Switching Losses Test

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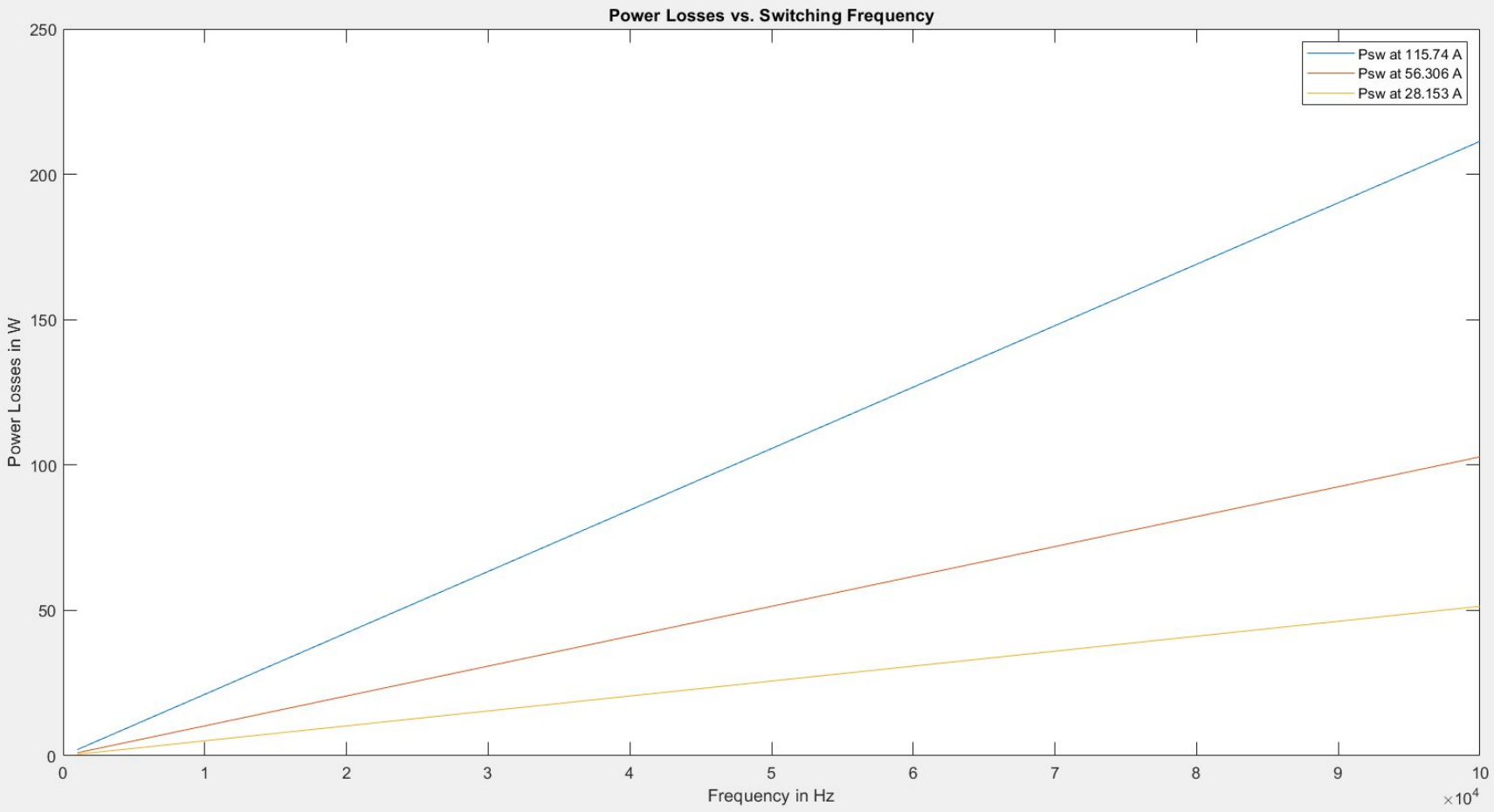
Parameters

- **Used Equation Psw = Vin*Iout*Fsw*Qgate/Ig**
- **Used DC Bus voltage of 144*3.7 V**
- **Rdson of 7.38 nOhms (at 125C)**
- **Calculated Ig Using gate capacitance, 15 V/-5 V Vgs, and fall time for 125C**
- **Calculated Q for 600 V**
  - Assumed Q = V*C
  - Used Q1/V1 = Q2/V2 ratio
  - Inaccurate for highly variable gate capacitance
- **Switching frequencies variable from 1 kHz to 100 kHz**
- **Tested at three different currents**
  - Ipeak = 115.7 A (50 kW)
  - Inominal = 56.3 A (30 kW)
  - Ilight = 28.15 A (15 kW)
- **It should be noted that this is for one switching module, not for the entire inverter.**

Results


Power Losses vs. Switching Frequency
Psw at 115.74 A
Psw at 56.306 A
Psw at 28.153 A
Power Losses in W
Frequency in Hz
×10^4
0
50
100
150
200
250
0
1
2
3
4
5
6
7
8
9
10

Results

- **We can see a linear relationship between power losses and switching frequency.**
  - This is supported by many of the online resources I could find
  - The highest likely switching frequency will be around 40 kHz, in which case we get a switching loss of about 85 Watts per switch, or a total of 510 Watts per Inverter
- **This is not 100% accurate as some characteristics change with temperature and I was unable to find those equations**
  - A more accurate calculation would include the variation in these parameters.
- **The values shown in the graph match those of other examples of switching losses within SiC MOSFETS**
  - Plan on a follow up calculation for last year's switches and the switches within the Lenze Inverters (if able to find)
- **Resources:**
  - Texas Instruments
  - Toshiba