DIY Kit 50 - 25W HI-FI AUDIO AMPLIFIER MODULE

INTRODUCTION
This kit contains the essential components needed to build a high fidelity amplifier module using the National Semiconductor LM1875 IC. With the addition of a handful of parts and a suitable power supply, this module will deliver 25W RMS into 8 ohms @ 1% THD. PCB dimensions are a tiny 53 x 50mm (2.1" x 2").

Heatsink, speaker and cables are not included. This is not only to save weight in the kit but also because such items are often a matter of personal preference by the user. Some users may choose to spend more money to buy top quality cables, connectors and speakers, while others may have all these items already in their junk box.

The kit is constructed on single-sided printed circuit board. Protel Autotrax & Schematic were used in the design.

LM1875 SPECIFICATIONS
- Up to 30W output power into 8 ohms
- Typical THD of 0.015% @ 1kHz, 20W output
- Short circuit protection
- 94dB supply rejection ratio
- In-built thermal protection
- S/N ratio in excess of 100dB
- Open loop gain typically 90dB
- 70mA quiescent current (typical)

CONSTRUCTION
Start with the lowest height components first, resistors and capacitors. Be careful to get the electrolytic capacitors in the correct way around. The positive lead is marked on the overlay. The negative lead is marked on the body of each capacitor. Leave the fuse holders and IC to last.

The following items have to be supplied by you:

- a **heatsink** with a thermal resistance of **1.4 °C/W** or better. Use the silicon impregnated washer supplied when attaching it to the IC.
- 8 ohm speaker of suitable power
- suitable cables.

Solder the power and audio cables directly to the pads provided on the PCB.

CIRCUIT DESCRIPTION
The IC can be used with two power supply arrangements - single supply and dual supply. We have decided to use the dual supply version. The single supply version would require the use of 63V electrolytic capacitors, thus increasing the cost and overall size of the module.

The input signal is coupled via R1 and C1 to the non-inverting input (pin 1) of the IC. The closed loop gain of the amplifier is set to 19 by resistors R5 (180K) and R4 (10K). R4 and C3 (22uF) set the lower 3dB frequency point to 7Hz.

The output appears at pin 4 of the IC and drives a loudspeaker directly. Long speaker leads can produce enough capacitance to drive amplifiers into VHF oscillation. Resistor R6 (1Ω) and capacitor C4 (0.22uF) help prevent this. They are connected across the output and form a Zobel network which provides high-frequency stability when driving capacitive loads.

The IC power supply is connected via 2A fuses to protect against any external shorts to ground. Capacitors C5 and C7 provide further on-board supply decoupling.

POWER SUPPLY
The module is powered by a dual +/- 25V supply. These rails are supplied by a separate power supply board.

We have one kit available for this purpose - Kit 114. It consists of four diodes (1N5401) connected as a bridge rectifier and four electrolytic capacitors (2200uF) to smooth out the ripple.

The mains transformer used to power the module should be rated at 60VA with a 35V centre-tapped secondary winding. A 30V secondary winding transformer could also be used but the lower DC output would result in reduced power output.

If you want to run two modules in a stereo amplifier you can use a common power supply. In this case the transformer should be rated at 80VA.

TESTING
Before applying power, check that all parts are inserted in the correct locations. Make sure that the electrolytic capacitors are the right way round. Connect the power supply leads with a multimeter (set to read amps) in series with the positive rail. Do not connect a speaker or audio input yet.

Switch on the power and check that the current settles down to 50-70mA. There will be a brief suge as the main filter capacitor (C7) charges.

Note: You **must have the heatsink fitted**, otherwise the thermal overload protection circuit will cut in and switch the device off.

If the quiescent current is correct, check the DC offset volrage across the speaker terminals. It should be less than +/- 50mV. If all is well, switch off the power and connect a speaker and an audio input signal.

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OPERATION

Do not operate the module without a heatsink.

The heatsink tab on the LM1875 IC is internally connected to the negative supply pin (3) and therefore the negative supply rail. **If the module is mounted inside an earthed metal chassis then it must be isolated from the heatsink using an insulating washer.** If not, the negative supply rail will be shorted to ground.

The LM1875 can drive either 4Ω or 8Ω loads but it delivers slightly more power into 8Ω loads. Maximum output power into 4Ω loads is 20W. It is recommended to use an 8Ω speaker.

To minimize noise and distortion, keep the input signal leads away from the power supply leads.

IF IT DOES NOT WORK

Poor soldering ("dry joints") is the most common reason that the circuit does not work. Check all soldered joints carefully under a good light. Re-solder any that look suspicious. Check that all components are in their correct position on the PCB. Are the electrolytic capacitors the right way round? Are the fuses OK?

If the negative supply fuse (FS2) blows, check the insulating washer between the LM1875 IC and the heatsink. This will happen when the heatsink is bolted to an earthed metal chassis. Remember that the metal tab on the IC is internally connected to the negative supply rail.

PARTS LIST - KIT 50

Resistors (0.25W carbon)

1R brown black gold	R6	1
1K brown black red	R1	1
10K brown black orange	R4	1
22K red red orange	R3	1
180K brown grey yellow	R5	1
1M brown black green	R2	1

Capacitors

100nF monobloc	C2,6	2
0.22uF polyester film	C4	1
1uF 50V electrolytic	C1	1
22uF 63V electrolytic	C3	1
220uF 50V electrolytic	C7,5	2

Semiconductors

LM1875	IC1	1
25W Audio Power Amplifier IC		

Miscellaneous

Fuse holder & cover	FS1,2	2
2 amp fuses		2
Silicon impregnated insulated TO-220 washer		1
Screw, 3 x 12mm		1
Nut, 3mm		1
Washer, 3mm		1
PCB, K50		1

Download the LM1875 data sheet from the National Semiconductor website at

http://www.national.com