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Last century we described a Peltier-powered tinnie cooler which could be built into a reasonably large Esky and so keep your food and drinks cool. Here's another one – quite a bit smaller, just right to build into a six-pack Esky to really cool down the tinnies. As a bonus, it will also keep food warm!

By Ross Tester

Every true-blue Aussie knows there is nothing worse than a warm beer (or soft drink, for that matter). But how do you get your drinks cold – and keep them cold? There's the old ice-in-the-Esky routine. But ice melts – especially if you keep putting warm cans in.

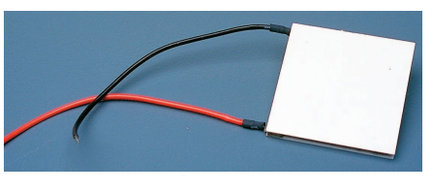
Wouldn't it be nice to have the cooler itself cool your cans? This one does! Just plug it into your car cigarette lighter (or any other 12V DC supply) and it will silently cool cans down to the "aaaaaaahhhhhh" level.

Like the cooler we presented back in September 1999 (see, it was last century!) this one is based on a Peltier Effect device. We explained this semiconductor device and its operation in some detail in that issue (and in the August 1999 issue) so we won't go into too much detail again.

Suffice to say that it consists of a number of P-N junctions sandwiched between two metal plates. Pass current through the junctions one way and they absorb heat – one of the plates gets very much colder than the other. Pass current through the other way and the reverse happens, the plate which was cold heats up.

If you thermally bond the Peltier (that's shorthand for Peltier Effect device!) to another object, that object will either cool down or heat up, depending on the polarity of supply to the Peltier. That's why a Peltier can be used for both cooling and heating.

If you'd like more info on the operation of Peltier Effect devices, we suggest you refer to the issues mentioned above.



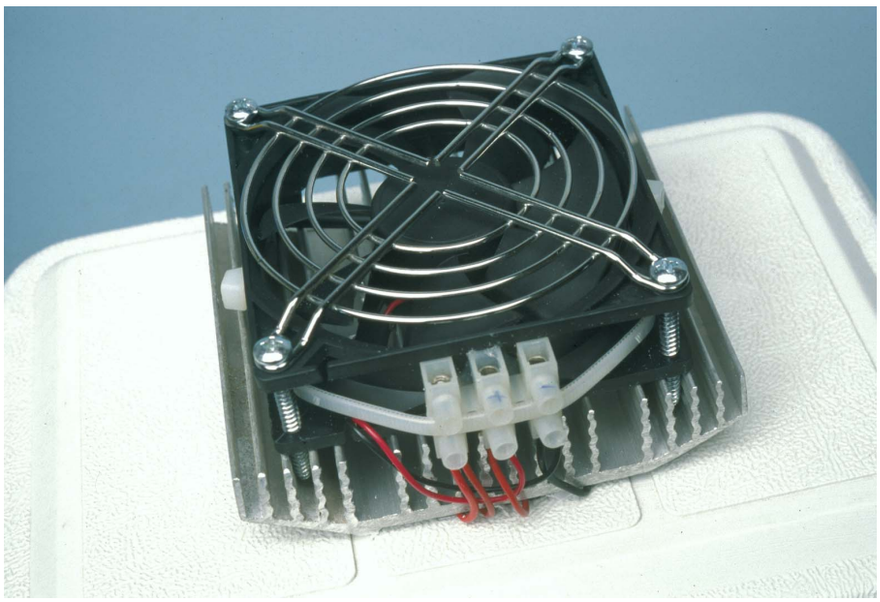
Just in case you haven't seen one before, this is what the Peltier device looks like. This is a lower rated device than the one in this module.

Peltier "module"

There are two major differences between this project and the earlier one.

First, it's much smaller – this one is designed to fit into a 6-pack cooler (the earlier one fitted a larger cooler). It really is intended as a drink cooler, not a mobile fridge!

Second, and most importantly, this



(Above): the Peltier module attached to the top of the cooler lid while below is the view from inside the cooler.

project is based on an almost-complete Peltier module.

The earlier project required you to source the bits individually; this one has a pre-assembled Peltier module which includes a fan, heatsink, thermal switch, aluminium block and gasket.

All you have to supply is an aluminium plate (size to suit your cooler) and a small piece of, say, 15mm-wide polystyrene foam (such as used for packaging).

The aluminium sheet needs to be as large as possible to ensure good heat transfer. We used a sheet 3mm thick because it was available – even thicker would be better still.

Incidentally, the module comes from Oatley Electronics and costs the princely sum of just $33.00 (plus p&p). Not real shabby, that: we've seen similarly rated Peltier Effect devices alone advertised for the best part of $150.00

Oh, nearly forgot: you also have to supply the cooler!

Thermal shock

Before we go too much further, a warning: one thing you cannot do with a Peltier is switch it between heating and cooling (or vice versa) without waiting for it to cool (or heat) back to room temperature. This would place enormous stresses on the device and would quite likely damage or even destroy it.

We have shown a "reversing" switch in our circuit of the device but bear in mind the comments above before switching over!

Thermal bonding

The reason we placed the module in the lid of the cooler was that it was convenient to do so. It's also true that cold air falls, so theoretically the air inside the cooler would eventually cool down via convection currents.

However, as every good cook will tell you, the secret in heating or cooling food or drinks is the thermal bond between the cold/heat source and the item being cooled/heated.

Now we have to say that the thermal bond between the aluminium plate and the cans in the cooler is not that great. The reason for this is that air is not particularly efficient at transferring cold/heat.

It's a bit like trying to boil a kettle by holding it above a hotplate rather than

placing it on it. Sure, the kettle will eventually get hot – but nowhere near as fast or efficiently as it would placed directly on the hotplate.

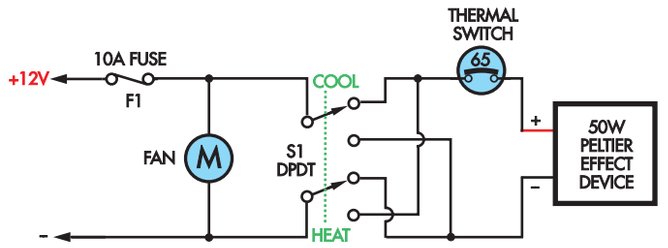
Similarly, it would be much better if the cans could be placed in intimate contact with the aluminium plate attached to the Peltier.

One way to achieve this would be to place the Peltier module not on the lid but on the side of the cooler, with an "L" shaped aluminium plate running down the side of the cooler and across the bottom, so that the cans actually sat on the cooling plate.

Even better would be to sit the cans in a small amount of water because this would achieve a much better thermal bond with the cans than the air in the cooler.

Indeed, using a cooler is not the only possibility. We've had thoughts about using a small length of suitably-sized aluminium tube, maybe a yacht mast extrusion, which often has a flat on one side suitable for mounting the block (or maybe even the Peltier direct). We haven't tried this yet – but will do so when we find a suitable extrusion.

We'll leave you with those thoughts in case you want to experiment. Placing the module in the lid of a cooler, as we have done, is certainly not the only possible approach.



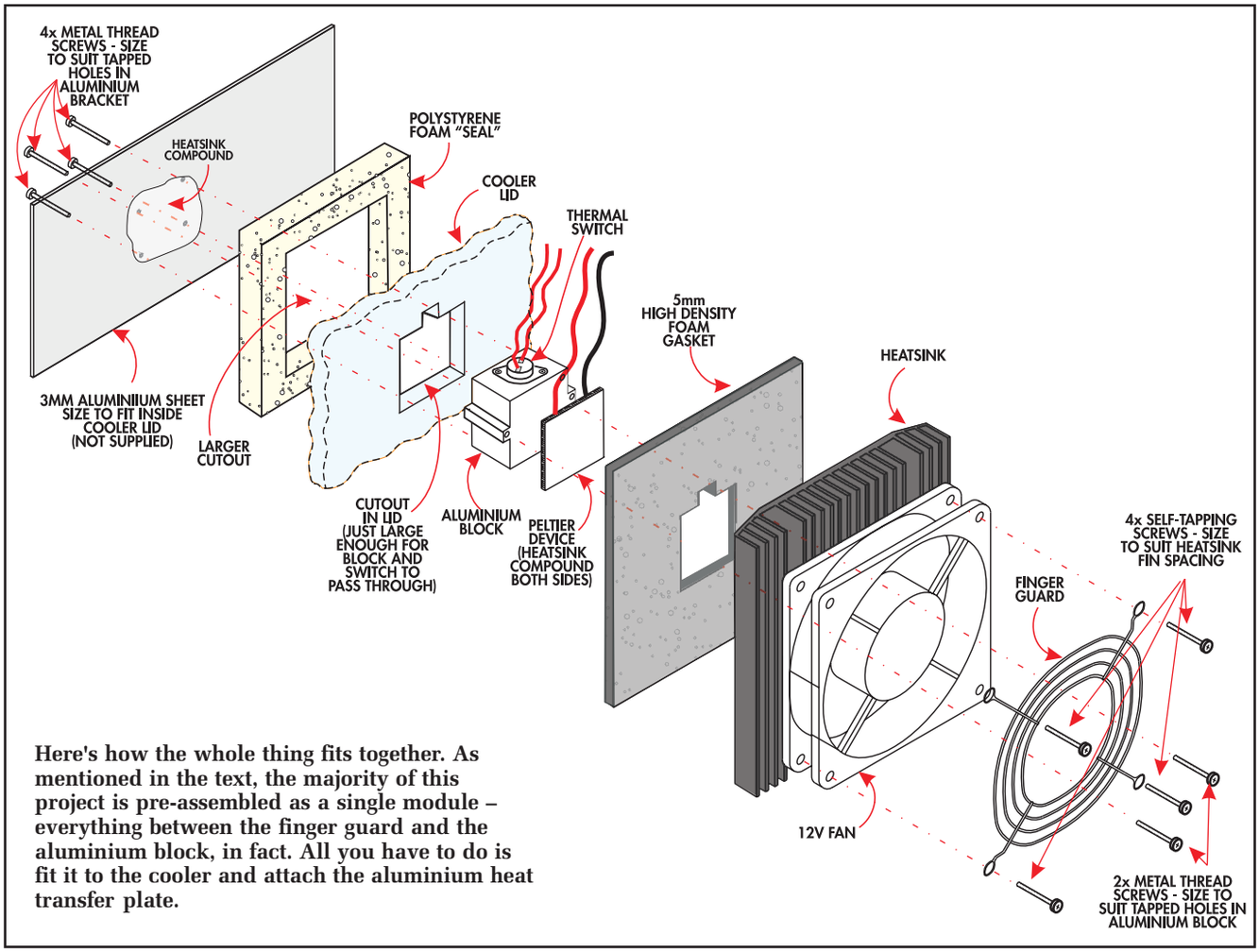
PELTIER-EFFECT TINNIE COOLER

This very simple circuit could be made even simpler if you don't want the "heat" option: leave out the switch and thermal switch.

Assembly

Because the Peltier module is pre-assembled, building this project is pretty simple: you cut an appropriate hole in the cooler (slightly larger than the aluminium block), pass the cooler module through it, fit the styrene foam seal and screw on your aluminium plate. Connect power and it's done.

The power lead would ideally be a suitable length (but shorter rather than longer) of polarised (red/black?) 10A figure-8 cable, fitted with a car cigar lighter plug at one end. Note that there are some "cheap" cigar lighter plugs



Here's how the whole thing fits together. As mentioned in the text, the majority of this project is pre-assembled as a single module – everything between the finger guard and the aluminium block, in fact. All you have to do is fit it to the cooler and attach the aluminium heat transfer plate.

around that are real junk – their springs aren't and deform badly after a few uses. It's better to pay a little bit more and get a good'n.

For safety's sake we have incorporated a 10A fuse in the + line between the changeover switch and the cigar lighter plug. 10A is more than is needed by the Peltier and fan but should protect in case of catastrophic short circuit.

Speaking of catastrophic, we have shown an "exploded" drawing of the assembly but that's just in case you need to know how it all goes together. However, you should not need to disassemble the Peltier module.

One thing you will note on the drawing is the use of heatsink compound, especially between the aluminium block and the aluminium plate. This will ensure maximum heat transfer.

The thickness of the styrene block depends on the thickness of the lid (or wall) of your cooler. The idea is that it compresses slightly when the aluminium plate is screwed to the block, making a nice airtight seal against the cooler lid/wall but still allowing the block to make intimate contact with the aluminium plate.

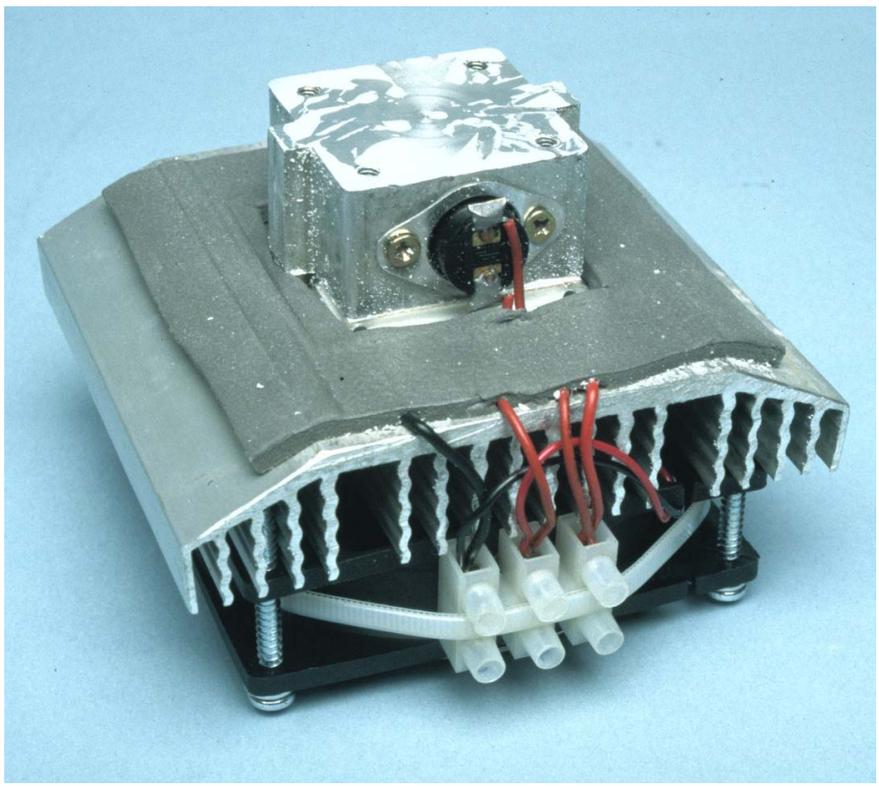
The high density foam gasket (supplied with the module) forms the airtight seal on the outside of the cooler.

The two seals probably won't be watertight but with a bit of work with silicone sealant could possibly be made so. Just make sure you don't get any sealant between the heatsink and Peltier, the Peltier and block or the block and plate – it is a good way to stop heat transfer!

The thermal switch

The project has a 65 degree thermal switch mounted on the side of the aluminium block.

This only comes into play when used as a heating device and is designed to prevent the thing getting so hot it starts melting (or at least deforming) the plastic lid or body of the cooler.



Upside-down view of the module as supplied by Oatley. Note the liberal use of heatsink compound on the aluminium block – you cannot see it in this photo but there is also a good dollop of the stuff on both sides of the Peltier device.

If you are not intending to use the device as a food heater, it (and of course the reversing switch) can be left out.

Power supply

The 50W Peltier device draws around 3.5A at 12V (DC). Therefore it is going to place a fairly significant load on your car battery if the engine is not running – certainly enough to prevent you starting the car after a day out.

Still, if you *are* caught out in the sticks with a flat battery, your drinks will be beautifully cold. . .

Of course, you could also run it from a suitable 12V (or 13.8V) DC power supply – a typical "CB" power supply is rated at about 4-5A so would be perfect.

Parts List – Tinnie Cooler

1 Peltier Effect module (Oatley Electronics)
1 6-pack plastic cooler
1 3mm thick aluminium plate, size to suit cooler
Suitable fig-8 connecting cable with car cigar lighter plug
In-line fuseholder and 10A fuse
Heatsink Compound
1 DPDT switch, 5A DC contacts (optional, see text)