Design a general purpose silicon n-p-n transistor with the following specifications. Assume that you can alter the minority carrier life time to any specific design value between 100 $\mu$sec and 0.1 $\mu$sec. Give the rationale of your design concisely and show that the specifications are expected to be met.

(Note: there is no unique design)

1) Maximum ratings
   a) Collector-emitter breakdown voltage: $BV_{CEO} \geq 30V$
   b) Collector-base breakdown voltage: $BV_{CBO} \geq 60V$
   c) Collector current: 800mA
   d) Total power dissipation: 1 Watt

2) Electrical characteristics (at 25°C unless otherwise noted)
   a) DC current gain: 100-300 for $I_C = 150mA, V_{CE} = 10V$
   b) Current gain-bandwidth product: $f_T \geq 300 MHz$
   c) Small signal current gain: $\beta \geq 50$ for $I_C = 1mA (dc), V_{CE} = 10V (dc), f = 1kHz$
   d) Switching characteristics: ($V_{CC} = 30V, I_C = 150mA, I_B = 15mA$)
      i) Turn-on time: $t_t \leq 30ns$
      ii) Storage time: $t_s \leq 700ns$
FIGURE 2.18. Minority-carrier (a) mobilities, (b) lifetimes, and (c) diffusion lengths as a function of doping concentration, calculated using the empirical equations (2.115) to (2.118).