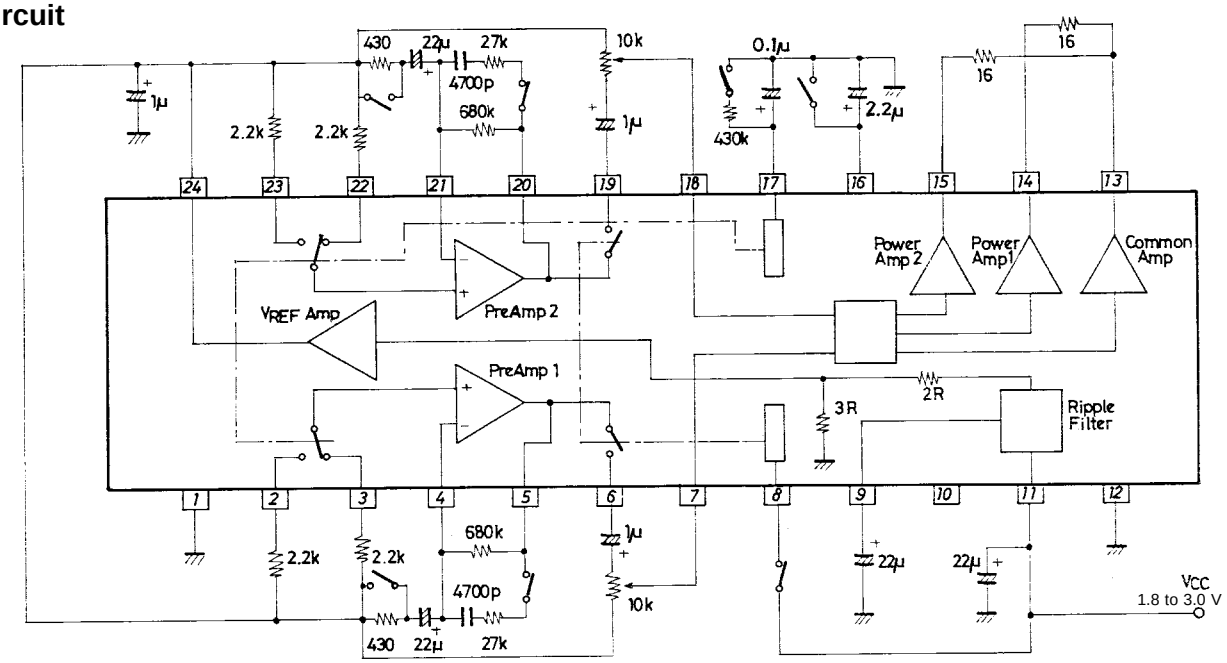
Parameter	Symbol	Output	min	typ	max	Unit
[Pre + Power]						
Quiescent current	I_{CCO}	Rg = 2.2 kΩ (preamplifer) V_{IN} = 0 V		17	27	mA
Voltage gain (Closed)	VG_T	V_O = –5 dBm	65	68	71	dB
[Preamplifier]						
Voltage gain (Open)	VGo	V_O = –5 dBm	70	80		dB
Voltage gain (Closed)	VG1	V_O = –5 dBm		40		dB
Maximum output voltage	$V_O$max	THD = 1 %, V_{CC} = 1.8 V	0.1	0.2		V
Total harmonic distortion	THD1	V_O = 0.2 V, VG = 40 dB/NAB		0.05	0.5	%
Equivalent input noise voltage	V_N1	Rg = 2.2 kΩ, B.P.F = 20 to 20 kHz		1.3	2.0	μV
Crosstalk	CT1	Rg = 2.2 kΩ, TUNE 1 kHz	60	80		dB
Ripple rejection ratio	R_r1	Rg = 2.2 kΩ, V_{CC} = 1.8 V, Vr = –20 dBm, f = 100 Hz	40	50		dB
[Power Amplifer]						
Output voltage	P_O	THD = 10%	23	32		mW
Voltage gain (Closed)	VG2	V_O = –5 dBm	25	28	31	dB
Total harmonic distortion	THD2	P_O = 1 mW		0.4	1.0	%
Interchannel crosstalk	CT_T	V_O = –5 dBm, R_v = 0 Ω	30	40		dB
Output noise voltage	V_{NO}	Rg = 0, B.P.F = 20 to 20 kHz		24	40	μV
Ripple rejection ratio	R_r2	Rg = 0, V_r = –20 dB, f = 100 Hz, V_{CC} = 1.8 V	45	60		dB
Input resistance	R_{IN}		22	30	38	kΩ
DC offset voltage	V_{ODC}off	Between 13-14 and 15	–90		+90	mV

Note) Power amplifier voltage gain VG2 increases by about 1 dB for min/max respectively than specified above when R_L = 32 Ω.

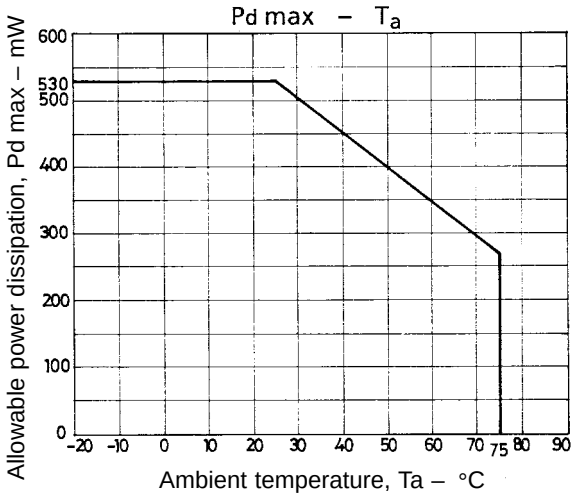
Block Diagram



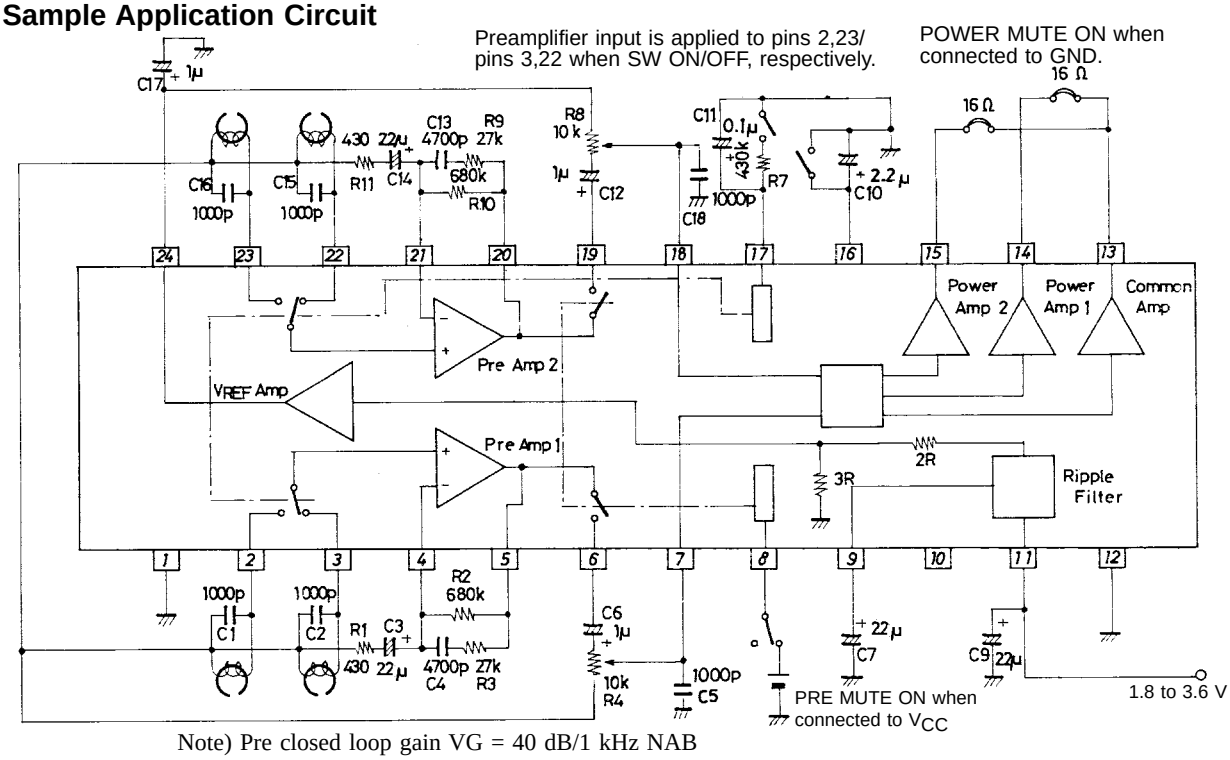
Test Circuit



Unit (resistance: Ω, capacitance: F)



Sample Application Circuit



Note) Pre closed loop gain VG = 40 dB/1 kHz NAB

Unit (resistance: Ω, capacitance: F)

Pin and external part functions (when the voltage is V_{CC} = 3.0 V)

Pin No.	Pin Function
1	PRE GND
2	PRE IN1R 1.8 V • Turns ON when pin 17 is grounded. • A bias resistor (2.2 kΩ) must be connected between pin 2 and pin 24 (V_{ref}) when no head is in use.
3	PRE IN1F 1.8 V • Turns ON when pin 17 is floating. • A bias resistor (2.2 kΩ) must be connected between pin 3 and pin 24 (V_{ref}) when no head is in use.
4	PRE NF1 1.8 V
5	PRE OUT1 1.8 V • Like pin 6, 10 kΩ load drivable.
6	SW OUT1 1.8V • Provides PRE AMP1 output when pin 8 is floating (PRE MUTE OFF)(equivalent to pin 5). • Disconnects from PRE AMP1 and sets $R_{IN} \geqq 500$ kΩ when pin 8 is at V_{CC} (PRE MUTE ON).
7	POWER IN1 1.8V • Input resistance $R_{IN} \doteqdot 30$ kΩ

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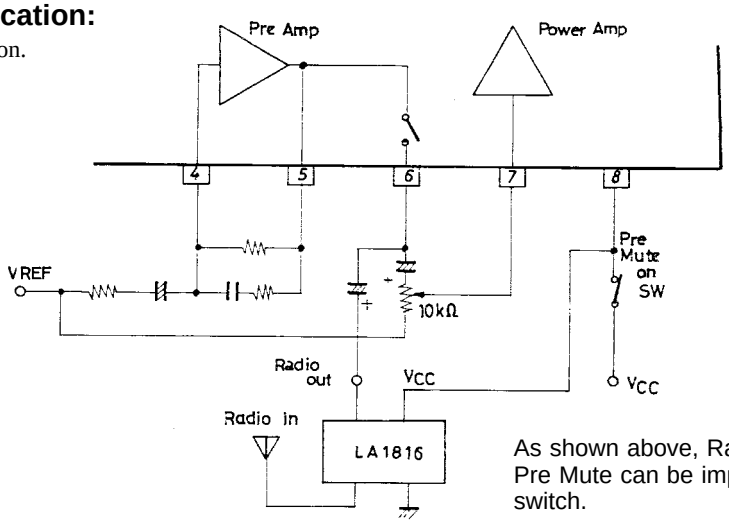
Pin No.	Pin Function
8	PRE MUTE • When V_{CC} is applied, PRE MUTE ON. • MUTE ON conditions: $V_{8IN} \geqq V_{CC} - 0.2$ V, inflow current $I_7 \fallingdotseq 60$ µA (when $V_{CC} = 3$ V)
9	Ripple Filter REF 2.7 V(C_7 = 2.2 µF to 33 µF) • Ripple Filter, V_{ref} reference • The V_{ref} ripple rejection ratio worsens when C_7 is made smaller. • R_r is 55 dB for 22 µF; 35 dB for 2.2 µF.
10	Ripple Filter OUT 2.7 V • Ripple rejection ratio: R_r is 38 dB when C_7 = 22 µF; 30 dB when C_7 = 2.2 µF. • Outflow current I_7 max = 1 mA
11	V_{CC} 3.0 V
12	POWER GND
13	COMMON 1.2 V
14	POWER OUT1 1.2 V • CH1 output.
15	POWER OUT2 1.2 V • CH2 output
16	POWER MUTE 0.7 V (C_{10} = 1.0 µF to 4.7 µF) • When connected to GND: POWER MUTE ON. • MUTE ON conditions: $V_{16} \leqq 0.3$ V, outflow current $I_{16} \fallingdotseq 2.5$ µA. • C_{10} can be used to control MUTE TIME. • When C_{10} = 2.2 µF, V_{CC} =3.0 V 0.7 sec.
17	FWD/REV SW (C11 $\leqq$ 0.47 µF) • When connected to GND, PRE IN1R (pin 2) and IN2R (pin 23) turn on. • When floating, PRE IN1F (pin 3) and IN2F (pin 22) turn on. • C_{11} and R_7 are intended for smoothing at the time of switching. • REV condition: $V_{17} \leqq 0.2$ V.
18	POWER IN2 1.8 V • Input resistance $R_{IN} \fallingdotseq 30$ kΩ
19	SW OUT2 1.8 V • Provides PRE AMP2 when pin 8 is floating (PRE MUTE OFF) (equivalent to pin 20). • Disconnects from PRE AMP2 and $R_{IN} \geqq 500$ kΩ when pin 8 is V_{CC} (PRE MUTE ON).
20	PRE OUT2 1.8 V • Like pin 19, 10 kΩ load drivable.
21	PRE NF2 1.8V
22	PRE IN2F 1.8 V • Turns on when pin 17 is floating. • A bias resistor (2.2 kΩ) must be connected between pin 22 and pin 24 (V_{ref}) when no head is in use.
23	PRE IN2R 1.8 V • Turns on when pin 17 is connected to GND. • A bias resistor (2.2 kΩ) must be connected between pin 23 and pin 24(V_{ref}) when no head is in use.
24	V_{ref} 1.8 V • The reference voltage is set to 3/5 × V_{CC}. Because Vref AMP ($r_O \fallingdotseq 10$ Ω) is built in, C_{17} can be made smaller (1 µF). • Inflow/outflow current I_{24} = ± 500 µA available.

Sample Application:

Radio set application.



As shown above, Radio on and Pre Mute can be implemented with one-circuit switch.