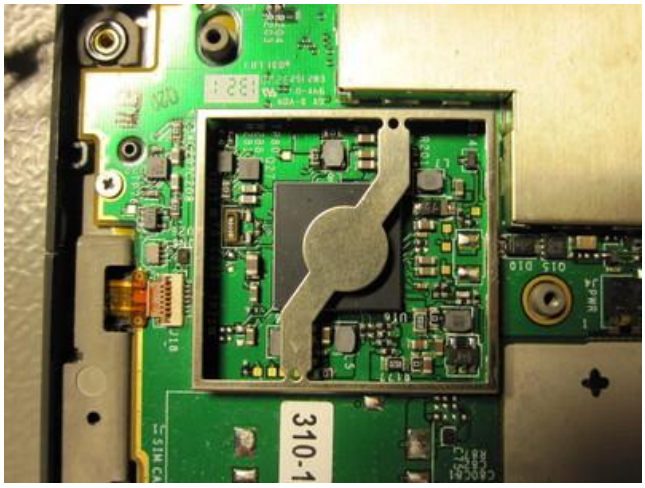
ON KINDLE POWER SUPPLY

Kindle's power supply (still talking about Kindle 3 that's been turned into a light-weight headless Debian box) is centered around MC13892. That is a power management integrated circuit (often referred to as PMIC in source code) specifically designed for powering Kindle's Freescale i.MX35 processor from a lithium-ion battery.

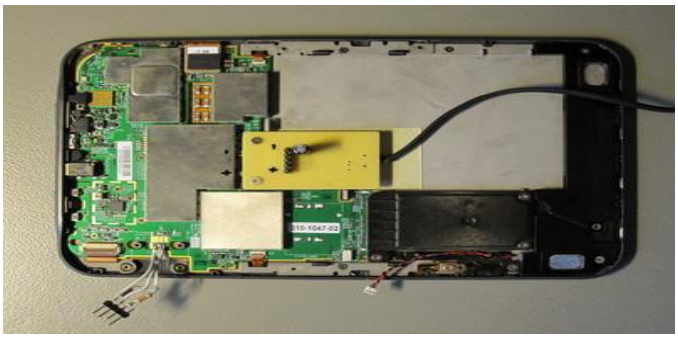


The chip itself hides under one of the shiny RF shielded enclosures and is connected to the main CPU over an SPI bus. TheMC13892 datasheet reveals a very flexible chip that contains several configurable switching and linear power supplies, handles power on an USB bus and can work with a main and a backup battery. It also has peripherals like the real time clock, touch screen, temperature and light sensor interface and several programmable LED drivers.

Actually, it's interesting that Kindle 3 already seems to have much of the hardware needed to implement a touch screen and a screen with a front light even though these features only appeared in much later models. Also interesting to note is that the e-ink has its own separate power supply, so a lot of the MC13892 functionality appears unused.

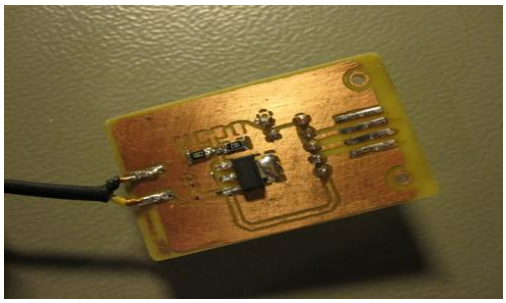
Talking about unused functionality, MC13892 also has a Coulomb counter that can accurately integrate battery current to predict its life time. This also appears unused as the battery module itself seems to integrate a management circuit with an I^2C bus. As far as I can see the built-in software actually uses information from that instead of MC13892. *libgasgauge.so* suggests it might be one of the Texas Instruments products.

Apart from curiosity, I also looked into this topic to find a most convenient way to power my Kindle without a battery attached. I'm powering my device from an outlet so it doesn't make sense to waste a perfectly good Li-ion battery by keeping it constantly connected to a charger.



However, as many people on the web with dead Kindle batteries found out, Kindle won't boot with no voltage on the battery connector. Looking into the supply tree in the MC13892 datasheet it's apparent that the battery voltage is the central point from which all other parts are powered. The datasheet also explicitly states that the MC13892 will not power up the CPU unless it detects a valid voltage on the battery, even if power is available from the USB interface.

Unfortunately, this check cannot be fooled by a high-impedance voltage source in place of the battery (I tried), which means that the only way to power it up is to provide a proper voltage source capable of around 100 mA at 3.0 to 4.2 V.



This led to me to make this tiny power adapter that attaches to the main PCB instead of the battery. It provides all the power for Kindle's main board which has another benefit of freeing up the USB connector for any future hacks (switching to USB host mode would be nice).

My random parts bin contained a small Nokia charger (recently donated as broken) that gives somewhere between 6.0 to 5.5 V under load. Unfortunately that's a bit too high for Kindle's battery input (absolute maximum rating 4.8 V). Instead of tearing the charger apart and adjusting its voltage feedback, I opted for a small low-drop regulator (also salvaged from a random piece of broken electronics) on the adapter itself to lower the voltage to 4.2 V.

I guess using a dissipative regulator like this ruins a bit the wonderful power efficiency of Kindle's hardware, but at a few tens of milliamps of typical current draw it hardly gets warm to the touch.

Source:

https://www.tablix.org/~avian/blog/archives/2013/03/on_kindle_power_supply/