

Solutions to *The Art of Electronics 3rd Edition*

February 3, 2024

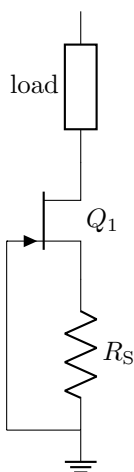
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Solutions for Chapter 3

Exercise 3.1

Figure 1.1: JFET current source



From Figure 3.21 of the book, one can see that a drain current equal to 1 mA corresponds to a gate-source voltage of -0.6 V . Therefore:

$$R_S = \frac{0.6\text{ V}}{1\text{ mA}} = 600\ \Omega$$

Exercise 3.2

At $V_{GS} = V_{G0}$:

$$r_{GS} = r_{G0} = \frac{1}{2k(V_{G0} - V_{th})}$$

The ratio between r_{DS} and R_{G0} returns:

$$\frac{r_{DS}}{r_{G0}} = \frac{2k(V_{G0} - V_{th})}{2k(V_{GS} - V_{th})}$$

Exercise 3.3

Being g_m the differential conductance of the FET operated in aturation region, it can be expressed as:

$$g_m = \frac{\partial I_D}{\partial V_{GS}} = \frac{\partial}{\partial V_{GS}} k (V_{GS} - V_{th})^2 = 2k (V_{GS} - V_{th})$$

Therefore:

$$g_m = \frac{1}{r_{DS}}$$

Exercise 3.4

- (a) The voltage across the drain-gate capacitance when the JFET is switched on ($V_{DS} = 0$ V) is equal to 50 V-10 V=40 V. Considering a maximum current across this capacitance equal to 1 mA:

$$t_{ON} = \frac{40 \text{ V } 200 \text{ pF}}{1 \text{ mA}} = 8 \text{ } \mu\text{s}$$

- (b) Since the current is equal to the charge over time, we have:

$$t_{ON} = \frac{40 \text{ nC}}{1 \text{ mA}} = 40 \text{ } \mu\text{s}$$

Exercise 3.5 **TODO: write solution**

Exercise 3.6 **TODO: write solution**

Exercise 3.7 **TODO: write solution**

Exercise 3.8 **TODO: write solution**

Exercise 3.9 **TODO: write solution**

Exercise 3.10 **TODO: write solution**

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Exercise 3.16 **TODO: write solution**

Exercise 3.17 **TODO: write solution**

Exercise 3.18 **TODO: write solution**