Re: Circuit Design Q. − battery charger

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2008−07/msg02883.html

- *From*: miso@xxxxxxxxx
- *Date*: Wed, 16 Jul 2008 23:59:01 −0700 (PDT)

On Jul 15, 9:57 am, Kris Krieger <m...@xxxxxxxxxx> wrote:

> m...@xxxxxxxxx wrote
> innews:3f1a1b76−d2bf−495a−bc6f−c40d94022ebb@xxxxxxxxxxxxxxxxxxxxxxxxxxxx:
>
> > On Jul 11, 11:41 pm, Kris Krieger <m...@xxxxxxxxxx> wrote:
> >
> > > m...@xxxxxxxxx wrote
> > > innews:adee4a0c−4ad1−47c3−abac−0d581c3dcfbc@z72g2000
> >
> > hsb.googlegroups.com:
> >
> > > > On Jul 9, 1:42 pm, Kris Krieger
> > > > <m...@xxxxxxxxxx> wrote:
> > > >
> > > > > Hello, All!
> > > > >
> > > > > I'm working on a
> > > > > high−brightness
> > > > > solar−charged lighting
> > > > > system,
> > > > > and I hav
> > > >
> > > > e
> > > >
> > > > > some questions (I'm just a
> > > > > beginning hobbyist, so I ask
> > > > > for your
> > > > > indulgence, and apologize
> > > > > for those questions that are
> > > > > overly−simplistic and/or
> > > > > worded in a non−technical

manner...)

[edited/snipped]

I don't know where to start.

If you have at least 6 hours of daylight, why would you do any sort of fast charge scheme?

To allow for half−decent charging when thr eis not 6 hrs of full bright sunlight in perfectly clear weather.

Boost converter, then a charger chip? Why not stack enough solar cells so you have sufficient voltage to charge the batteries?

First, because it seemed to me that it was more expensive that way (tho' I have to finish my parts spreadsheet and tally up all the prices, before I can say for sure); second, because I was worried I'd fry the batteries...

Then design a step down converter with current regulated output to charge the cells. I'd pick C/8. Sometimes you will be undercharged, and sometimes you will be overcharged, but it's a reasonable compromise. You may be able to find a charger chip that does this current regulated step down at C/8. The problem with doing a fast

> charge is you miss out on much of the solar
> energy.

I was told that NiMH bateiries don';t take well to either undercharging or overcharging, so, beleiving them to be persbickety,
i figured that the charging control IC might be what they needed...isn't "c/8" the same thing as "trickle charging"...? I read
that NiMH also don't deal well with trickle charging, and prefer
fast−charging.

Sorry but I'm not sure what you mean by "miss out on much of the
solar energy"... I just want to try to make the batteries "happy" so
to spea

k,

so that they will be able to drive whatever LEDs I need to get to
achieve the brightness I hope to get...

> Make sure your LED driver has
> undervoltage lockout so you don't
> kill the battery pack.

I'll have to look up "undervoltage lockout" − that's a new term for
me, I don't know what it means...I thought, tho', that the LED driver
is supposed to smooth everything out in terms of the relationship
between the LEDs and the batteries...?

> You shouldn't need a photodiode since you
> already have a solar cell
> to determine when it is night.

> Oh! OK, I thought that I needed it to be sure that the LEDs didn't
> run during the daytime − I wasn't clear on that...
>
> Thanks!
>
> − Kris

> Nicads and NiMH are more rugged than the manufacturers let on. Certainly Sanyo cells, which would be my choice.

I made a note of that, it's good to know.

> What I would do is
> insure the light stays on until the batteries reach the discharge voltage. Think of it like a discharge before chrage design. Then it will be very unlikely you will give the battery much of an overcharge.

OK, you mean have an indicator light. THis will be an automaticv outdoors light, so nobody is goingto be checking it. I'm looking at an example Switch−Mode circuit that will stop charging when the batteries are charged. THe Maxim peopl etold me that the indicator LED and it's associated resistor can simply be left out wiht no effect on the rest of the circuit.

No, not an indicator light. Burn the existing LEDs during the day to bring the battery down to the discharge level. This would be needed if you picked my simple scheme where you don't use a smart battery charger but just dump current into the cells.

> If you try to quick charge your batteries, you need more solar cells. This will make the design more expensive for a questionable improvement. Think about it this way. You have 8 hours of sunlight, but you want the job done in two hours, so you need 4 times the solar cells for this quick charge design. The remaining 6 hours of sunlight

> go to waste
>
> I'd like to shoot for 4 hours, which I think would allow for charging on less−than−perfect days (light haze or shorter WInter days, for example). A big complain of people I polled (and myself as well) is taht the existing lights charge *so* slowly, that you get almost nothing at all if the day isn't perfectly clear with bright sun. Few places have continual perfect days. One simply cannot expect/count on a full 8 hours of perfect weather with bright sunlight − especially given that the people who woudl buy a solar Art Glass lamp are not likely to have bare treeless/shrubless yards with zero shade, so one has to plan for less than 8 hours of full sun. The fact that manufacturers don't, is what gets so many people disgruntled with the existing products.
>
> So, if I'm going to make something, I'm not going to waste my time making what is already available (and for less $$ than what I can make it for). It's only worthwhile if I can think outsize teh proverbial box, and come up with somethign that isn't already available at every WalMart...
>
> So, if it charges in 4 hours, and is dormant for the rest of the day, so what?

This means you doubled your solar cell cost.

> Meanwhile, if sunlight is not perfectly bright, that 4 hour charge time will be expanded, since it'll take longer to collect the required photons so as to charge the battery.

And just how are you going to expand the charging? You will somehow have to bypass any safety fimers in the chip.

> There is no "waste" − it's not like keeping a porch light on all day; the sunlight is there whether it's being collected or not. OTOH, if the outdoor area only *gets* 4 hours of direct sunlight (due to shadows from trees, other houses, or so on), it'd instead a waste of one;s money to pay for something that simply cannotr charge within that 4 hours − been there, done that, and my huge annoynace with current "standards" is what's motivating me to try this.

> Now that I think about this, it might make sense to pick the capacity of the batteries such that you will never reach full charge. [Think about this a bit. Capacity is what you put into the battery, less charge efficiency losses. Nobody says you have to reach full capacity of the cells, but rather you need capacity just for your application.)

> True − I'd started out thinking of 1500mA AA's, but now I'm giving serious thought to 2000mA. THe Example Booster Circuit (using the MAX866 and MAX1771) that I'm looking at requires only 0.8V up to 4.5V, but the AppNote doesn't mention

To be clear here, I was picked the battery capacity to be at a level when you won't reach full capacity of the cells. This sounds odd, but it makes sense if you picked a simple current source charging scheme. Having more capacity than you require means you won't overcharge the cells.

> The incremental increase in battery cost would probably be made up with the simpler charger design, i.e. just a current source and perhaps an overvoltage protection. [Weak cells get resistive and will achieve a high voltage under charge.]

> You need undervoltage protection of the batteries not to discharge them too deeply. This should be in the LED driver datasheet. If the intent of the LED driver was to use primary cells, it may not have undervoltage lockout.

> Yup, I looked it up, and the "UVLO" rating for the MAX1848 means indicates − it won't send anything to the LEDs once the voltage drops to about 2.10V−2.15V.

There is UVLO for the sake of the chip, and UVLO for the sake of the battery. For instance, if you had 3 cells, then the batteries would be discharge to 0.7 v per cell, which would damage them.

UVLO for a chip is designed such that the chip will behave if the supply is too low. Generally it is a cascade of many circuits, i.e you first make sure you have enough voltage so that logic will function, then you insure there is enough voltage for the voltage reference to work, etc. It will only be a battery protector if you use two cells.

> I'm not sure if I made this clear, but the solar cell can both provide power and act as a sunlight detector, eliminating the need for another

> photodiode.
>
> I'm thinking of it as an added thing to be sure the LEDs don';t lgiht up during the day − IOW, any time the batteries have been charged. While tracing through all of the App Notes (and their sample circuits I'm trying to adapt), I can't see any way for the solar cell to influence whether teh LEDs light up − the sample switch−mode circuit for the DS2715 battery charging IC simply switches from charging, to discharging, once the batteries are "full". So I figure that a photocell between the battery−circuit output, and the LED driver, should do the trick. I've seen them for under $2.

The off the shelf units manage to use the existing solar cell to detect if the sun is shinning.

> I got a dirt cheap solar charged garden spotlight at Harbor Freight just for yucks. It is so simply built that everything is through hole.
>
> I looked at commercially available solar lights until my eyes got bleary, and not one of them provides the requisite amount of light. After all, this also has to shine through stained glass − not just one or two dabs of the stuff, and not that faux−stained−glas spaint stuff, but real stained glass. These will be primarily Glass Art pieces − the night−lighting is something I want to do to expand both the enjoyment time of the piece, and the use of the piece.
>
> So, Yes, the "cheap" ones *are* simple − and cost less than it takes to build tham, which makes building a cheapo one IMO a waste. Basically, tho', I am thorougly and completely fed up with and sick to death of "cheap" =>:−p Cheap is common, cheap is *everywhere*. If people want "cheap" solar lights, they sure ain't gonna spend $200 or more on a stained−glass lamp/lantern/3D−piece. OTOH, if they *are* going to spend that much, they most certainly will *not* be satisfied with "cheap"−level lighting...

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