



## Pump it up: MP3 booster

MP3 players are all the rage these days. The smaller ones in memory-stick format are particularly easy to take with you; your very own 'personal sound system' on the move! It's when you want others to share your taste in music that you find these players to have a lack of power. You can get round this problem with the help of the i-TRIXX MP3 booster, a small amplifier that can be used to connect your MP3 player directly to your Hi-Fi. When you next invite your friends to a party you can ask them to bring their 'personal music' as well as the usual drinks! But first we have to build this booster!

The small battery-powered players have an output signal that is more than sufficient to drive a set

of 32 Ohm headphones. You'll often find that with an output of 1 mW the sound pressure level (SPL) produced can reach up to 90 dB. This would be sufficient to cause permanent damage to your hearing after only one hour! The maximum output voltage will then be around 200 mV. This, however, is insufficient to fully drive a power amplifier. For this you'll need an extra circuit that boosts the output voltage. Power amps usually require 1 V for maximum output, hence the signal has to be amplified by a factor of five. We will also have to bear in mind that quieter recordings may need to be amplified even more. We've used a simple method here to select the gain, which avoids the use of potentiometers. After all, the MP3 player already has its own volume control. We decided to have two gain settings on the booster, one of three times and the other ten times.

Amplifiers IC1A and IC1B (for the right and left channels) are housed in a single package, a TS922IN. The output signal of the MP3 player is fed via a stereo cable and socket K1 to the inputs of the amplifiers. The gain depends on the relationship between resistors R2 and R1 (R6 and R5 for the other channel) and is equal to ten times. When you add jumper JP1 (JP2), resistor R3 (R7) will be connected in parallel with the negative feedback resistor R1 (R6), which causes the gain to be reduced to about three. When you start using the booster you can decide which gain setting works best for you.

Resistor R4 (R8) takes the amplified MP3 signal to the output socket K2 (K3). A cable then connects these phono sockets to the input of your power amplifier. The resistors connected in series with the output (R4 and R8) are there to keep the booster stable when a long cable is connected to its output. Cables have an unwelcome, parasitic capacitance. This capacitive effect could (due to phase shifts of the signal) affect the negative feedback of the booster in such a way

that a positive feed back occurs, with the result that the booster oscillates and possibly damages the power amplifier! The resistors (R4 and R8) effectively isolate the output of the booster from the parasitic capacitance of the output cable. They also protect the booster outputs from short circuits.

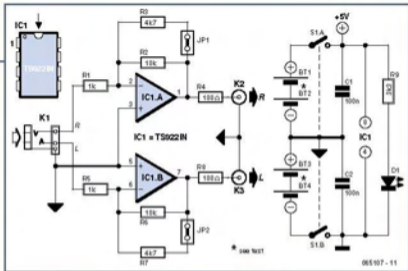
We've used a TS922IN opamp in this booster because it can operate at very low supply voltages (the maximum is only 12 V!), but can still output a reasonable current (80 mA max.).

For the supply we've used rechargeable batteries (e.g. NiCd or NiMH cells) so that we don't need a mains supply. To keep the number of cells required as small as possible, we've chosen a supply voltage of 5 volt; this can be supplied by four rechargeable batteries. It is also possible to use four ordinary, non-rechargeable batteries; it's true that the supply voltage then becomes a bit higher (6 Volts), but that won't cause any harm.

Since we've used a symmetrical supply for the booster (2 x 2 batteries), it will be easiest if you use two separate

battery holders, each with two AA cells. The two holders are connected in series. Make sure that the batteries are connected the right way round; the positive of one always has to be connected to the negative of the next. This also applies to the connection between the two battery holders. S1A/B is a double pole switch, which is used to turn both halves of the battery supply on or off simultaneously.

If you can't find the (dual) opamp we've used (or an equivalent), you could always use standard opamps such as the NE5532, TL082 or TL072. These do need a higher supply voltage to operate properly. In these cases you should use two 9 V batteries and replace resistor R9 with a 15 k $\Omega$  one. Do take care when you connect the circuit to your power amplifier because the output signal can be a lot larger and you could overload the power amplifier. (Although you're more likely to damage the loudspeakers, rather than the amplifier!) (Please note that these two 9 V batteries can't be used as a supply for the TS922IN!)



In our circuit we've used a stereo jack socket for the input and phono sockets for the output because these are the most compatible with MP3 players and power amplifiers respectively. If you wanted to, you could solder shielded cables directly to the circuit instead, with the correct plugs on the ends. You'll never find yourself without the correct connection leads in that case!

