

200W BRIDGE AMPLIFIER



413x2

How to connect two ETI 413 100 watt amplifiers to double the output.

NO MATTER how big an amplifier you design — someone always wants a bigger one! We have certainly found this to be true, for hundreds of our ETI 413 Guitar Amplifiers have been built, and the only complaint that some builders have is that they would like even more power — especially into eight ohms.

Whilst a 200 watt amplifier can quite readily be designed, special high-voltage, high-power output transistors and a large and expensive power transformer are required. Fewer people require such power and hence, for commercial amplifiers, this means even higher cost in terms of £-per-watt of output power.

Here is a way to couple two ETI 413 amplifiers together to obtain 200 watts into 8 ohms.

The ETI 413 was first described in February of 1973. That issue of ETI is long out of print but was reprinted in Project Book No. 1 which is still

available from us for 85p inc. postage.

Normally the ETI 413 provides 100 watts into 4 ohms or 65 watts into 8 ohms. By connecting the two amplifiers in a bridge configuration each amplifier effectively sees an 8 ohm load as 4 ohms. Their combined output will therefore be 200 watts. The only additional components required, apart from the two amplifiers are four resistors and three capacitors.

CONSTRUCTION

Construction of the individual 100 watt amplifiers is detailed in Project Book No. 1. If two existing amplifiers are to be interconnected they should be mounted end-to-end on a common base such that the connections between the two printed circuit boards are as short as possible. Of course, if the amplifiers are being specially built for the purpose, it is preferable to

mount them in a common box.

For 200 watts into eight ohms two complete power supplies will need to be constructed and their outputs commoned. This is cheaper than buying a larger transformer to supply both amplifiers. A larger transformer will certainly cost more than two individual transformers but, if one is available, it may be used together with a single rectifier bridge. If the amplifier is to be used to supply 100 watts to a speaker load of 16 ohms minimum, one single supply (as for the normal amplifier) will be sufficient.

Before modifying the amplifiers for bridge connection set up and test each of them separately.

To modify the amplifiers add the series 0.1 microfarad and 4.7 ohm network across the output of each amplifier and add the series 0.01 microfarad and 10 ohm network from the base of transistor Q6, in the second amplifier, to ground. Using

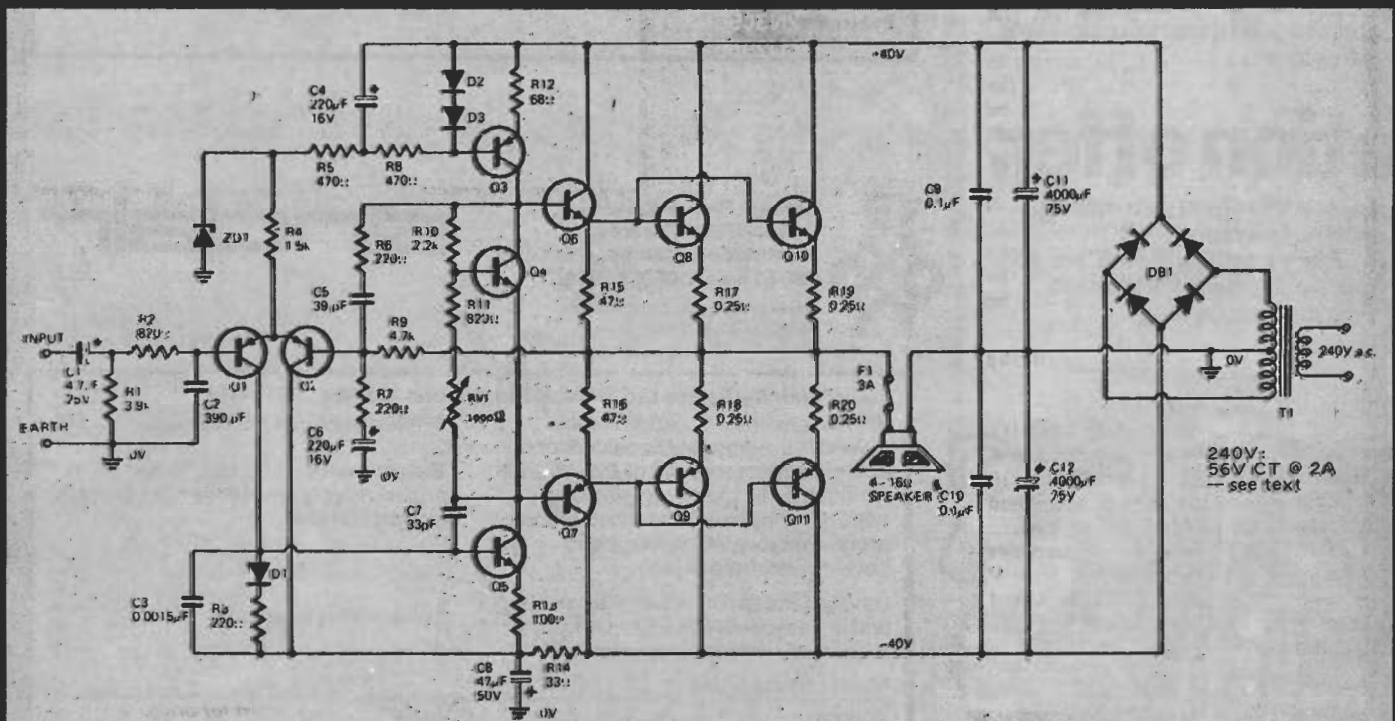


Fig. 1. Circuit diagram of the ETI 413 amplifier. Full constructional details of this unit are given in Top Projects No. 1. Send 85p to: ETI Top Projects No. 1, ETI Magazine, 36 Ebury Street, London SW1W 0LW.

23/0076 wire (or heavier) link each of the +40 V, 0 V and -40 V, of one amplifier, to the corresponding rails of the other amplifier. The 4.7 k ohm resistor may now be installed between the output of the first amplifier and the base of transistor Q2 in the second amplifier. Use insulated wire to extend the resistor leads. The input of the second amplifier should be shorted out to prevent noise pickup. The speakers may now be connected (with a fuse in series) between the outputs of the two amplifiers.

Note that if it is possible to use two separate amplifiers, each delivering 100 watts into separate four ohm

loads, this is preferable to a bridge amplifier supplying 200 watts into an eight ohm load. In a bridge amplifier if one of the amplifiers fails then all output is lost. Thus from a reliability point of view the bridge amplifier should only be used where the eight ohm load cannot be separated.

The most queries arising from the original article concern the availability of the transformer. 56V centre-tapped types are not common however 25-0-25 and 30-0-30 types at 2A are widely available and are perfectly suitable. The values of C11 and C12 can also lie between 2500 and 5000 μ F.

SPECIFICATION

OUTPUT POWER

8 Ohms 200 watts
15 Ohms 120 watts*
Loads less than 8 ohms not recommended.

INPUT IMPEDANCE 3.9 k

INPUT SENSITIVITY 1 volt

*A single transformer may be used for 15 ohm loads in which case the power output will be 100 watts.

HOW IT WORKS -- ETI 413x2

One of the amplifiers is driven normally such that the output signal is in phase with the input. The second amplifier is driven from the output of the first and is connected as a unity-gain inverting amplifier. The second amplifier is changed to an inverting amplifier by injecting the signal, via a 4.7 k resistor, into the base of transistor Q2. The differential pair, Q1 and Q2, always tries to balance the voltages at the bases of the transistors by means of a change in output voltage. In the unmodified amplifier if the input voltage increases, the output voltage must also increase by the ratio of $(R9+R7)/R7$ (gain determining components). In the inverting mode the voltage on Q1 is constant and therefore, to keep the voltage at the base of Q2 constant, the current in the new 4.7 k resistor (from the output of amplifier 1) must be balanced by an equal current through R9 in amplifier 2. Therefore the output of amplifier 2 is identical to that of amplifier 1 except that it is out of phase by 180 degrees. The speaker, being connected between the two amplifiers, receives twice the output voltage that could be delivered by one amplifier alone.

Some additional stabilizing networks are needed when working in this mode and these consist of a 4.7 ohm resistor and an 0.1 microfarad capacitor in series across each output. Also required is a 10-ohm resistor and an 0.01 microfarad capacitor in series from the base of Q6 to ground on the second amplifier only. The power rails (+40 V, 0 V and -40 V) should also be linked between the two amplifiers.

SEMICONDUCTORS:

Q1,Q2,Q3 BFX30
Q4,Q5 BFY50
Q6 BD139
Q7 BD140
Q8,Q10 2N3055
Q9,Q11 MJ2955
D1,D2,D3 1N4005
ZD1 15V, 1A
DB1 4A, 200V diode bridge

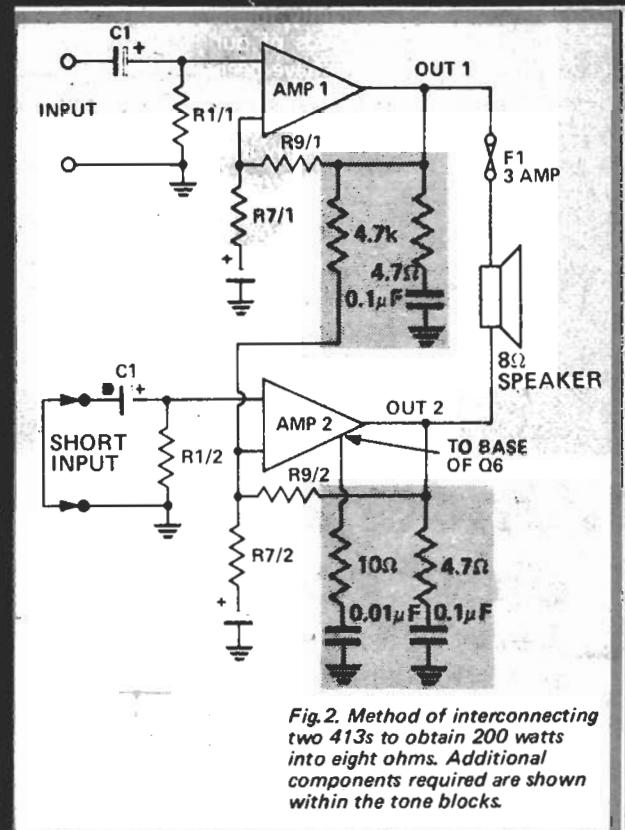


Fig.2. Method of interconnecting two 413s to obtain 200 watts into eight ohms. Additional components required are shown within the tone blocks.

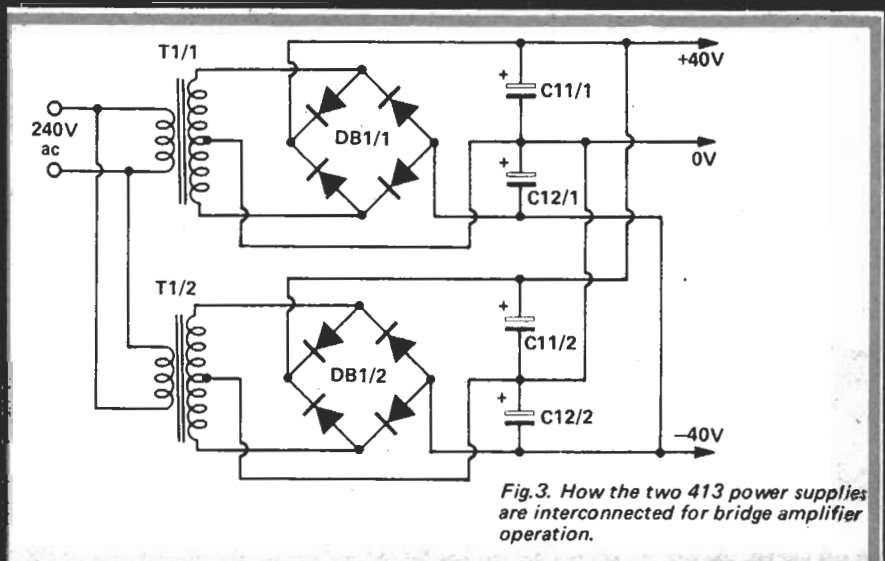


Fig.3. How the two 413 power supplies are interconnected for bridge amplifier operation.