Tesla Model 3 Long-Range Supercharging Curves

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The time dependence of charging any electric car starts at 0 charge added, goes to a peak and then exponentially declines to the final State-Of-Charge (SOC). This article collects data for several Tesla Supercharging charging events of a Tesla Model 3 Long-Range BEV.

The author has observed that the following function can fit the Tesla-Model-3-Long-Range Supercharger charging curves reasonably accurately:

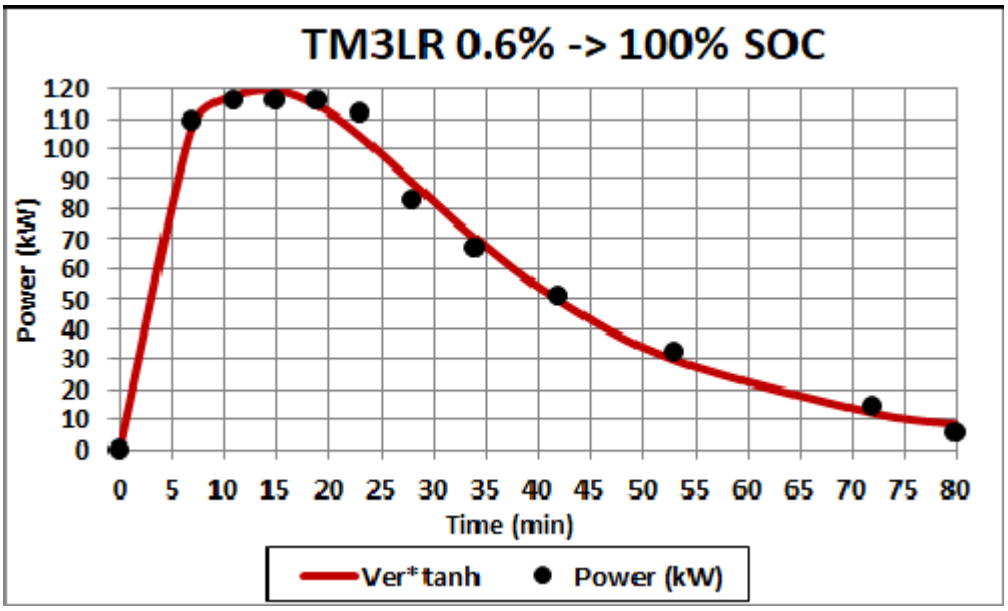
$$\text{Verhulst}\left(t-t_o\right)\tanh(t) \text{ where}$$

$$\text{Verhulst}\left(t-t_o\right)=\frac{Q_\infty}{n\tau}\frac{\left(2^n+1\right)\exp\left[\left(t-t_0\right)/\tau\right]}{\left\{1+\left(2^n+1\right)\exp\left[\left(t-t_0\right)/\tau\right]\right\}^{\left[(n-1)/n\right]}}$$

$$\text{and } \tanh\left(t\right)=\frac{\exp\left(t\right)-\exp\left(-t\right)}{\exp\left(t\right)+\exp\left(-t\right)}.$$

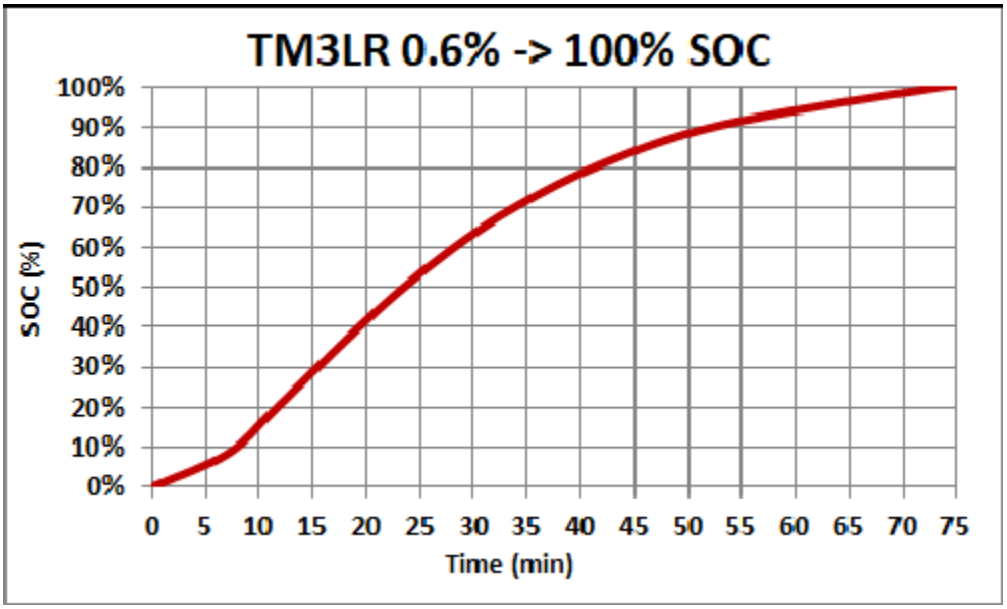
The follow red curves are a fit of this function to the charging-power data.

Supercharging 0.06% -> 100%

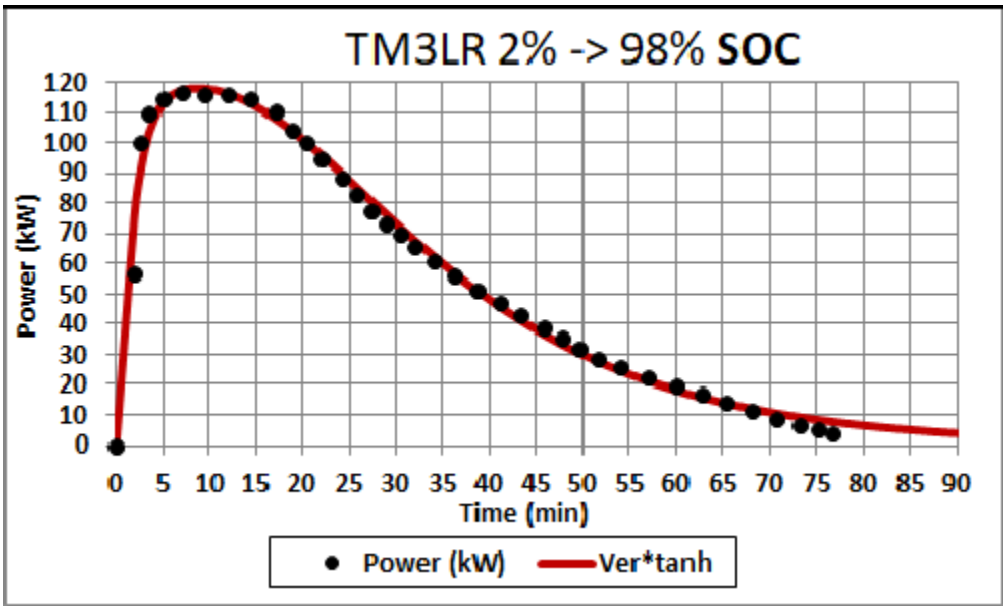


These data are from

https://www.youtube.com/watch?v=HUseaY0IduU

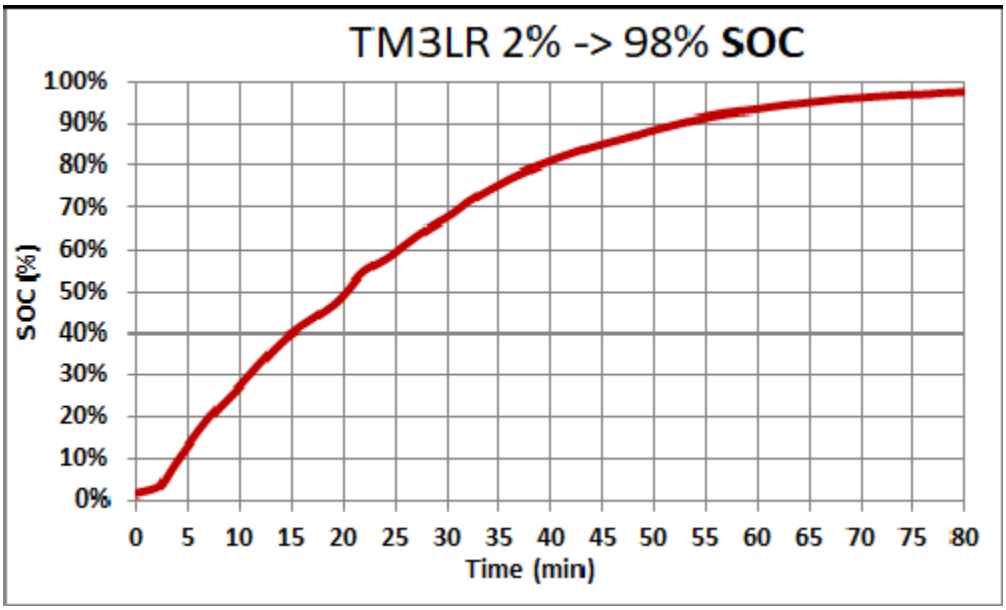


Supercharging 2% -> 98%

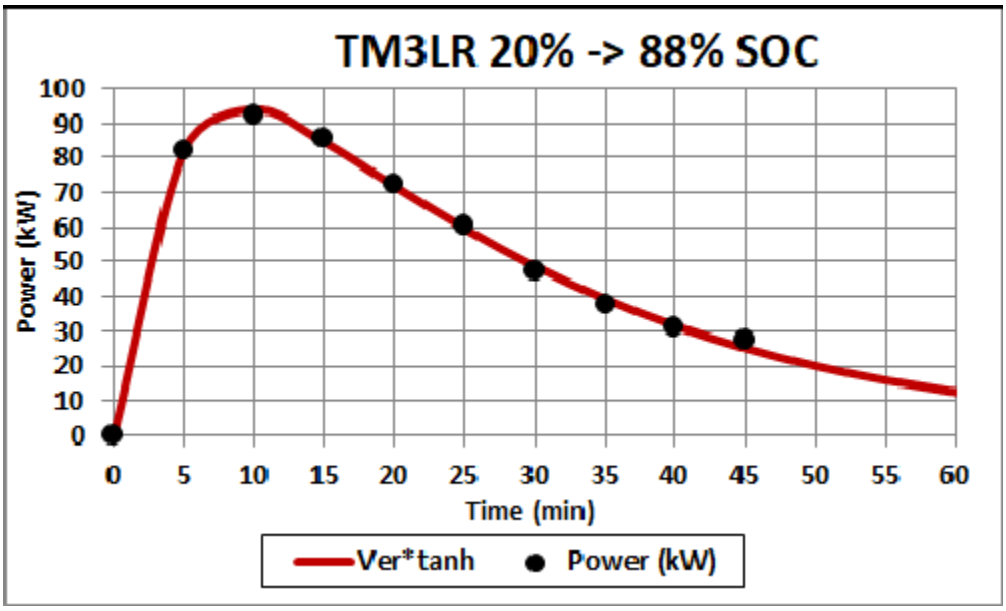


These data are from

https://teslamotorsclub.com/tmc/threads/supercharger-speed-116kw.107619/?utm_source=threadloom&utm_medium=email&utm_campaign=ed9&utm_content=iss30#post-2540001

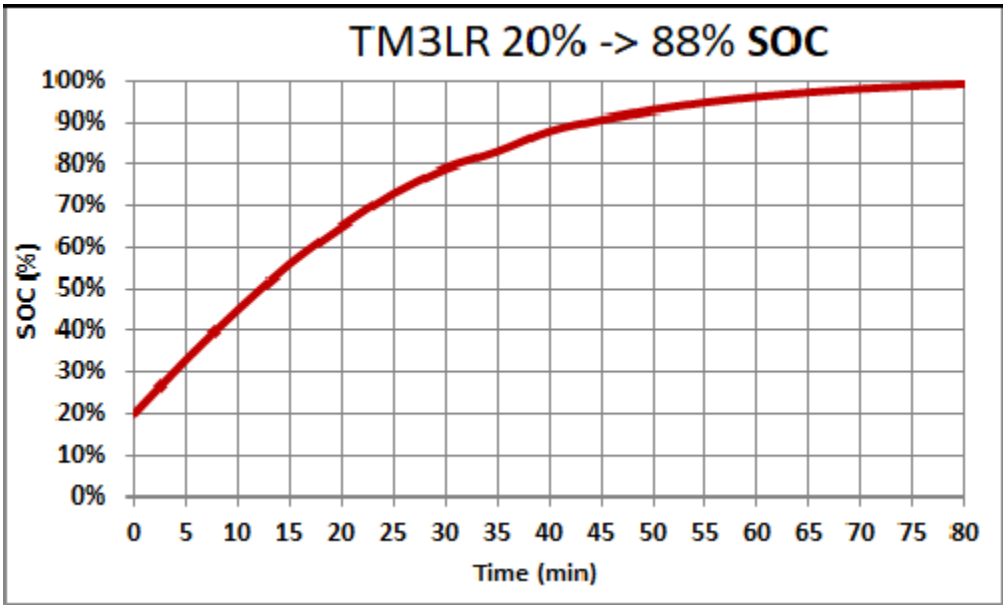


Supercharging 20%->88%

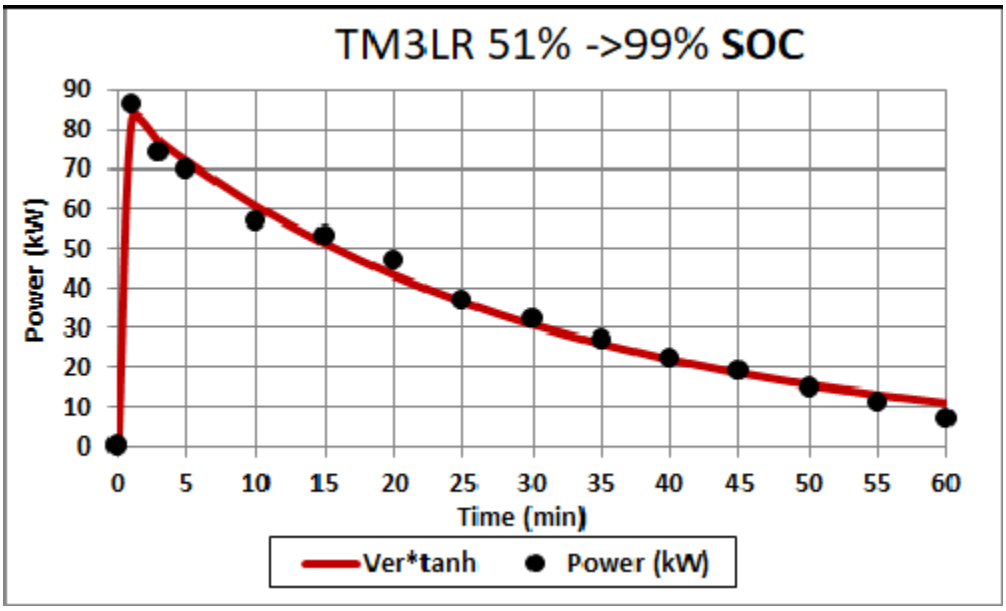


These data are from

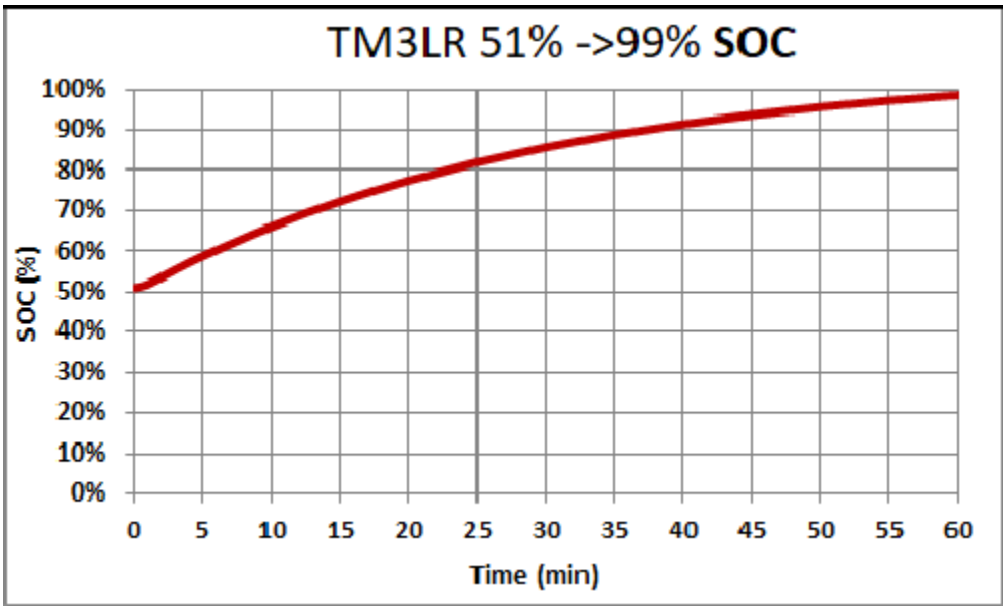
https://model3ownersclub.com/threads/request-to-an-owner-supercharging-rate.5427/#post-128114



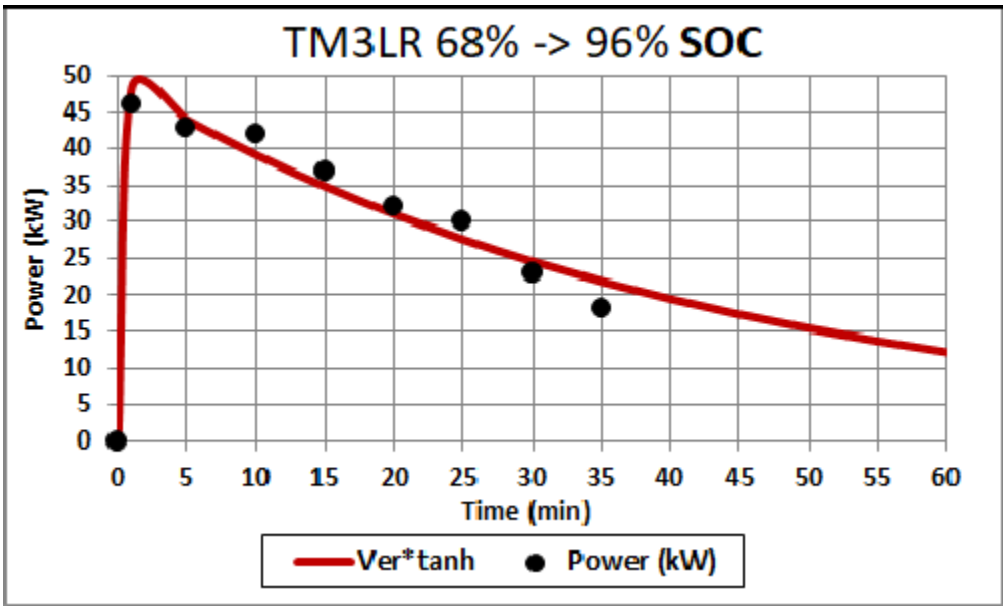
Supercharging 51% ->99%



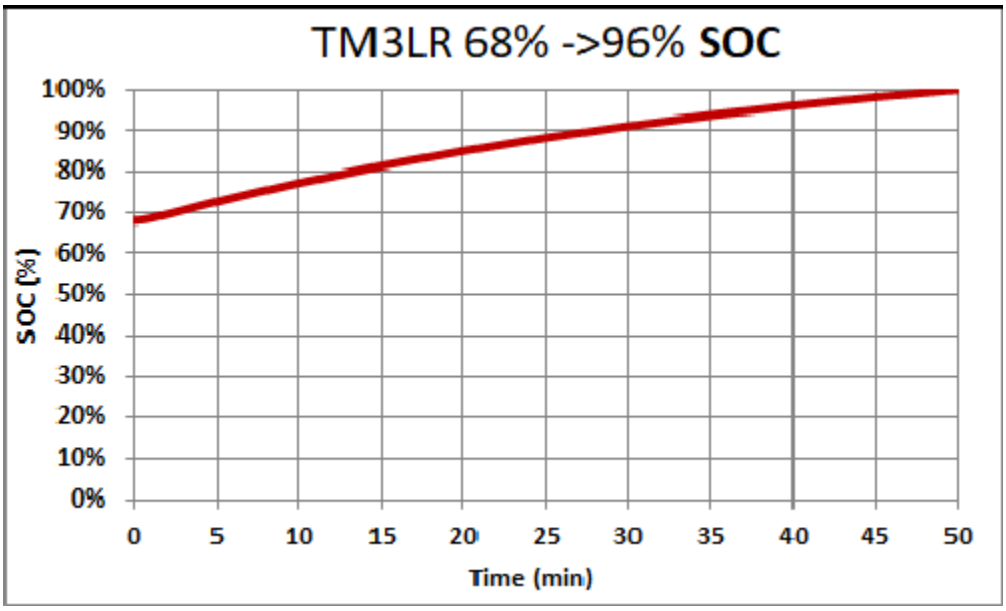
These data were crudely measured by the author.



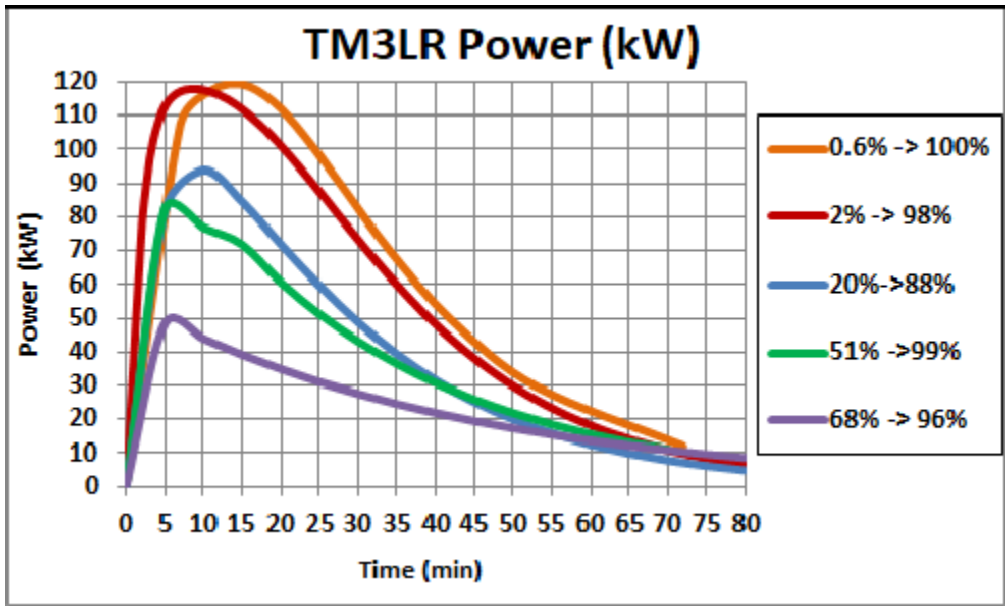
Supercharging 68% -> 96%

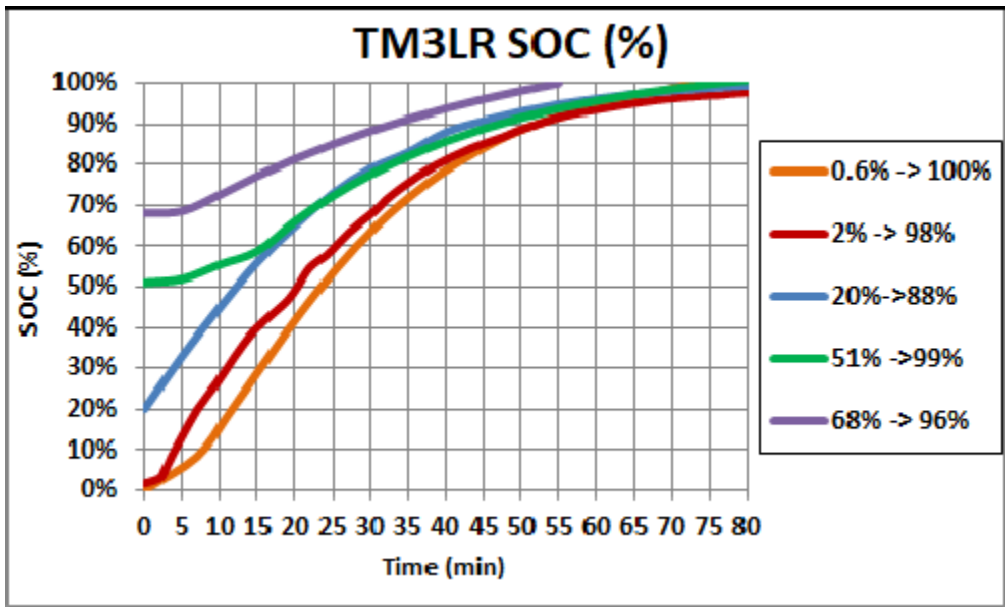


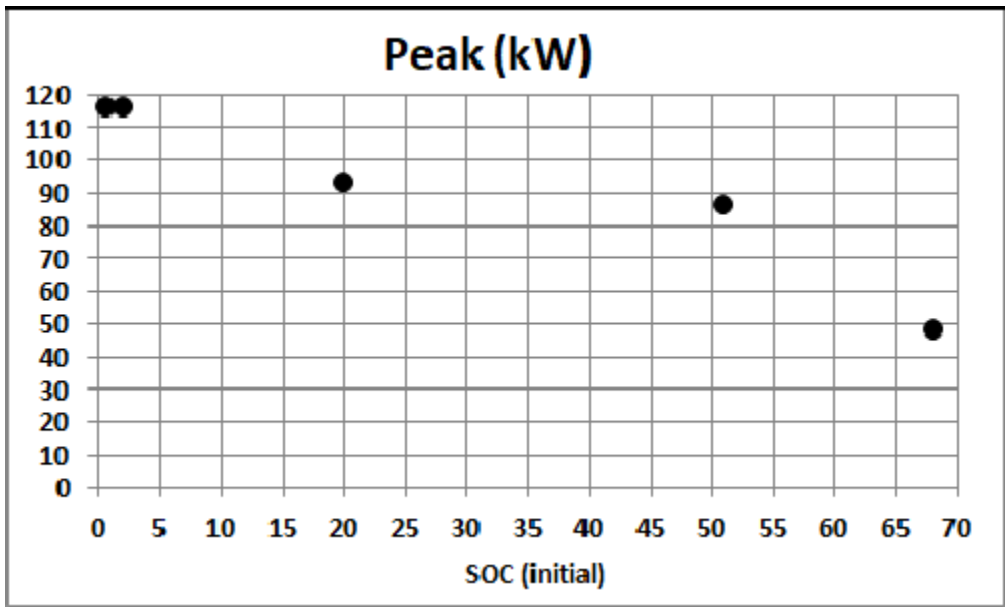
These data were crudely measured by the author.



Combining the Four Supercharging Events







Conclusion

The ratio of SOC in % to full-charging time in minutes is about 1.25 for the three charging events starting at 0.6%, 2% and 20% and about 0.8 for the two charging events starting at 51% and 68%.

As often stated, it is faster to charge when the SOC is low than when it is high.

http://www.roperld.com/personal/roperldavid.htm

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