

Assignment 2

1) Why use MRAM instead of SRAM or DRAM?

save space/power
non-volatile (DRAM isn't)
faster than DRAM and most SRAM
cheaper than SRAM

2) An electron in a semiconductor is affected naturally by a potential $V(x,y,z)$ due to the effects of atomic nuclei surrounding it, depending on its (x,y,z) spatial position in the material. If its total energy E is only due to this potential plus its free energy due to its momentum p , what is $E(x,y,z)$ in terms of $V(x,y,z)$, p , and its mass m ?

$$E = V + \frac{p^2}{2m}$$

3) If a valence electron escapes to the conduction band, what is the added potential energy that it has absorbed equal to (in words), and how did it receive this energy?

$$\Delta V = E_c - E_v = \text{difference in energy of conduction and valence bands}$$

E field,
B field

light absorption, thermal heat, or other free electron absorption

4) If you were building a microchip, would you use bipolar transistors or MOSFETs? Why?

bipolar trans.

~~Mosfets~~ - they switch faster

Mosfets - ~~and~~ take less power

5) You are applying voltage across the gate of a MOSFET that stirs current across it. What kind of field is being applied to the electrons that motivates them to move, and explain how this field fits into the formula for the total energy of the electron.

electric E field gives energy to the electron to move as it converts potential energy due to the electric field ($\int E \cdot dl$) to its kinetic energy ($\frac{p^2}{2m}$)

$$E_{\text{electron}} = V + \frac{p^2}{2m} \quad \text{at all times}$$

part of this is due to the E field
~~is $\int E \cdot dl$~~

Extra credit

Since noise is random, yes

a stack overflow can occur

even if it only occurs on average

every 5 msec, with a 1 msec ISR