Re: Using a PCB as a heatsink

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2007−02/msg02805.html

- *From*: MassiveProng <MassiveProng@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Thu, 15 Feb 2007 17:05:59 −0800

On Fri, 16 Feb 2007 01:35:36 +0100, Fred Bartoli
<fred._canxxxel_this_bartoli@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> Gave
us:

> MassiveProng a ?crit :
>
> > On Fri, 16 Feb 2007 08:09:29 +1300, Terry Given <my_name@xxxxxxxx>
> > Gave us:
> >
> > > John Larkin wrote:
> > >
> > > > On Thu, 15 Feb 2007 04:33:03 −0800,
> > > > MassiveProng
> > > > <MassiveProng@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>
> > > > wrote:
> > > >
> > > > > On Thu, 15 Feb 2007
> > > > > 05:35:18 +0000, Eeyore
> > > > > <rabbitsfriendsandrelations@xxxxxxxxxxx>
> > > > > Gave us:
> > > > >
> > > > > > And
> > > > > > a
> > > > > > solder
> > > > > > mask
> > > > > > adds
> > > > > > a
> > > > > > minute
> > > > > > amount
> > > > > > of
> > > > > > thermal
> > > > > > resistance,
> > > > > > not

> > > enough
> > > to
> > > worry
> > > about.
>
> > I'd have
> > thought so
> > myself.
>
> A blanket is a blanket is a
> blanket. Period.

> It's like resistors in series. A couple of mils
> of solder mask in
> series with inches of air. And the mask
> material is a much better heat
> conductor than air. So the mask adds a small
> fraction of a percent to
> overall theta, not enough to matter. It
> probably improves radiation a
> bit, more than it impedes conduction.
>
> John

I've never looked at solder mask in this respect, but I did the calcs
once on powder−coating. Its a surprisingly good blanket (after all, its
plastic). The conclusion was: dont powder coat heatsinks. So we anodised
it instead − "it" being a flat Al plate

disclaimer: I had no idea they were going to be powder coated until I
saw one; some marketing guy decided he wanted everything black.....

Cheers
Terry

If you make sure to have it grit blasted before the anodize, you'll maximize its thermal efficiency. Matte black IR paint (not just any shit) will make it radiate AND thereby convect to the surrounding air even better still, further maximizing the capability of the sink.

The finish extrusion typically places on the Aluminum is usually too smooth for my tastes, but I used to make fully traceable Black Body calibration sources for NIST, so what do I know?

> So you should have no pb giving us some emissivity figures and back of the envelop convection/radiation ratio at usual temperatures. Right?

Our tests were such that a matte finish surface of any media radiated IR better than a polished or glazed surface will. It is also in just about any CRC physics book around. Surface emissivity listings tend to refer to surface quality and many times give two figures. Polished, and a rougher surface quality figure.

> I tend to prefer figures to "taste".

I prefer common sense to your need for hard documents or formulae. Pretty basic physics.

It all depends on how the face being observed is finished.

We cut grooves in ours so nothing "looking at" the black body source was ever actually pointed at a perpendicular surface, and a device "looking at" the surface could also be at other than a perpendicular angle and still get the same reading.

We had others where the target was heated air that were essentially a coil of nichrome heating wire wrapped around a basketball (literally) then doped up with fiberglass/silica "paper mache" <sp>. After that dries, we split the halves, and remove the ball, and apply more silica medium to the inside of the sphere., then the two halve get assembled back together with a 2" silica tube about ten inches long on it. That assembly gets baked. We suspend that in am insulated cabinet, and provide NIST with a source that can do 3000 C at an emissivity of 0.995, and hold/keep temperature within a few degrees of setpoint.
That's pretty awesome!

On the benchtop sources, getting a uniform temperature across an 6" plate sized surface with a single heating element source is not an easy task. The ingot is several inches thick, and by the time it (the heat source) soaks out to the front surface, all but the last half inch at the outer edges of the ingot are evenly radiating. Especially since it gets recessed in a case so that no local air currents play upon it.
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