

Roy on torches

I am writing this in hope that it may be of help to people who looking for a decent torch out of the mass of torches on sale. It's about torches I use or have used, and also about some modding and a home build.

I tend to divide torches into 3 groups, small pocket torches, ones slightly larger and more powerful, and the big searchlight jobs. Out of the three, the first category is in my view the most useful as they can be quite powerful for their size. I will deal with these first.

The thing about the small pocket torch is that providing it's reasonably waterproof the torch is ideal as back up underground lighting. However, for this purpose it belongs fastened to the side of your helmet not in a pocket or worse still in a kit bag where it can be left 50 yards back.

One of the best is my Fenix E11, there is probably an updated version available now. Takes one single AA battery and gives enough light to get you out of anywhere for up to 7 hours. Use a good quality ordinary battery, not a rechargeable, or it will go flat on you.

Fenix probably make the best torches available, and they are not overpriced. I think I paid about £20 off eBay for my E11. Only issue is they do not dismantle! I have never heard of one going wrong, but if one did that would be that. Also forget upgrading.

Worth mentioning for a lot of power in a small package is this:

http://kaidomain.com/Led-Flashlights/kdlitker-flashlights/KDLITKER-C8_2-Cree-XHP35-HD-2200-Lumens-5-Mode-LED-Flashlight

It's a Cree XHP 35 overdriven at 1.5 amps, at least until the battery depletes. The electronics are not the sharpest tool in the box being a generic driver, but it's a lot of power for the money. XHP 35s can be safely overdriven. Imolent do it and I have tested them exhaustively. They are one up on the XHP 50 because they are highly focusable, the XHP 50s and worse still, the 70s , are not.

Another good one is the Convoy from Fasttech.

<https://www.fasttech.com/products/1601/10002364/2222907-convoy-s2-1-cree-xm-l2-u2-1a-623lm-2-group-3-5>

It has two groups, one without the silly flashes. Fasttech also supply them as a shell for a DIY build, which is what I did. I bought six.

<https://www.fasttech.com/products/1618/10002463/1277401-convoy-s2-diy-edc-led-flashlight-host>

Now a lot of these pocket torches use AMC 7135 linear chips in parallel arrays, each outputs 350 mA. There is also a reverse polarity protection diode in case some chump puts the battery in the wrong way round. Problem here is that an ordinary diode has a Vf drop of about 0.7V, a Schottky diode is better as its only a drop of about 0.3V. But that's still enough for a fresh off charge battery at 4.2 volts to only deliver 3.87V to the driver chips, obviously as the battery depletes you loose brightness and run time.

The host shells come complete but without the LED and driver. My tests have found that best beam pattern and output at lower currents is from the Cree XPG 2, which is what I fitted. My driver is just a straight 4 X 7135 chip driver with the diode removed and the contact points bridged. Its about 500 lumens output as a very nice beam for about 2 hours off a decent Li Ion cell. No modes, no signals to Mars, all it does is work. You will know when it's going flat as it will go dim, the way torches always did.



Here are the links for the LEDs and drivers.

<https://www.fasttech.com/p/1311505>

<https://www.fasttech.com/p/1127404>

Get rid of the diode, it looks like an ordinary small signal. And don't load your batteries wrong way round or it go poop.

A really useful cheap torch I have is a modded one of the cheap poor quality jobs off eBay like this:

<https://www.ebay.co.uk/itm/XLightFire-28000LM-11-x-CREE-XM-L-T6-LED-Hunting-Flashlight-Powerful-Lamp-Torch/231978776166?ssPageName=STRK%3AMEBIDX%3AIT&var=531172300970&trksid=p2060353.m1438.l2649>

I bought one some time ago and upgraded the driver and fitted a waterproof switch. As they come they are pretty awful. They take 4 18650 Li Ion cells in parallel and are quite bright to start with but nosedive as the batteries deplete disproportional to the amount of discharge. The photo of the driver you get says it all, it's just a control chip switching a MOSFET. I would love to identify this chip but it has no part number. I suspect it's an illicit overproduction of a propriety brand, what you get when you move production to China. The driver I fitted was from Fasttech and actually has an inductor, all for £4.50, but bad news is that they now all sold out. Mine was getting a bit past it with the parallel wired LEDs beginning to fade so I bought a new one and swapped the modification bits rather than mess about changing the emitters.

I had an idea for the old torch.

I also have an Imolent DX 80, I have heard of these going on eBay for as little as £160, and as such they are a bargain. But really a portable floodlight rather than a torch, they tend to spill light everywhere, but good for photography. Sold as IP 68, I trashed my battery management module due to water ingress when I was foolish enough to submerge it for only a few seconds. I could not replace the damaged chip or get a replacement module, so I had to buy a new battery pack. Bloody £90!

Anyway, I have managed to machine up a sleeve to fit the shortened DX 80 battery case to the head of the old eBay junk torch, so that was the start of my torch project.

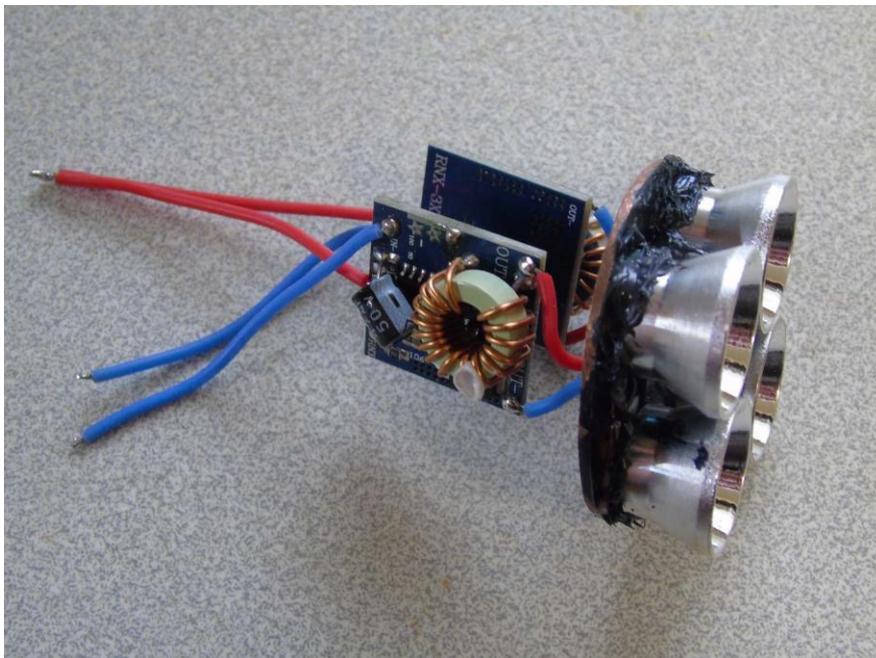
I decided to make a 16V sealed rechargeable using technology I developed for the Scorpion X16 caplamp. I was hopeful of being able to get 4 X 20700 cells into it. I managed this but no room for the management PCB, so I ended up using the same Samsung INR 18650-30Q cells as the X16.

The head.

I cut a disk out of 16 swg (1.6mm) copper and mounted 4 Cree XHP 35s in 2 parallel arrays. Now these have a Vf of about 12 volts, but a drive current of just over 1 amp, so in this case parallel is the way to go. Reflectors are as Dragon caplamp. I used these drivers, albeit modded.

http://kaidomain.com/S025219-FX-3XT6-25mm-2A-5_5V-16V-4-Groups-3-to-5-Mode-Driver-Circuit-Board-for-3-x-Cree-XM-L?search=S025219

I actually had bought a few of them for evaluation. Like a lot of Chinese components they are generic, there is a place for a second sense resistor and components rated at 5 amps. They can be safely pushed up to 3 amps, but no more. Add a second sense resistor of 0.18 ohms in the place provided. The reverse polarity diode can also be removed and pushes efficiency up by an amazing 22% on the lower settings. I had a few of these left lying around so used them up; I don't use them in any of my lamps.



They have a control chip with no part number, seen this before, so was unable to get a data sheet. Evaluation therefore consisted of my lab tests which trashed a few. The ones left came in useful as they don't have mode memory so I was able to fit two, each to one pair of parallel emitters. So output of 3 amps gives 1.5 amps to each XHP 35.

I drilled a hole in one side and fitted a 3mm red led as a low battery warning which comes on at 13 volts. It's a LM 393 referencing a + Z13V/1KR against a + 10KR/R300

The switch is an IP 67 one I had spare which is rated at about 10 amps. It has a cover over it so it cannot be accidentally activated.

Batteries

As I have said, its 4 series 18650, high discharge. Management PCB is same as X16 and they come off charge at just over 16.7 volts. Shut down is at 10.8V.

Charging is by a 19V laptop mains adaptor charger, or an 19V inverter charger for charging off an in car 12V socket, output 19V.

The heart of the management PCB is an ABLIC dedicated S 8254 A battery protection integrated circuit chip whose no1 pin (Open Drain) is the FET gate connection pin for charge control. On charge this is low but goes high when charge complete, so I take an LM 393 voltage reference to compare with second reference 8MR/8MR. This charge indicator circuit is isolated from the batteries by a Schottky diode, so can only draw power from the charger input. I have built into the tailcap a charge socket to take the laptop charger plug with a flashing red "on charge" LED and a green "charge complete" LED same as the X16 and using the electronics above described. The green is very bright and only consumes about 3 or 4 mA, a gallium nitride emitter at its best.

The reason for all this is that I have a powerful, 9200 lumen torch, which is small enough to fit into a pocket. It's waterproof and cannot come on accidentally, unlike the Imolent which did just that and nearly set me on fire, actually burned a hole through its case.



The whole thing with its toggle switch and red cover looks so delightfully politically incorrect in these days of everything being smooth and featureless. When I bought a new computer monitor it took 5 minutes for me find the switch. Oh for the old days of car engines with gleaming manifolds and rows of SU carbs, nowadays all you see is a square block.

It's a very practical torch, watching it charge is thing in itself, just like the X16.

The cheap eBay 4 battery torch is on the face of it a modders dream, but a project beset with problems. They came with a varying number of LEDs at slightly different prices, and outrageous output claims. But there is space for a lot of improved electronics and little else. The LEDs as they come are all parallel wired. So the 6 LEDs (actually Cree XML T6s) that would need a massive 18 amps to drive them all at full power and get just under 6000 lumens. ($6 \times 3 = 18$). The batteries are all parallel as I said so common sense solution is to series wire and fit a charge plug. You could use a dedicated 16.8V mains adaptor charger, but would still need to fit a charge plug and add a cell management board. So where?

I went through all this a while ago. I doubt that any of the torches on offer that use this diecast body, and there are a few, at varying prices, will actually deliver what they claim. The same goes for a lot of the funny brand names, Ultrfire etc which is free to use for anyone brand.

The Nitecore range looks very impressive but I have not worked with them. I especially like their Concept 2 which is also 4 X Cree XHP 35s. They do others with this emitter which I see as the answer to easily portable power due to the fact that this emitter is highly focusable unlike the other XHP 50 and 70 quad die emitters. The TM10K and TM28 are worth a look. Nitecore do not overdrive them, this is suggested by the output, and accounts for the small size of the Concept 2 and TM 10K. My only reservation is accidental switch on, is there a safeguard against this? I don't know.

As far as a lot of the others are concerned, Funyfire etc, I doubt that they will deliver what they claim