BEC Technical Article

Linear Regulator based BEC:

All of the Novak ESCs designed for 6-cell or 2S Li-Po batteries, use a very low drop out linear regulator. These regulators, typically, use a very low-saturation voltage PNP transistor in series with the load. These pass transistors operate in linear region to maintain a constant output voltage. This type of regulator performs exceptionally well when the battery voltage is close to the BEC output voltage but tends to be not very energy efficient.

These pass transistors act like a potentiometer to regulate the BEC output voltage. As the resistance of the transistor is increased, the voltage drop across the transistor goes up, which, in turn, increases the power dissipated by the regulator. When a BEC is used with a 3S Li-Po pack, the input voltage to the regulator is approximately 12.5V, and the output voltage is 6V. This translates to a delta of 6.5V across the BEC circuit. At a 3-amp load, the BEC has to dissipate around 19.5 watts (6.5V *3A). This level of power dissipation causes the BEC to overheat and cause thermal shut down. This type of circuit operates normally, as long as the input voltage is around 7-8V. Additionally, the circuit's small size makes it relatively easy to implement in a space-constrained ESC.

Switching Regulator based BEC:

In a switching-regulator type BEC, the transistor is also in series with the load, but the transistor is used as a digital element: it is either ON or OFF using a PWM signal and only operates in OFF or saturation regions. This type of regulator is very efficient, but requires a lot of components and real estate on the PCB. It's common for a switching regulator to attain 90% or higher efficiency. A switching regulator can be designed to operate with very high input voltages. Switching regulators have a very poor voltage drop out performance and, therefore, are not used in 2S Li-Po applications.