

## EB-707/432 LOW-COST ALL-FET MM/MC Phono preamp.

The EB-707/432 is a high quality, low-cost All-FET MM/MC phono preamp with on-board All-FET regulators. The combination of very low input noise and high gain allows you to use it with practically all pickups on the market. RIAA accuracy is 0.1dB. Two phono preamps are laid out on a PCB of 285mm x 145mm, each with its own independent regulator. It is highly recommended to use independent power supplies for the two channels. This will ensure best noise/cross talk performance

The EB-707/432 is using a two-amplifier approach instead of the usual single amplifier. This allows you to optimize it for low noise, RIAA accuracy, gain and dynamic range. The block schematic is shown in fig. 1.

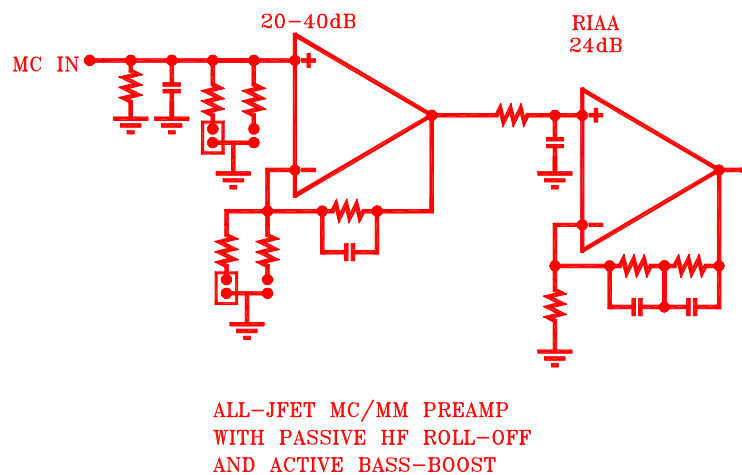


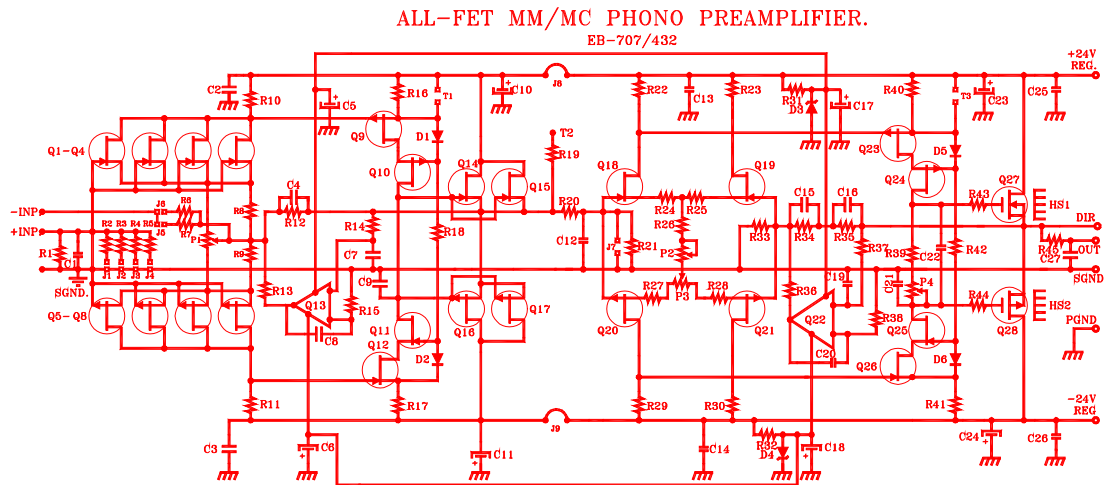
Fig. 1. Block schematic for EB-707/432.

In fig. 1 the amp on the left is a high-gain amplifier with extremely low input noise and flat frequency response. It can be used with 20 or 40dB gain by changing the feedback resistor. The R-C network between the two amplifiers provides the 75-microsecond roll-off for the RIAA equalization. The amp on the right provides a further amplification of 24 dB at 1kHz and at the same time boosts the bass according to the RIAA characteristics. MM gain is 44 dB and MC gain is 64 dB.

### EB-707/432 MM/MC phono preamp.

Fig. 2 shows the schematic of the EB-707/432. The input amp has been developed from the basic 4-JFET complementary amp described in my article: “The All-FET Line Amp” fig. 5 (1), see also copy of the article on [www.borbelyaudio.com](http://www.borbelyaudio.com). 3 more pairs of complementary JFETs have been added in parallel to the input JFETs to reduce the input noise. The second stage has been cascoded as described in fig. 7 of the same article. Finally, two complementary output stages in parallel have been added to be able to drive a low-impedance feedback network, see fig. 8. Since the DC gain of the circuit can be very high a servo circuit is used to keep the offset close to zero Volt.

R20/C12 provides the 75-microsecond roll-off. The second amp of the phono preamp uses a complementary differential input stage. These JFETs are very closely matched. The second stage is using the same cascoded JFET circuit as the input amp. The output stage is a complementary MOSFET follower operating at approx 45mA, capable of driving low impedance load and long cables. Due to the high gain at DC (44dB) a servo circuit is used to control the offset. Both servo amps are supplied from common +/-10V shunt regulators.



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**Fig. 2. The EB-707/432 ALL-FET MM/MC phono preamp.**

### Typical Specifications.

Input stage:

Gain:	20 or 40dB
THD, 20dB gain, 3V/1kHz:	0.001%
3V/10kHz:	0.0028%
Maximum output voltage:	10VRMS
Rise time, 20dB gain:	300ns
Equivalent short circuit input noise:	<100nV
Current consumption:	40mA

Second stage:

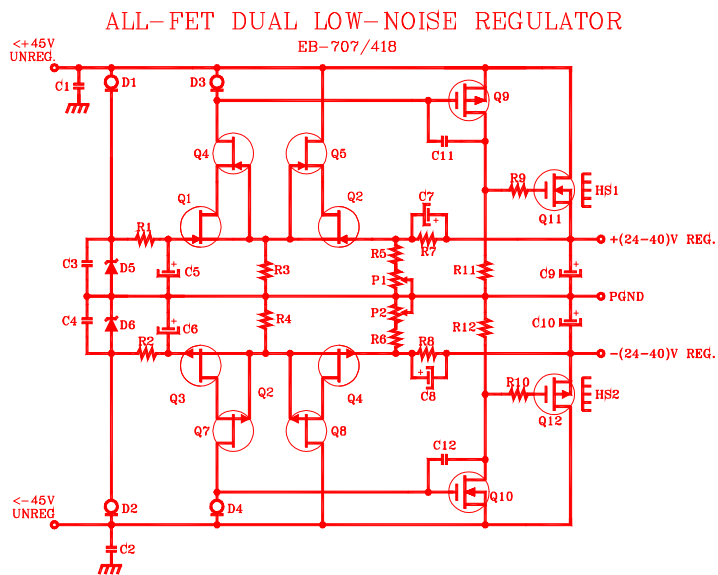
Gain:	24dB
THD, 3V/1kHz:	0.001%
3V/10kHz:	0.0015%
Maximum output voltage:	12VRMS
Risetime:	300ns
Current consumption:	70mA

RIAA accuracy:	0.1dB
Total current consumption:	110mA

### EB-707/418 ALL-FET regulator.

The schematic of the on-board EB-707/418 All-FET regulators is shown in fig. 3. The regulators are discrete FET opamps, the positive regulator is made up of differential JFET pair Q1-Q2, cascoded with Q4-Q5 and Mosfets Q9 and Q11, the negative of Q3-Q4, cascoded with Q7-Q8 and Mosfets Q10 and Q12. Q1-Q2 and Q3-Q4 are closely matched devices. The differential pair JFETs are working at 2mA drain current each, which is set up through the 6.9V reference diodes D5 and D6 and source resistors R3 and R4. The reference diodes are fed from constant current diodes D1 and D2. Q11 and Q12 Mosfet source followers have to be heatsinked as the total current of the phono preamp is 110mA per channel.

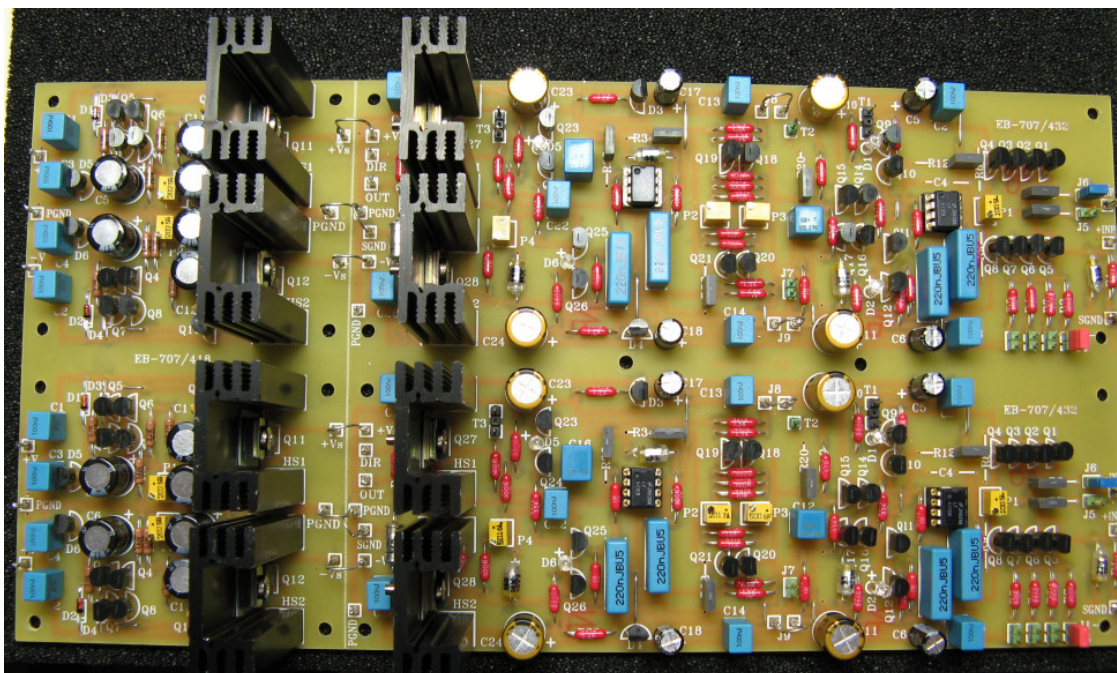
Output voltage can be changed between 20 and 30V with P1 and P2. If they are used with fixed 24V output, then P1 and P2 can be shorted by changing R5 and R6 to 3k32. Minimum input/output voltage diff. is 4V, but min. 5V is recommended, i.e. unregulated input voltage should be minimum +/-29V.



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**Fig. 3. EB-707/418 ALL-FET regulators.**

The PS has to deliver +/- 29-31V at 110mA. Recommended PS is the EB-108/291 or the EB-906/275 low ESR PS. It is recommended to mount the PS and the mains transformer in a separate box, to avoid hum problems.



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References:

1. Erno Borbely: The All-FET Line Amp. AudioXpress, May 2002, page 28. See copy of article on [www.borbelyaudio.com](http://www.borbelyaudio.com)