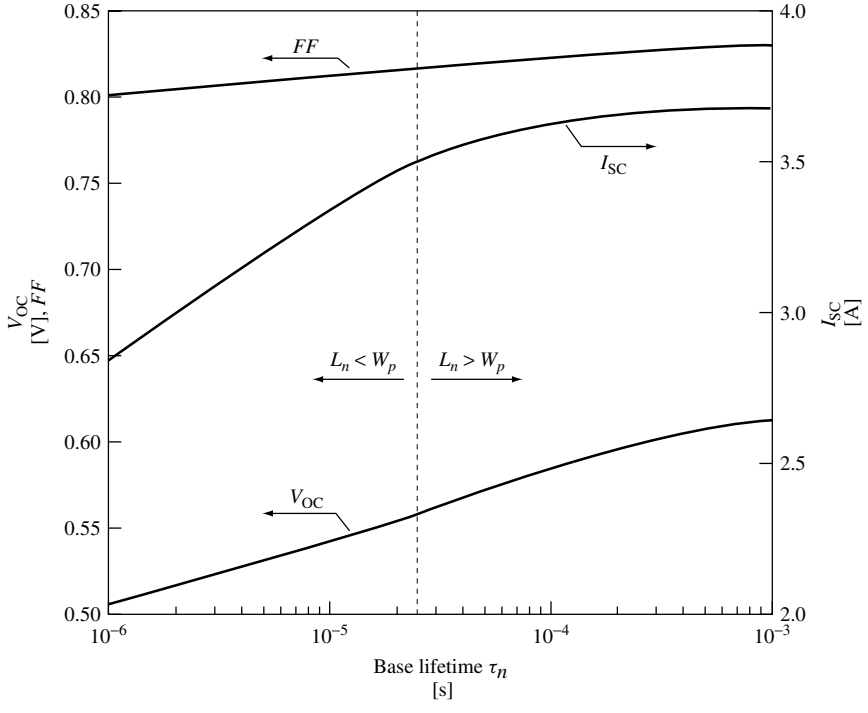

Figure 3.17 Effect of base lifetime on solar cell performance for the solar cell parameters in Table 3.2. The minority-carrier diffusion length ($L_n = \sqrt{D_n \tau_n}$) is equal to the base thickness (W_P) when $\tau_n = 25.7\ \mu s$

Front surface recombination for solar cells with contact grids on the front of the device is really an average over the front surface area of the relatively low surface recombination velocity between the grid lines and the very high surface recombination velocity of the ohmic contact. An expression for the effective front surface recombination velocity is given by [16]

$$S_{\mathrm{F,eff}} = \frac{(1-s)S_{\mathrm{F}}\overline{G}_N\tau_p\left(\cosh\dfrac{W_N}{L_p}-1\right)+p_o(\mathrm{e}^{qV/A_okT}-1)\left[s\dfrac{D_p}{L_p}\dfrac{\cosh\dfrac{W_N}{L_p}}{\sinh\dfrac{W_N}{L_p}}+S_{\mathrm{F}}\right]}{(1-s)\left[p_o(\mathrm{e}^{qV/A_okT}-1)+\overline{G}_N\tau_p\left(\cosh\dfrac{W_N}{L_p}-1\right)\right]} \tag{3.144}$$

where S_{F} is the surface recombination velocity between the grid lines and $\overline{G}$ is the average generation rate in the emitter region. It is obvious that $S_{\mathrm{F,eff}}$ is dependent upon the solar cell operation point. This is better seen in Table 3.3 where some special cases are illustrated (assuming $L_p \gg W_N$).