



LM-386 BASIC AMPLIFIER KIT

Almost every ham radio project needs an audio amplifier. Rather than reinventing the wheel every time I've started making a series of modular kits so I can just pull a generic board off the shelf and use it. I am also trying to encourage more hams to build goodies. It isn't that hard - it is actually easier today than it was when I started in the early 1960's.

The first kit in the series is an LM386 audio amplifier. This nice little chip can run on from 4V to 15V and (certain versions) can produce up to 1 Watt of audio. This is way more than enough to run a pair of headphones or even a small speaker. It was tempting to do the amplifier in surface mount, but I expected that there would be others wanting to use the board and most "junque" boxes have leaded components - so this is a through-hole version. A later

version will be surface mount. This version is 1.2 inches by 1.25 inches so it should fit almost any spot. I tried to minimize the space requirements and yet leave future expansion possibilities, so this is intentionally a tightly packed board.

I included the bass boost components although they aren't necessary for most ham purposes. I also brought all the wires out to an optional connector. In most cases the connector will only add expense and annoyance so it's not included in the kit. It is easier to just solder the wires in the holes - but the connector could be used if desired. Future audio amplifiers will have the mounting holes and the connector in the same locations so they can be interchanged easily. Included on the board are de-coupling (F1, R1, C1, C2) from the power supply to make sure the amplifier remains stable. The circuit can be set for gains of 20 to 200 depending upon selection of components.

Note: If powering-up the board without connecting Pin 2 on J1, the input, to a volume control or other signal source you should provide something like a 10K ohm resistor from pin 2 to ground. Allowing the lead to float may cause the board to oscillate.

More kits and/or plain circuit boards are available from www.dwepe.com/kits. The latest assembly instructions will also be available for download. LM386 data sheets are available on the internet from www.national.com.

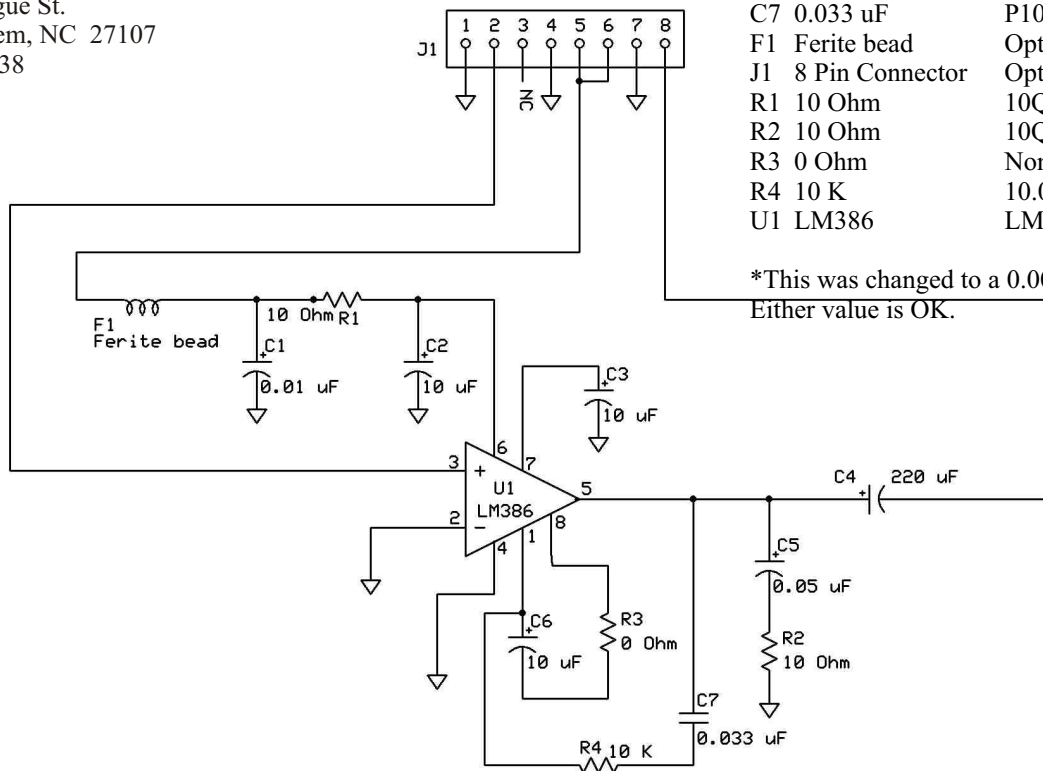
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Parts List

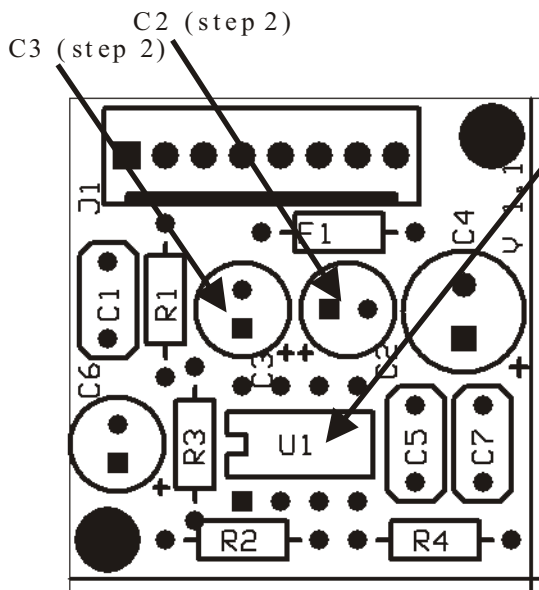
Digikey Number

C1	0.01 uF*	495-1098-ND
C2	10 uF	493-1036-ND
C3	10 uF	493-1036-ND
C4	220 uF	565-1674-ND
C5	0.05 uF	495-1101-ND
C6	10 uF	493-1036-ND
C7	0.033 uF	P10961-ND
F1	Ferite bead	Optional
J1	8 Pin Connector	Optional
R1	10 Ohm	10QBK-ND
R2	10 Ohm	10QBK-ND
R3	0 Ohm	None
R4	10 K	10.0KXBK-ND
U1	LM386	LM386N-3-ND

*This was changed to a 0.0015 in the kits.
Either value is OK.



C7 & R4 optional for bass boost.



() Step 1. Start by mounting the LM386 in the space for U1. Be certain to note that the notch in the IC and the notch shown in the silk screen line up. Pin 1 goes in the square solder pad, the rest of the pins are numbered counter-clockwise. After confirming that IC1 is in the correct orientation solder the IC leads on the underside of the board.

() Step 2. Mount C3 and C2. Confirm that the positive lead is in the square hole. The negative side of the capacitor is marked with an arrow and minus signs going down the negative side of the capacitor. Solder C3 and C2 into place.

() Step 3. R1 is a ten ohm resistor in series with the power for the IC. It's purpose is to decouple any fluctuations in supply voltage from any other circuitry. F1 is also in series with the power. F1 is an optional inductor or ferrite bead for additional decoupling in severe cases. It is unlikely to be necessary. Insert R1 (brown-black-brown) as shown and solder. Save one of the cut leads from R1 and insert the lead into the holes for F1 and solder.

() Step 4. C1 is a yellow polystyrene capacitor. It is also for decoupling any high frequency noise on the power supply leads. The schematic may call for a 0.01 but I changed the value to 0.001uF. Either will be fine. It's value isn't critical, the kit will supply either a 0.001 or a 0.0015 uF capacitor. A 0.0015 uF, 63 V cap will be yellow and will say "1n5k 63" on the top.

() Step 5. C4 couples the amplifier AC output to the speaker or headphones and blocks any DC from flowing through the speaker. It is a 220 uF (16V or higher) and is likely the largest capacitor in size. The negative lead is marked with a minus sign and an arrow down the negative side of the capacitor. Again make certain that the positive lead goes through the square hole.

() Step 6. C5 and R2 are a roll-off network required by the data sheet. C5 will be a 0.05 (or 0.047) polystyrene capacitor. It will be yellow and marked on top with 50nk 63 (or 47nk 63). R2 is a 10 ohm, 1/4 watt resistor (brown-black-brown). Insert both components, solder them and cut off the excess leads.

() Step 7. Bass-boost option. R4 and C7 are a feedback network to increase the bass response of the amplifier. While not necessary for ham purposes you may want to install it and the parts are provided in the kit. R4 is a 10.5 K resistor (brown-black-green-red-gold). [Yes, I know the datasheet says 10K - I'm out of those right now - but I've got thousands of 10.5 K and the value isn't critical.] C7 will be a 0.033 uF 63 volt capacitor. C7 will be yellow and will say 33nk 63 on top. C7 does not have a polarity.

() Step 8. Gain option. C6 and R3 are optional. Leaving both out lowers the gain to about 20. Using a 1.3K resistor for R3 along with a 10 uF for C6 makes the gain about 50. Using only a 10 uF capacitor and a jumper for R3 (zero ohms) provides a gain of about 200. [A variable 1.3 K resistor can be used for R3 to vary the gain from about 20 to 200, but I can't imagine why you would want to do this.] Mostly likely you will want the higher gain and vary the signal applied by the use of a volume control (not included). Insert a 10 uF capacitor (watch the polarity!) for C6 and use a clipped lead from another component as a jumper for R3 and solder both parts. Clip the excess leads.

() Step 9. That completes the board. Please double check your solder connections and make certain that the caps are inserted correctly. On J1 Pin 1 is the square hole. Pins 1 and 2 should go to your volume control, with pin 2 being the wiper and Pin 1 is ground. The high side of the volume control should go to whatever your signal source is. Pin 4 should go to the minus side of the power supply. Either pin 5 or 6 (they connect together) needs to connect to your power source. The speaker or headphones will connect to pins 8 (ground) and 9 (output). That's it!

