The University of Sheffield
Department of Electronic and Electrical Engineering

Electronic Devices in Circuits Tutorial Sheet

Power Amplifiers

Q1 A class B power amplifier is required to deliver a maximum power of 150W into an 8Ω resistive load. For each of sinusoidal, triangular and square voltage waveforms across the load, calculate:

- **(i)** The minimum supply voltage rails necessary. (±49V, ±60V, ±34.6V)
- **(ii)** The peak load current at maximum output power. (6.13A, 7.5A, 4.33A)
- **(iii)** The efficiency of the amplifier at maximum power output. (78.5%, 67%, 100%)
- **(iv)** The output voltage amplitude at which maximum power dissipation occurs in the transistors. (31.2V, 45V, 17.3V)
- **(v)** The maximum power dissipation in each output device. (30.4W, 42.2W, 18.8W)
- **(vi)** The maximum thermal resistance of the heatsink if both transistors, which have a junction to case thermal resistance of $0.75^{o}CW^{-1}$, are mounted on a single heatsink using insulating washers with a thermal resistance of $1^{o}CW^{-1}$ and the heatsink and junction temperatures must not exceed $90^{o}C$ and $150^{o}C$ respectively in an ambient of $35^{o}C$. ($0.9^{o}CW^{-1}$, $0.49^{o}CW^{-1}$, $1.47^{o}CW^{-1}$)

You should assume that the output devices can operate down to $V_{CE}= 0$; ie, the output signal amplitude can equal the supply rails.

Q2 If the amplifier of Q1 was an integrated circuit and the maximum output voltage amplitude was limited to supply voltage minus 5V, how would the answers to parts **(i)** to **(vi)** in Q1 change?

You should assume for part **(vi)** that the integrated circuit has a junction to case thermal resistance of $1^{o}CW^{-1}$, that it is bolted directly to the heatsink (ie, $\theta_{CS} = 0$) and that its maximum junction temperature is $125^{o}C$. (**(i)** ±54V, ±65V, ±39.6V; **(ii)** no change; **(iii)** 71%, 61.5%, 87.6%; **(iv)** 34.4V, 48.75V, 19.8V; **(v)** total P_D: 73.8W, 99W, 49W; **(vi)** $0.22^{o}CW^{-1}$, $-0.09^{o}CW^{-1}$, $0.84^{o}CW^{-1}$)