



BM15A Service Manual

Revision **3.0** / 2002

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IMPORTANT:

The BM15A amplifier has been redesigned: the "Mk. II" version.

The main differences are:

- Low voltage supply has now its own secondary taps on the transformer.
- Voltage selector is now a rotary switch type.
- New test points added.
- Test point numbers are changed (Please refer to the schematics).
- Mounting depth. Capacitors C2 and C3 are higher than on the Mk.I module
- a Mk. II module does NOT fit into a speaker cabinet designed for a Mk. I module.

BM15As with serial no. LOWER than 695960 are fitted with the Mk. II module,
- however exceptions might occur...

Precautions:

Servicing should be undertaken only by a qualified person and in a proper workshop environment, with anti-static precautions taken and a full compliment of tools and instruments.

If powering up the module out of its cabinet beware of mains voltage on the mains connector, switches and capacitor.

Possible Faults

If a single LF or HF drive unit seems to have failed then remove and test it. However, if there is no output at all, the amp module may be faulty.

If no LED is lit then first check the mains fuse and replace it with the correct value for the mains voltage used if necessary, if the mains fuse is intact the internal fuses may have blown.

If the red LED is lit it means that the power MOSFET mounting bracket has overheated (more than 70°C) or a DC voltage has arisen at an amp output.

Disassembly

The drive units and the amp module are held in place using Allen head M4 bolts. These should be moderately tight; the factory setting is correct, do not over-tighten.

Drive Units

Support the weight of the drivers while removing the bolts; they must not hang on their wires. The color code for the bass driver is red to the positive terminal and black to the negative; the tweeter wiring is blue to the positive and black to the negative. The black wires are interchangeable. Be careful not to bring anything into contact with the diaphragms, especially the tweeter, which is easily damaged.

Replacement Driver Part Numbers

Driver	Description	DA Item No.	TC order code
Tweeter	D-260 DA with protector	81622	795005011
Woofers	24W100XL04 DA	87581	795026011

Amp Module

The amp module can be taken out with the cabinet face down if it is certain that nothing impinges on the drive units or LED's, but it is best removed with the speaker standing vertically on a solid support with access all round. The bolts should first be loosened so that they can subsequently be removed with one hand while supporting the weight of the module (it's heavy) with the other hand by holding the heatsink.

When all the bolts are out, withdraw the module a little way and unlatch the small 4-pin connector and LED cable at the top of the circuit board. The large 4-pin connector with speaker wires towards the bottom of the board needs to be rocked slightly from side to side while disconnecting, taking care not to bend the pins.

Fault Finding

If powering up the module out of its cabinet beware of mains voltage on the mains connector, switches and capacitor.

Connect the extension lead for the LED's but not for the drive units. Inspect the on-board fuses. If they are blown the likely cause is failed output MOSFETs.

To test the MOSFETs, look for a low resistance between positive and negative power rails, putting meter probes on the sources of a pair of MOSFETs (pinout: 1-gate, 2-drain, 3-source. Please refer to figure 1) or on the right hand side terminals of R2 & R3. Both MOSFETs in an output pair will usually fail and to trace which pair, test for a low gate/source or gate/drain resistance. These devices effectively go to short circuit when blown. Replace MOSFETs in pairs.

N.B. Q14 & Q15 must be replaced with a matched pair which must be obtained from the manufacturer.

The drain resistors R60, R61, R90, R91, R102, R103 and the driver transistors Q6, Q8, Q10, Q13 should be tested if the MOSFETs are blown.

If the HF amp MOSFETs has failed please test the HF limiter circuit Zeners (ZD8 & ZD9) with a diode tester and test the lightbulb (LDR1-A) with a resistance tester.

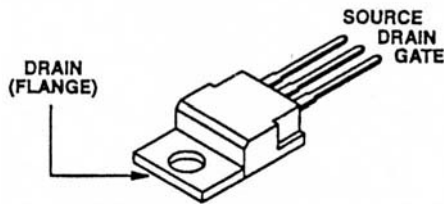


Figure 1 -Pin configuration of Transistors in BM6A

A rare fault might be for example the failure of a single MOSFET or a driver transistor or op-amp, or the relay drive circuit itself may be faulty.

If the module can be powered up without blowing the on-board fuses, check PSU voltages on R2 and R3. Voltages on the right hand side terminals are nominally +/-51V, and on the left hand side, +/-28V. The low voltage power supply is +/-12V measured at the supply pins of the op-amps. If PSU voltage (close to +/-15V) appears on any of the op-amp outputs (pins 1 & 7 on U1 - U6), this would show a fault in the signal handling circuitry.

To find a DC voltage at a power amp output, measure the voltages on the MOSFET mounting tabs, these are connected to their drains which are effectively the output, and are close to 0V when the circuit is working properly. DC voltage can't be measured at the output terminals because these will be out of circuit if the relay is open.

Replacing Components

To remove the PCB desolder the transformer and XLR wires. Remove the thermal switch nut and bolt and the MOSFET mounting clip screws, not allowing the clips to rotate. Desolder the XLR connector wires, remove the screws holding the board and lift it off. The heatsink mounting pads may have stuck the MOSFETs to the bracket, if so, put a small screwdriver to the edge of each MOSFET and gently tap it sideways to free it.

If MOSFETs are to be replaced, make sure they sit at exactly the same height and reach as the original devices. It is essential for reliability to ensure that the MOSFETs have a proper, high pressure mounting to the heatsink.

Bend the pins of the MOSFETs in order to get correct position before mounting/soldering using a flatnose plier without stressing the devices.

LDR/Lightbulb assembly: Solder the LDR on the circuit board and bend the legs of the bulb so the bulb lies flat on top of the LDR. Solder the bulb and fit the heatsink tube on top. Shrink the tube and while the glue in it is still hot, close the top with a flat nose plier forming a light tight "hat" for the lamp/LDR.

Reassembly

Replace the board and the securing screws leaving a little vertical play. Use high efficiency heatsink pads (Bergquist Sil-Pad K-10-43) to mount the MOSFETs and thermal switch. Make sure the mounting clips are level and tighten them all the way.

Resolder the transformer and XLR wires. Finally locate the heads of thermistors R54 and R85 inside the mounting tab holes of their respective MOSFETs, and apply ample heatsink paste in the hole and around the heads.

Setting Quiescent Current

Install T1A fuses in case there is a fault remaining. Check that there is a high resistance between +51V and -51V power rails, and set the Iq preset (VR1 / VR2) on the channel whose devices have been replaced, to zero resistance. N.B. Grey 10mm presets have zero resistance turned clockwise. blue 6mm presets -anticlockwise. Check for zero resistance across thermistor terminals.

Power up the module monitoring the voltage between test points for the faulty / replaced section.

The mains voltage must be 230V (or 115V if selected) and should be monitored during setting of the quiescent current. If it is found to be more than 2% out, a variac should be used to set it correctly. The Iq settings have an NTC characteristic, i.e. the tendency is for current to reduce as temperature increases. For example, when the module has been driven hard for a period of time and is quite hot, the settings will be up to 20% down.

The quiescent current must be re-adjusted about two minutes after switch on from cold.

The voltage in the HF section is to be set to

Mk. I module:	TP2-TP1	28mV
Mk. II module:	TP7-TP8	28mV

The LF section is more complex. Two voltages must add to give 28mV. The voltage across R90 and R91 is each to be nominally 14mV. (e.g. the respective voltages might actually be 12mV and 16mV).

Mk. I module:	TP3-TP7 + TP4-TP7	Sum = 28mV
Mk. II module:	TP5-TP2 + TP6-TP2	Sum = 28mV

Similarly, on the negative supply side, the voltages are nominally -14mV. This should be easy to understand on examining the circuit diagram.

Mk. I module:	TP5-TP8 + TP6-TP8	Sum = 28mV
Mk. II module:	TP3-TP1 + TP4-TP1	Sum = 28mV

If all is well replace the fuses with spiral wound T3.15A type.

Verifying Frequency Response

Measure the frequency response at the output terminals. The gain switch should be set to +4, and the trim pots first set to maximum. The generator signal should be -10dBu.

First measure the LF output, which is presented to the bottom pin on the speaker connector. Make two runs: the first run with the LF trim pot set to +3dB (max), the second with the pot set to -3dB (min). Measure the HF output next (top speaker pin), again make two runs: first run with the HF trim pot set to +3dB (max) second set to -3dB (min).

The output should be within +/-1 dB of the values shown below:

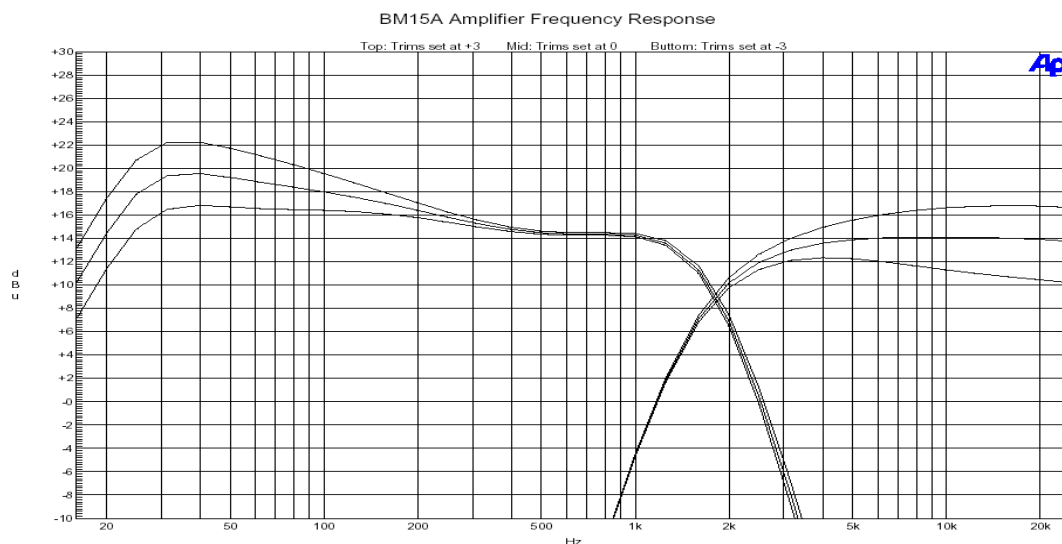


Figure 2: Amplifier Frequency Response, Input: -10dBu

LF Amp. Freq	trim -3 dBu	trim +3 dBu	HF Amp. Freq	trim -3 dBu	trim +3 dBu
20 Hz	11,3	17,4	500 Hz	-29,4	-29,2
25 Hz	14,8	20,7	630 Hz	-20,7	-20,6
31,5 Hz	16,5	22,2	800 Hz	-12,1	-12,0
40 Hz	16,8	22,2	1 kHz	-4,7	-4,5
50 Hz	16,7	21,7	1,25 kHz	1,6	1,9
63 Hz	16,6	21,1	1,6 kHz	6,8	7,4
80 Hz	16,5	20,3	2 kHz	9,7	10,6
100 Hz	16,4	19,6	2,5 kHz	11,3	12,6
125 Hz	16,3	18,8	3,15 kHz	12,1	14,0
160 Hz	16,1	17,9	4 kHz	12,3	14,9
200 Hz	15,8	17,0	5 kHz	12,3	15,6
250 Hz	15,4	16,2	6,3 kHz	12,0	16,1
315 Hz	15,0	15,5	8 kHz	11,6	16,4
400 Hz	14,6	14,9	10 kHz	11,3	16,6
500 Hz	14,4	14,6	12,5 kHz	11,0	16,8
630 Hz	14,3	14,5	16 kHz	10,7	16,8
800 Hz	14,3	14,5	20 kHz	10,4	16,8
1 kHz	14,1	14,4	25 kHz	10,2	16,7
1,25 kHz	13,4	13,8			
1,6 kHz	11,0	11,6			
2 kHz	6,5	7,4			
2,5 kHz	-0,3	1,1			
3,15 kHz	-8,8	-6,9			
4 kHz	-18,6	-16,0			
5 kHz	-28,2	-24,8			
6,3 kHz	-38,4	-34,2			

Table 1: Amplifier Frequency Response, Input: -10dBu

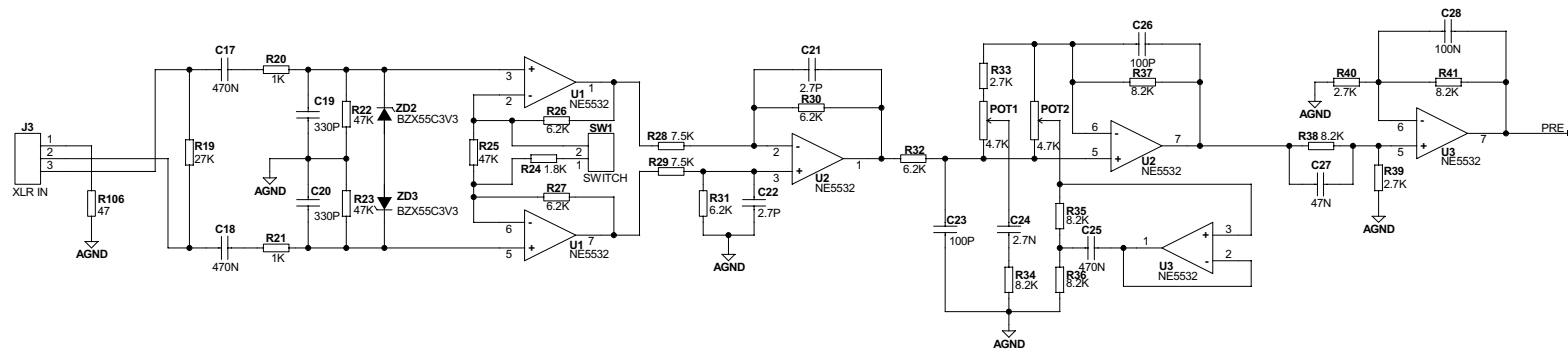
Mk. I module Part List:

Ref.	Value	Description	Type	Ref.	Value	Description	Type
BR 1	FB-2502L			POT1	POT 4K7 Hex Adj.		
C1	47n 250V 5%	Polyester 5mm		POT2	POT 4K7 Hex Adj.		
C2, C3	10000u 63V	Electrolytic 10mm pitch			Meggit Piher PT10MV4K7		
C4, C5	100u 35V	Electrolytic 2.5mm pitch			Meggit Piher PT10MV4K7		
C6 - C9	100n 100V	Ceramic 2.5mm		Q1	BC546A		
C10, C11	10u 16V	Tantalum 2.5mm		Q2	BC556A		
C12, C13	22u 63V	Bipolar Electrolytic 3.5mm		Q3, Q4	BC546A		
C14	220u 16V	Electrolytic 2.5mm pitch		Q5	BC556A		
C15, C16	100u 35V	Electrolytic 2.5mm pitch		Q6	BC546A		
C17, C18	470n 100V 5%	Polyester 7.5mm		Q7	IRF5210 INT. RECTIFIER ONLY		
C19, C20	330p 100V	COG Ceramic 2.5mm		Q8	BC556A		
C21, C22	2p7 100V 5%	Ceramic 2.5mm		Q9	IRF540 INT. RECTIFIER ONLY		
C23	100p 100V	Ceramic 2.5mm		Q10	BC546A		
C24	2n7 50V	Polyester 5mm		Q11, Q12	IRF5210 INT. RECTIFIER ONLY		
C25	470n 100V 5%	Polyester 7.5mm		Q13	BC556A		
C26	100p 100V	Ceramic 2.5mm		Q14 / Q15	IRF540 MATCHED PAIR IR ONLY		
C27	47n 250V 5%	Polyester 5mm					
C28	100n 100V 5%	Polyester 5mm		R1	10R 1W 5% PRO1		
C29	47n 250V 5%	Polyester 5mm		R2, R3	470R 2.5W 5% AC03		
C30	3n3 100V 5%	Polyester 5mm					
C31, C32	4n7 400V	Polyester 5mm		R4	10R 0.6W 1% MRS25		
C33	10n 400V	Polyester 5mm		R5 - R8	22K 0.6W 1% MRS25		
C34	330n 100V	Polyester 7.5mm		R9	270K 0.6W 1% MRS25		
C35	10n 400V	Polyester 5mm		R10, R11	56K 0.6W 1% MRS25		
C36 - C48	100n 100V	Ceramic 2.5mm		R12	270K 0.6W 1% MRS25		
C49	150p 100V 5%	COG Ceramic 2.5mm		R13	470R 0.6W 1% MRS25		
C50	330p 100V	COG Ceramic 2.5mm		R14	10K 0.6W 1% MRS25		
C51	150p 100V 5%	COG Ceramic 2.5mm		R15	10R 0.6W 1% MRS25		
C52	100n 100V	Ceramic 2.5mm		R16	1K0 0.6W 1% MRS25		
C53, C54	22n 100V	Ceramic 2.5mm		R17	330R 2.5W 5% AC03		
C55	15n 100V 5%	Polyester 5mm		R18	1K0 0.6W 1% MRS25		
C56	22n 400V	Polyester 5mm		R19	27K 0.6W 1% MRS25		
C57	4n7 400V	Polyester 5mm		R20, R21	1K0 0.6W 1% MRS25		
C58	22n 400V	Polyester 5mm		R22, R23	47K 0.6W 1% MRS25		
C59	4n7 400V	Polyester 5mm		R24	1K8 0.6W 1% MRS25		
C60, C61	220n 100V 5%	Polyester 7.5mm		R25	47K 0.6W 1% MRS25		
C62	470n 100V 5%	Polyester 7.5mm		R26, R27	6K2 0.6W 1% MRS25		
C63	15n 100V 5%	Polyester 5mm		R28, R29	7K5 0.6W 1% MRS25		
C64	220u 63V	Electrolytic 5mm pitch		R30 - R32	6K2 0.6W 1% MRS25		
C65	330p 100V	COG Ceramic 2.5mm		R33	2K7 0.6W 1% MRS25		
C66, C67	100n 100V	Ceramic 2.5mm		R34 - R38	8K2 0.6W 1% MRS25		
C68	22n 100V	Ceramic 2.5mm		R39, R40	2K7 0.6W 1% MRS25		
C69	100n 100V	Ceramic 2.5mm		R41	8K2 0.6W 1% MRS25		
C70	150p 100V 5%	COG Ceramic 2.5mm		R42	3K3 0.6W 1% MRS25		
C71	100n 100V	Ceramic 2.5mm		R43, R44	100R 0.6W 1% MRS25		
C72	100n 100V	Ceramic 2.5mm		R45	6K8 0.6W 1% MRS25		
C73	22n 100V	Ceramic 2.5mm		R46	36K 0.6W 1% MRS25		
C74	15n 100V 5%	Polyester 5mm		R47	13K 0.6W 1% MRS25		
C75 - C87	100n 100V	Ceramic 2.5mm		R48	2K7 0.6W 1% MRS25		
				R49	470R 0.6W 1% MRS25		
D1	1N4002			R50	3K0 0.6W 1% MRS25		
D2	1N4148 NATIONAL/FAIRCHILD ONLY			R51, R52	240R 0.6W 1% MRS25		
D3, D4	1N4002			R53	3K0 0.6W 1% MRS25		
D5, D6	1N4148 NATIONAL/FAIRCHILD ONLY			R54	15K NTC PHILIPS		
D7 - D12	1N4002			R55	10K 0.6W 1% MRS25		
D13	1N4148 NATIONAL/FAIRCHILD ONLY			R56	510R 0.6W 1% MRS25		
F1, F2	FUSE 3.15AT	Spiral Wound 20x5mm		R57	220R 0.6W 1% MRS25		
				R58	100R 0.6W 1% MRS25		
K1	Relay 12V/5A DPNO			R59	1K5 1W 5% PRO1		
	Omron G5Z-2A 12V			R60, R61	0R22 2.5W 5% AC03		
				R62, R63	100R 0.6W 1% MRS25		
LDR1	LDR ORP12 10mm dia.			R64	1K5 1W 5% PRO1		
LDR1-A	BULB 12V 80mA	Wire ended Ø5MM		R65	470R 0.6W 1% MRS25		
				R66	220R 0.6W 1% MRS25		

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Mk. I module Part List, continued:

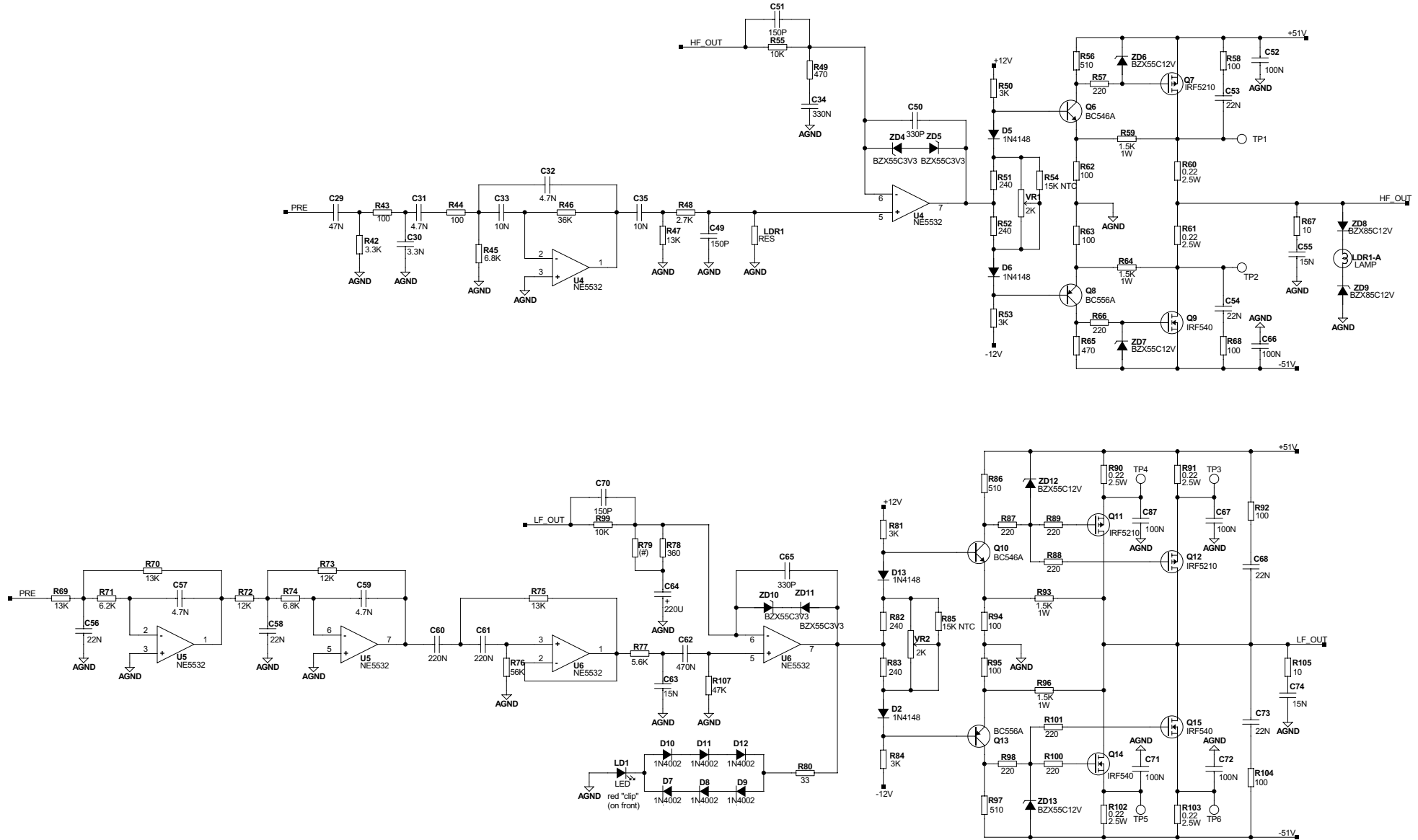
Ref.	Value	Description	Type	Ref.	Value	Description	Type
R67	10R	1W 5%	PRO1	S2	67L070	THERMAL SWITCH	AIRPAX
R68	100R	0.6W 1%	MRS25	SW1	S/W TOGGLE	.5VA TT SERIES	
R69, R70	13K	0.6W 1%	MRS25	U1 - U6	NE5532N		
R71	6K2	0.6W 1%	MRS25	U7	7812CT		
R72, R73	12K	0.6W 1%	MRS25	U8	7912CT		
R75	13K	0.6W 1%	MRS25	VR1, VR2	2K POT	1/4" Sealed Cermet, TopAdj.	
R76	56K	0.6W 1%	MRS25	ZD1	BZX85C12V	12V 1.3W	
R77	5K6	0.6W 1%	MRS25	ZD2 - ZD5	BZX55C3V3	3.3V 0.5W	
R78	360R	0.6W 1%	MRS25	ZD6, ZD7	BZX55C12V	12V 0.5W	
R80	33R	0.6W 1%	MRS25	ZD8, ZD9	BZX85C12V	12V 1.3W	
R81	3K0	0.6W 1%	MRS25	ZD10, ZD11	BZX55C3V3	3.3V 0.5W	
R82, R83	240R	0.6W 1%	MRS25	ZD12, ZD13	BZX55C12V	12V 0.5W	
R84	3K0	0.6W 1%	MRS25				
R85	15K	NTC	PHILIPS				
R86	510R	0.6W 1%	MRS25				
R87 - R89	220R	0.6W 1%	MRS25				
R90, R91	0R22	2.5W 5%	AC03				
R92	100R	0.6W 1%	MRS25				
R93	1K5	1W 5%	PRO1				
R94, R95	100R	0.6W 1%	MRS25				
R96	1K5	1W 5%	PRO1				
R97	510R	0.6W 1%	MRS25				
R98	220R	0.6W 1%	MRS25				
R99	10K	0.6W 1%	MRS25				
R100, R101	220R	0.6W 1%	MRS25				
R102, R103	0R22	2.5W 5%	AC03				
R104	100R	0.6W 1%	MRS25				
R105	10R	1W 5%	PRO1				
R106, R107	47R	0.6W 1%	MRS25				



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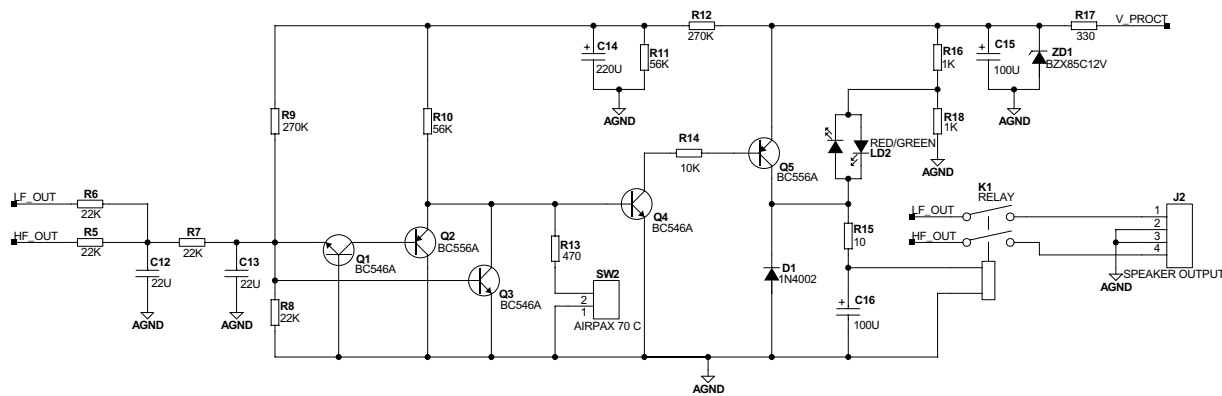
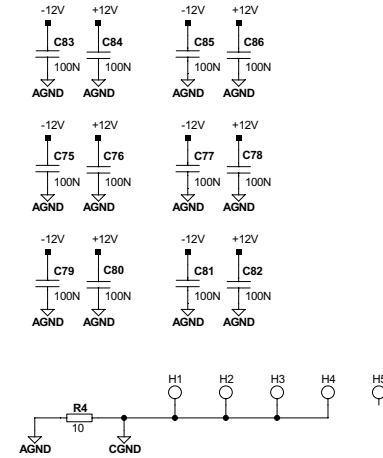
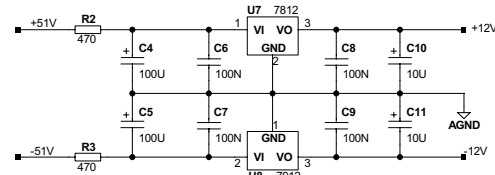
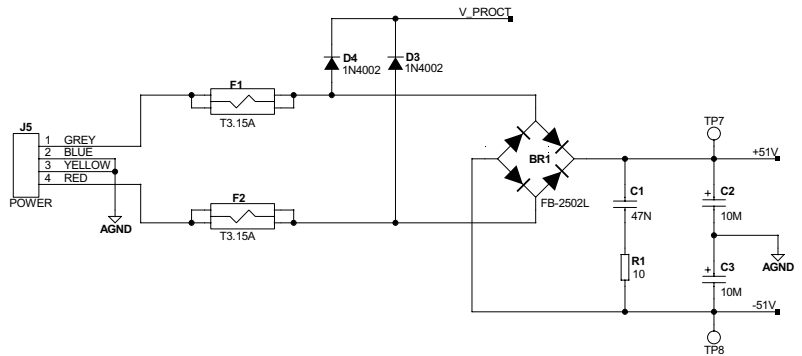
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Designer
CM / JVO



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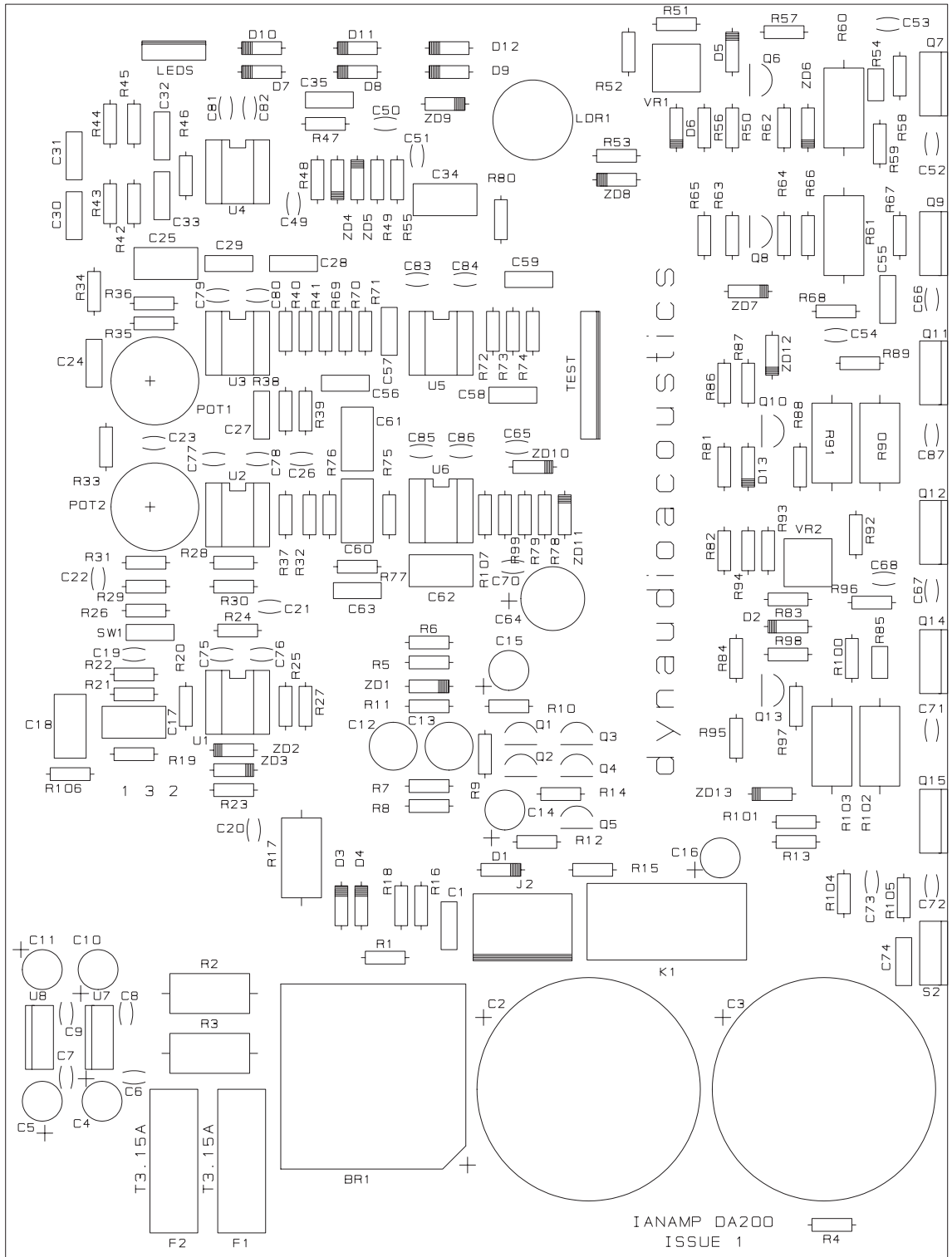
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BM15A		PSU AND PROTECTION	
Number	Revision	Previous page	
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Date	Filename	Page / of	
9-7-2001 15:00	BM15A.3	3 / 3	

Mk. I module Circuit Board Component Layout



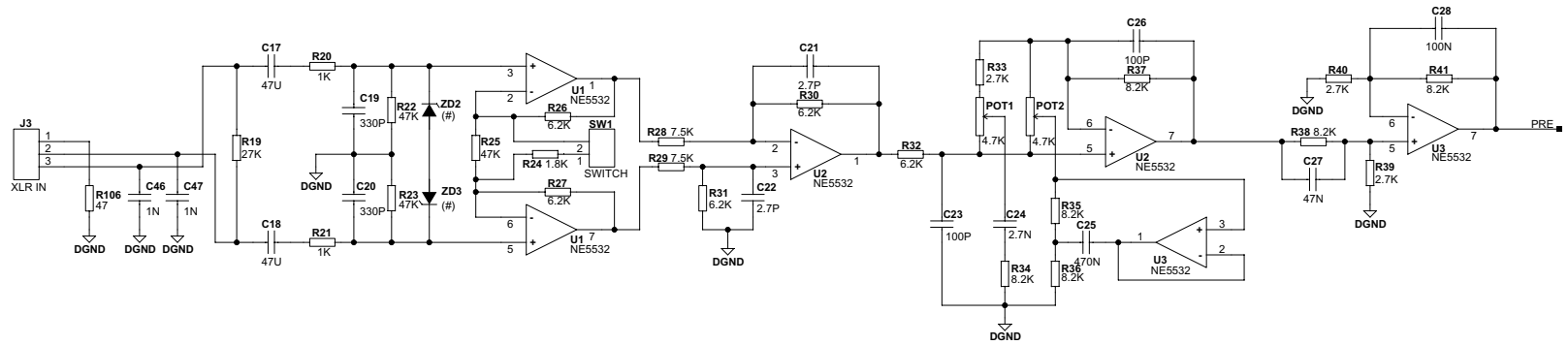
Mk. II module Part List:

Ref.	Value	Description	Type	Ref.	Value	Description	Type
BR 1	FB-2502L			LDR1	LDR NORP-12	10mm dia.	
BR 2	DB152			LDR1-A	BULB 12V 80mA	Wire ended Ø5MM	
C1	47n	250V 5%	Polyester 5mm	K1	Relay 12V/5A DPNO		
C2, C3	10000u	63V	Electrolytic 10mm pitch		Omron G5Z-2A	12V	
C4 - C9	100n	100V	Ceramic 2.5mm	POT1	POT 4K7 Hex Adj.		
C10, C11	10u	16V	Tantalum 2.5mm		Meggitt Piher PT10MV4K7		
C12, C13	22u	63V	Bipolar Electrolytic 3.5mm	POT2	POT 4K7 Hex Adj.		
C14	220u	16V	Electrolytic 2.5mm pitch		Meggitt Piher PT10MV4K7		
C15, C16	100u	35V	Electrolytic 2.5mm pitch	Q1	BC546A		
C17, C18	470n	100V 5%	Polyester 7.5mm	Q2	BC556A		
C19, C20	330p	100V	COG Ceramic 2.5mm	Q3, Q4	BC546A		
C21, C22	2p7	100V 5%	Ceramic 2.5mm	Q5	BC556A		
C23	100p	100V	Ceramic 2.5mm	Q6	BC546A		
C24	2n7	50V	Polyester 5mm	Q7	IRF5210 INT. RECTIFIER ONLY		
C25	470n	100V 5%	Polyester 7.5mm	Q8	BC556A		
C26	100p	100V	Ceramic 2.5mm	Q9	IRF540 INT. RECTIFIER ONLY		
C27	47n	250V 5%	Polyester 5mm	Q10	BC546A		
C28	100n	100V 5%	Polyester 5mm	Q11, Q12	IRF5210 INT. RECTIFIER ONLY		
C29	47n	250V 5%	Polyester 5mm	Q13	BC556A		
C30	3n3	100V 5%	Polyester 5mm	Q14 / Q15	IRF540 MATCHED PAIR IR ONLY		
C31, C32	4n7	400V	Polyester 5mm	R1	10R 1W 5% PRO1		
C33	10n	400V	Polyester 5mm	R2, R3	470R 2.5W 5% AC03		
C34	330n	100V	Polyester 7.5mm	R4	10R 0.6W 5%		
C35	10n	400V	Polyester 5mm	R5 - R8	22K 0.6W 5%		
C36 - C45	100n	100V	Ceramic 2.5mm	R9	270K 0.6W 5%		
C46, C47	1n	100V	Ceramic 2.5mm	R10, R11	56K 0.6W 5%		
C48	100n	100V	Ceramic 2.5mm	R12	270K 0.6W 5%		
C49	150p	100V 5%	COG Ceramic 2.5mm	R13	Not used		
C50	330p	100V	COG Ceramic 2.5mm	R14	10K 0.6W 5%		
C51	150p	100V 5%	COG Ceramic 2.5mm	R15	10R 0.6W 5%		
C52	100n	100V	Ceramic 2.5mm	R16	1K0 0.6W 5%		
C53, C54	22n	100V	Ceramic 2.5mm	R17	56R 2.5W 5% AC03		
C55	33n	100V	Ceramic 5mm	R18	1K0 0.6W 5%		
C56	22n	400V	Polyester 5mm	R19	27K 0.6W 5%		
C57	4n7	400V	Polyester 5mm	R20, R21	1K0 0.6W 5%		
C58	22n	400V	Polyester 5mm	R22, R23	47K 0.6W 5%		
C59	4n7	400V	Polyester 5mm	R24	1K8 0.6W 5%		
C60, C61	220n	100V 5%	Polyester 7.5mm	R25	47K 0.6W 5%		
C62	470n	100V 5%	Polyester 7.5mm	R26, R27	6K2 0.6W 5%		
C63	15n	100V 5%	Polyester 5mm	R28, R29	7K5 0.6W 5%		
C64	220u	63V	Electrolytic 5mm pitch	R30 - R32	6K2 0.6W 5%		
C65	330p	100V	COG Ceramic 2.5mm	R33	2K7 0.6W 5%		
C66, C67	100n	100V	Ceramic 2.5mm	R34 - R38	8K2 0.6W 5%		
C68	22n	100V	Ceramic 2.5mm	R39, R40	2K7 0.6W 5%		
C69	100n	100V	Ceramic 2.5mm	R41	8K2 0.6W 5%		
C70	150p	100V 5%	COG Ceramic 2.5mm	R42	3K3 0.6W 5%		
C71	100n	100V	Ceramic 2.5mm	R43, R44	100R 0.6W 5%		
C72	100n	100V	Ceramic 2.5mm	R45	6K8 0.6W 5%		
C73	22n	100V	Ceramic 2.5mm	R46	36K 0.6W 5%		
C74	33n	100V	Ceramic 5mm	R47	13K 0.6W 5%		
C75 - C91	100n	100V	Ceramic 2.5mm	R48	2K7 0.6W 5%		
C92, C93	33n	100V	Ceramic 5mm	R49	470R 0.6W 5%		
C94, C95	470u	35V	Electrolytic 5mm pitch	R50	1K21 0.6W 1%		
D1	1N4002			R51, R52	240R 0.6W 5%		
D2	1N4148	NATIONAL/FAIRCHILD ONLY		R53	3K0 0.6W 5%		
D3, D4	1N4002			R54	15K NTC PHILIPS		
D5, D6	1N4148	NATIONAL/FAIRCHILD ONLY		R55	10K 0.6W 5%		
D7 - D12	1N4002			R56	510R 0.6W 5%		
D13	1N4148	NATIONAL/FAIRCHILD ONLY					
F1, F2	FUSE 3.15AT	Bussman S504					
F2, F3	FUSE 500mAT	Bussman S504					

- continued on next page.

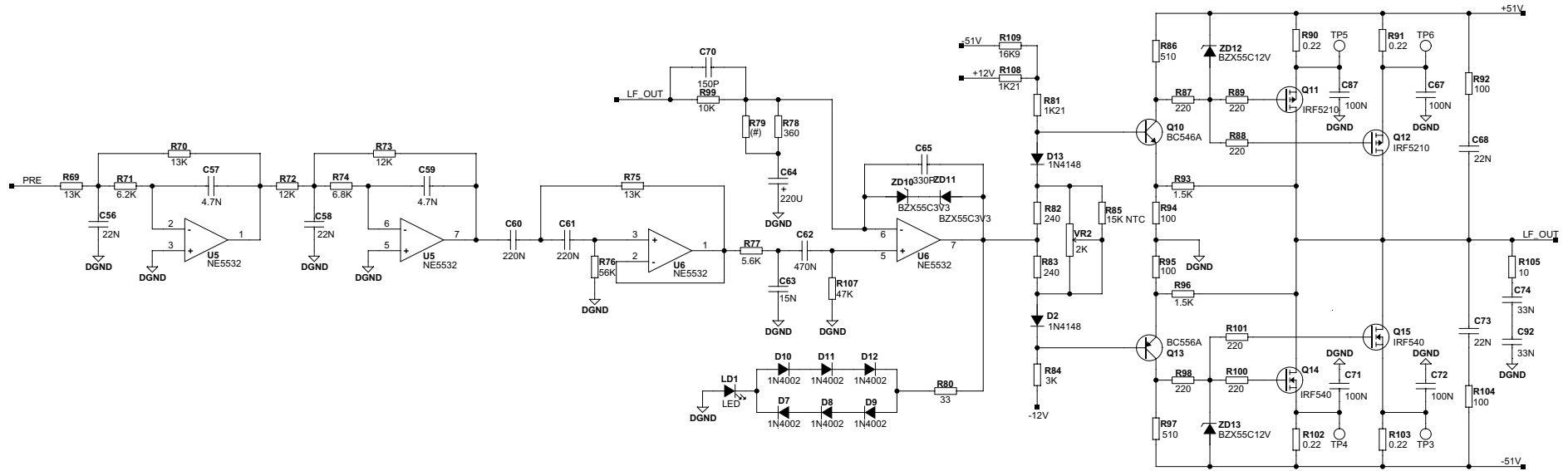
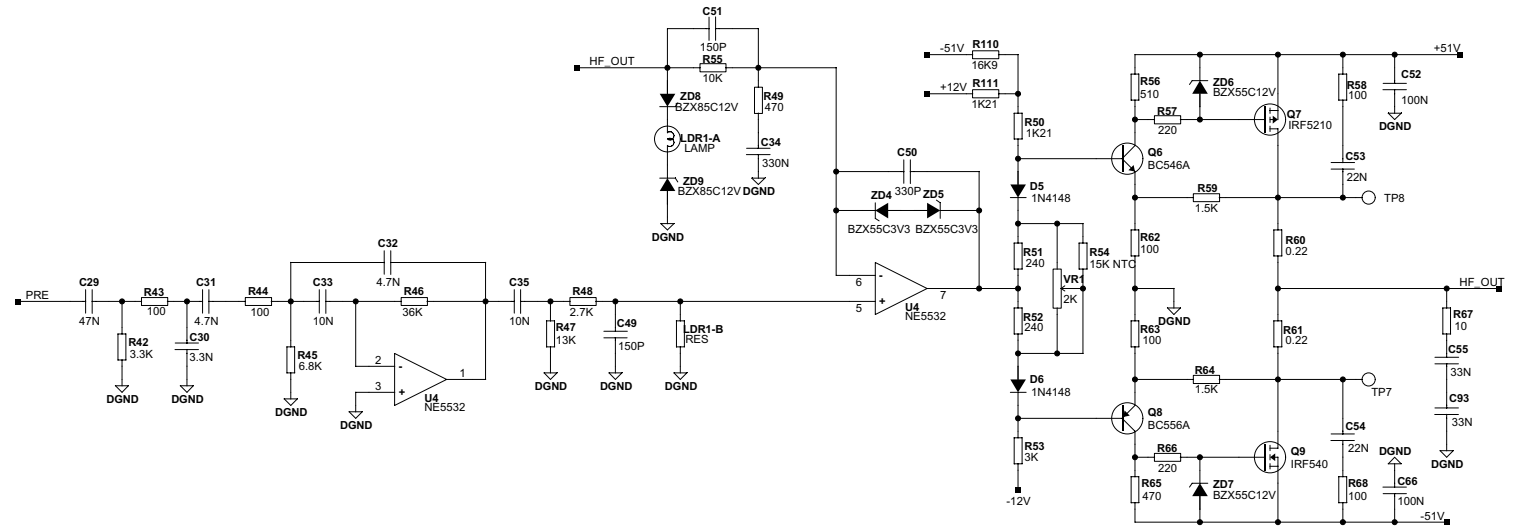
Mk. II module Part List, continued:

Ref.	Value	Description	Type	Ref.	Value	Description	Type
R57	220R	0.6W 5%		S2	67L070	THERMAL SWITCH	AIRPAX
R58	100R	0.6W 5%		SW1	S/W TOGGLE	.5VA TT SERIES	
R59	1K5	1W 5%	PRO1	U1 - U6	NE5532N		
R60, R61	0R22	2.5W 5%	AC03	U7	7812CT		
R62, R63	100R	0.6W 5%		U8	7912CT		
R64	1K5	1W 5%	PRO1	VR1, VR2	2K POT	1/4" Sealed Cermet,TopAdj.	
R65	470R	0.6W 5%		ZD1	BZX85C12V	12V 1.3W	
R66	220R	0.6W 5%		ZD2, ZD3	Not used		
R67	10R	1W 5%	PRO1	ZD4, ZD5	BZX55C3V3	3.3V 0.5W	
R68	100R	0.6W 5%		ZD6, ZD7	BZX55C12V	12V 0.5W	
R69, R70	13K	0.6W 5%		ZD8, ZD9	BZX85C12V	12V 1.3W	
R71	6K2	0.6W 5%		ZD10, ZD11	BZX55C3V3	3.3V 0.5W	
R72, R73	12K	0.6W 5%		ZD12, ZD13	BZX55C12V	12V 0.5W	
R74	6K8	0.6W 5%					
R75	13K	0.6W 5%					
R76	56K	0.6W 5%					
R77	5K6	0.6W 5%					
R78	360R	0.6W 5%					
R80	33R	0.6W 5%					
R81	1K21	0.6W 1%					
R82, R83	240R	0.6W 5%					
R84	3K0	0.6W 5%					
R85	15K	NTC	PHILIPS				
R86	510R	0.6W 5%					
R87 - R89	220R	0.6W 5%					
R90, R91	0R22	2.5W 5%	AC03				
R92	100R	0.6W 5%					
R93	1K5	1W 5%	PRO1				
R94, R95	100R	0.6W 5%					
R96	1K5	1W 5%	PRO1				
R97	510R	0.6W 5%					
R98	220R	0.6W 5%					
R99	10K	0.6W 5%					
R100, R101	220R	0.6W 5%					
R102, R103	0R22	2.5W 5%	AC03				
R104	100R	0.6W 5%					
R105	10R	1W 5%	PRO1				
R106	47R	0.6W 5%					
R107	47K	0.6W 5%					
R108	1K21	0.6W 1%					
R109, R110	16K9	0.6W 1%					
R111	1K21	0.6W 1%					



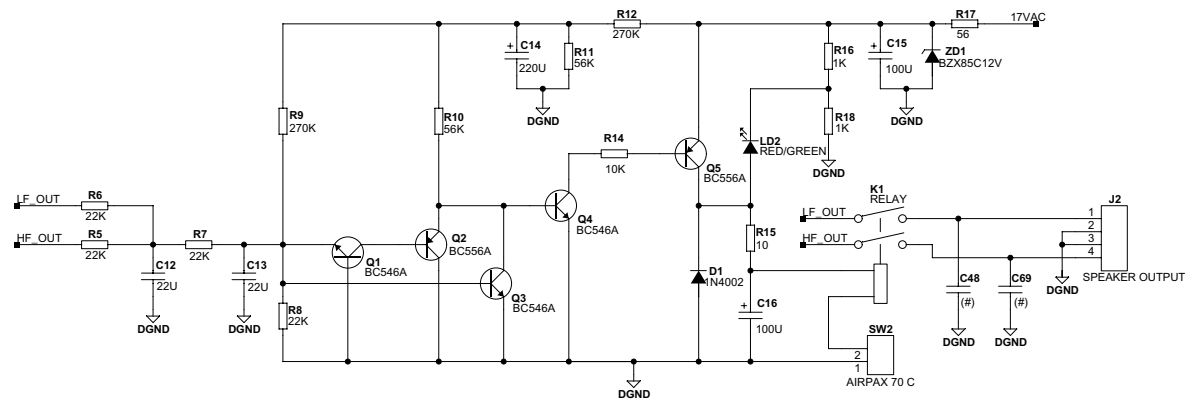
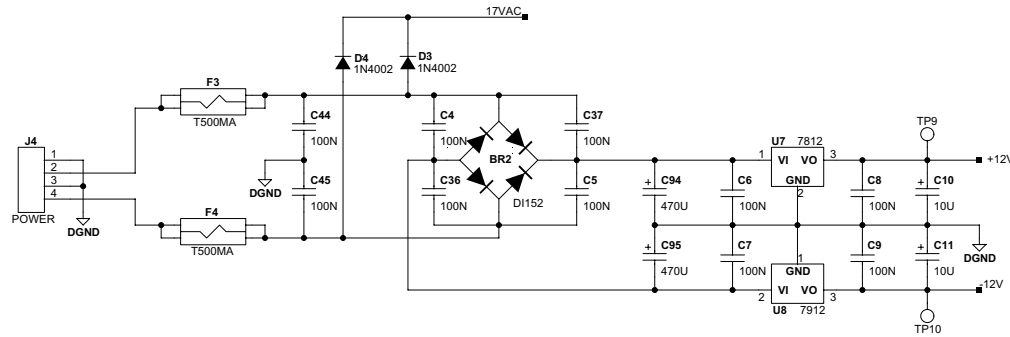
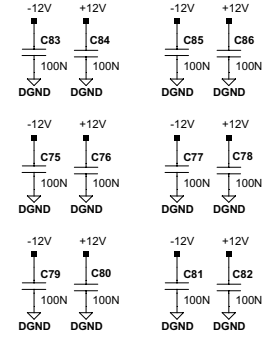
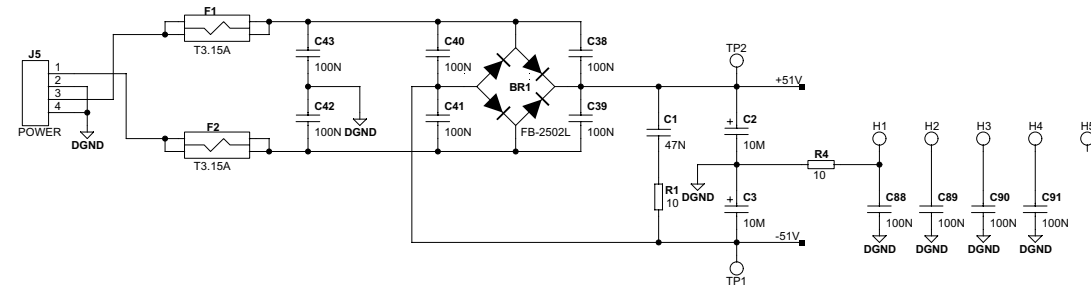
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Title BM15A MKII		Module title PREAMPLIFIER
Number P11015	Revision BAA-1	Previous page NONE
Date 23-12-2002	Filename BM15A_MKII	Page / of 1 / 3



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DynaudioAcoustics		Designer CM / JVO
Title BM15A MKII		Module title AMPLIFIERS
Number P11015	Revision BAA-1	Previous page 1
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DynaudioAcoustics		Designer CM / JVO
Title BM15A MKII		Module title PSU AND PROTECTION
Number P11015	Revision BAA-1	Previous page 2
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