Calculation Report: Heat Sink Power Amplifier PRO-Q2

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EQ2.a
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1 Introduction

In this calculation report the heat sink of the selected monolithic power amplifier is calculated.

2 Calculation: Heat Sink Power Amplifier

Imagine that the maximum temperature of the power amplifier can be 150 °C and that the surrounding temperature goes up to 70 °C. The maximum output power equals to 15 W. Then the total junction-to-ambient thermal resistance must be less than[1]:

$$\theta_{ja} = \frac{150 - 70}{10} = 8,0^{o}C/W \tag{1}$$

The thermal resistance of a metal-metal interface equals:

$$\theta_{jc} = 1,2^{o}C/W \tag{2}$$

The thermal resistance of the heatsink equals:

$$\theta_{ca} = \theta_{ja} - \theta_{jc} = 8,0^{o}C/W - 1,2^{o}C/W = 6,8^{o}C/W \tag{3}$$

To check whether the calculations are correct, we determine the temperature of the junction as a result of the thermal resistance.

The maximum average power that the IC will be required to dissipate is approximately [1]:

$$P_dMAX = \frac{V_S^2}{2\pi^2 R_L} + P_Q = \frac{18^2}{2\pi^2 \cdot 8} + 10 = 12,05W \tag{4}$$

- V_S is the total power supply voltage across the power amplifier.
- R_L is the load resistance.
- P_Q is the quiescent power dissipation of the amplifier. The maximun power of the power amplifier is 15 W and the maximum required power is 15 W. Therefore

$$P_Q = 25W - 15W = 10W \tag{5}$$

The maximum temperature is:

$$T = P_dMAX \cdot \theta_{ja} = 12,05 \cdot 8 = 96,4^{o}C \tag{6}$$

96,4 °C is higher than 70,0 °C and therefore the new

$$\theta_{ja} = \frac{150 - 96,4}{10} = 5,36^{o}C/W \tag{7}$$

The new ϑ_{ja} (5,360 °C/W) is lower than 8,0 °C/W, which means it meets the required specifications.

References

[1] Texas Instruments. (2004, May). "*LM1875 20W Audio Power Amplifier*" [online]. Available: http://www.farnell.com/datasheets/1703151.pdf [April 3, 2015].