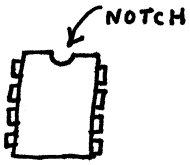
Hello and welcome to the third parcel in our soldering subscription. We've looked at a number of components already including LEDs, resistors, transistors and capacitors. This month we're going to see the first of a new component: the 'chip'.

I can remember my great uncle Reg talking about 'the chip' as if it was some mysterious world-changing invention, speaking of it almost in the same breath as 'the bomb'. In reality, chips are far less mind-blowing when we call them by their real name: *integrated circuits*. What this means is that an i.c. (integrated circuit) is not really a new type of component but, rather, a whole bundle of existing components all squeezed (or 'integrated') onto a single 'chip' of silicon. A simple i.c. will have *dozens* of transistors and resistors but a complex i.c. (like a computer processor) will have *millions*.

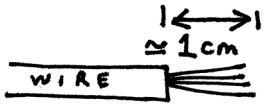
The chip we are using today is an audio amplifier i.c. called the TDA7052A which is a fantastic 8-pin device that requires very few extra components to make a decent mono amplifier. You will remember from month #2 that a transistor can act as an 'amplifier' to allow a small current to produce a larger current. Our chip contains several transistors connected in such a way as to allow us to take the relatively small signal from a phone's headphone socket (or the Raspberry Pi's audio output) and then drive a loudspeaker. The loudspeaker I've provided is quite a small one but you could always salvage a larger one from an old hifi - you might be surprised at how beefy a loudspeaker this little chip can drive!

All chips have a number of 'pins' or 'legs' that need soldering to the circuit board: ours has 8. To avoid mishaps, it's common not to solder the chip directly to the board but to solder a socket to the board and then insert the chip at the end (the legs on the chip may need gently bending inwards slightly before inserting it into the socket). It's important that the chip is connected the correct way around: to help with this, the manufacturer puts a small 'notch' at one end (see diagram) with a similar notch on the chip socket. The position of this notch is also indicated on the circuit board.

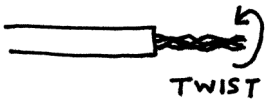



Before you solder your amplifier kit, there is a decision you need to make: do you want your amplifier to have a *fixed* volume or a *variable* volume? If you want the *fixed* volume then you should solder the 1MΩ *fixed* resistor to the board (a 'fixed' resistor is simply the normal type of resistor that we have used plenty of times before now). If you want the *variable* volume then you should solder the three-legged 1MΩ *variable* resistor to the board to act as your volume control. YOU SHOULD ONLY CONNECT ONE OF THESE TWO TYPES OF RESISTOR! If you plump for the fixed volume option then remember that you can still vary the output by using the volume control on your phone (or Raspberry Pi / whatever audio device you connect your amplifier to).

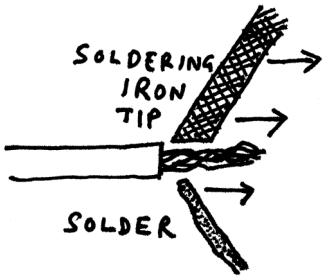
Something else you are going to need to know about is how to 'tin' wires i.e. apply a thin coat of solder to them. This is useful with 'stranded' wire and makes it easier to solder them to the PCB. Start by removing approx. 1cm (or ½") of the plastic sleeving from the end of the wire




and then twist the strands between your thumb and forefinger:




With the wire on the table, heat the twisted wire with your soldering iron and then drag a small amount of solder along. Really not much solder at all: just enough to bind the strands together. Start nearest the plastic sleeving and drag along to the end where you will often be left with a small solder blob that you can trim off with your cutters.



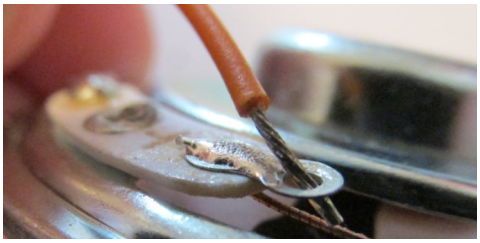

## How to build the monophonic audio amplifier kit

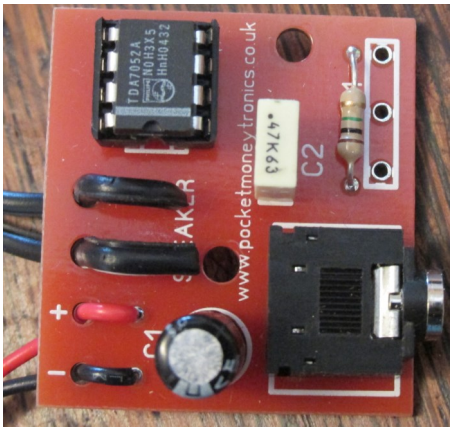
***www.pocketmoneytronics.co.uk***

1. If you have opted for fixed volume, solder the 1MΩ resistor in place. It's not marked on the PCB but it goes into the two holes just behind the three holes for VR1.
2. Solder the 8-pin i.c. socket in place ensuring that the notch is aligned with the notch marked on the circuit board.
3. Solder the 3.5mm jack socket: note that it won't lie completely level against the circuit board but you can raise the back pins very slightly if that bothers you.
4. Now solder the two capacitors. With C1, make sure that the longer wire goes in the hole marked with a '+' symbol.
5. If you're opting for the variable volume, solder the variable resistor VR1 in place.
6. Solder the PP3 battery clip in place with the red wire going to the '+' hole and the black wire to the '-' hole. Before soldering, pass the wire up through the larger holes and then down into the holes where the wires are to be soldered as this will provide a degree of 'strain relief'.
7. The length of wire is for connecting the loudspeaker to the PCB. Cut the wire in half and strip and tin all four ends.
8. Solder one end of a wire to one of the solder tags on the loudspeaker and then the other end to one of the two 'speaker' connections on the PCB. Again, pass the wire up through the larger hole and then down into the hole to be soldered.
9. Solder the remaining speaker wire.
10. You can now fit the i.c. into the socket: make sure the notch on the chip is in the same position as the notch on the socket (which should be in the same position as notch marked on the PCB i.e. on the end of the chip nearest the centre of the PCB). Press gently on the chip. If it doesn't fit easily, bend the legs of the chip inwards very slightly: take care when doing this as it is very painful to accidentally jab one of the chip's pins into your finger!
11. You can now connect your amplifier to your phone / audio device's headphone socket using the supplied 3.5mm jack cable. You may have to adjust the volume on your audio device for the best result.

**Please note: this amplifier may not work well with cheap 9v batteries. Instead, use a good quality alkaline 9v battery or four AA cells.**

*Below: soldering wire onto the speaker tags.*






*Above: the optional 1MΩ resistor is located in the top right-hand corner of the PCB. Notice that the 'notch' is on the end of the chip nearest the speaker wires.*

*Below: the optional volume control VR1 in place next to the 3.5mm audio input jack.*