

OUTPUT STAGE FOR ALL-FET CLASS A POWER AMP 20W AND 50W

Borbely Audio [EB-1199/114](#)
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Building Blocks

The EB-1199/114 Output Stage consists of only 1 building group:

1. EB-1199/114

Group 1 is detailed in this document. The mechanical design and layout of this kit is highly individualistic and personalized.

Deliverables

The EB-1199/114 kit is complete; meaning the etched and drilled PC board, all electronic components and this document is included with your purchase. It is assumed the builder has the basic construction tools, soldering iron, solder, etc. This kit can be adjusted with a common voltmeter (i.e. DVM, DMM, VOM etc.) Other audio equipment is desirable to conduct other tests, but is not necessary. This project is a “module” that can be easily installed on a variety of heatsinks, or retrofitted into existing systems.

Take the time to read the text. With the purchase of this kit, a parts list will be included that you will need to identify the components and their proper layout on the PC board. Please check the components for correct quantity and accuracy. When inserting components on the PC board(s) please check the schematic as well as the stuffing guide for proper placement. This will save time if a problem arises later.

If you find a discrepancy, please let us know immediately.

General design information

The EB-1199/114 is the recommended output stage for the “Ribbon” driver. Laid out for one pair of TO-220 GSD driver MOSFETs and five pairs of TO-3P GSD output MOSFETs, the output MOSFETs are matched and do not require source resistors. The EB-1199/114, if properly heatsinked, can deliver up to 50W in pure Class A, and 100W in Class AB. With the supply limitations of the “Ribbon” driver, the maximum output is 40W.

For 20W Class-A only three pairs of output MOSFETs are needed. In this case Q4, Q6, Q9, Q11 and the associated components are not used. In case of <20W output (say an efficient ribbon tweeter), there is also the possibility to leave out the drivers Q1, Q2 and connect the output stage to the driver board directly. The resistors R1, R7 and the MOSFETs Q1 and Q2 have to be bypassed to get to the output devices directly. Some linearity is traded here against speed and resolution, but the sacrifice is worthwhile.

As long as the output MOSFETs are of the 2SK1058/2SJ162 type, the output stage is thermally stable and the bias MOSFET Q14, shown on the driver board, does not have to be mounted on the output heatsink. However, with other types of MOSFETs thermal tracking is mandatory! This can be accomplished by selecting the bias MOSFET from the same generic type of MOSFETs as the output ones and mounting this on the heatsink.

The PC board for the output stage is used with the copper-side up, i.e. only the jumpers are mounted on the “component side”, and the rest of the components are mounted on the copper side. Consequently the output board is not silk-

screened and you have to follow the stuffing guide supplied with the output board. The resistors and capacitors are all mounted 3-5mm off the PC board, be careful when soldering the short leads under the components. The electrolytics C6/C7 are laid down on the PC board, and although they are self supporting, it is recommended to tie them down with a wire, soldered to the ground plane on both sides. These caps should be rated for 105° C operation.

The EB-1199/114 PC board is mounted on 5mm stand-offs on the heatsink. In mounting the MOSFETs on the heatsink, the important thing is not to damage the MOSFET chip inside the package. The PC board is laid out in such a way that the MOSFETs can be soldered two ways, see fig.1

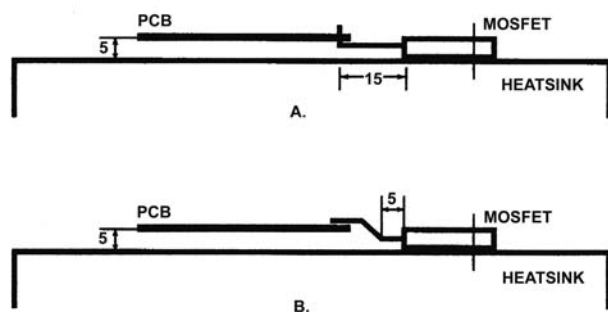
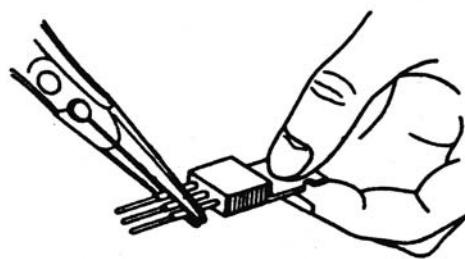
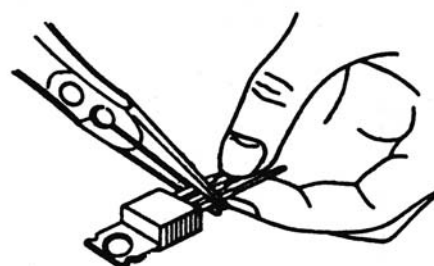


Fig 1.

In fig.1a the MOSFET pins are bent straight up 15mm from the body, then put through the holes in the PC board and soldered to the tracks. In fig. 1b the pins are bent twice and soldered to the top of the PC board. In both cases utmost care must be exercised in bending the leads. Use a pair of narrow, flat pliers to hold the leads **next** to the MOSFETs body. (See Fig.2) Without flexing the body, bend the leads with your fingers. The recommended distance between the body and bend is minimum 5mm.



WRONG



RIGHT

Fig.2

The next important issue is how you screw the MOSFETs to the heatsink. The very minimum is to use a large (15-20mm) flat washer under the screw holding the MOSFET. Alternatively, you can place an aluminum bar (20mm and 4-5mm thick) across all the transistors and use the individual screws to tighten the bar (and consequently the MOSFETs). And finally, don't forget to use an insulator under the devices!

Construction considerations

There are a few performance related concerns to consider in conjunction with the physical layout of your amplifier. Even though the majority of the physical construction belongs solely to the realm of personal preference, here are a few helpful hints to consider in improving the oval performance (and possibly avoid a problem or two).

There are many good methods of mechanical layout of an amplifier – just keep these in mind: The line cord, line fuse, power switch, power

transformer and bridge rectifier need to be mounted all close to each other in the rear of the amplifier enclosure. Mount all of the AC mains devices and power supply components in close proximity to each other, keeping this entire mounting area as far removed as possible from low-level signal, high impedance areas of the power amplifier. Mount the driver boards so that the input stages are close to the front of the enclosure area, maximizing the physical distance between these areas and the power supply. The importance of this issue in principal is to make sure that the input wires are kept away from the power supply. You may want to mount the power supply and power transformer to one side of the amplifier enclosure in an effort to accomplish the same goal. There are many other good options also.

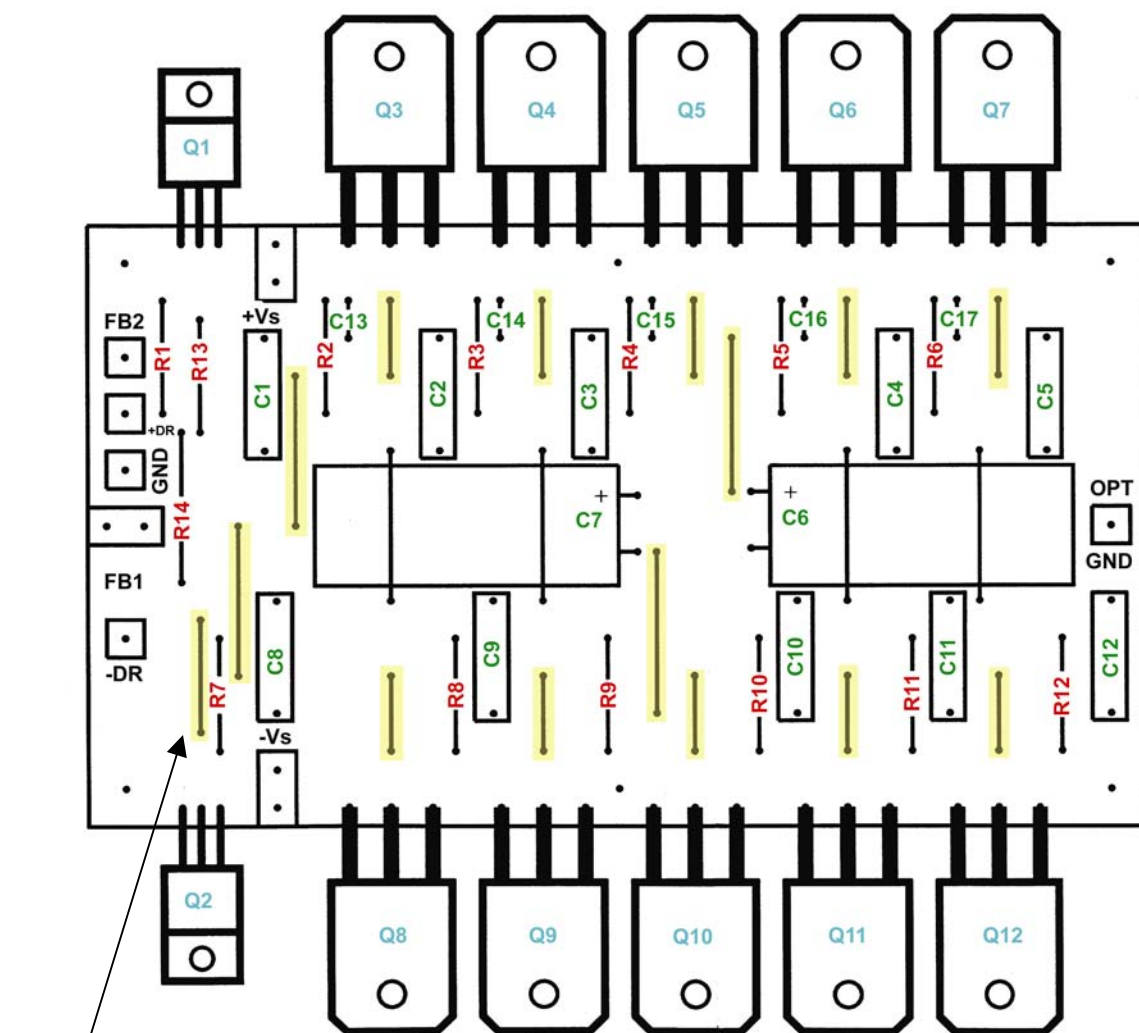
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The high-quality ground point, or star point, should be located in a good central and accessible location. There will be several “return” lines connected to this point from both driver boards and the power supply, so its good to make it centrally located. (See wiring diagram).

Hum problems in audio amplifiers are often the result of improper ground wiring in the completed amplifier. Make sure to provide adequate return wiring to the various internal amplifier sections.

Cost and Ordering

Pricing for the EB-1199/114 is available on our website at www.audiokits.com. Please refer to our website for updated pricing and kit availability. For your convenience on-line shopping is available with secure purchasing and order fulfillment. You may even track your purchase from order placement to delivery.



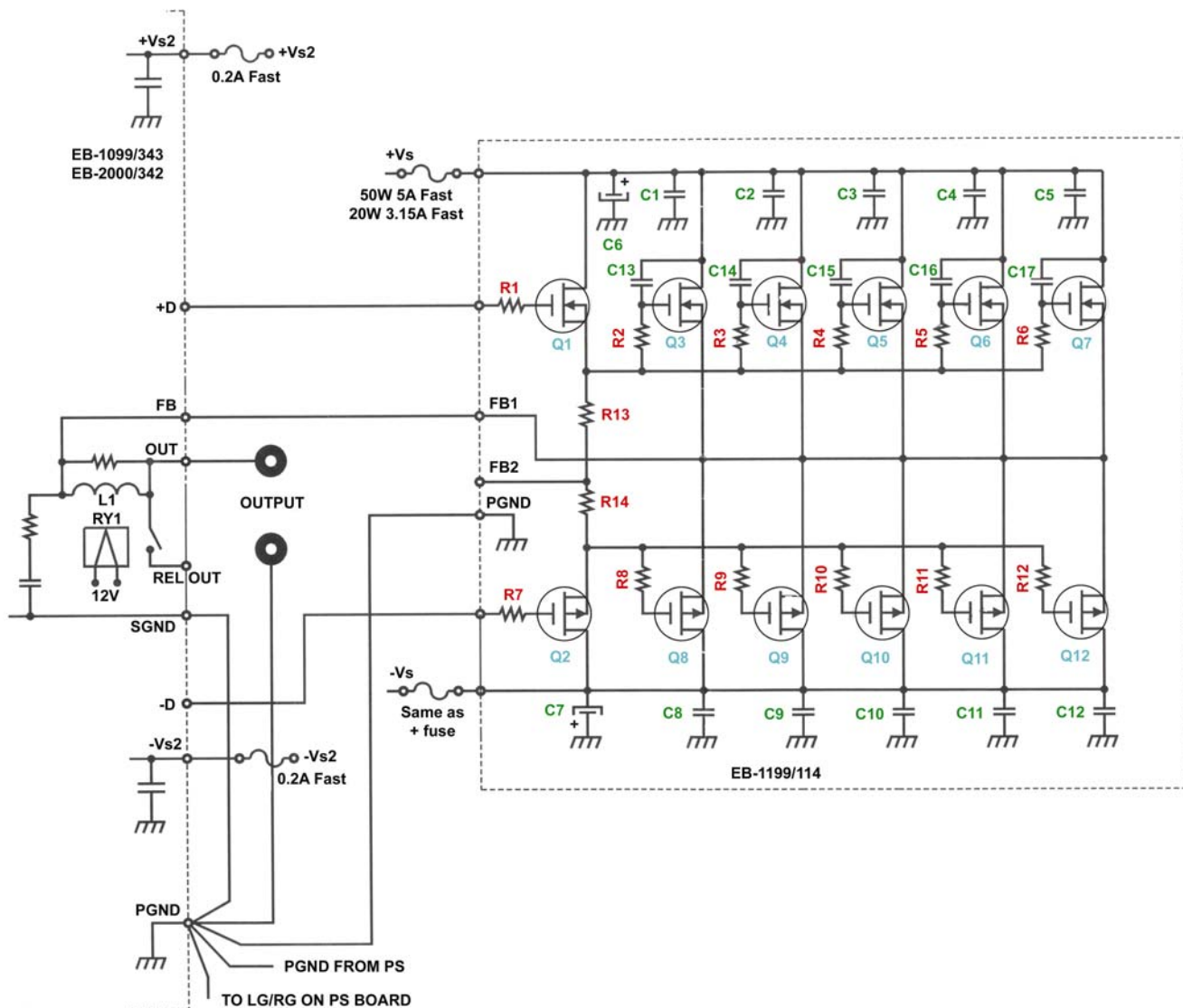
Jumper

Stuffing Guide for All-FET 20/50W Class A Output

Note: Components are mounted on Copper-side.

Jumpers on "Component" side

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All-FET Class-A Power Amplifiers 20W and 50W Output Stage

Note: In the 20W version Q4, Q6, Q9 and associated components are NOT used

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