2 Monolithic Power Amplifier

2.1 Requirements

The power amplifier has the following specifications:

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- Input impedance of at least 50 kΩ
- Output power: 15 W sine in R_{load} = 8 Ω at 1 kHz
- Frequency range: 10 Hz to 100 kHz (−3 dB) at P_{load} = 0.5 W in 8 Ω

2.2 Chosen Power Amplifier

For the power amplifier, the LM1875 (Farnell code: 1468913) was chosen. This specific power amplifier has been chosen because the LM1875 meets the specified requirements.

2.3 Calculations

For determining the maximum output voltage and current, it is assumed the amplifiier drives an 8 Ω load at 15 W.

The formula for the power equals to:

$$P = U * I \tag{1}$$

Therefore the following formulas can be derived:

$$U_{OUT,max} = \sqrt{P * R} = \sqrt{15 * 8} = 11V \tag{2}$$

−15,5

$$I_{OUT,max} = \sqrt{\frac{P}{R}} = \sqrt{\frac{15}{8}} = 1,37A \tag{3}$$

1,93 ✓

The amplifier has a bandwidth of 70 kHz at 20 W output power, however the desired dynamic range of 10 Hz to 100 kHz can be easily achieved at lower power output. ?

According to the datasheet from LM1875 [1] the supply voltage need to be approximately ± 18 V to accomodate to the 15 W output power.

Ueff = 11V →

acc

Calculation Report: Heat Sink Power Amplifier PRO-Q2

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EQ2.a
EQ2.c

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2 Calculation: Heat Sink Power Amplifier

Imagine that the maximum temperature that 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]:

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

eigen vermogen.

The thermal resistance of a metal-metal interface equals:

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

The therminal resistance of the heatsink equals:

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

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]:

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

- 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:

$$T = P_d MAX * \theta_{ja} = 12,05 * 8 = 96,4řC \tag{6}$$

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

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

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

Lezen!