SERVICE MANUAL

ADCOM®

POWER AMPLIFIER

GFA-2535

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INTRODUCTION

This service manual is intended to assist trained and qualified technical personnel in verifying the performance of, adjusting, and repairing the ADCOM GFA-2535 power amplifier. The procedures described here are not intended for persons unfamiliar with the appropriate safety and test procedures.

⚠ WARNING ⚠

THERE ARE POTENTIALLY LETHAL VOLTAGES WITHIN THE GFA-2535 AMPLIFIER WHICH WILL BE ACCESSIBLE ONCE ITS TOP COVER IS REMOVED. DO NOT ATTEMPT FAMILIARIZATION, INSPECTION OR ANY PROCEDURE WHATSOEVER UNLESS YOU HAVE DISCONNECTED THE GFA-2535 FROM THE WALL AC OUTLET OR OTHER SOURCE OF AC POWER AND THE POWER-SUPPLY CAPACITORS ARE COMPLETELY DISCHARGED. PLEASE TAKE NOTE THAT THE POWER-SUPPLY CAPACITORS TAKE AS LONG AS 5 MINUTES TO DISCHARGE. THESE INSTRUCTIONS ARE PROVIDED FOR USE ONLY BY COMPETENT TECHNICAL PERSONNEL. DO NOT UNDERTAKE ANY SERVICE PROCEDURES IN THE GFA-2535 UNLESS YOU ARE TECHNICALLY QUALIFIED TO DO SO.

CIRCUIT DESCRIPTION

The ADCOM GFA-2535 is a 4-channel power amplifier with two channels which can be bridged. The amplifier is rated at 0.06% THD from 20Hz to 20kHz with 60 watts into 8 ohms and 0.09% THD with 90 watts into 4 ohms. The output stage is capable of greater then 20 amps into low impedance loads. The amplifier employs a discrete differential class-A front end followed by a Class-A voltage gain stage which amplify the input signal to the voltage required at the output of the amplifier. This high-voltage signal drives the high-current triple Darlington-follower output stage which amplifies the current by a factor of about 50,000.

Referring to the accompanying schematic, describing the right channel, non-bridgeable only, the input passes through R702 and C702 which provide a 3dB roll-off at 500kHz to the input of the amplifier. VR701 provides input level adjustment. C704 is a DC blocking capacitor to stop the position of VR701 from affecting the DC bias at the base of Q602, thereby maintaining low DC offset at the output of the amplifier. R604 provides the proper base bias current to Q602.

Q602 and Q604 form the differential input stage. Open loop gain is defined by R606, R608, and the bias current through Q602 and Q604. The small-signal gain is approximately 825/(33+2x25)10. The next voltage gain stage consists of Q612 with Q614 as a current-source load. DC bias is set by R624, D601, D602. Open loop gain is defined by R626, with R628, R630, C614, C616, and C608 providing high frequency compensation.

Feedback is provided from the output to the base of Q604 by the network R662, R614, C604, C606, and C610. C610 provides a high-frequency roll-off above 150kHz, improving stability by taking high frequency feedback before the triple Darlington. C604 and C606 provide a low frequency roll-off below 3.4Hz to isolate the amplifier output from DC and low-frequency errors at the amplifier input.

The input stage is biased by R617, R618, D603, D604, Q609, R619, R620, D001 (the power LED), S601 (the thermal breaker), D601, D602, D002 (thermal protection LED), Q606, and R610. Q609 is turned on when the B+ supply is on. A current of about 4mA flows through the power LED and the thermal breaker on the heatsink into D601 and D602. If the heatsink overheats, the breaker opens and the current flows through D602 and the thermal protection LED instead. When the breaker carries the current, D601 and D602 are biased at 1.4V. This creates about 0.7V across R610, Q606 then sources about 2mA to Q602 and Q604, the differential input stage. If the negative supply fails or the fuse opens, Q606 saturates, Q602 turns off, turning off Q612, Q614 saturates. This hold the input to the triple Darlington to near ground. If the positive supply fails or its fuse opens, Q609 turns off and the bias circuitry is disabled.

The bias network of VR602, R634, R632, and Q616 form a temperature-compensated DC bias voltage to the input of the triple Darlington-follower output stage. Mid- and high-frequency bypassing is provided by C612.

R660 and C618 provide a load for the amplifier at high frequencies, stabilizing the amplifier under varying load conditions. D606 and D608 provide a high current return to the power supply for backlash current from the load.

The output stage consists of two sets of 2 parallel transistors operated as emitter followers, driven by another pair of emitter followers. This configuration minimizes distortion caused by varying load impedances. The output transistors have 0.33 ohm ballast resistors to ensure current sharing and bias stability.

IMPORTANT

BEFORE PROCEEDING WITH ADJUSTMENTS, MAKE SURE AMPLIFIER IS AT ROOM TEMPERATURE.

TEST PROCEDURES

All tests are performed with a 120V, low-distortion (less than 2%), AC-power source, 8-ohm resistive load, and a signal source of not more than 600 ohms.

Tests are performed after warming up the amplifier at 20 watts into an 8-ohm load for at least 10 minutes.

All grounds during testing are referred to the ground of the black output terminal.

80kHz low-pass filter is employed during THD distortion measurements.

Signal-to-noise measurements are "A" weighted.

Damping factor is measured by comparing the 20-watt-output voltage with and without an 8-ohm load.

BIAS ALIGNMENT

1. With set-up as per the first paragraph of TEST PROCEDURES and with **NO SIGNAL IN,** set bias controls (VR601 and VR602) of either amplifier A or amplifier B to midpoint.

2. Connect a millivolt meter across TP1 and TP3.

3. Turn amplifier on and allow a 3 to 5 minute settling period.

4. Adjust **BIAS** control VR601 to obtain either a + or –10 mV (±1 mV) indication on the millivolt meter.

5. Connect a millivolt meter across TP2 and TP4.

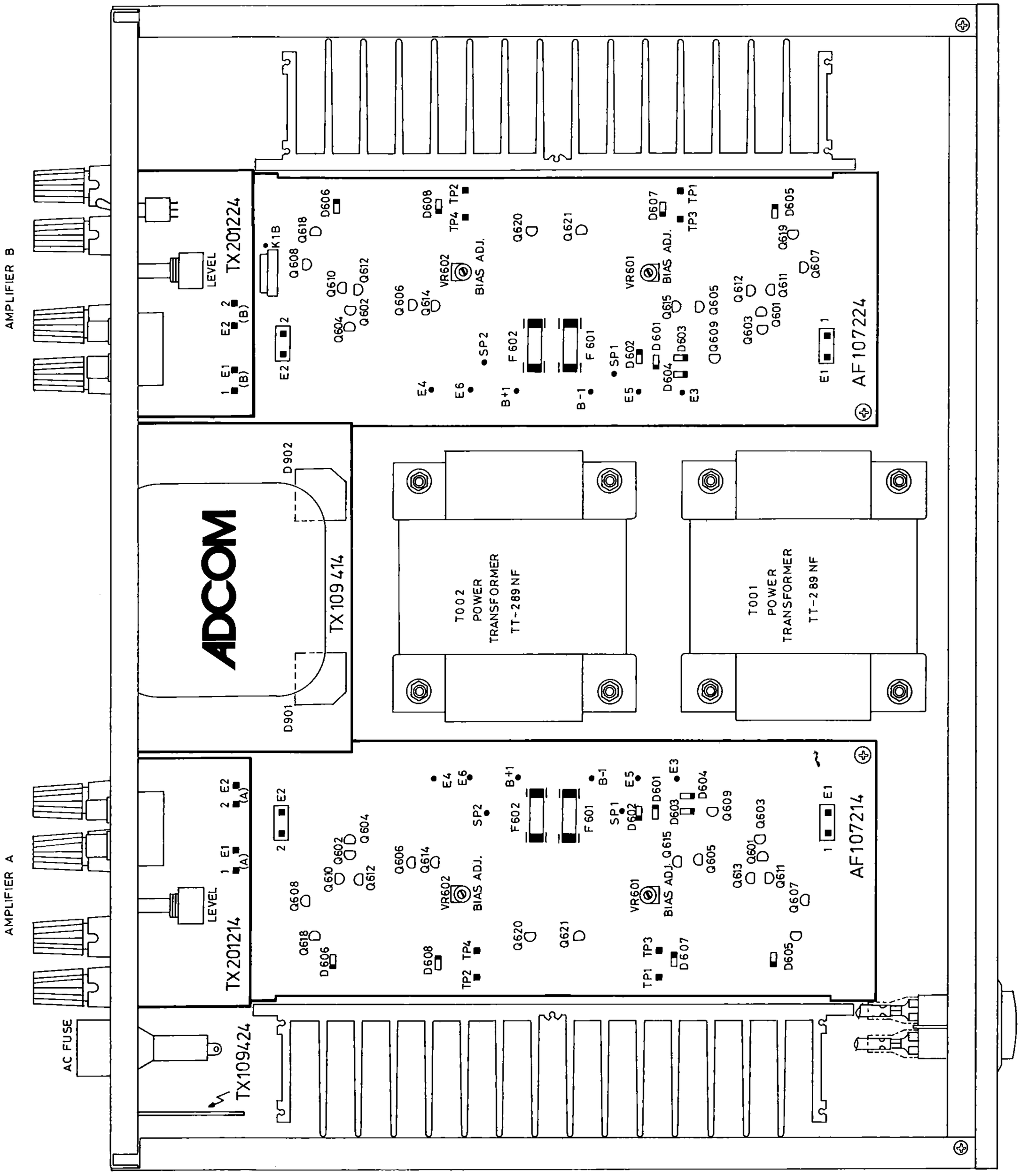
6. Adjust **BIAS** control VR602 to obtain either a + or –10 mV (±1 mV) indication on the millivolt meter.

7. To check for proper bias setting, remove millivolt meter and apply input signal to obtain 20 watts into 8 ohms for 10 minutes with cover on.

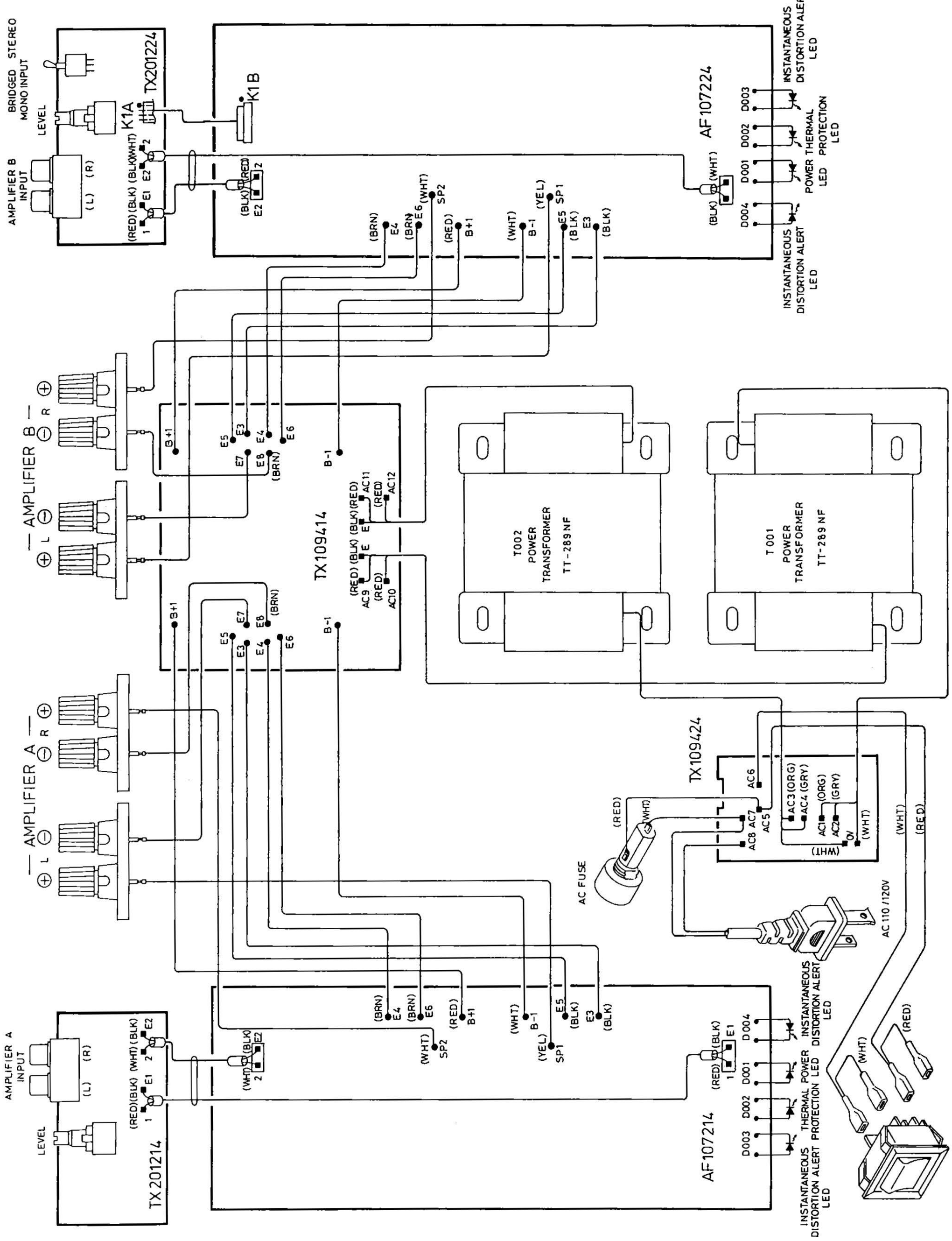
8. Remove input signal and connect the millivolt meter as in Step 2 and Step 5. Let amplifier idle until bias stabilizes and readjust to 10 mV (±1 mV).

9. Now repeat whole procedure for remaining amplifier.

GFA-2535 Chassis Layout



GFA-2535 Wiring Diagram



ADCOM GFA-2535 SERVICE PARTS LIST

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION
AF107214 PCB ASSEMBLY		
R601,602	RM81001612	METAL-FILM MK2 001KFECZ *
R603,604	RM82212618	METAL-FILM MK2 22K1FECZ *
R605,606	RM88250617	METAL-FILM MK2 825RFECZ *
R607,608	RM83329610	METAL-FILM MK2 33R2FECZ *
R609,610	RM83320617	METAL-FILM MK2 332RFECZ *
R611,612	RM84750619	METAL-FILM MK2 475RFECZ *
R613,614	RM81001612	METAL-FILM MK2 001KFECZ *
R615,616	RM82741615	METAL-FILM MK2 2K74FECZ *
R617	RM84752616	METAL-FILM MK2 47K5FECZ *
R618	RM82212618	METAL-FILM MK2 22K1FECZ *
R619	RM81210614	METAL-FILM MK2 121RFECZ *
R620	RM85621610	METAL-FILM MK2 5K62FECZ *
R621	RM81002616	METAL-FILM MK2 010KFECZ *
R622,623	RM84750619	METAL-FILM MK2 475RFECZ *
R624,625	RM81330619	METAL-FILM MK2 133RFECZ *
R626,627	RM83329610	METAL-FILM MK2 33R2FECZ *
R628,629	RM86819611	METAL-FILM MK2 68R1FECZ *
R630,631	RM86819611	METAL-FILM MK2 68R1FECZ *
R632,633	RM82741615	METAL-FILM MK2 2K74FECZ *
R634,635	RM84990618	METAL-FILM MK2 499RFECZ *
R636,637	RM83320617	METAL-FILM MK2 332RFECZ *
R638,639	RM84759611	METAL-FILM MK2 47R5FECZ *
R640,641	RM84759611	METAL-FILM MK2 47R5FECZ *
R642,643	RM82219613	METAL-FILM MK2 22R1FECZ *
R644,645	RM81009611	METAL-FILM MK2 010RFECZ *
R646,647	RM81009611	METAL-FILM MK2 010RFECZ *
R648-655	RS20338230	CEMENTED WIRE WOUND MPC70-0.33F
R656,657	RM81009611	METAL-FILM MK2 010RFECZ *
R658,659	RM81009611	METAL-FILM MK2 010RFECZ *
R660,661	RM95108227	METAL-OXIDE 2W 5.1
R662,663	RM82212618	METAL-FILM MK2 22K1FECZ *
R667,668	RM84991611	METAL-FILM MK2 4K99FECZ *
C603,604	CP61007432	POLYESTER, 1uF/100V MKT22-100V105
C605,606	CE74706340	ELECTROLYTIC, 47uF/100V ECEA2AGE470
C607,608	CS32212323	POLYSTYRENE, 22pF/125V SRA220J125
C609,610	CS33912328	POLYSTYRENE, 39pF/125V SRA390J125
C611,612	CE74713502	ELECTROLYTIC, 4.7uF/50V ECEA1HFS4R7
C613,614	CS36812321	POLYSTYRENE, 68pF/125V SRA680J125
C615,616	CS36812321	POLYSTYRENE, 68pF/125V SRA680J125
C617,618	CP61008321	POLYESTER, 0.1uF/100V MKT18-100V104
C619,620	CP62208330	POLYESTER, 0.22uF/100V MKT18-100V224
C621,622	CP62208330	POLYESTER, 0.22uF/100V MKT18-100V224
D601,602	DD80000021	1N4148-86
D603,604	DD80000021	1N4148-86
D605,606	DD10000366	DSC-30TC
D607,608	DD10000366	DSC-30TC
D001,002	DD40000757	LED RED, LTL2201A
D003,004	DD40000745	LED YELLOW, LTL2251A
Q601,602,603, 604,605,606	TR30000212	2SC2362-F,G
Q607,608	TR10000023	2SA1016-F,G
Q609	TR10000308	2SA1376-L,K
Q610,611	TR10000357	2SA970-BL
Q612,613	TR10000308	2SA1376-L,K
Q614,615	TR30000558	2SC3478-L,K
Q616,617	TR40000069	2SD600K-E,F
Q618,619	TR30000558	2SC3478-L,K
Q620,621	TR10000308	2SA1376-L,K
Q622,623	TR30000613	2SC3902-R,S
Q624,625	TR10000345	2SA1507-R,S
Q626,627	TR40000045	2SD1047-D,E
Q628,629	TR20000040	2SB817-D,E

Q630,631		TR40000045	2SD1047-D,E
Q632,633		TR20000040	2SB817-D,E
F601,602 §	⚠	AGC-8/250V	BUSSMAN
	⚠	3AG312008/250V	LITTELFUSE
	⚠	CES14-8A/250V	SOC
VR601,602		RV40000046	VARIABLE, VM6CKPV-1S-B, 220 OHM
S601	⚠	SH60000148	THERMOSTAT, UP62 85 C C-4270A01

AF107224 PCB ASSEMBLY

R601,602	RM81001612	METAL-FILM MK2 001KFECZ *
R603,604	RM82212618	METAL-FILM MK2 22K1FECZ *
R605,606	RM88250617	METAL-FILM MK2 825RFECZ *
R607,608	RM83329610	METAL-FILM MK2 33R2FECZ *
R609,610	RM83320617	METAL-FILM MK2 332RFECZ *
R611,612	RM84750619	METAL-FILM MK2 475RFECZ *
R613,614	RM81001612	METAL-FILM MK2 001KFECZ *
R615,616	RM82741615	METAL-FILM MK2 2K74FECZ *
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R636,637	RM83320617	METAL-FILM MK2 332RFECZ *
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R642,643	RM82219613	METAL-FILM MK2 22R1FECZ *
R644,645	RM81009611	METAL-FILM MK2 010RFECZ *
R646,647	RM81009611	METAL-FILM MK2 010RFECZ *
R648-655	RS20338230	CEMENTED WIRE WOUND MPC70-0.33F
R656,657	RM81009611	METAL-FILM MK2 010RFECZ *
R659,659	RM81009611	METAL-FILM MK2 010RFECZ *
R660,661	RM95108227	METAL-OXIDE 2W 5.1
R662,663	RM82212618	METAL-FILM MK2 22K1FECZ *
R664,665	RM82212618	METAL-FILM MK2 22K1FECZ *
R667,668	RM84991611	METAL-FILM MK2 4K99FECZ *
C603,604	CP61007432	POLYESTER, 1uF/100V MKT22-100V105
C605,606	CE74706340	ELECTROLYTIC, 47uF/100V ECEA2AGE470
C607,608	CS32212323	POLYSTYRENE, 22pF/125V SRA220J125
C609,610	CS33912328	POLYSTYRENE, 39pF/125V SRA390J125
C611,612	CE74713502	ELECTROLYTIC, 4.7uF/50V ECEA1HFS4R7
C613,614	CS36812321	POLYSTYRENE, 68pF/125V SRA680J125
C615,616	CS36812321	POLYSTYRENE, 68pF/125V SRA680J125
C617,618	CP61008321	POLYESTER, 0.1uF/100V MKT18-100V104
C619,620	CP62208330	POLYESTER, 0.22uF/100V MKT18-100V224
C621,622	CP62208330	POLYESTER, 0.22uF/100V MKT18-100V224
D601,602	DD80000021	1N4148-86
D603,604	DD80000021	1N4148-86
D605,606	DD10000366	DSC-30TC
D607,608	DD10000366	DSC-30TC
D001,002	DD40000757	LED RED, LTL2201A
D003,004	DD40000745	LED YELLOW, LTL2251A
Q601,602,603, 604,605,606	TR30000212	2SC2362-F,G
Q607,608	TR10000023	2SA1016-F,G
Q609	TR10000308	2SA1376-L,K
Q610,611	TR10000357	2SA970-BL
Q612,613	TR10000308	2SA1376-L,K
Q614,615	TR30000558	2SC3478-L,K
Q616,617	TR40000069	2SD600K-E,F
Q618,619	TR30000558	2SC3478-L,K
Q620,621	TR10000308	2SA1376-L,K
Q622,623	TR30000613	2SC3902-R,S

Q624,625		TR10000345	2SA1507-R,S
Q626,627		TR40000045	2SD1047-D,E
Q628,629		TR20000040	2SB817-D,E
Q630,631		TR40000045	2SD1047-D,E
Q632,633		TR20000040	2SB817-D,E
F601,602 §	⚠	AGC-8/250V	BUSSMAN
	⚠	3AG312008/250V	LITTELFUSE
	⚠	CES14-8A/250V	SOC
VR601,602		RV40000046	VARIABLE, VM6CKPV-1S-B, 220 OHM
S601	⚠	SH60000148	THERMOSTAT, UP62 85 C C-4270A01

TX109414 PCB ASSEMBLY

C901,902		CE61003436	ELECTROLYTIC, 63LAP10000M
C903,904		CE61003436	ELECTROLYTIC, 63LAP10000M
D901,902	⚠	DD10000147	BRIDGED RECTIFIER, KBPC802
R901,902		RM95601126	METAL-OXIDE 1W 5.6K
R903,904		RM95601126	METAL-OXIDE 1W 5.6K

TX109424 PCB ASSEMBLY

COO1	⚠	CK00000035	SPARK KILLER DE7150F472M
MOV001	⚠	DD30000104	METAL OXIDE VARISTOR (120V) TNRG221K
MOV002	⚠	DD30000116	METAL-OXIDE VARISTOR (220V/240V) TNRG391K

TX201214 PCB ASSEMBLY

R701,702	RM81001612	METAL-FILM MK2 001KFECZ *
C701,702	CS33311321	POLYSTYRENE, 330pF/125V SRA331J125
C703,704	CP42207332	POLYESTER, 2.2uF/100V
VR701	RV10001681	VARIABLE, 4TR-2922 50KBx2
	JP02000260	RCA JACKS, 4TR-2709#3

TX201224 PCB ASSEMBLY

R701,702	RM81001612	METAL-FILM MK2 001KFECZ *
C701	CS33311321	POLYSTYRENE, 330pF/125V SRA331J125
C702	CS33011325	POLYSTYRENE, 300pF/125V SRA301J125
C703,704	CP42207332	POLYESTER, 2.2uF/100V
VR701	RV10001681	VARIABLE, 4TR-2922 50KBx2
	JP02000260	RCA JACKS, 4TR-2709#3

CHASSIS MOUNTED COMPONENTS

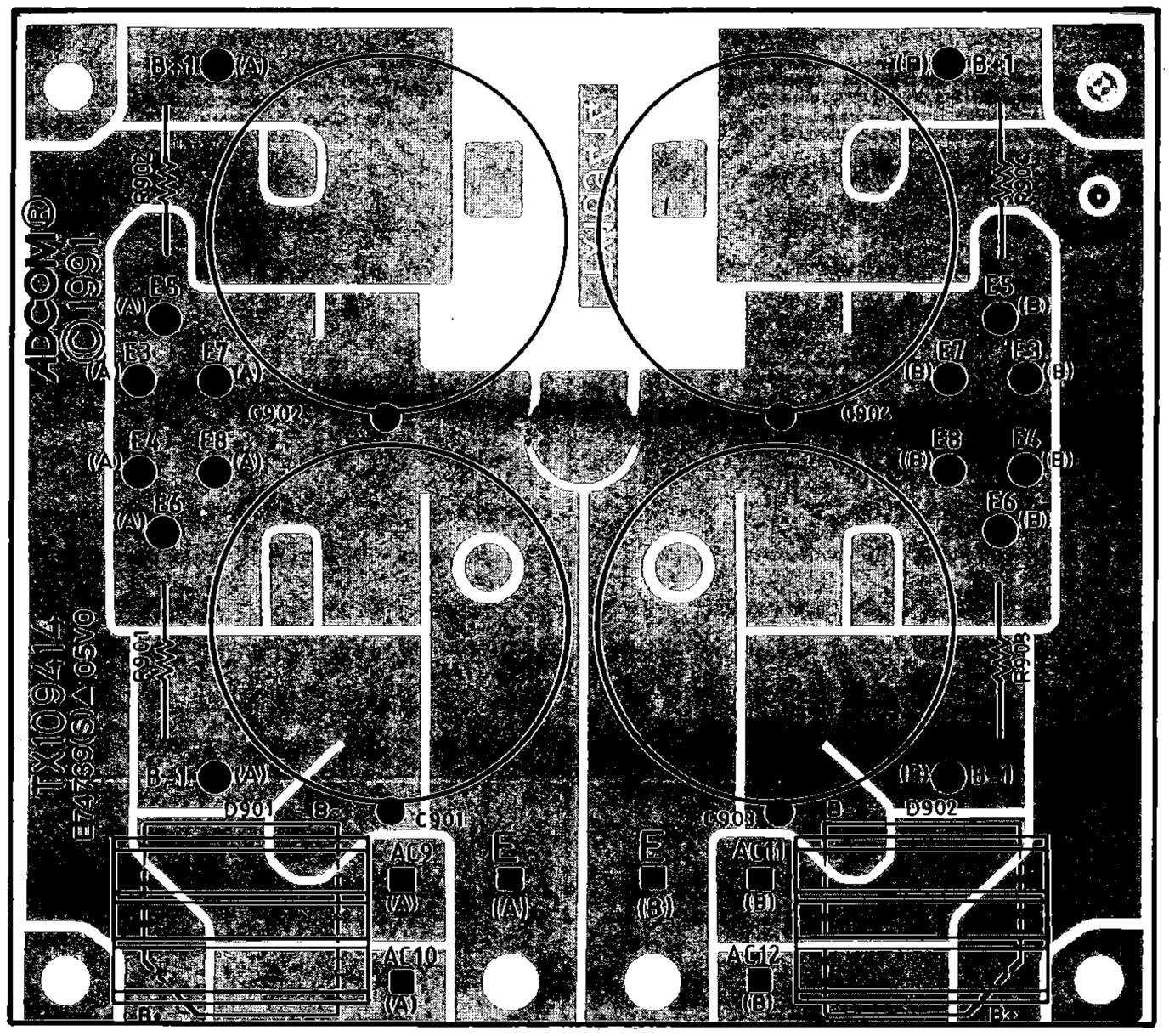
T001,T002	⚠	PT28910103	POWER TRANSFORMER, TT-289NF
S001	⚠	SH40000180	POWER SWITCH, BLACK, RGSCC711-R-B-B-O
F001 (120V) §	⚠	AGC-8/250V	BUSSMAN
	⚠	3AG312008/250V	LITTELFUSE
	⚠	CES14-8A/250V	SOC
F001	⚠	AGC-4/250V	BUSSMAN
(220V/240V) §	⚠	3AG312004/250V	LITTELFUSE
	⚠	3AG 4A/250V	BEL
	⚠	FD00000100	FUSE HOLDER, S-N2056#06
	⚠	CD00000220	AC POWER CORD, 4TR-670#5
	⚠	SC00000120	AC CORD STRAIN RELIEF, SR5KN-4
		VCRB2BPA	SPEAKER TERMINALS, ONE PER CHANNEL
		AA80001461	FRONT PANEL, BLACK, 2TQW-1#1 TFP-672
		AU00001122	TOP COVER, 3TQW-4
		FT00000230	RUBBER FOOT, FOUR PER UNIT 4TR-2823
		FT00000023	RUBBER FOOT, ONE PER UNIT 4TR-790B

* ROEDERSTEIN 1/4W 1%, ONLY, TO PRESERVE LOW NOISE CHARACTERISTICS

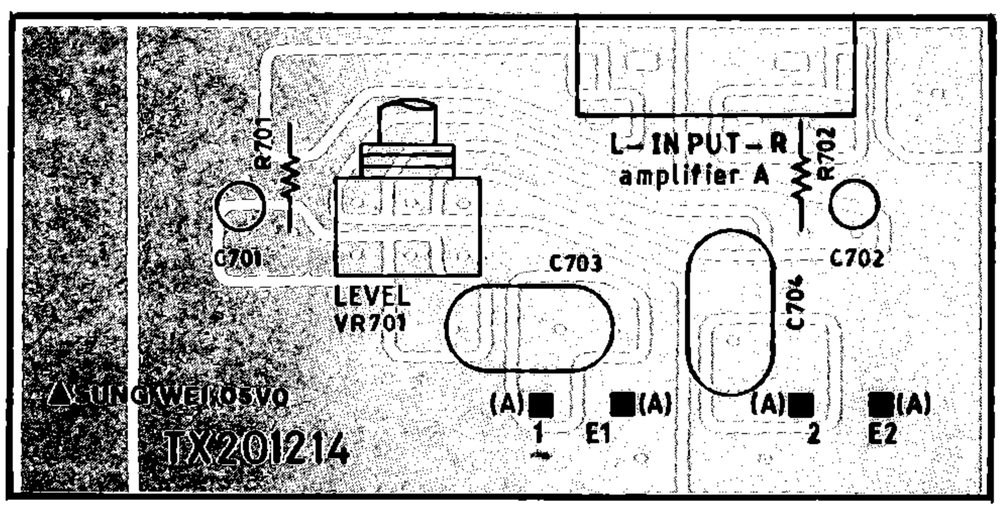
§ The fuses listed,and their time-current blowing points, have been carefully selected and thoroughly tested to deliver optimal performance while still accomplishing their protective functions. Replace these fuses, individually,only with the specific types listed. DO NOT USE ANY SUBSTITUTE FUSES WITH DIFFERENT RATINGS, TIME-CURRENT CURVES OR VALUES. Failure to observe this precaution may cause serious damage to the amplifier circuits, MAY CREATE A FIRE HAZARD, AND MAY VOID THE WARRANTY

⚠ Because of fire, shock and/or other hazards, parts identified by and listed with this sign **MUST** be replaced with the **IDENTICAL FACTORY PART** listed in the **SERVICE PARTS LIST.** No substitutions with other "equivalent" parts can be made.

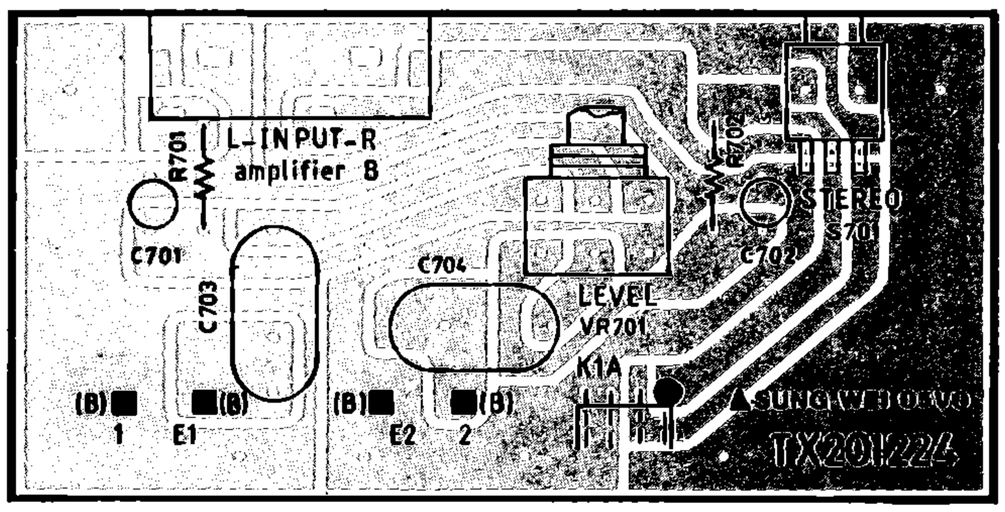
Filter Capacitor PCB



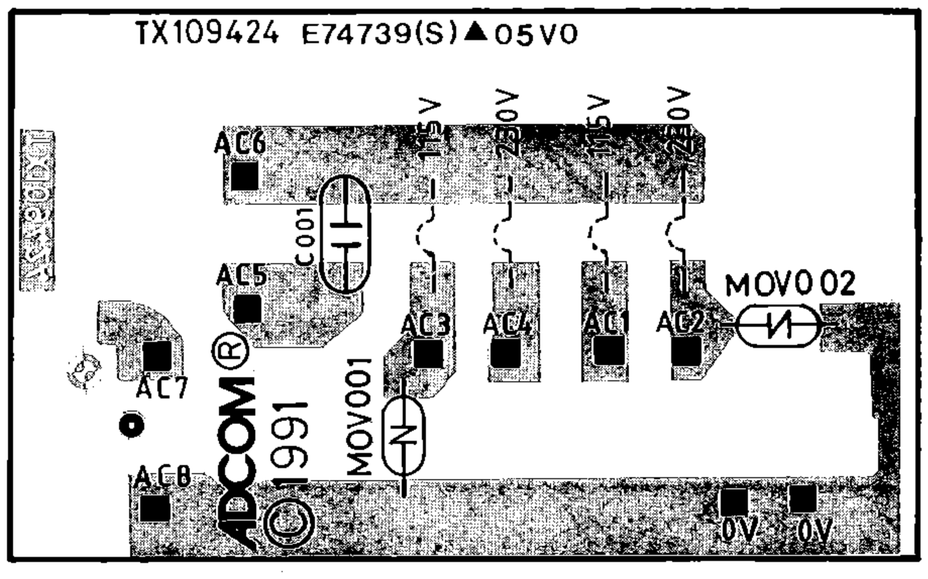
Amplifier A Input PCB



Amplifier B Input PCB

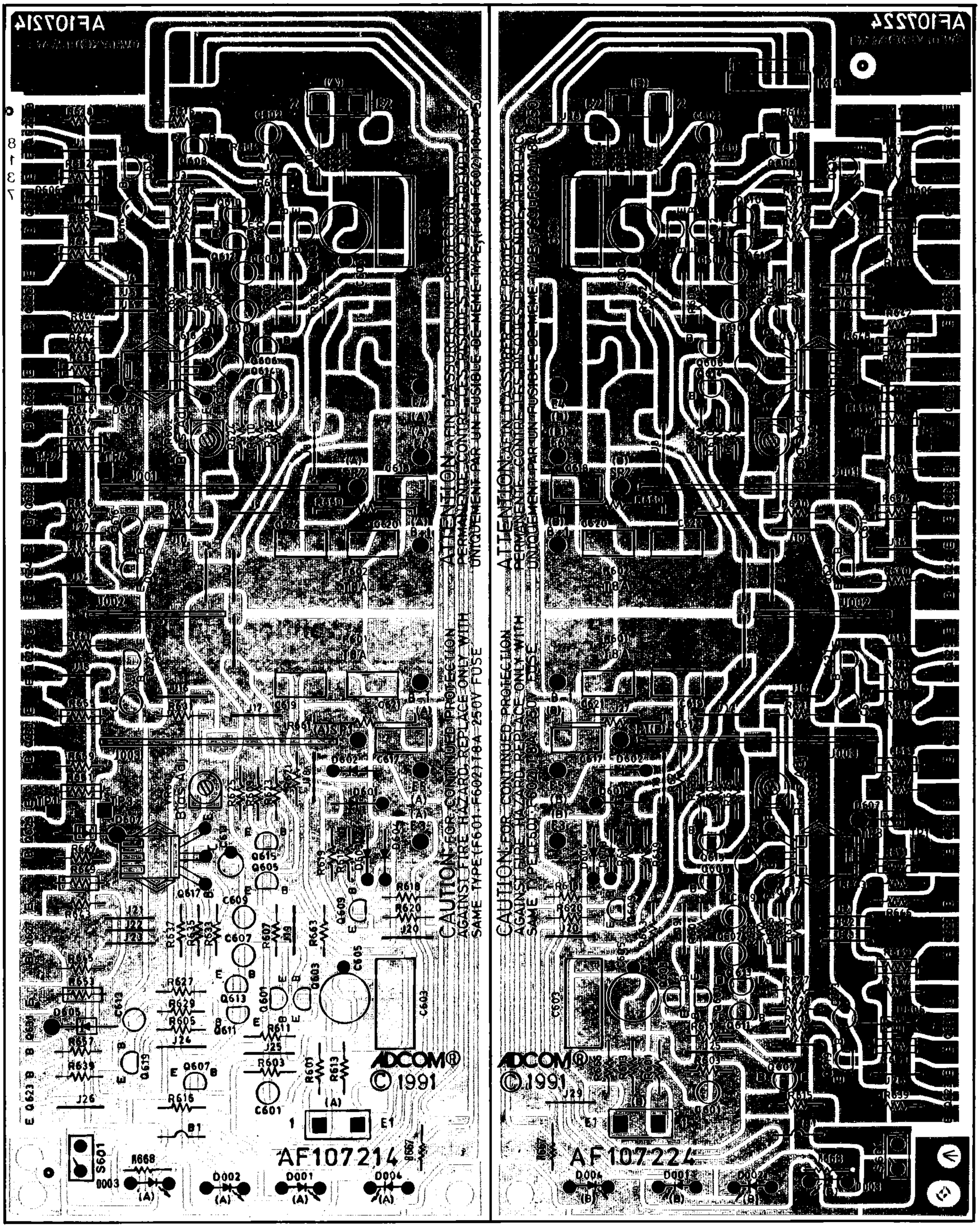


AC Input PCB



Amplifier A PCB

Amplifier B PCB



GFA-2535 SPECIFICATIONS

Power Rating (To FTC Requirements)

60 watts continuous average power into 8 ohms at any frequency between 20Hz and 20kHz with both channels driven at less than 0.06% THD.

90 watts continuous average power into 4 ohms at any frequency between 20Hz and 20kHz with both channels driven at less than 0.09% THD.

200 watts continuous average power into 8 ohms at any frequency between 20Hz and 20kHz at less than 0.09% THD, bridged, AMPLIFIER B only.

IM Distortion (SMPTE)

1 watt to 60 watts into 8 ohms ..... ≤ 0.05%
1 watt to 90 watts into 4 ohms ..... ≤ 0.07%

IM Distortion (CCIF, Any Combination from 4kHz to 20kHz)

60 watts into 8 ohms ..... ≤ 0.01%
90 watts into 4 ohms ..... ≤ 0.02%

THD + Noise at 60 Watts into 8 Ohms

20Hz 0.01%
1kHz 0.009%
10kHz 0.015%
20kHz 0.025%

THD + Noise at 90 Watts into 4 Ohms

20Hz 0.02%
1kHz 0.02%
10kHz 0.04%
20kHz 0.06%

IM Distortion, Bridged (SMPTE), AMPLIFIER B, Only

1 watt to 200 watts into 8 Ohms ..... ≤0.09%

IM Distortion, Bridged (CCIF, Any Combination from 4kHz to 20kHz), AMPLIFIER B, Only

200 watts into 8 Ohms ..... ≤0.02%

THD + Noise at 200 Watts into 8 Ohms, Bridged, AMPLIFIER B, only

20Hz 0.02%
1kHz 0.02%
10kHz 0.04%
20kHz 0.06%

Frequency Response @ 1 Watt into 8 Ohms

10Hz to 20kHz ..... +0, -0.5db

Power Bandwidth (-3dB) ..... 7Hz to 150kHz

Dynamic Headroom into 4 Ohms 1.5dB

Signal-to-Noise Ratio, "A" Weighted

60 watts into 8 ohms ..... ≥ 100dB

Gain 27dB

Input Impedance ..... >17,000 ohms

Input Sensitivity

60 watts into 8 ohms ..... 1.0V rms
1 watt into 8 ohms ..... 130mV rms

Input Sensitivity, Bridged, AMPLIFIER B, Only

200 watts into 8 ohms ..... 1.75V rms
1 watt into 8 ohms ..... 130mV rms

Damping Factor
20Hz to 20kHz ..... > 400

Rise Time
5kHz, 60V peak-to-peak square wave, 20% to 80% 2.3us

Semiconductor Complement ..... 66 transistors, 16 diodes, 2 diode bridges

Power Consumption (Continuous, Both Channels Driven)
Quiescent 65VA
Maximum 960VA
60 watts into 8 ohms 510VA
90 watts into 4 ohms 840VA

GENERAL

Power (available in 220-240VAC on special order) 110-120VAC/50-60Hz
Chassis Dimensions ..... 5"(127mm) x 17" (432mm) x 13" (330mm)
Maximum Dimensions ..... 5-½" (140mm) x 17" (432mm) x 14" (356mm)
Weight ..... 32 lbs.(15kg)
Weight, Packed ..... 35 lbs.(16kg)

Specifications subject to change without notice.

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FD2970

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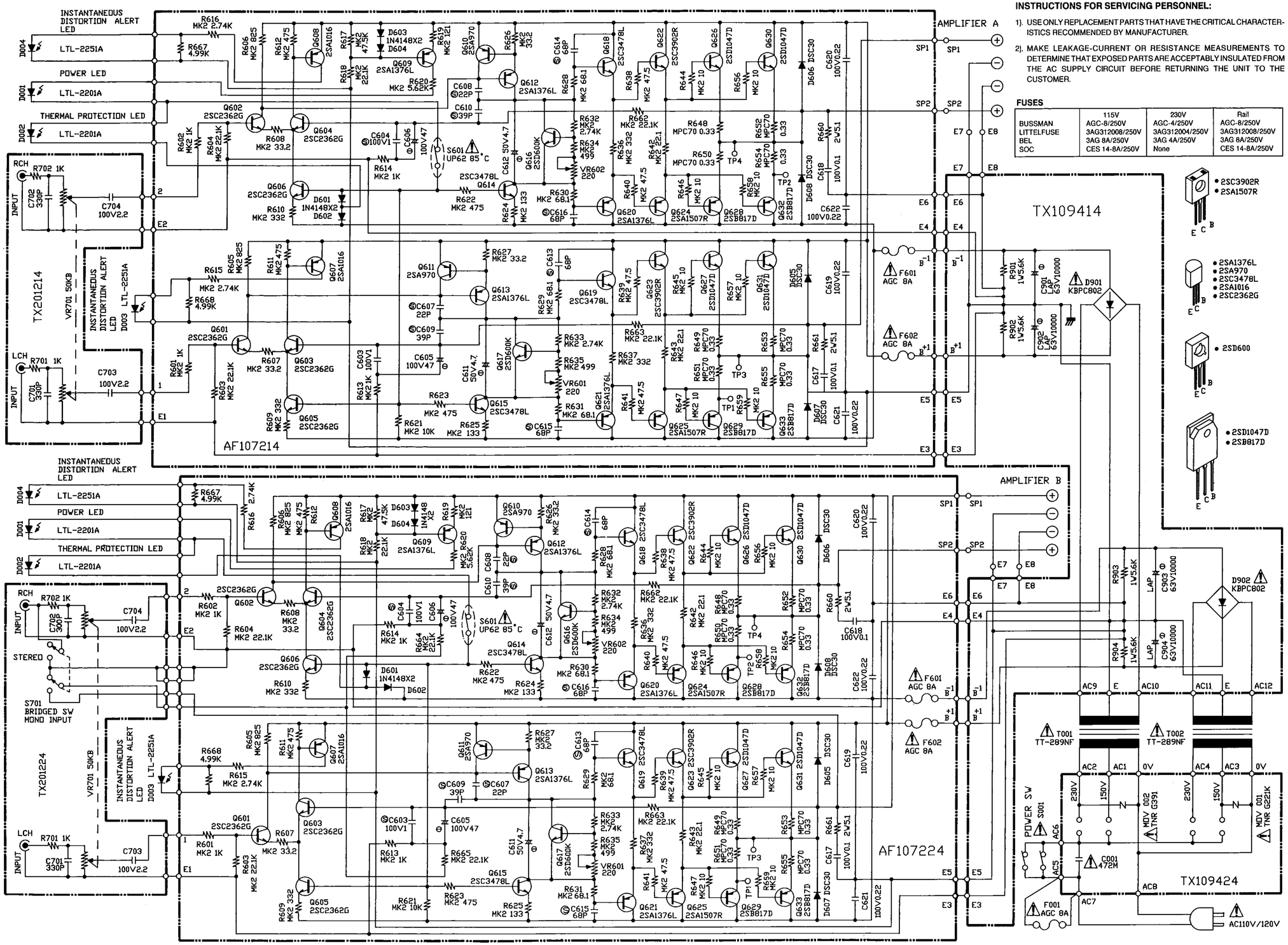
Schematic Diagram Model GFA-2535

NOTE: ADCOM RESERVES THE RIGHT TO MODIFY CIRCUITRY AND/OR CHANGE COMPONENTS TO UPGRADE PRODUCT WITHOUT PRIOR NOTICE OR INCURRING ANY LIABILITY.



INSTRUCTIONS FOR SERVICING PERSONNEL:

1). USE ONLY REPLACEMENT PARTS THAT HAVE THE CRITICAL CHARACTERISTICS RECOMMENDED BY MANUFACTURER.

2). MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE AC SUPPLY CIRCUIT BEFORE RETURNING THE UNIT TO THE CUSTOMER.

FUSES

	115V	230V	Rail
BUSSMAN	AGC-8/250V	AGC-4/250V	AGC-8/250V
LITTELFUSE	3AG312008/250V	3AG312004/250V	3AG312008/250V
BEL	3AG 8A/250V	3AG 4A/250V	3AG 8A/250V
SOC	CES 14-8A/250V	None	CES 14-8A/250V