HEATSINK2.RTF Rev2 John Macey 28 Jul 2012

THERMAL DESIGN BASICS

Circuit

7805 regulator supplied by a 12V battery (NOT allowing for 14V MAX during charging)
Max voltage drop across the regulator = 12-5 = 7Volts
For a design load current of .5 Amp
Max regulator dissipation = 7V x .5A = 3.5 Watts

Regulator Specs

Case 221A
Thermal Resistance, Junction–to–Ambient RqJA 65 °C/W
Thermal Resistance, Junction–to–Case RqJC 5.0 °C/W
Max Operating Junction Temperature TJ 150 °C

Thermal Design

What is the max current with no heatsink?
With no heatsink, RqJA = 65C/W

Assuming a 50C ambient temperature, max allowable temp rise = (Tj - Ta) = (150-50) = 100C Then max power = 100C/(65C/W) = 1.538W
Max current without a heatsink = 1.538W/7V = .22A = 220mA

For the nominated .5A, 3.5W load and an ambient temperature of 50C
We need a heatsink and an overall RqJA of (150-50)C/3.5W = 28.6 C/W
RqJC = 5C/W so we need a (case-ambient) RqCA = (28.6-5) = 23.6C/W
Jacar $1 HH-8502 (19x19x9.5mm) 20C/W will marginally do
{ alternatively, the Jaycar $1.45 HH-8504 12C/W is much better}

The junction temperature will be (20+5)C/W *3.5W = 87.5C above ambient [Tj = 137.5C]
{or with the 12C/W heatsink (12+5)C/W*3.5W = 59.5C above ambient [Tj = 109.5C] }

For the 12C/W heatsink, the case temperature will be 109.5C - 5C/W*3.5W = 109.5C-17.5C = 92C