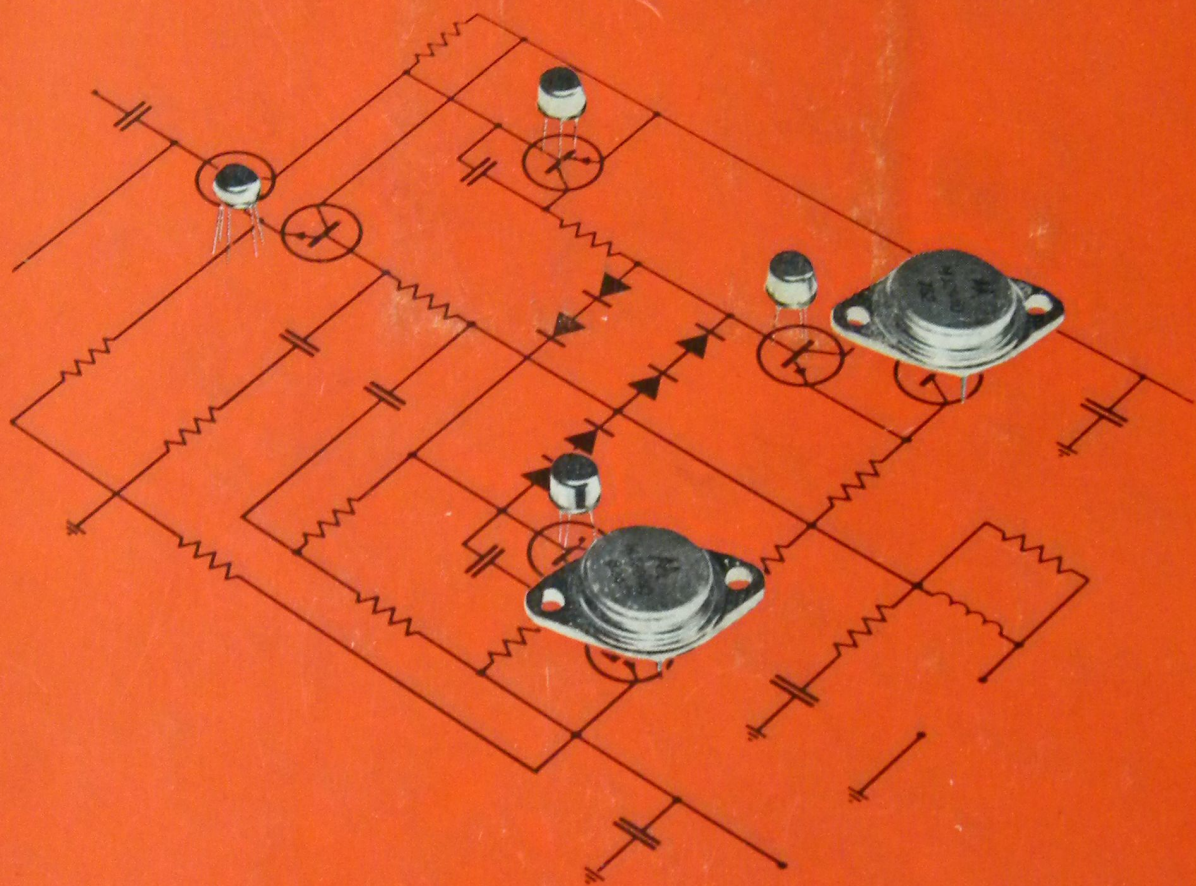


MS/402/302

AUDIO CIRCUIT DESIGN

with
SILICON COMPLEMENTARY PAIRS



MOTOROLA Semiconductor Products Inc.


AUDIO CIRCUIT DESIGN
with
SILICON COMPLEMENTARY PAIRS

Third Edition

June 1971

by
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Applications Engineering

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INTRODUCTION

This booklet is primarily intended for the European market. It is therefore simultaneously published in three languages - English, German and French.

Since the advent of complementary pairs of silicon transistors, able to deliver more than 100 Watts continuous power, it has appeared opportune to condense in a small brochure the necessary information for the design and construction of audio amplifiers with these devices.

The reader will find here not only schematics for 1 Watt to 100 Watt circuits but also pictures of printed boards which should help him in rapidly constructing an amplifier.

However, some tests must be performed in spite of the information given. This is evident since a compatibility has to be reached between load and circuit. These tests are mainly related to worst case conditions and will determine if the circuit is operated safely or not.

The procedure recommended to carry out this investigation is described for two examples : the 10W and 60W amplifiers. But the same method can be used for every other circuit.

While in the United States the loud-speaker impedances are practically limited to three different values, the values encountered in Europe are a faithful image of the diversity of our Continent. In such conditions, it was difficult to suggest schematics

for every load, and examples will be given for only three commonly used values : 4, 8 and 16 ohms.

To complete the presentation, the booklet contains device specifications and a theoretical section in which fundamental relations and design equations are summarized.

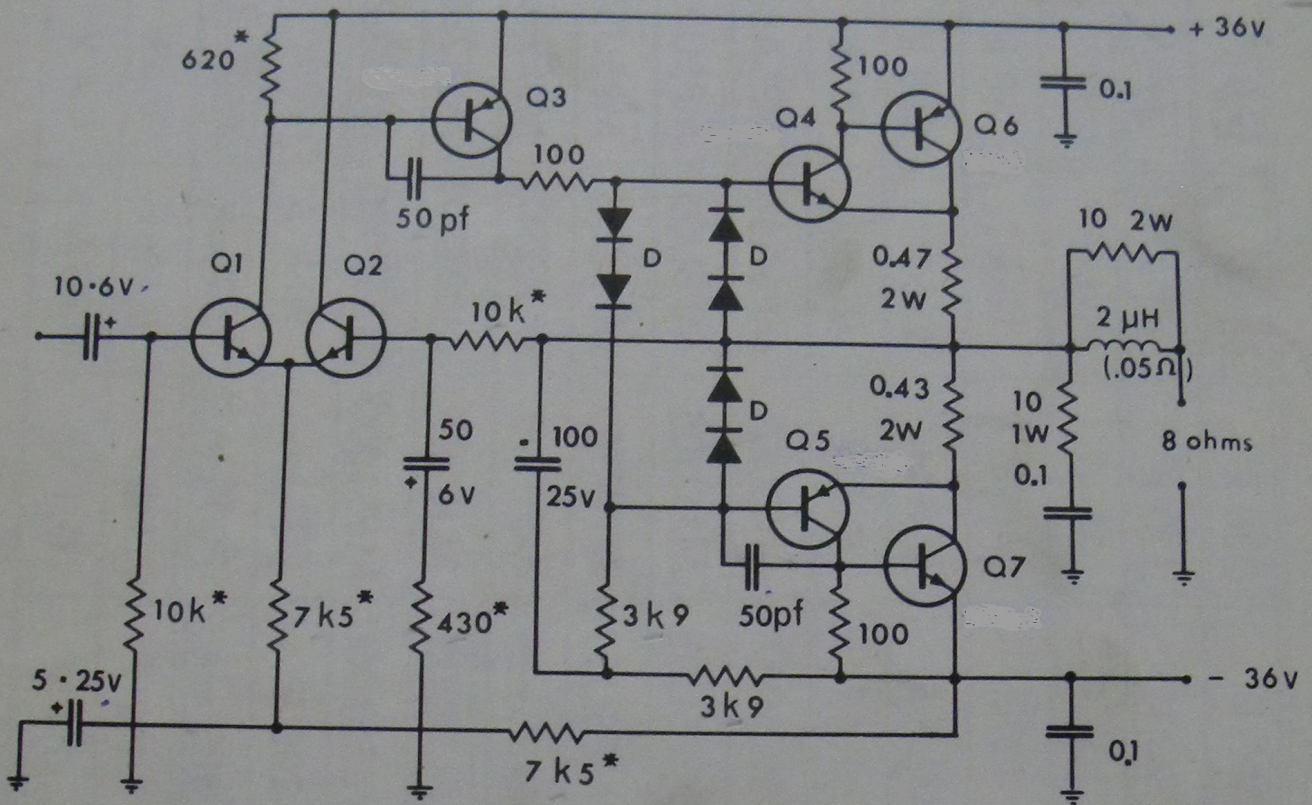
This booklet is edited by the Communications Group of the Applications Laboratory in Geneva, but it is in part based on designs made by the Applications Department in Phoenix.

The author is indebted to the specialists in audio engineering of this Department as well as to Messrs J. C. Cornamusaz and J. Francoz in Geneva for their collaboration.

Bruno Becciolini

C. 35 to 100W AMPLIFIERS

1. 60W-Amplifier for 8 Ohm-load with current limiting diodes



Performance

Power 60W with 8 Ohm Impedance

Harmonic distortion 0.1% at 60W

Intermodulation distortion 0.1% at 60W

Sensitivity 1V input for 60W output

Input resistance 10k Ohm

Frequency response 3db from 10Hz to 100kHz

Resistors 1/2W 10% or 5% (*) Tol.

Capacitors in μF

Idling current 90mA

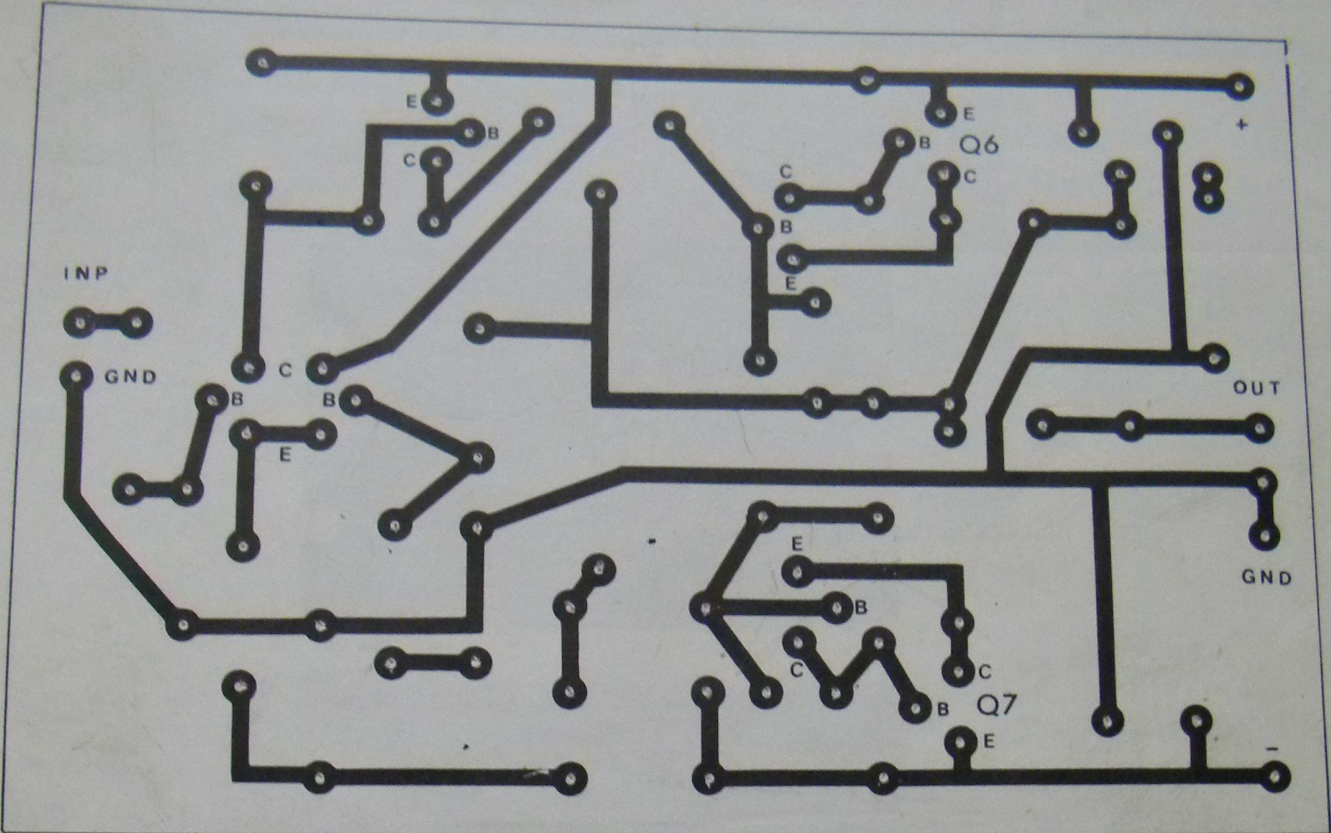
DC-current at 60W 1200mA

Dynamic range 96db (10k Ω -source)

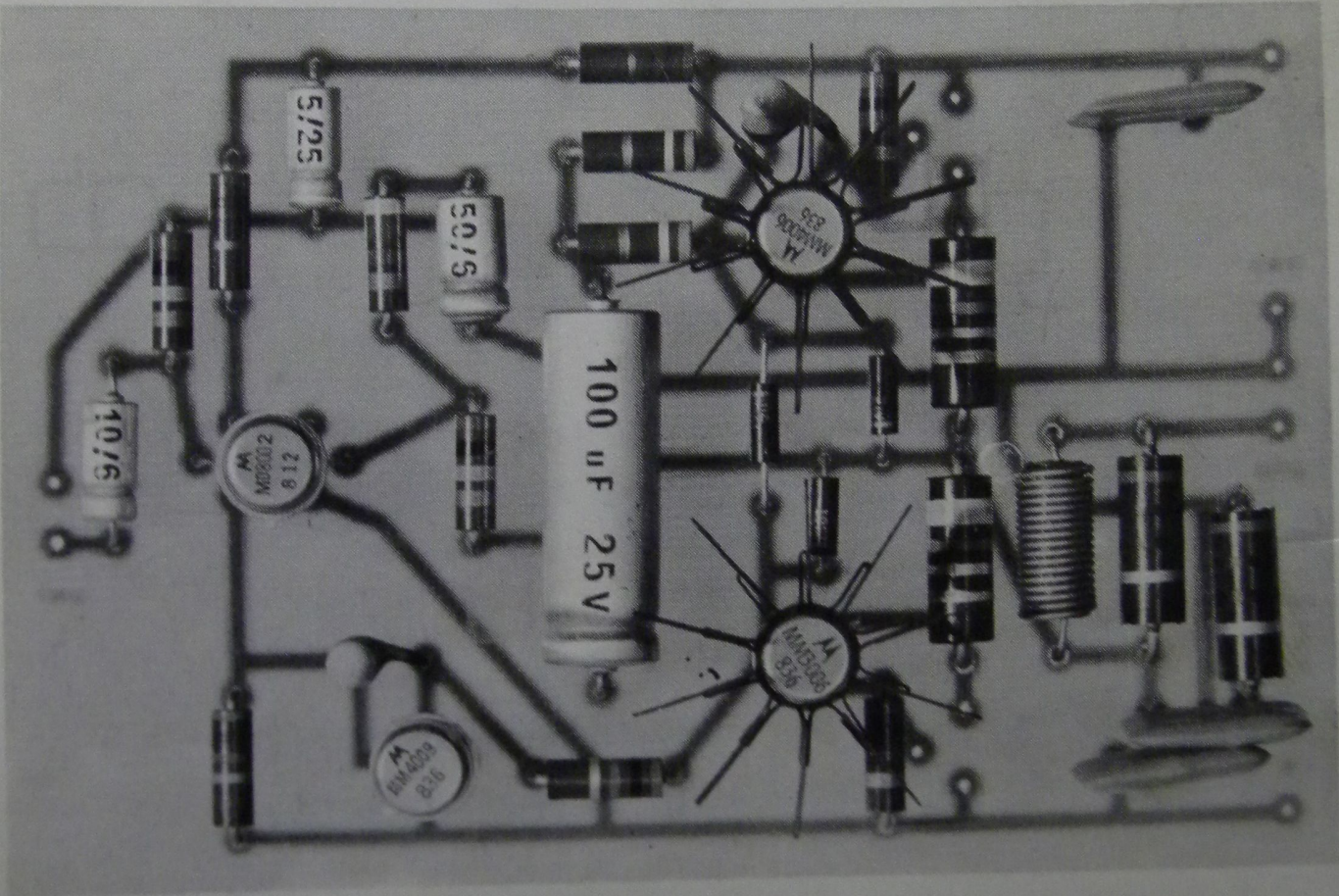
Q1	Q2	MD 8002
Q3		MM 4009
Q4		MM 3006
Q5		MM 4006
Q6		MJ 2941
Q7		MJ 2841
D		MZ 2361

60W Amplifier

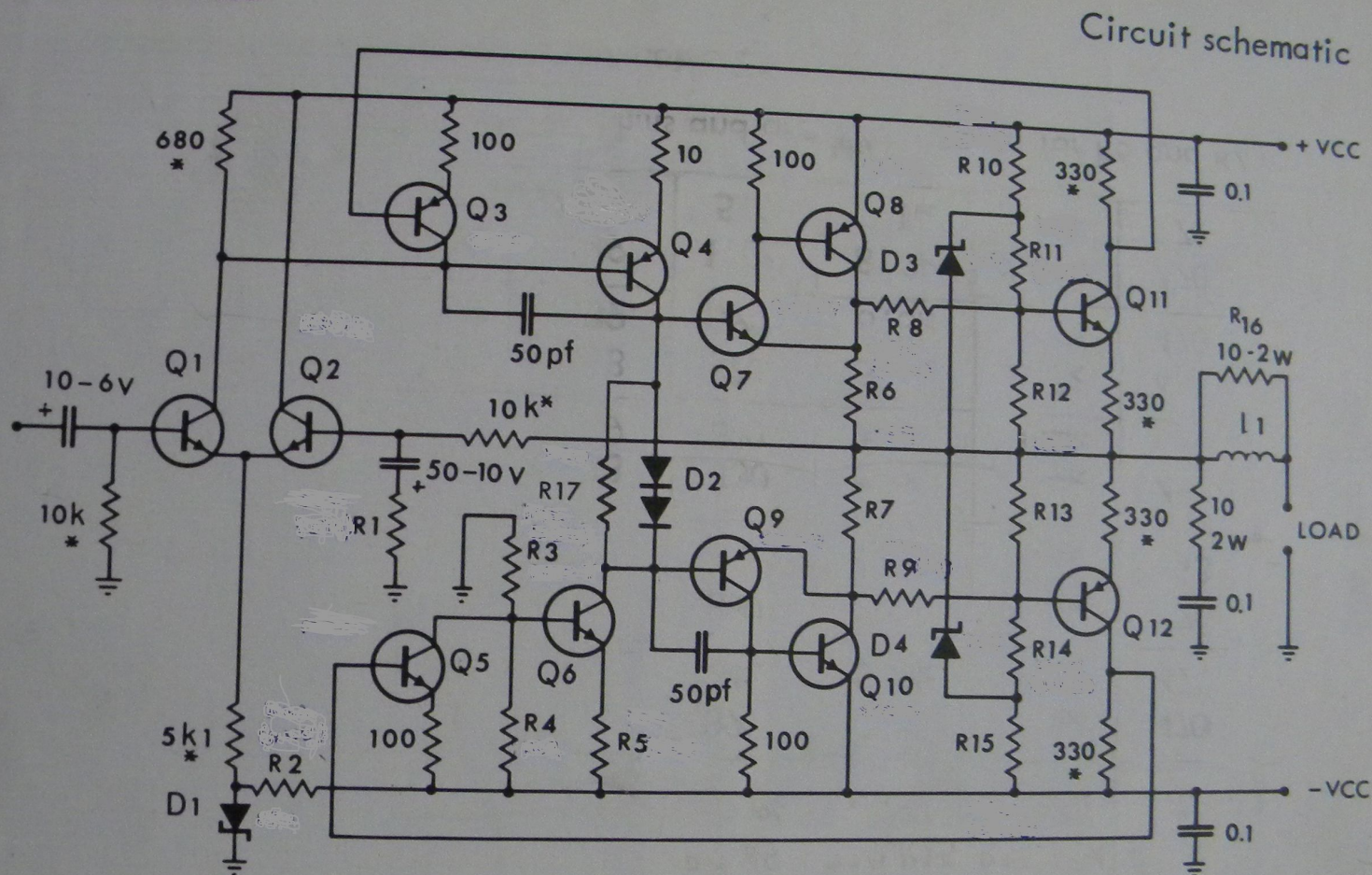
PC-board actual size



Completed board actual size



2. 35W to 100W Amplifiers for 4 and 8 Ohm-loads with power limitation



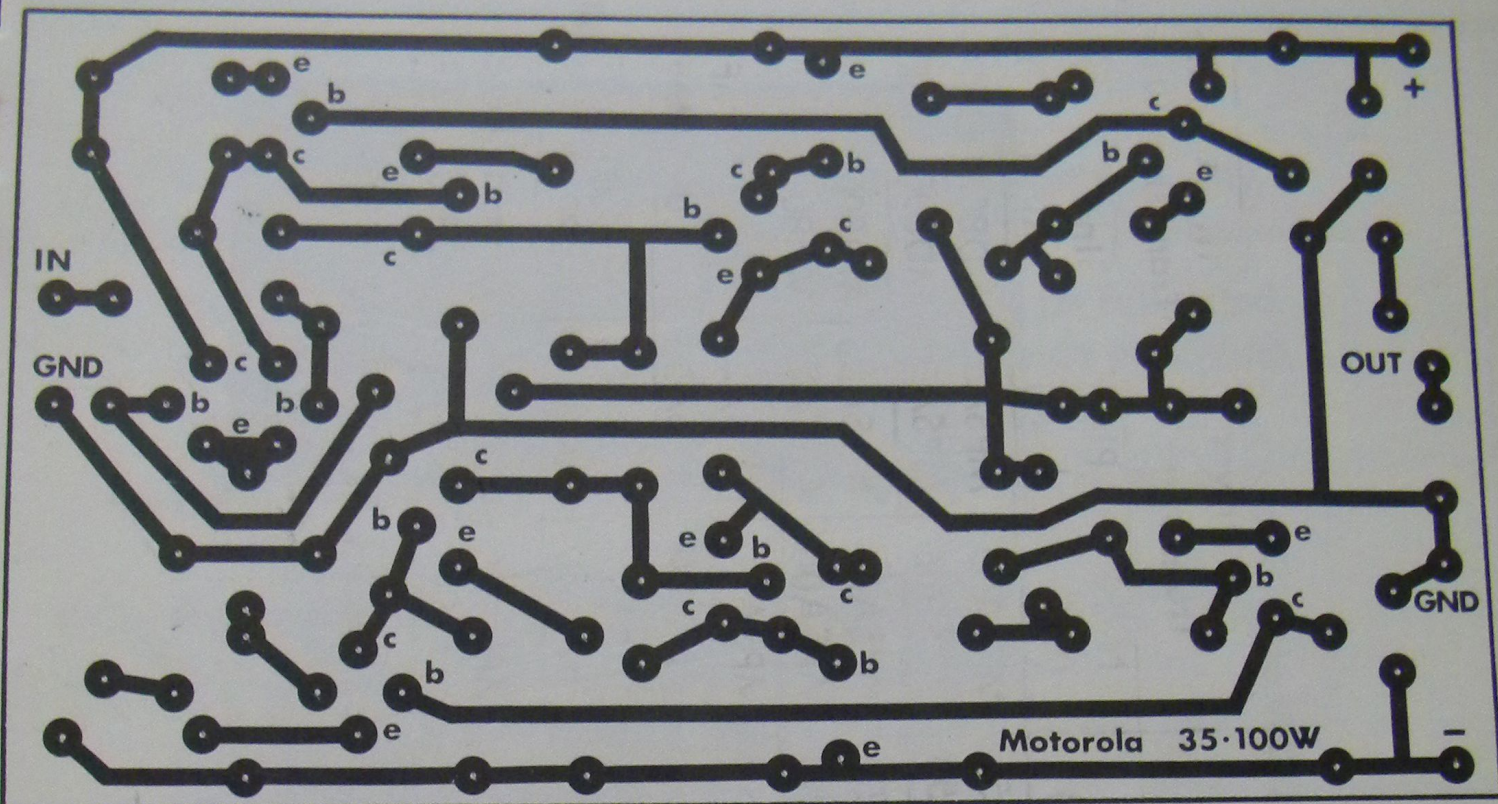
NOTE 1 : All of the resistors with the values shown are $\pm 10\%$ tolerance, except where * indicates $\pm 5\%$

2 : L1 is $\neq 20$ wire close-wound for the full length of resistor R16.

3 : R17 (Only for 100 W.) = $820\ \Omega$

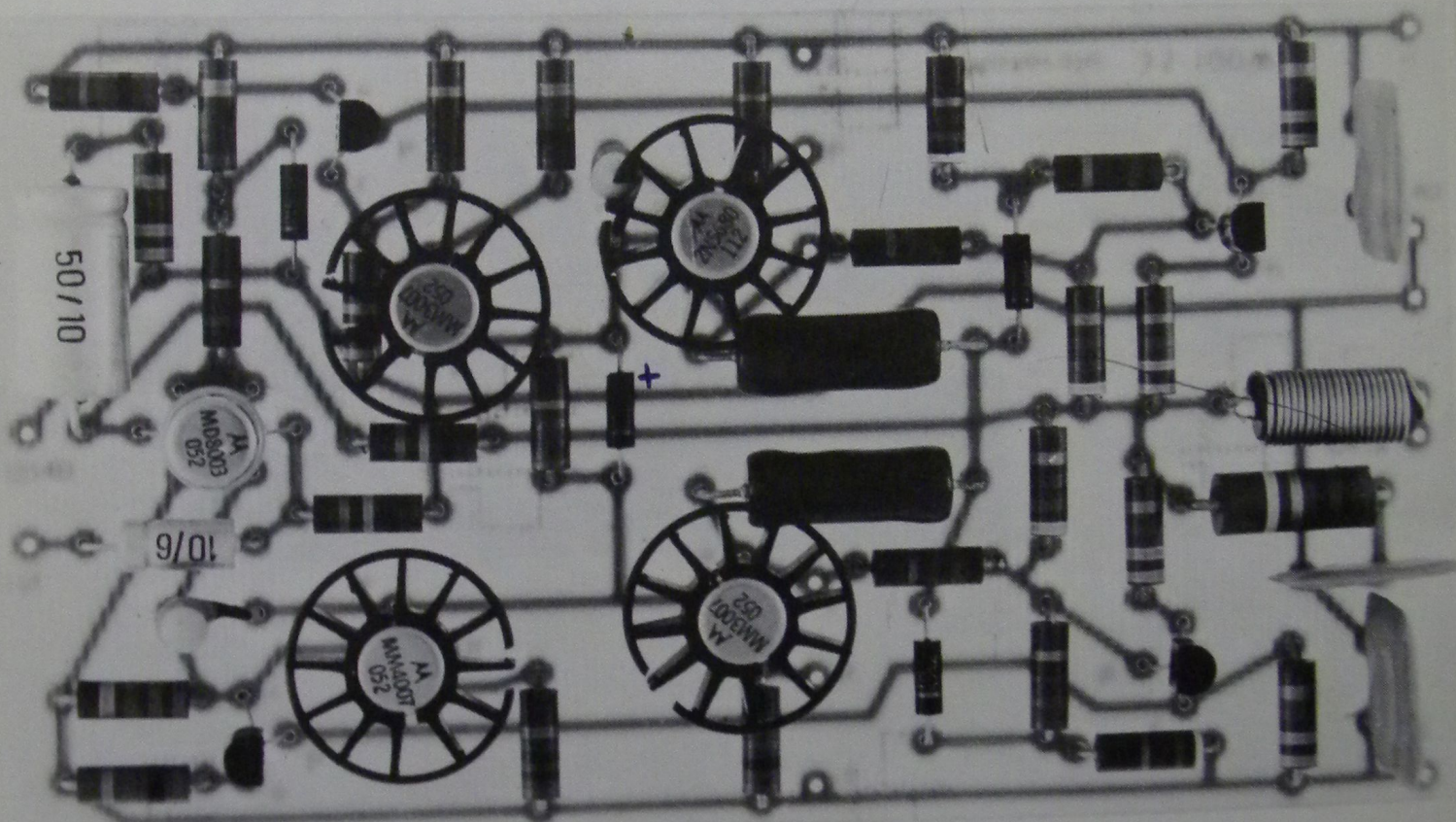
100 W Amplifier

PC-board actual size



Completed board

actual size



Performance

All of the amplifiers listed above will perform typically as shown as follows :

Output Power : Each amplifier will deliver its full rated output power into the nominal load impedance providing the power supply has adequate regulation.

Input Sensitivity : $1 V_{\text{rms}}$ into $10 k \Omega$ for full rated output power.

Frequency Response : Less than 3-dB rolloff from 10Hz to 100kHz referenced to 1kHz.

Power Bandwidth : Full rated output power $\pm 1/2$ dB from 20Hz to 20kHz.

Total Harmonic Distortion : Less than 0.2% at any power level between 100 mW and full rated output and at any frequency between 20Hz and 20kHz.

Intermodulation Distortion : Less than 0.2% at any power level from 100 mW to full rated output. (60Hz and 7kHz mixed 4 to 1)

Damping Factor : Over 150 at any frequency from 20Hz to 20kHz.