1 Block diagram

soon

2 Inputs and outputs

2.1 Inputs

Input	Symbol	Unit
DC current	I_{dc}	A
Ambient temperature	T_{amb}	°C

2.2 Outputs

Output	Symbol	Unit
Internal charge	Q	coulomb
Terminal voltage	V_{dc}	V
Internal temperature	T_{pack}	°C

3 Background, rationale, modeling strategy

3.1 Electrical model

Each battery cell is modeled as an equivalent circuit:

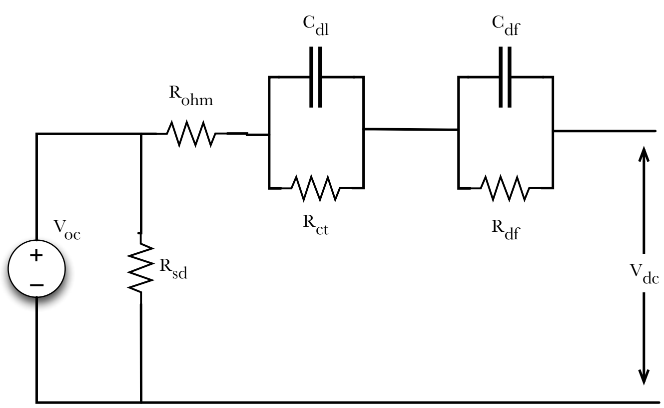

Figure 1: Battery cell equivalent circuit

where:

What in Sam Hill do these parameters depend on?

V_{oc}	is the battery open-circuit voltage in volts
R_{sd}	is the battery self-discharge resistance in ohms
R_{ohm}	is the battery ohmic resistance in ohms
R_{ct}	is the battery ?? resistance in ohms
R_{df}	is the battery ?? resistance in ohms
C_{dl}	is the battery ?? capacitance in farads
C_{df}	is the battery ?? capacitance in farads

The battery open-circuit voltage, V_{oc}, is a function of the remaining cell capacity Q, and is represented by a lookup table.

V_{oc} probably has a temperature dependence as well

Need to expand this electrical model to the n-series-cell equivalent circuit (assume all cells are identical?)

3.2 Thermal model

The battery pack is modeled as a single thermal mass which has some thermal resistance to ambient temperature:

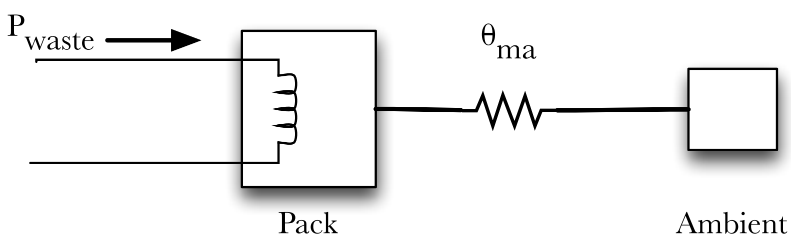

Figure 2: Battery cell thermal equivalent circuit

The waste power (heat input) P_{waste} is the sum of the heat dissipated in each resistance:

$$P_{waste} = I_{dc}(R_{ohm})^2 + I_{Rct}(R_{ct})^2 + I_{Rdf}(R_{df})^2 + I_{sd}(R_{sd})^2 \tag{1}$$

and the thermal resistance to ambient, θ_{ma}, is an arbitrary nonlinear function of vehicle speed, represented by a 1D lookup table:

$$\theta_{ma} = h(v) \tag{2}$$

where v is the vehicle's longitudinal velocity.

4 Parameters

Parameter	Symbol	Unit
Pack thermal mass	C_{th}	J °C^{-1}

There are more parameters.

5 Assumptions