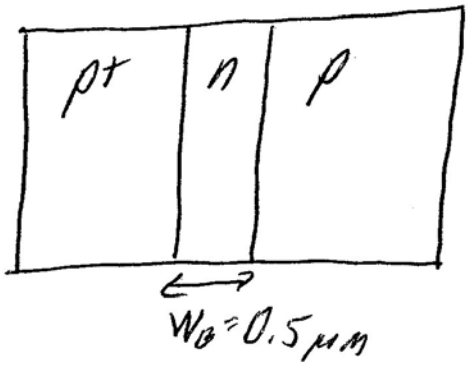
Recitation 9

EE 3161 – Spring 2008

1) For the silicon pnp bipolar transistor shown below, what are α_T and β if we include base recombination? If $V_{EB} = 0$, at what V_{CB} does the transistor reach a punchthrough condition (base region fully depleted)? How does this compare to the open base breakdown voltage? (Let m=4.)



p^+: $N_a = 5\times10^{17}$ cm^{-3}

n: $N_d = 3\times10^{16}$ cm^{-3}

p: $N_a = 6\times10^{15}$ cm^{-3}

$\tau_E = \tau_B = \tau_C = 1\mu s$

$A = 1cm^2$

2) We have a transistor in the common emitter configuration and:

i.) the base recombination time, $\tau_B = 0.1\mu s$

ii.) the base transit time, $\tau_t = 1ns$

iii.) the base current in the 'ON' state, $I_{B\,on} = 1.0mA$

iv.) The collector current in saturation, $I_{C\,sat} = 10.0mA$

If we apply $I_{B\,on}$ to the transistor in cutoff, what is the rise time for this device?

What is the switching delay for the device to switch from 'ON' to 'OFF' if we switch I_B from $I_{B\,on}$ to 0? What about from $I_{B\,on}$ to $-I_{B\,on}$?