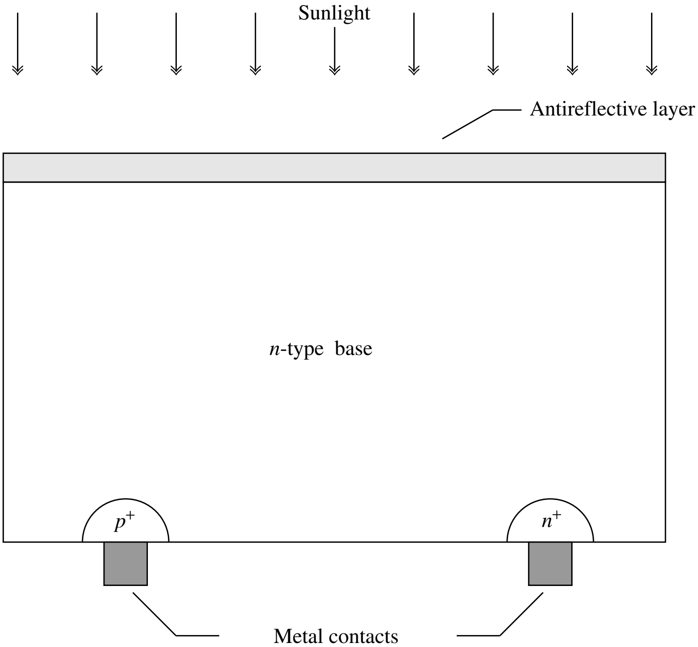

Figure 3.26 Schematic of a back-contact solar cell

cell [22], as illustrated in Figure 3.26. Since both electrical contacts are on the back, there is no grid shadowing. These cells are typically used in concentrator application and high-level injection conditions pervade. Assuming high-level injection, a simple analysis is possible.

Returning to equations (3.76) and (3.77), it can be seen that in high-level injection, the electric field can be eliminated (it is not necessarily zero), resulting in the ambipolar diffusion equation

$$D_{\mathrm{a}} \frac{\mathrm{d}^2 p}{\mathrm{d}x^2} - \frac{p}{\tau_n + \tau_p} = -G(x), \tag{3.166}$$

where the ambipolar diffusion coefficient is given by

$$D_{\mathrm{a}} = \frac{2 D_n D_p}{D_n + D_p}. \tag{3.167}$$

The ambipolar diffusion coefficient is always less than the larger diffusion coefficient and greater than the smaller one.

In silicon, where $D_n/D_p \approx 3$ over a wide range of doping, the ambipolar diffusion coefficient is $D_{\mathrm{a}} \approx 3/2 D_p \approx 1/2 D_n$ and, if we also assume $\tau_p \approx \tau_n$, the ambipolar diffusion length is

$$L_{\mathrm{a}} \approx \sqrt{3} L_p \approx L_n. \tag{3.168}$$