ECEN 4797 Fall 2014 **Vince Coghlan**

Homework #5

5.1: This problem uses information extracted from portions of the data sheet for a Vishay Siliconix power MOSFET SiHF620 (the full datasheet is available at `http://www.vishay.com/docs/91027/sihf620.pdf`). The on- state resistance of this MOSFET ($R_{\mathrm{DS(on)}}$) is 0.8Ω at 25° C. This on-state resistance varies with junction temperature, as illustrated in Fig. 4 (note that Fig.4 plots the normalized variation). The junction-to-case thermal resistance (R_{thJC}) is 2.5° C/W (see above table). Also the junction-to-case transient thermal impedance versus pulse duration, for a single rectangular power dissipation pulse and repeated pulses of different duty ratios, is given in Fig. 11. For both parts of this problem assume that the maximum allowable junction temperature (T_J) is 140° C and the maximum ambient temperature (T_A) is 50° C.

(a) The MOSFET is first attached to a heat sink using an insulating pad resulting in a case-to-sink thermal resistance (R_{thCS}) of 0.75° C/W. Assuming that the MOSFET must carry a (forward) rms current of 2.5 A, and that switching losses can be ignored, what is the maximum allowable thermal resistance of the heat sink (R_{thSA})?

(b) The MOSFET is now instead operated in a pulsed fashion, carrying rectangular pulses of current of magnitude I_p, 1 ms in duration with 99 ms of off time between pulses. If the MOSFET is mounted to an extremely good heat sink that maintains the case temperature at 50° C, what is the maximum allowable current pulse magnitude (I_p)? You may assume that the MOSFET on-state resistance is always at its 140° C value.