



Fig.3 a) (top) The MX50 PCB, as supplied with component values, and b) (bottom) PCB track layout revealed after sanding.

Circuit

The circuit is clearly based on Douglas Self's Blameless 50W amplifier design, described in his *Audio Power Amplifier Design Handbook*, a distillation of years of research into the distortion mechanisms of the standard Lin circuit. Just like Baxandall and his tone control design, Self would have become rich if all amplifier manufacturers using his circuitry had paid him a small royalty. There are a few simplifications to his design (see the MX50 circuit in Fig.2) possibly to avoid copyright infringement. The main change being the omission of a buffer stage between the long-tailed pair (LTS) input stage and the voltage amplifier stage (VAS). This will make the distortion a bit higher. This is likely to be audibly insignificant because input stage distortion is subjectively much more benign than output stage distortion. Instead of an emitter-follower (EF) output stage, a complementary follower pair (CFP) stage is used. This configuration has slightly lower measured THD, but the distortion residue usually exhibits sharper spikes than the EF version, which may be more dissonant. The CFP stage does make the kit easier to build, because the temperature sensing V_{be} multiplier bias transistor can be mounted on the driver transistor heatsink on the board, rather than on the main output transistors.

The circuit has no quiescent current adjustment, just a $1k\Omega$ resistor (R17) which gives a current that is safe at 10mA, but too low to be optimum. The driver transistor collector-load resistors, R23 and R24 are 47Ω rather than the normal 100Ω , which increases the driver dissipation, but this may give faster turn-off of the output devices. The lower-arm feedback capacitor (C3) is bypassed by a film capacitor (C4). This audiophile tweak was shown to be ineffective by the late Cyril Bateman. A couple of ultra-fast diodes (D1 and D2) have been placed across the supply rails to protect the output transistors from potentially damaging back EMFs from the speaker.

Short circuit

Do note that there's no short-circuit protection on this module; a possibly dangerous omission. One touch of the speaker leads, and bang! Possibly, this module is designed for use in active speakers where this should not happen, but it could happen in testing. I came across an active PA speaker where the aluminium wire voice-coil in the woofer had rubbed against the pole piece, causing a melted short-circuited voice-coil. I thought it could never happen! I've never seen it with a copper wire voice-coil though.

Hi-Fi designers often say no protection sounds better, but try telling that to a studio owner who's turning clients away because his monitoring system is burnt out. Adding short circuit protection is complex, involving a dozen components. Fuses will protect the transformer, PCB and most speakers, but bipolar transistor failure is much quicker and they usually blow before the fuses.

