

Designing a H-Bridge Drive Power Stage for a Brush DC Motor Application

By

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Agenda

- List DC Brush motor application requirements
- Summarizes features of the IR3220 H-Bridge driver
- Summarizes model of the IR3220
- Show results of analyzing a design employing the IR3220
- Summary

Application Requirements

- Door Lock Motor Assembly
 - -55C to 85C
 - Battery Voltage 8V to 18V
 - 3.3V Logic
 - Self Protected for ground faults
 - 5 Amp motor
 - Forward and Reverse direction

IR3220

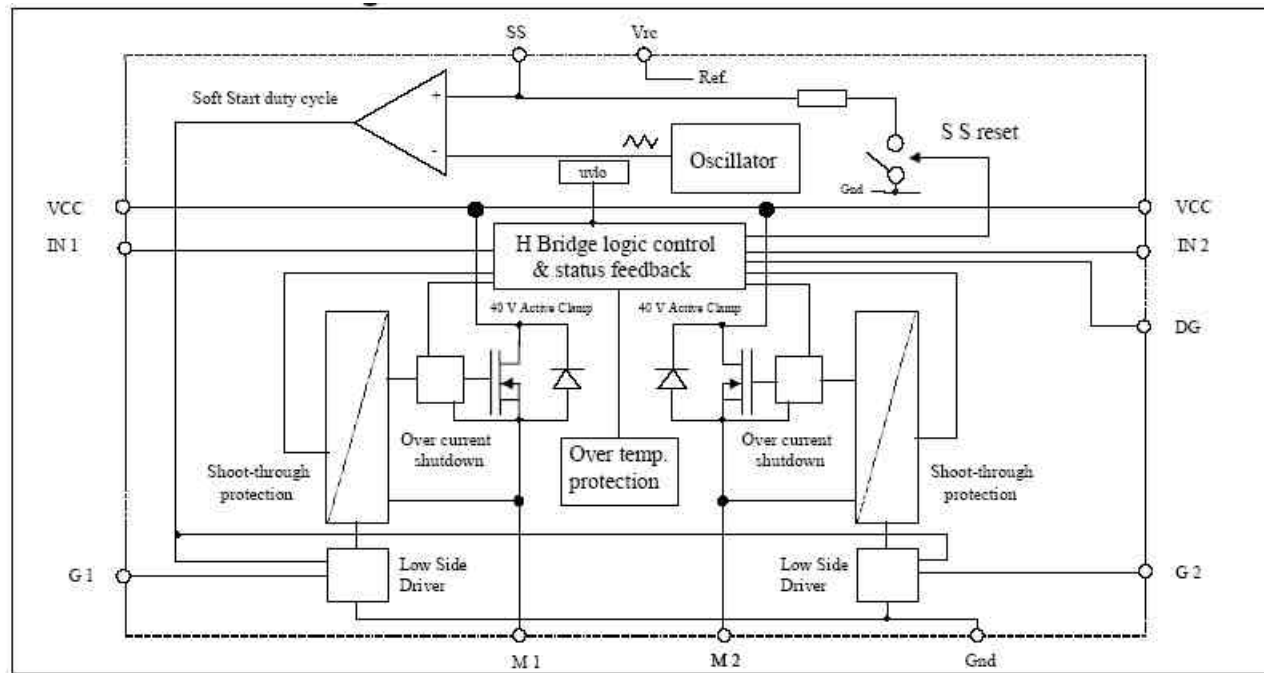
- Fully protected H-Bridge for D.C. Motors
- Features
 - Over temp Shutdown
 - Over current shutdown
 - Inrush current limited by Soft-Start sequence
 - ESD protection
 - Status feedback
 - Sleep mode for direct battery connection
 - Braking/non-braking operation
 - Shoot through protection

IR3220

- Specifications
 - $R_{dson(max)}$ 12m Ω
 - Operating voltage range 5.5V to 35V
 - I_{cont} .7A ($T_a=85^{\circ}C$)
 - $I_{shutdown}$ 30A
 - Soft Start frequency 20KHz
 - R_{th} 45 $^{\circ}C/W$ (Thermal junction to ambient resistance 1” sq. footprint 1 MOS on)
 - 20 pin SOIC (Wide Body)

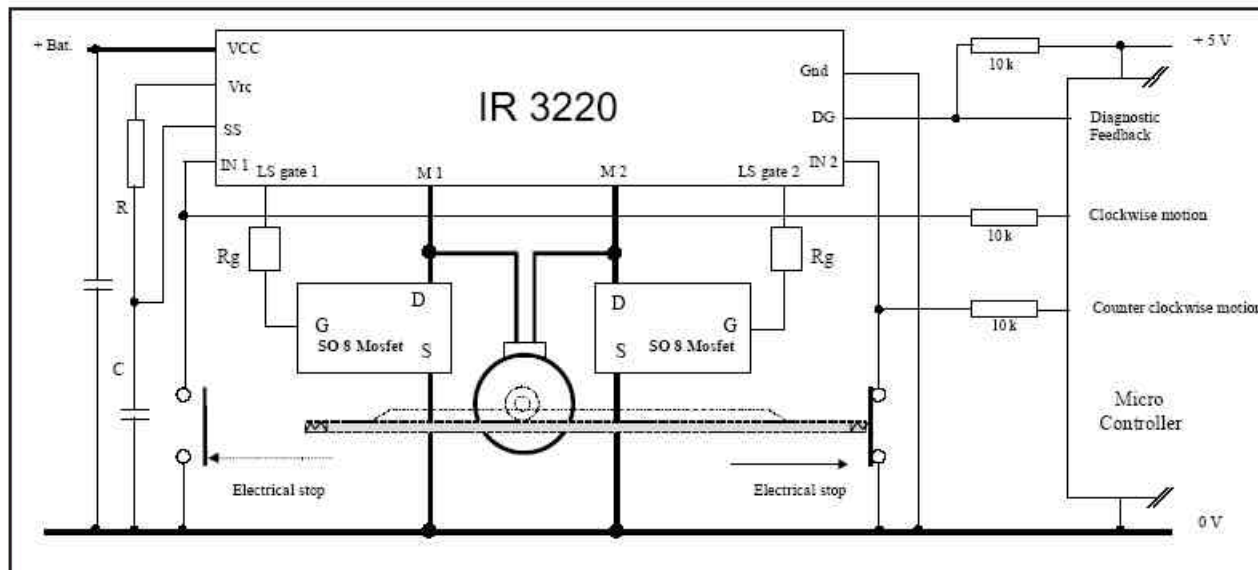
IR3220

Functional Block Diagram



IR3220

Typical Application



IR3220 Model

- Features
 - Input control
 - Over current Shutdown
 - Over temperature Shutdown
 - Soft Start
 - Voltage clamp
 - Dynamic thermal junction and case temperature
 - Status feedback
 - Braking/Non-Braking operation

Model Limitations

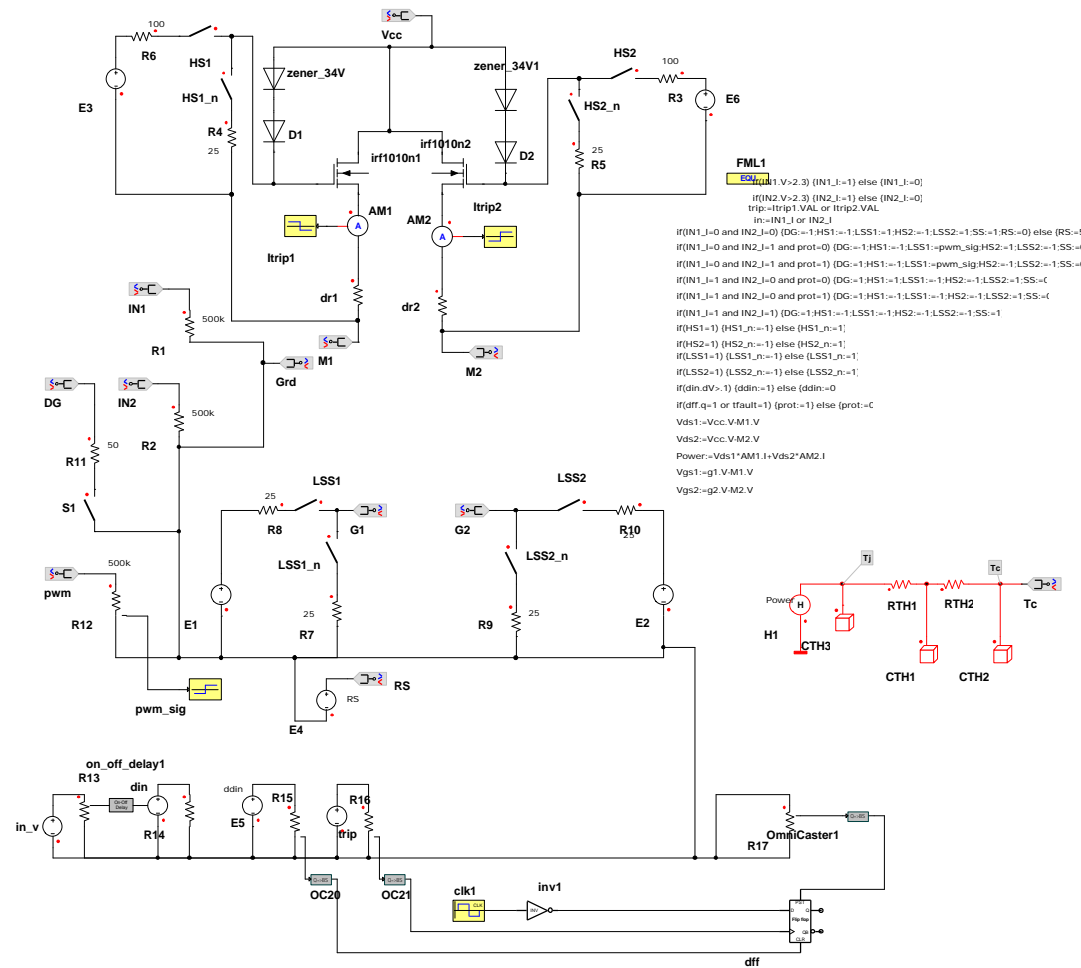
- All parameters except R_{dson} of output FET's remain nominal through out the simulation
- Shoot through protection not fully implemented.
- Sleep mode not implemented
- Supply current not accurately modeled

Model Uses

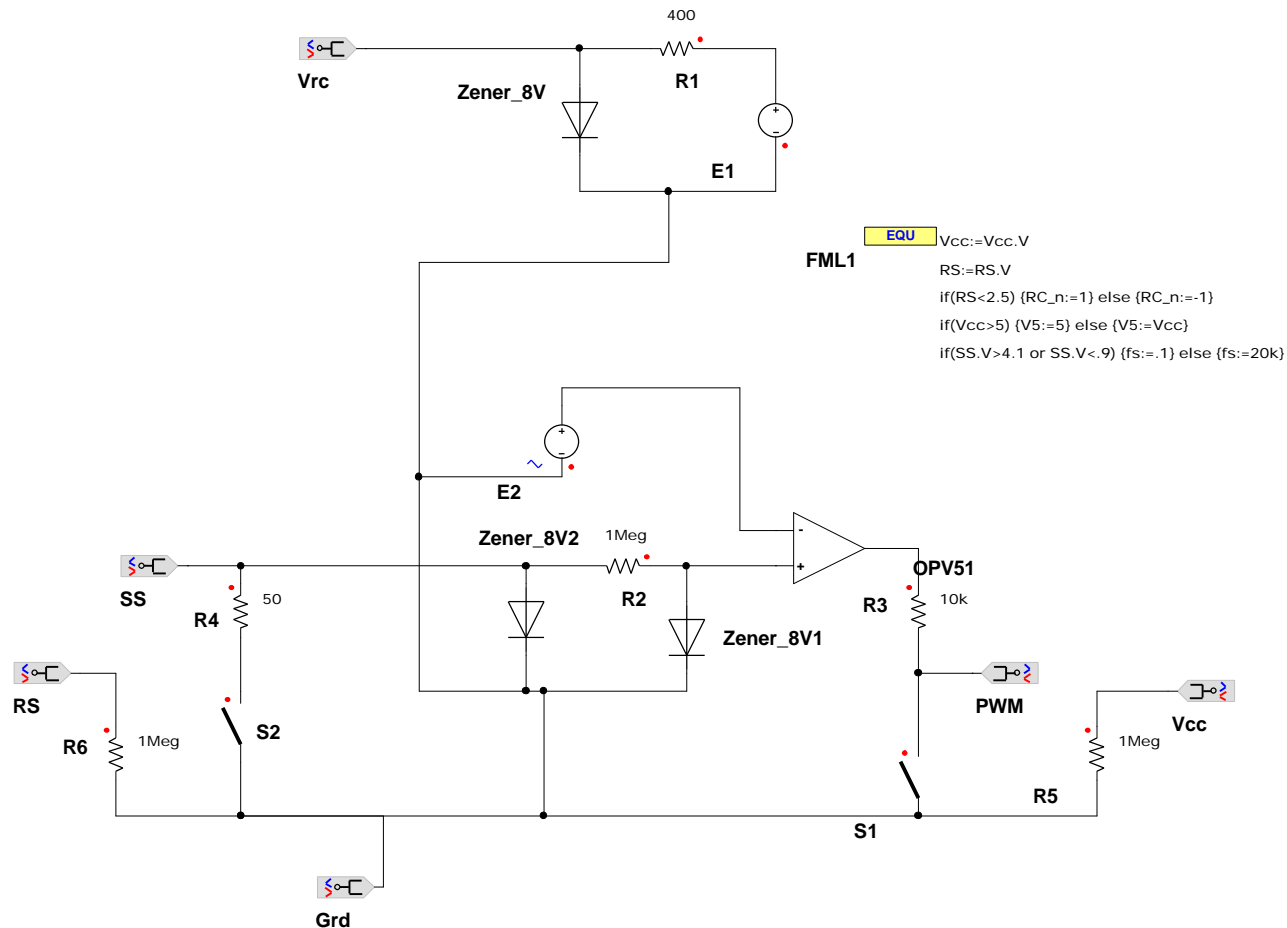
- Die temperature estimates (Power)
- Soft Start Time Optimization
- Selection of Low Side FET's
- Motor performance in application

All analysis can be performed over ambient temperature and battery voltage range

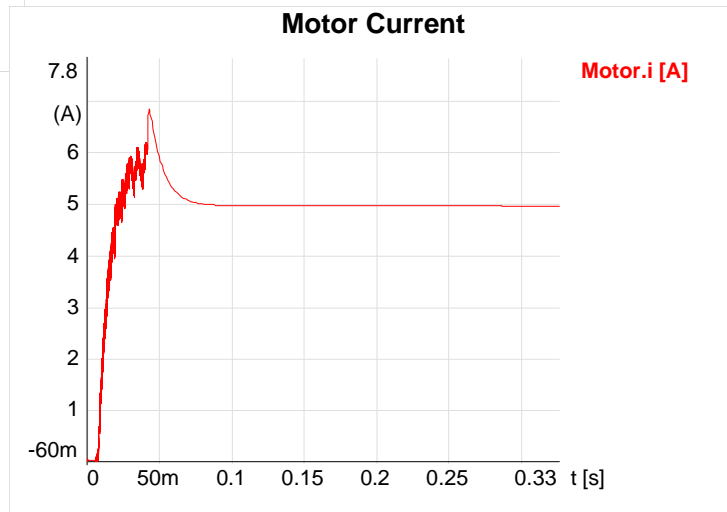
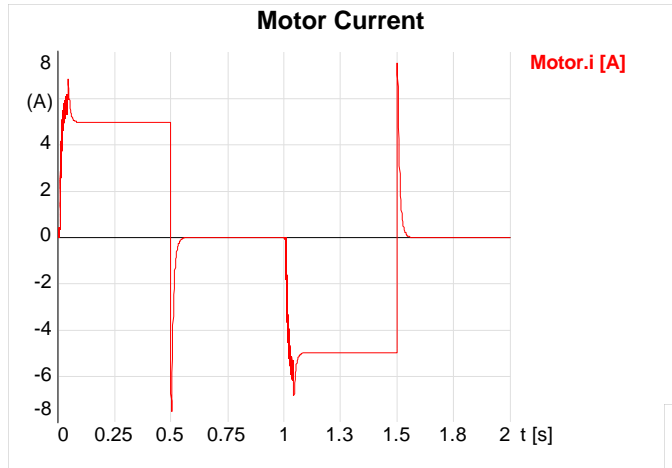
Power Stage Model



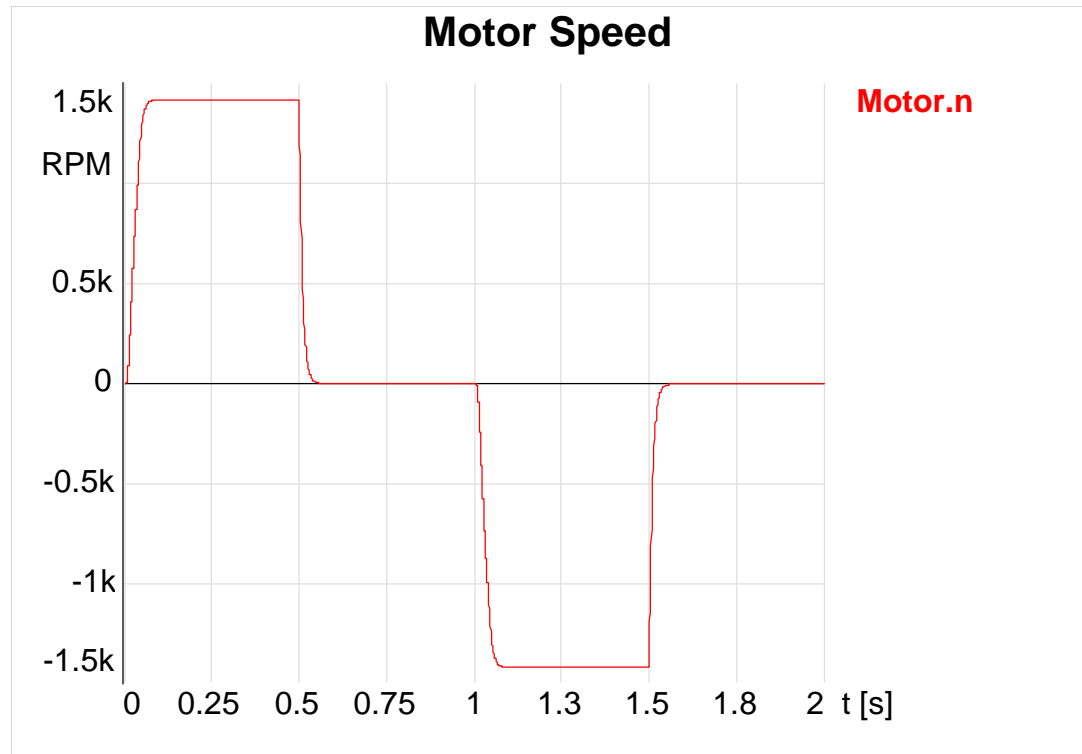
Soft Start Model



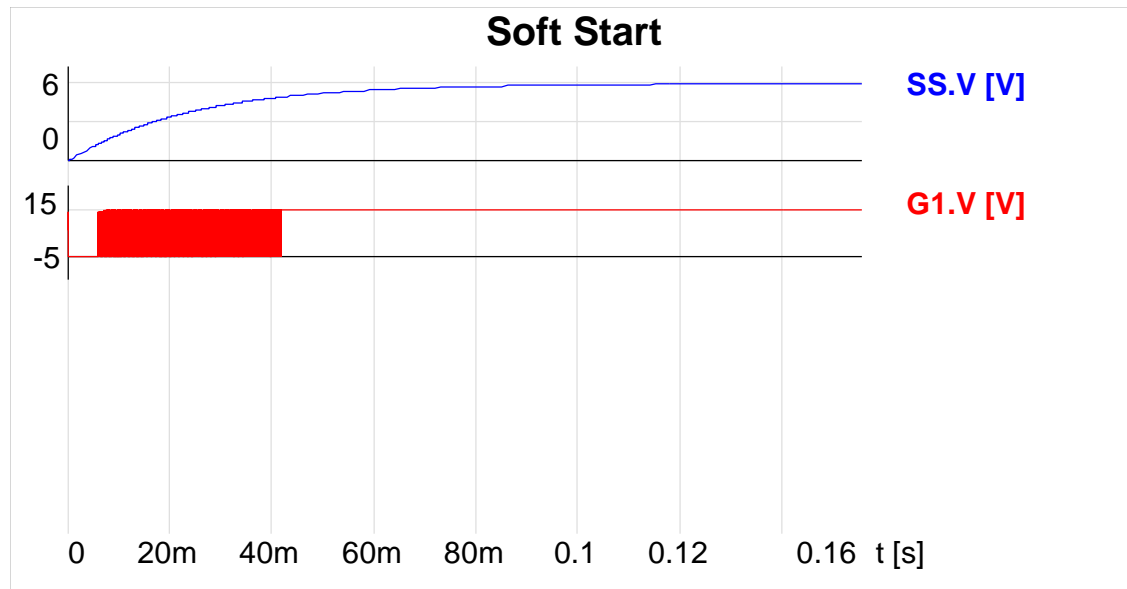
Motor Current



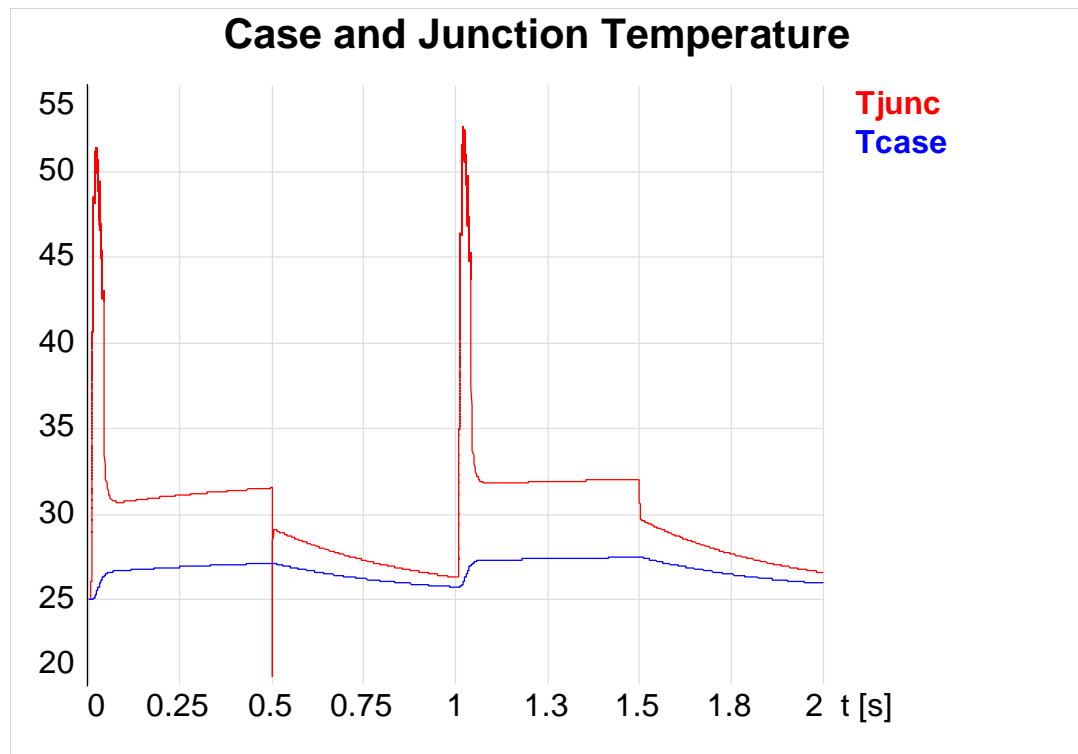
Motor Speed



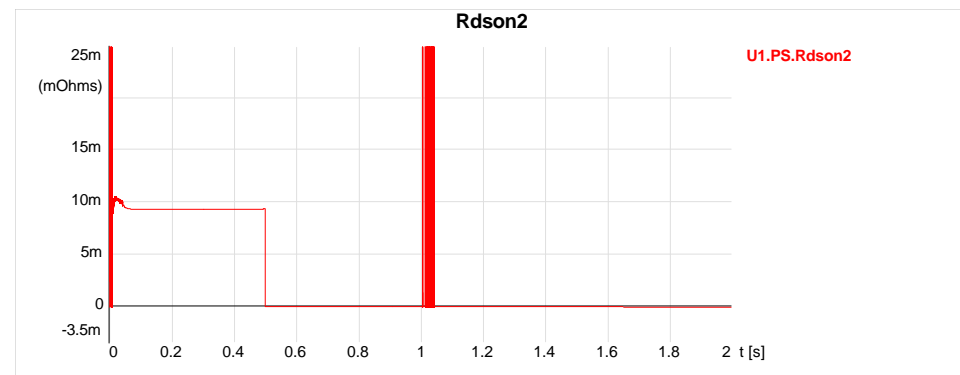
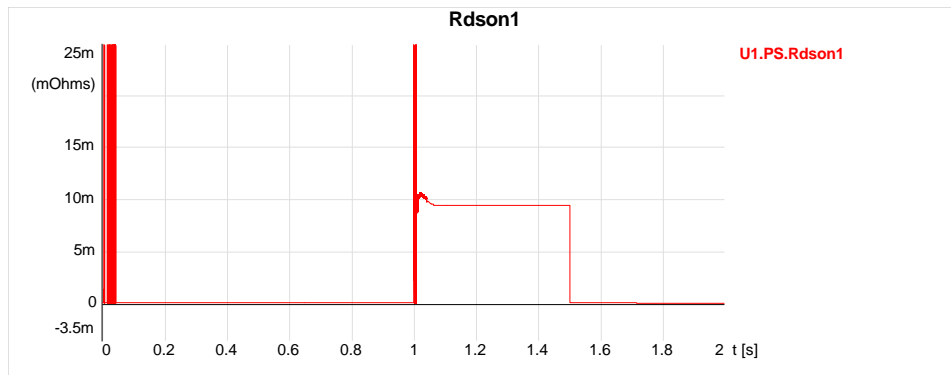
Soft Start



Case and Junction Temperature



Rdson for Internal FET's



Summary

- IR3220 is a 3 part solution
- The model includes electrical and thermal performance
- The model has functional limitations
- Simplorer is a good tool for evaluating this type of application