AV1000 MOSFET Power Amplifier Assembly Manual

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Introduction

The AV1000 1kw Amplifier and share the same topology and PCB layout as the AV800 only with 20 IRF HEXFET Output devices. This output stage enables this amplifier to deliver 1000 watts RMS into a 4-Ohm load and 550 Watts into an 8-Ohm load.
There are several ways of getting this amplifier to achieve this power level in terms of supply rail voltage used and different loading.
The AV1000 requires a nominal supply voltage of +-105 volts DC and a Transformer Core rating of at least 1.5KVA per channel, with 20,000uf of supply filtering per rail voltage.
If 2-Ohm loads are to be driven then a nominal +-75 volt power supply with the same transformer rating is required, but with twice the filtering, in other words at least 40,000uf per voltage rail is required. This configuration will allow 1000 watts RMS into a 2-Ohm load.
The final option is to supply the module with separate power supplies to the Output stage and a separate supply to the Differential and Voltage Amplification Stage.
A supply voltage of +-110 volts is supplied the Input and VAS and a supply of +-100 volts is supplied to the Output Stage. This improves the efficiency of the amplifier and gives the output stage an easier time by reducing some of the power dissipation across the output stage.

Power supply requirements for the AV1000 Amplifier

Power supply recommendations for One Module only
1 x 1.5Kva toroidal transformer.
2 x 75 volts AC at full load.
2 x 400 Volt 35 Ampere, Bridge Rectifiers.
2 x 4.7K 5-Watt ceramic resistors
Minimum filter capacitor requirements would be 2 x 10,000uf 130 volts.
Ideal capacity would be 40,000uf or greater per voltage rail.

Power supply recommendations for Two Modules only
1 x 3kva toroidal transformer
2 x 75 volts AC Secondaries Windings at full load.
2 x 400 volt 35 amp bridge rectifier
4 x 10,000uf 130-volt electrolytic capacitors
2 x 4.7K 5-Watt ceramic resistors

Power Supply Requirements for Split power supply Mode

Input and VAS driver stages power supply for 1 or 2 power modules.
1 x 300VA toroidal transformer
2 x 78 VAC secondaries windings at full load
1 x bridge rectifier rated at 400 volts DC 4 amp rating
2 x 1000uf 160v filter electrolytic capacitors

Output stage power supply for 1 module
1 x 1.5Kva toroidal transformer.
2 x 75 volts VAC Secondaries at full load.
2 x 400 Volt 35 Ampere, Bridge Rectifiers.
2 x 4.7K 5-Watt ceramic resistors
Minimum filter capacitor requirements would be 2 x 10,000uf 130 volts.
Ideal capacity would be 40,000uf or greater per voltage rail.

Output stage power supply for 2 modules
1 x 3kva toroidal transformer
2 x 75 volts VAC secondary windings at full load
2 x 400 volt 35 amp bridge rectifier
4 x 10,000uf 130-volt electrolytic capacitors
2 x 4.7K 5-Watt ceramic resistors

Power Supply Requirements for 2 Ohm Drive Mode

Power supply recommendations for One Module only
1 x 1.5Kva toroidal transformer.
2 x 55 volts VAC secondary windings at full load
2 x 400 Volt 35 Ampere, Bridge Rectifiers.
2 x 4.7K 5-Watt ceramic resistors
Minimum filter capacitor requirements would be 2 x 10,000uf 100 volts.
Ideal capacity would be 40,000uf or greater per voltage rail.

Power supply recommendations for Two Modules only
1 x 3kva toroidal transformer
2 x 55 volts VAC secondary windings at full load
2 x 400 volt 35 amp bridge rectifier
4 x 10,000uf 100-volt electrolytic capacitors
2 x 4.7K 5-Watt ceramic resistors

Schematics for various power supply configurations found at page 20 of the Manual

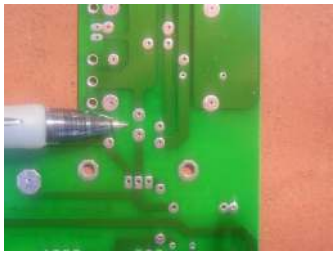
Assembling the Printed Circuit Board

One of the first things to do is to look at the PCB and see if all of the holes on the board are of the correct size for the components you wish to insert. The holes that have been drilled into the PCB should be OK. However it does pay to check before you start. If you find that some of the holes are not big enough then you will need to drill them out to the correct size. The standard holes sizes used for most electronic components are as follows.

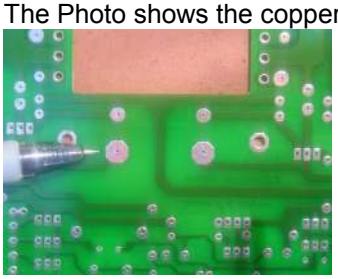
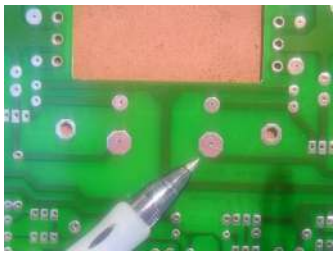
¼ watt ½ watt resistors = 0.7mm to 0.8mm
1–watt resistors = 1.0mm
¼ watt to 1-watt Zener and normal power diodes = 0.8mm
Small signal transistors such as BC546 of the TO-92 pack = 0.6mm
Medium signal transistors such as MJE340 of the TO-220 pack = 1.0mm
Power Output devices such as the IRFP240 require a Hole size of 2.5mm
The output devices require mounting on the copper side of the PCB.

Power supply Options

If you are not going to use the split power supply option
Add a wire link on the copper side of the PCB at the pads
Shown. This will connect the Input and VAS stages back
to the main power supply.

If the split power supply option is used, shown below are
Input and VAS stages power supply connections.
The one on the Left is the –110-volt supply
The one on the Right is the +110-volt supply
The Photo shows the copper side of the PCB.

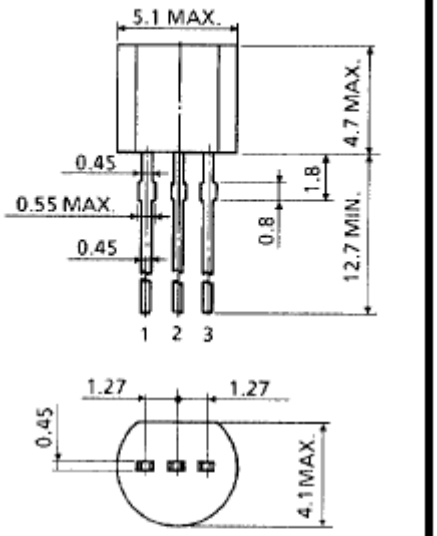



Start constructing the PCB by inserting any wire links, which are shown on the component overlays as Wire1, Wire2. The wire links are made from spare component leads such as from 5-watt ceramic resistors or ¼ or 1/2 watt resistor leads.
Once the links have been taken care of the insertion of all the resistors is next, followed by the capacitors and then the small signal semiconductors.
You will need to cross-reference the parts list with the printed screen component overlay on the PCB to see where to insert the required component. Be careful to always insert the polarised components in the right way as shown on the screen-printed overlay.
Failure to do this will most likely result in the module not functioning properly or damaging one or more of the components in the module.
The output stage transistors and Q8, which is the IRF610 device, are to be left till last.

Special Mounting requirements for Q1 and Q2

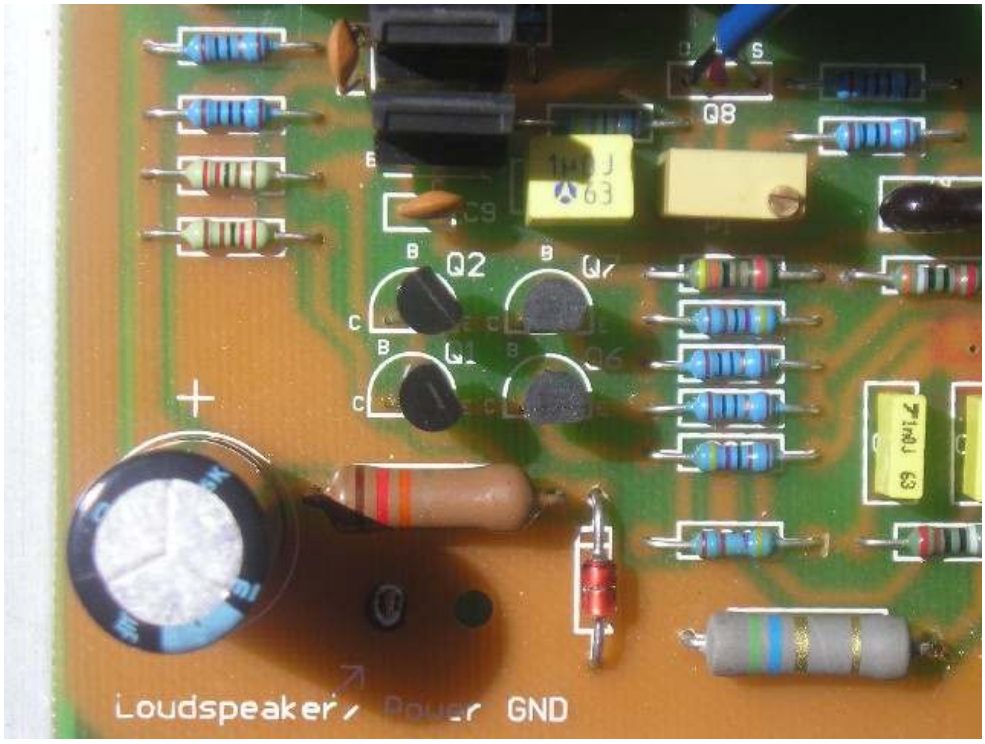
The 2SC2240 TO-92 devices need some special attention when mounting into the PCB. These are marked on the Screen Overlay on the PCB as Q1 and Q2.
The pin outs are not the same as Q6 & Q7 or the BC546B devices.
On the 2SC2240 the pin outs are as follows. With the flat side of the device facing you and the leads of the pins facing down to the ground, from left to right the pin outs are Emitter, Collector, and Base.
The Pinout's are marked on the PCB.

Pin outs for 2SC2240



1. EMITTER
2. COLLECTOR
3. BASE

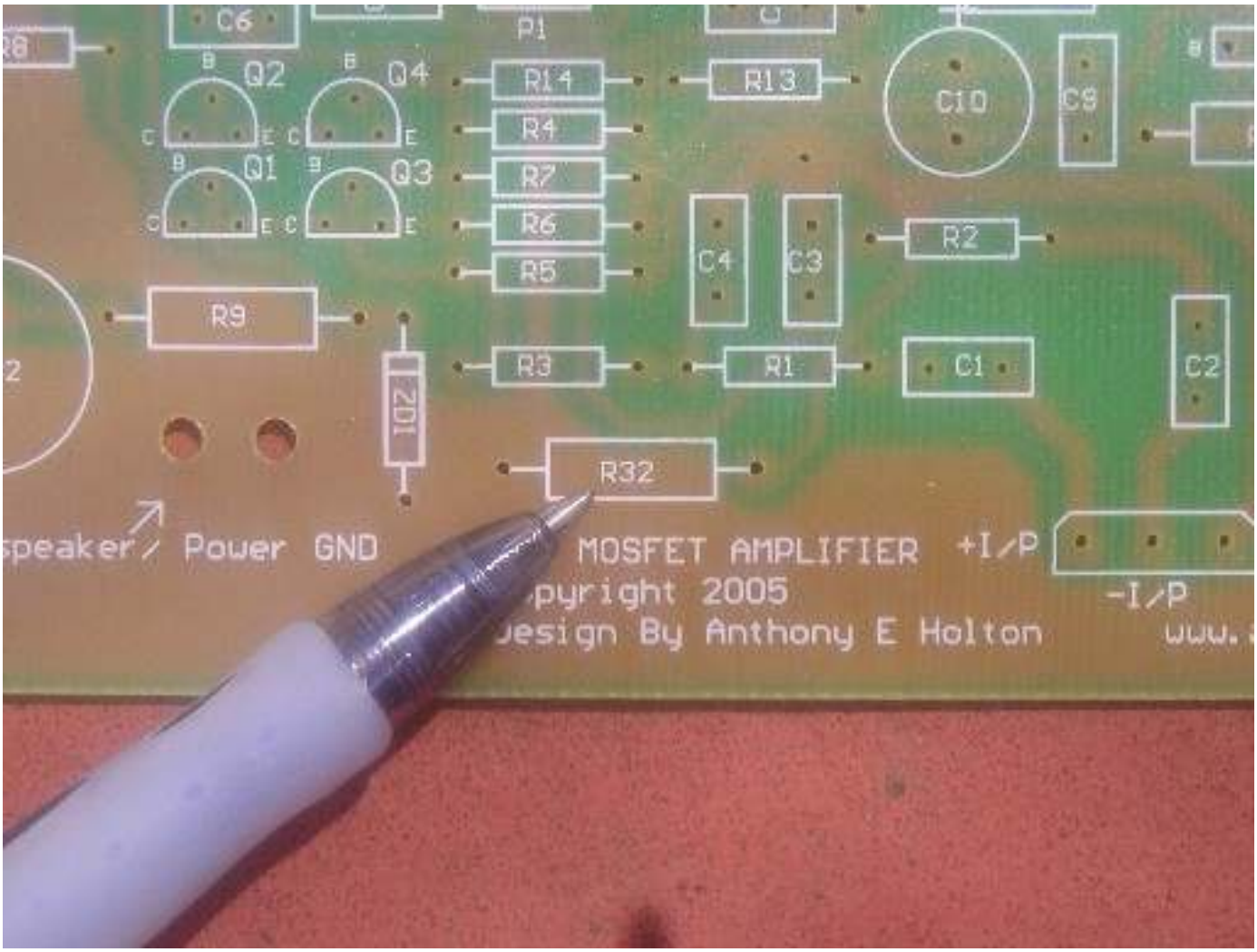
JEDEC	TO-92
JEITA	SC-43
TOSHIBA	2-5F1B



Also do not insert Q8 directly into the PCB; this device is to be connected via flying leads from the PCB to the Q8, which is to be mounted on top of the output stage.
See Photo at the end of the section "Testing the Module"
The buffer stage transistors are to be mounted on 10 degrees/watt heats sinks with a one-inch pitch mounting.

Notes and Errata

Unfortunately an error has crept into the component screen overlay
In the AV800 and AV1000 PCBs. Version 1.2 and 1.5 PCBs
The 1.05 Version of AV800 does not have this issue.
There is a component designator duplication of R32 as shown below
This should be R73 As shown in the Bill of Materials and schematic.
This device is a 10 Ohm 1 Watt 5% Carbon Resistor.



Pre-flight test

OK at this stage I am assuming you have populated all of the PCB except Q8 and the main output stage devices IRFP240's and IRFP9240's
For the time been temporarily wire up Q8 via flying leads. Making sure that you match up the Drain, Gate and Source pinout's on the PCB, with the Drain, Gate and Source pinout's on the IRF610. Don't insert Q8 directly into the PCB.
It is important to test the function of the amplifier at this point in time, to make sure it is working properly. This is achieved by soldering a 10-Ohm ¼ watt resistor from R19 (the side connected to the output of the amp) to one side of the 330-Ohm 1W resistor found at R25.
What this does is to connect the feedback resistor R19 to the output of the buffer stage. In doing so it bypasses the output stage and turns it into a very low powered amplifier, which can be tested without damaging the expensive output stage. Assuming you have connected the resistor from o/p to the buffer stage. It is now time too connect the +-105 volt supply to it and power it up.
If you have access to a Variac transformer, then slowly power up the amplifier with this as it is much safer and one can monitor the progress as this is done.
Be sure to have 4k7 Ohm 5-watt bleeder resistors across the power supply capacitors.
Now assuming that there was no smoke, with a multimeter on volts. Measure the following voltage drops across these resistors locations marked in blue and if they match to within +-10% then you can be sure that the amplifier is OK.
When you have done the checks, be sure to power down and remove the
10-Ohm resistor.

R8~1.5 volts Approximate
R10~1.5 volts Approximate
R15~0.9 volts Approximate
R17~455mv Approximate
R18~455mv Approximate
Offset voltage at R37 should be close to 0 volts, but can be as high as 100mv.

If you are having problems getting anywhere near these values
Then start by looking at the first differential stage current source, Measure with a voltmeter across ZD2, you should read around 14.5 to 15.5 volts DC, now measure across R12 you should measure approximately 13.9 to 14.8 volts DC.
If you can confirm this then the current source is working OK.
Now measure across R8 and R10 you should measure around 1.5 volts DC approximately, on each resistor.
If this measurement is correct then the differential stage is working fine.
Now measure across R15 this should measure approximately 0.8 to 0.9 volts DC.
If this checkout then the amplifier should be working OK.
Most problems are due to in correct placement of components or bad soldering joints.
I have seen some people have problems with fake semiconductors, such as Toshiba transistors, so please choose your components carefully.

Completing the Module

Now we have come to the soldering in of the output devices. It is assumed at this point that you have all ready matched the output stage devices as outlined in the accompanying document on How to match output devices.
If this is already done then you can proceed by getting the PCB and flipping it over so the copper side of the board is facing you.
Now identify which is the positive supply side of the PCB and start soldering the IRFP240 devices face down on the appropriate pads so the metal tabs on the back of the power MOSFET's are facing you.
Once all of the N-channel devices are done proceed with the IRFP9240
P-channel devices, in the same way

After completing this task the module for the most part is completed.
Now there is one device that requires some special attention. This is Q8 and this device is the Vbe multiplier or bias compensation device, which needs to be mounted off board on a bar of 10cm x 2cm x 6mm thick piece of aluminium and it is this bar of aluminium that will clamp down the output stage. Q8 will need to be insulated with a TO-220 mica-washer kit from this piece of metal and flying leads need to be soldered from the Gate, Source and Drain pins of the IRF610 to the appropriately marked pads on the PCB shown as Q8.
One other thing that needs to be done is to mount some 4mm high rubber feet on copper side of the front and back of the PCB. This is to hold the PCB off the heat sink, so as not to allow the PCB to touch the heat sink in any way.

Completing the Module Continued

Now having completed the power module and tested the Error, VAS and Buffer stages and you are confident that it is working OK. Its time to bolt it down to a suitable heat sink. Remember that all of the o/p devices must be insulated with either silicon rubber washers or mica –washers and heat sink compound. The type, size and shape of heat sink are left up to you and the local availability of heat sinks. But be sure to have a heat sink rated at 0.2 degrees/watt for home use and 0.2 degrees/watt with fan cooling for PA use.

Testing the module

So we have come to the point where we need to do a full test on the amplifier module.
There are a few checks that need to be done first.

- The Drain pins on all the o/p devices need to be checked for Short circuit to the heat sink.
- The power supply wiring has been checked for correct polarity to the PCB.
- The Multi-turn pot P1 has been turned back to 0 Ohms, so that a measurement of approximately 4.7k is measured across the Gate and Drain pins of Q8 IRF610.
- When wiring up the power supply, be sure to have 10 amp fuses inserted on each of the supply lines.
- Connect a multimeter on DC volt range to the o/p of the amplifier.

Ok now that you are happy that the module is set-up correctly apply power via a VARIAC if you have access to one, otherwise just power the amplifier up.
Looking at the voltmeter you should get from 1mv to 50mv offset voltage.
If this is not the case then power the amplifier down and check your work.
Assuming all is well then power the amplifier down and find a small flat blade screwdriver so you can be ready to adjust P1 for the biasing of the o/p stage.
But first connect the voltmeter across one of the o/p stage Source resistors using Alligator leads.
Now re-apply power to the amplifier and slowly adjust P1 while watching the voltmeter, for a reading of 18mv.
Now check across the rest of the Source resistors and find the one, which has the highest reading, and adjust P1 till 18mv is read.
Now connect a load and signal source to the amplifier and with a CRO if you have access to one observe that the waveform is clean and free from noise and distortion.
If you don't have a CRO and Signal generator, connect a pre-amp and loudspeaker and have a good listen. The sound should be very clean and dynamic.

See over page for a Photo of the completed Amplifier Module.

Testing the module

The Amplifier shown below is an example of how
The AV800 and AV1000 Power MOSFET amplifiers
Should look like once completed.
The one shown is the AV800. The AV1000 will be
Almost identical, but has 6 more output devices
Notice the Q8 how it is mounted on top of the output stage
And a flying lead goes back to the PCB.
The aluminium bar, which is holding the output stage down, is not
Optional. Do not use 3mm bolts for each output device, as this
Will not apply even pressure across the output stage devices.
The aluminium bar also acts as small heat sink and helps to thermally stabilise the output stage.

Congratulations, Your amplifier module is complete.

Kind Regards

Anthony Eric Holton
www.aussieamplifiers.com

Specifications for the AV1000 MOSFET Amplifier

All measurements were taken at an AC Mains input of 240 volts.
And with a 2kva Toroidal Transformer powering the Amplifier module.
Filtering with only 20,000uf per voltage rail
One channel only was been driven.

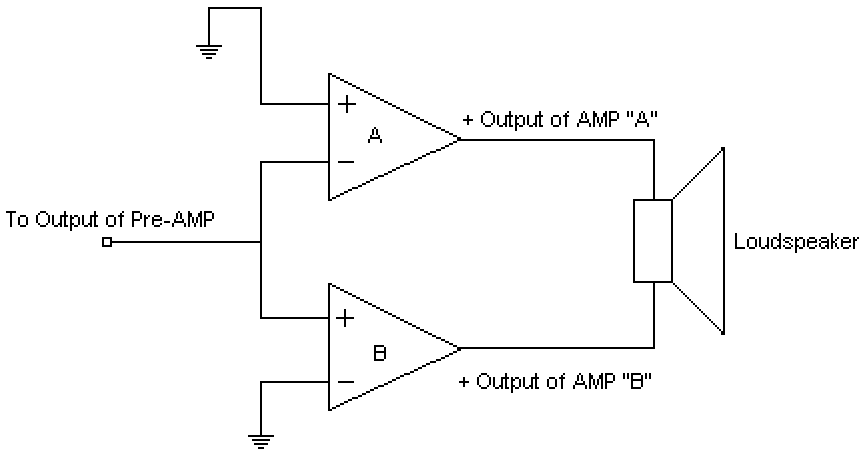
Frequency response 10hz to 100khz
THD measured at 100 watts into 8 Ohms 0.01% @1khz
Power Output into 8 Ohms = 550 Watts RMS
Power Output into 4 Ohms = 1056 Watts RMS
Damping Factor = 400

How to bridge 2 x AV1000 Power modules For 1800-2000 Watts RMS into 8 Ohms.

Power output in bridging mode is dependant on your power supply used
And is only recommended you load the bridged amplifier with an 8 Ohm load.

To Bridge the AV1000 amplifier modules, connect the speaker load across the 2 positive outputs
Of each amplifier module, no ground connection is made to the loudspeaker load at all.

The AV1000 module has 2 active inputs. One is Non-Inverting +.I/P the other is inverting –I/P.
Amplifier “A” has the Non-Inverting input connect to the pre-amp
Amplifier “B” has the Inverting input connected to the pre-amp
The other un-used inputs on each respective amplifier are connected to the signal ground connection.



Bill of Materials for the AV1000 Power MOSFET Amplifier

Designator	Component	Cross Reference List
C1	22uf Bipolar	
C2	22uf Bipolar	
C3	1nf MKT 100v	
C4	1nf MKT 100v	
C5	10nf MKT 63v	
C6	22pf Ceramic Now Removed Do Not Use	
C7	100pf Ceramic Updated to New Value	
C8	10nf MKT 63v	
C9	100nf MKT 63v	
C10	100uf 25 volt RB PCB Mount	
C11	220nf - 1uf MKT 63v	
C12	100uf 100v RB PCB Mount	
C13	100uf 100v RB PCB Mount	
C14	100uf 100v RB PCB Mount	
C15	100uf 100v RB PCB Mount	
C16	100uf 100v RB PCB Mount	
C17	100uf 100v RB PCB Mount	
C18	100uf 100v RB PCB Mount	
C19	100uf 100v RB PCB Mount	
C20	100uf 100v RB PCB Mount	
C21	100uf 100v RB PCB Mount	
C22	100uf 100v RB PCB Mount	
C23	100uf 100v RB PCB Mount	
C24	100uf 100v RB PCB Mount	
C25	100uf 100v RB PCB Mount	
C26	100uf 100v RB PCB Mount	
C27	100uf 100v RB PCB Mount	
C28	100uf 100v RB PCB Mount	
C29	100uf 100v RB PCB Mount	
C30	100uf 100v RB PCB Mount	
C31	100uf 100v RB PCB Mount	
C32	100nf x2 Main 250 volt AC Rated	
C33	22pf Ceramic	Now Removed Do Not Use
D1	1N4007 1 Amp 1000 Volt Diode	
D2	1N4007 1 Amp 1000 Volt Diode	
D3	BY550-600 6 Amp Diode	
D4	BY550-600 6 Amp Diode	
P1	5k Ohm Multiturn Pot Vertical Adjust	
Q1	2SC2240	
Q2	2SC2240	
Q3	BC546B	
Q4	BC546B	
Q5	2SA1837	
Q6	2SA1837	
Q7	2SC4793	
Q8	IRF610 or 2SC4793	
Q9	2SC4793	
Q10	2SC4793	
Q11	2SC4793 or IRF610	
Q12	2SA1837 or IRF9610	
Q13	IRFP9240	
Q14	IRFP240	
Q15	IRFP9240	
Q16	IRFP240	
Q17	IRFP9240	
Q18	IRFP240	

Bill of Materials for the AV1000 Power MOSFET Amplifier

Designator	Component
Q19	IRFP9240
Q20	IRFP240
Q21	IRFP9240
Q22	IRFP240
Q23	IRFP9240
Q24	IRFP240
Q25	IRFP9240
Q26	IRFP240
Q27	IRFP9240
Q28	IRFP240
Q29	IRFP9240
Q30	IRFP240
Q31	IRFP9240
Q32	IRFP240
R1	1k 1/4 watt Metal Film 1%
R2	1k 1/4 watt Metal Film 1%
R3	15k 1/4 watt Metal Film 1%
R4	15k 1/4 watt Metal Film 1%
R5	15k 1/4 watt Metal Film 1%
R6	150 1/4 watt Metal Film 1%
R7	150 1/4 watt Metal Film 1%
R8	2k2 1/4 watt Metal Film 1%
R9	22k 1-Watt Carbon 5%
R10	2k2 1/4 watt Metal Film 1%
R11	22k 1-Watt Carbon 5%
R12	10k 1/4 watt Metal Film 1%
R13	330 1/4 watt Metal Film 1%
R14	4k7 1/4 watt Metal Film 1%
R15	150 1/4 watt Metal Film 1%
R16	10k 1-Watt Carbon 5%
R17	100 1/4 watt Metal Film 1%
R18	150 1/4 watt Metal Film 1%
R19	15k 1/4 watt Metal Film 1%
R20	1K 1/4 watt Metal Film 1%
R21	100 1/4 watt Metal Film 1%
R22	4k7 1/4 watt Metal Film 1%
R23	100 1/4 watt Metal Film 1%
R24	100 1/4 watt Metal Film 1%
R25	330 1 Watt Carbon 5%
R26	10 1/4 watt Metal Film 1%
R27	10 1/4 watt Metal Film 1%
R28	330 1/4 watt Metal Film 1%
R29	330 1/4 watt Metal Film 1%
R30	330 1/4 watt Metal Film 1%
R31	330 1/4 watt Metal Film 1%
R32	330 1/4 watt Metal Film 1%
R33	330 1/4 watt Metal Film 1%
R34	330 1/4 watt Metal Film 1%
R35	330 1/4 watt Metal Film 1%
R36	330 1/4 watt Metal Film 1%
R37	330 1/4 watt Metal Film 1%
R38	330 1/4 watt Metal Film 1%
R39	330 1/4 watt Metal Film 1%
R40	330 1/4 watt Metal Film 1%
R41	330 1/4 watt Metal Film 1%
R42	330 1/4 watt Metal Film 1%

Bill of Materials for the AV1000 Power MOSFET Amplifier

Designator Component Cross Reference List

R43	330 1/4 watt Metal Film 1%
R44	330 1/4 watt Metal Film 1%
R45	330 1/4 watt Metal Film 1%
R46	330 1/4 watt Metal Film 1%
R47	330 1/4 watt Metal Film 1%
R48	0.22 Ohm 5 Watt Wire Wound or Metal Film
R49	0.22 Ohm 5 Watt Wire Wound or Metal Film
R50	0.22 Ohm 5 Watt Wire Wound or Metal Film
R51	0.22 Ohm 5 Watt Wire Wound or Metal Film
R52	0.22 Ohm 5 Watt Wire Wound or Metal Film
R53	0.22 Ohm 5 Watt Wire Wound or Metal Film
R54	0.22 Ohm 5 Watt Wire Wound or Metal Film
R55	0.22 Ohm 5 Watt Wire Wound or Metal Film
R56	0.22 Ohm 5 Watt Wire Wound or Metal Film
R57	0.22 Ohm 5 Watt Wire Wound or Metal Film
R58	0.22 Ohm 5 Watt Wire Wound or Metal Film
R59	0.22 Ohm 5 Watt Wire Wound or Metal Film
R60	0.22 Ohm 5 Watt Wire Wound or Metal Film
R61	0.22 Ohm 5 Watt Wire Wound or Metal Film
R62	0.22 Ohm 5 Watt Wire Wound or Metal Film
R63	0.22 Ohm 5 Watt Wire Wound or Metal Film
R64	0.22 Ohm 5 Watt Wire Wound or Metal Film
R65	0.22 Ohm 5 Watt Wire Wound or Metal Film
R66	0.22 Ohm 5 Watt Wire Wound or Metal Film
R67	0.22 Ohm 5 Watt Wire Wound or Metal Film
R68	10 5 Watt Wire Wound or Metal Film
R69	100 1/4 watt Metal Film 1%
R70	100 1/4 watt Metal Film 1%
R71	47k Ohms ¼ watt 1% Metal Film
R72	47k Ohms ¼ watt 1% Metal Film
R73	10 Ohm 1 Watt Carbon 5%
ZD1	1N4744 15-volt 1Watt
ZD2	1N4744 15-volt 1Watt
ZD3	1N4744 15-volt 1Watt
ZD4	1N4744 15-volt 1Watt
LD1	Light Emitting Diode “Any Colour”
LD2	Light Emitting Diode “Any Colour”
HS1	Small 1” pitch To-220 PCB mount heat sink
HS2	Small 1” pitch To-220 PCB mount heat sink

Component Inventory for the AV1000 Amplifier Module

Capacitors

2 x 22uf Bipolar
2 x 1nf 100-volt MKT
1 x 100pf 100-volt Ceramic
2 x 100nf 100-volt MKT
15 x 100uf 100-volt RB PCB mount
1 x 100nf 250 volts AC mains X2
1 x 10nf 100v MKT

Resistors

1 x 5k Ohm Vertical Adjust Multi-Turn Pot
3 x 1k Ohm 1% watt ¼ watt metal film
4 x 15k Ohm ¼ watt 1% metal film
1 x 4.7k Ohm ¼ watt 1% metal film
2 x 10 Ohm ¼ watt 1% metal film
2 x 2.2k Ohm ¼ watt 1% metal film
1 x 10k Ohm 1 watt 5% carbon
2 x 22k Ohm 1 watt 5% carbon
1 x 10k Ohm ¼ watt 1% metal film
1 x 330 Ohm ¼ watt 1% metal film
7 x 100 Ohm ¼ watt 1% metal film
3 x 150 Ohm ¼ watt 1% metal film
1 x 330 Ohm 1 watt 5% carbon
20 x 330 Ohm ¼ watt 1% metal film
20 x 0.22 Ohm 5 watt 5% wire wound or metal film
1 x 10 Ohm 5 watt 5% wire wound
2 x 47k ¼ watt 1% metal film

Semiconductors

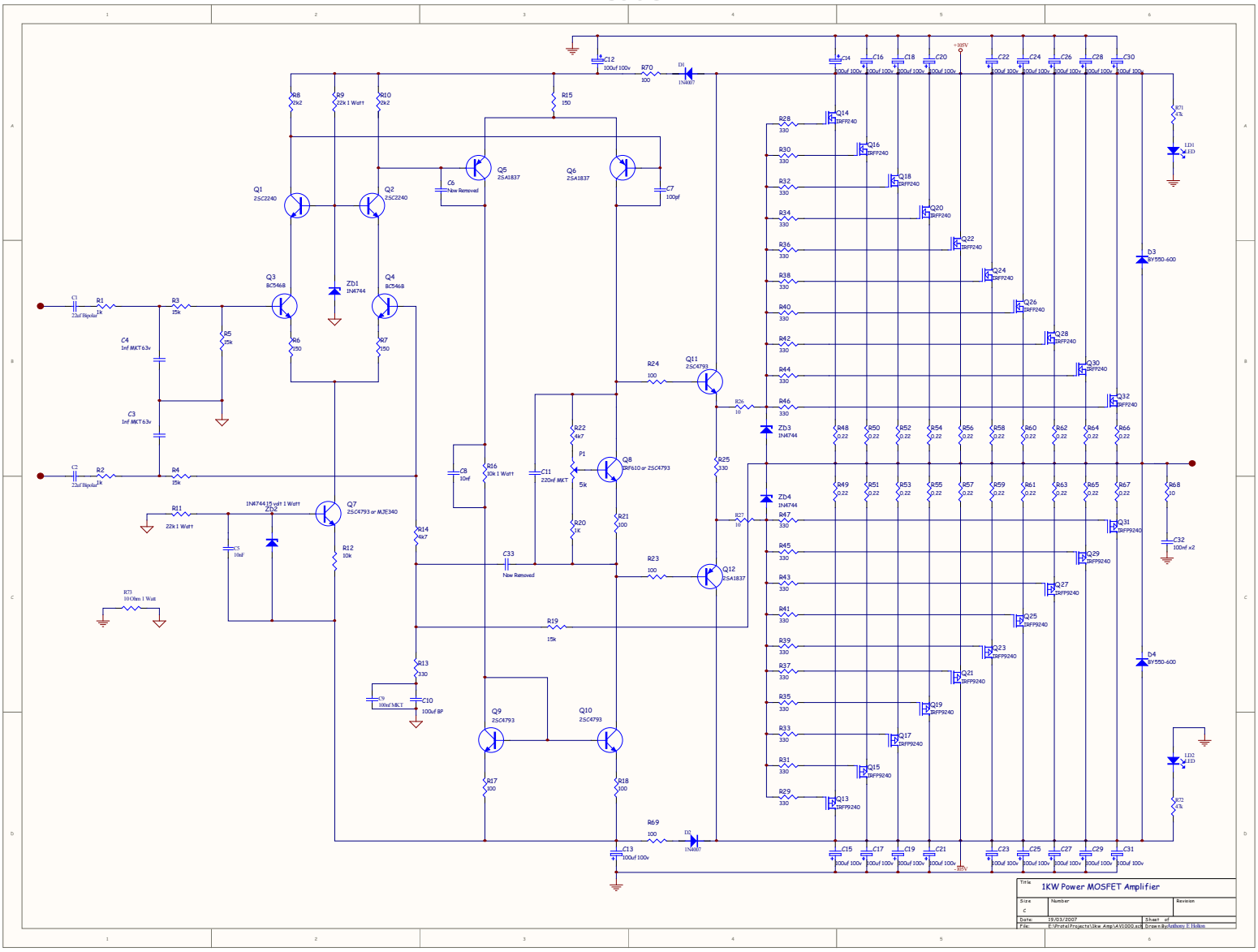
2 x BY550-600 6 Amp diodes
4 x 1N4744 15 volts 1 watt Zener diodes
2 x BC546B NPN Transistors
2 x 2SC2240 NPN Transistors
3 x 2SC4793 NPN Transistors
2 x 2SA1837 PNP Transistors
10 x IRFP240 Power MOSFET’s
10 x IRFP9240 Power MOSFET’s
1 x IRF9610 Power MOSFET
2 x IRF610 Power MOSFET

Misc Components

1 x AV1000 Printed Circuit Board
1 x 3 Screw Terminal PCB mount connector
4 x 1” mount TO-220 transistor Heat Sinks
2 x RED LEDS
4 x 5mm Rubber Feet

AV1000 MOSFET Power Amplifier Schematic Version 3 Release Date 27th October 2005

Use Zoom Function in Adobe Acrobat Reader

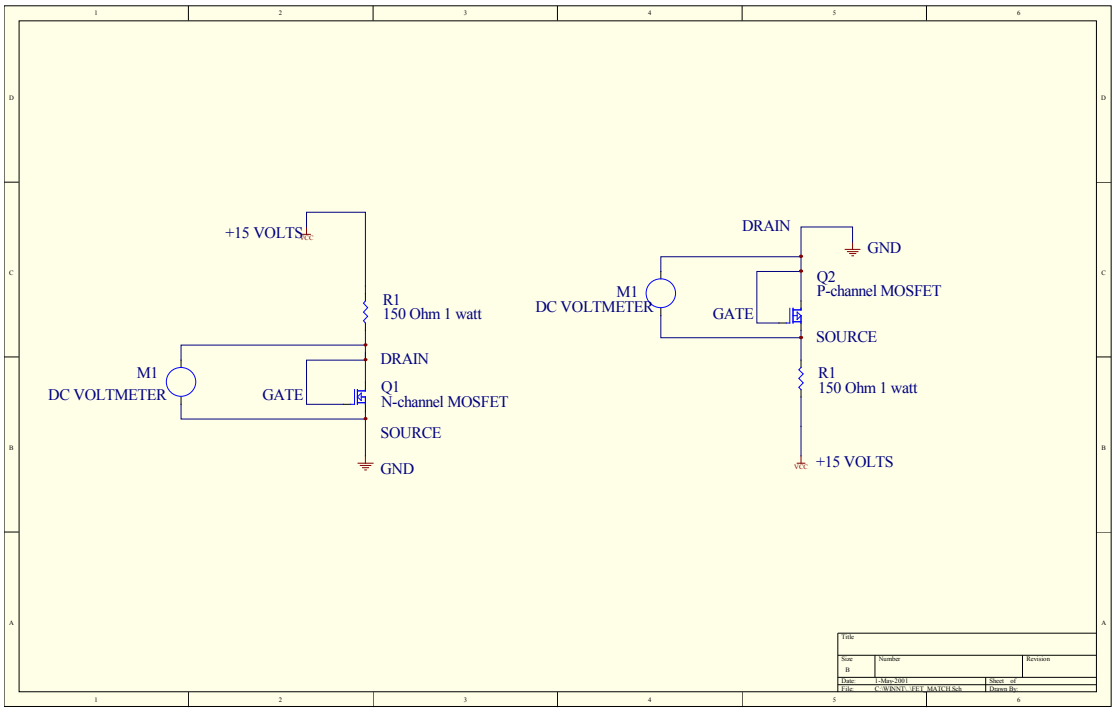


, to view component Values.

Matching Hexfet MOSFET's for the AV1000

When using this type of MOSFET in the AV1000 amplifier is strongly recommended that the output stage devices be matched. As it has been found that if this is not done then there is no guarantee that they will share the current under load.
The Source resistors provide only a bit of local feedback and don't in any way force the devices to current share.

The best method I have found to work very well utilises just a 150 Ohm 1 watt resistor and a +15 volt DC power supply.
If you look at the schematic below it shows how to connect and measure the N-channel devices and the P-channel devices.
With the devices connected, as shown measure across the Drain and Source pins with a multimeter set to DC volts and measurement of between 3.8 volts and 4.2 volts will be shown. Simply match the device in-groups to a tolerance of +-100mv.
Please note that you only have to match the n-channel to the n-channel devices and the p-channel to the p-channel devices, not the N-channel devices to the P-channel devices.



Optional Heat Sinking

The Heat Sink shown below would be the smallest I would recommend and with
The addition of a Fan, blowing cool air across the PCB
For Home use the Fan could removed.

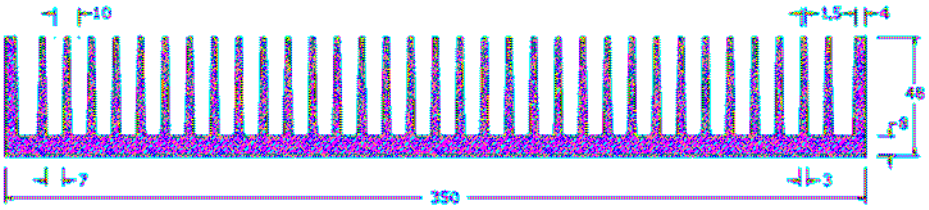
Conrad Heatsinks
36 Victoria Street
Brunswick East, 3057
Melbourne, Victoria
Australia

Phone: 61-3-9387 7106
Fax: 61-3-9387 2896
sales@conradheatsinks.com
www.conradheatsinks.com

MF35-151.5

MF35 Series

All dimensions are in mm.



Product Code	Standard Lengths in mm	Thermal Resistance C/Watt for 80 C rise.	Weight in kg.
MF35-50	50.0	0.43	0.81
MF35-75	75.0	0.32	1.22
MF35-100	100.0	0.28	1.62
MF35-151.5	151.5	0.21	2.46

Pin Outs for all of the Transistors used in the AV1000

FAIRCHILD SEMICONDUCTOR™

MJE340

MJE340

High Voltage General Purpose Applications
- High Collector-Emitter Breakdown Voltage
- Suitable for Transformer
- Complement to MJE350

1. Emitter 2.Collector 3.Base TO-126

NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_C=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	300	V
V_{CEO}	Collector-Emitter Voltage	300	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	500	mA
P_C	Collector Dissipation (T_C=25°C)	20	W
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	- 65 ~ 150	°C

Electrical Characteristics T_C=25°C unless otherwise noted

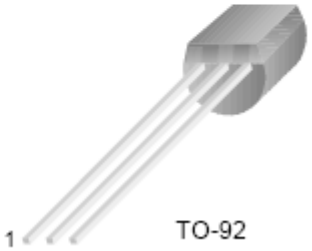
Symbol	Parameter	Test Condition	Min.	Max.	Units
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 1mA, I_B = 0	300		V
I_{CBO}	Collector Cut-off Current	V_{CB} = 300V, I_E =0		100	μA
I_{EBO}	Emitter Cut-off Current	V_{BE} = 3V, I_C = 0		100	μA
h_{FE}	DC Current Gain	V_{CE} = 10V, I_C = 50mA	30	240	

FAIRCHILD SEMICONDUCTOR™

BC546/547/548/549/550

Switching and Amplifier

- High Voltage: BC546, V_{CEO}=65V
- Low Noise: BC549, BC550
- Complement to BC556 ... BC560



1. Collector 2. Base 3. Emitter TO-92

NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter		Value	Units
V_{CBO}	Collector-Base Voltage	: BC546	80	V
		: BC547/550	50	V
		: BC548/549	30	V
V_{CEO}	Collector-Emitter Voltage	: BC546	65	V
		: BC547/550	45	V
		: BC548/549	30	V
V_{EBO}	Emitter-Base Voltage	: BC546/547	6	V
		: BC548/549/550	5	V
I_C	Collector Current (DC)		100	mA
P_C	Collector Dissipation		500	mW
T_J	Junction Temperature		150	°C
T_{STG}	Storage Temperature		-65 ~ 150	°C

Pin Outs for all of the Transistors used in the AV1000

TOSHIBA 2SC4793

TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL TYPE

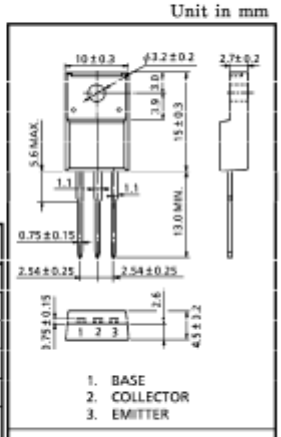
2SC4793

POWER AMPLIFIER APPLICATIONS

DRIVER STAGE AMPLIFIER APPLICATIONS

- High Transition Frequency : f_T = 100MHz (Typ.)
- Complementary to 2SA1837

Unit in mm



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	230	V
Collector-Emitter Voltage		V_{CEO}	230	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current		I_C	1	A
Base Current		I_B	0.1	A
Collector Power Dissipation	Ta = 25°C	P_C	2.0	W
	Tc = 25°C		20	
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

JEDEC	—
EIAJ	—
TOSHIBA	2-10R1A

Weight : 1.7g

TOSHIBA 2SA1837

TOSHIBA TRANSISTOR SILICON PNP EPITAXIAL TYPE

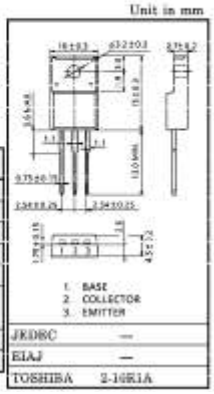
2SA1837

POWER AMPLIFIER APPLICATIONS

DRIVER STAGE AMPLIFIER APPLICATIONS

- High Transition Frequency : f_T = 70MHz (Typ.)
- Complementary to 2SC4793

Unit in mm



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	−230	V
Collector-Emitter Voltage		V_{CEO}	−230	V
Emitter-Base Voltage		V_{EBO}	−5	V
Collector Current		I_C	−1	A
Base Current		I_B	−0.1	A
Collector Power Dissipation	Ta = 25°C	P_C	2.0	W
	Tc = 25°C		20	
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

JEDEC	—
EIAJ	—
TOSHIBA	2-10R1A

FAIRCHILD
SEMICONDUCTOR®

IRF610B/IRFS610B

200V N-Channel MOSFET

General Description

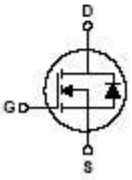
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supplies, DC-AC converters for uninterrupted power supply and motor control.

Features

- 3.3A, 200V, $R_{DS(on)}$ = 1.5Ω @V_{GS} = 10 V
- Low gate charge (typical 7.2 nC)
- Low Crss (typical 6.8 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

TO-220
IRF Series

TO-220F
IRFS Series



Pin Outs for all of the Transistors used in the AV1000

FAIRCHILD
SEMICONDUCTOR®

IRFP240

Data Sheet **January 2002**

20A, 200V, 0.180 Ohm, N-Channel Power MOSFET

This N-Channel enhancement mode silicon gate power field effect transistor is an advanced power MOSFET designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. All of these power MOSFETs are designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. These types can be operated directly from integrated circuits.

Formerly developmental type TA17422.

Ordering Information

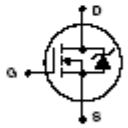
PART NUMBER	PACKAGE	BRAND
IRFP240	TO-247	IRFP240

NOTE: When ordering, include the entire part number.

Features

- 20A, 200V
- $r_{DS(ON)} = 0.180\Omega$
- Single Pulse Avalanche Energy Rated
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Related Literature
  - TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol



Packaging

JEDEC STYLE TO-247

Pin Outs for all of the Transistors used in the AV1000

FAIRCHILD SEMICONDUCTOR®

IRFP9240

Data Sheet **January 2002**

12A, 200V, 0.500 Ohm, P-Channel Power MOSFET

This P-Channel enhancement mode silicon gate power field effect transistor is an advanced power MOSFET designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. All of these power MOSFETs are designed for applications such as switching regulators, switching convertors, motor drivers, relay drivers, and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. These types can be operated directly from integrated circuits.

Formerly developmental type TA17522.

Ordering Information

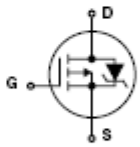
PART NUMBER	PACKAGE	BRAND
IRFP9240	TO-247	IRFP9240

NOTE: When ordering, use the entire part number.

Features

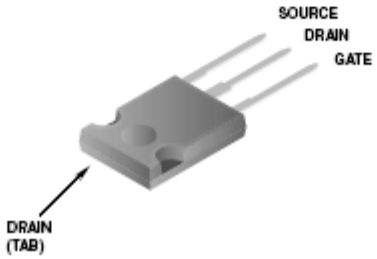
- 12A, 200V
- $r_{DS(ON)} = 0.500\Omega$
- Single Pulse Avalanche Energy Rated
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance

Symbol



Packaging

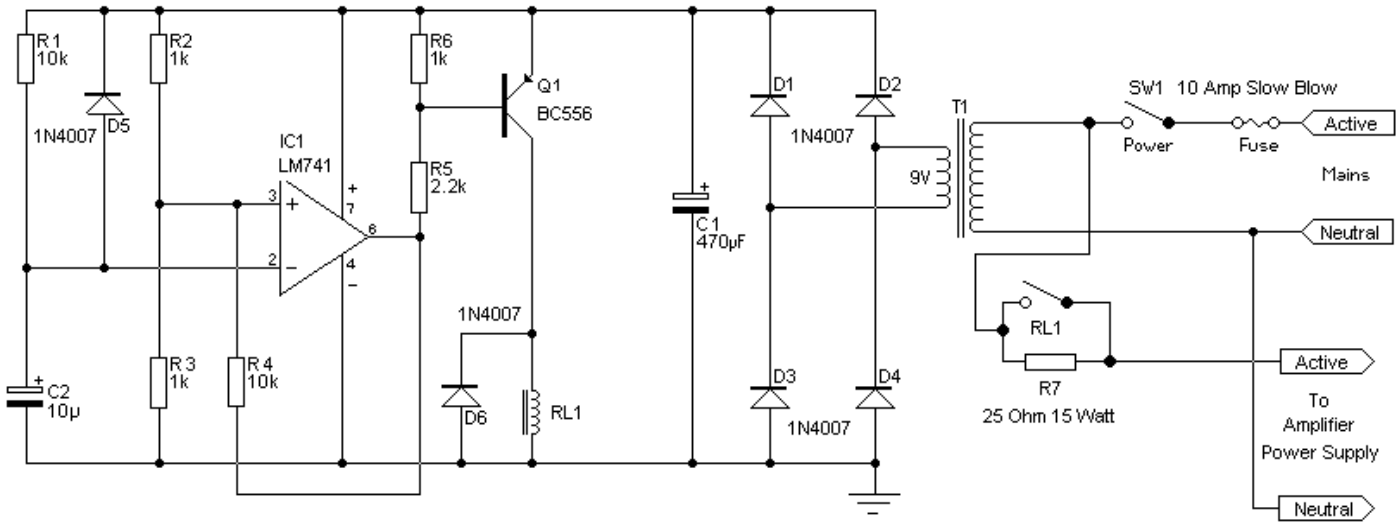
JEDEC STYLE TO-247



Toroidal Transformer Mains Surge Limiter

Toroidal transformers with a rating from 500 VA and up require a mains surge limiter. Otherwise you run the risk of tripping the 16-20 Amps mains circuit breaker in your home. While this is not dangerous it is annoying and inconvenient.

Here is a circuit you can build up to circumvent this issue.



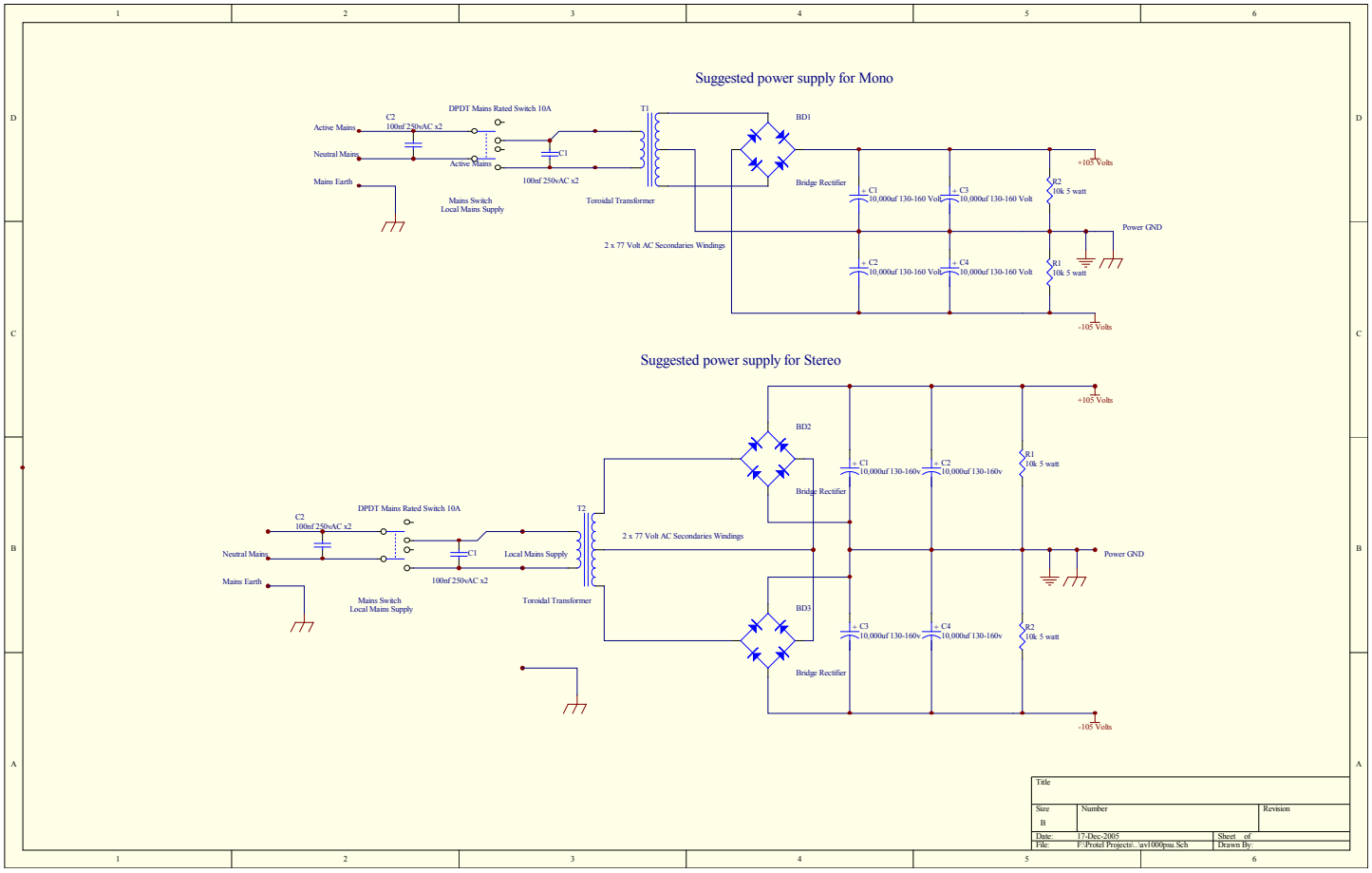
Suggested Mains Surge Limiter

The part list is shown below

2 x 10k Ohm ¼ watt carbon or metal film resistors
3 x 1k Ohm ¼ watt carbon or metal film resistors
1 x 2.2k Ohm ¼ watt carbon or metal film resistor
1 x 25 Ohm 15 to 50 watts Metal Clad resistor
1 x 10uf 25-volt electrolytic capacitor
1 x 470uf 25v electrolytic capacitor

6 x 1N4007 1-amp diodes
1 x LM741 Opamp
1 x BC556 PNP transistor
1 x 12 volt activated relay with 10 amps or greater contact rating
1 x mains power transformer with 1 x 9vAC secondary winding rating @ 1 Amp

Suggest Power Supply for AV1000 MOSFET Amplifier



Use the Zoom option in Acrobat Reader to see the schematic clearer