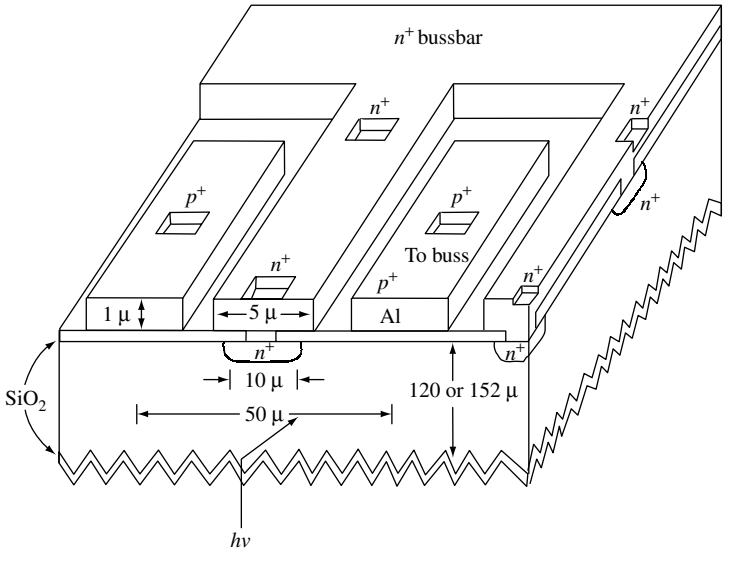

Figure 11.13 The point-contact cell design. Reproduced from Sinton R, Swanson R, "An Optimization Study of Si Point-Contact Solar Cells", Presented at *Nineteenth IEEE Photovoltaic Specialists Conference* (New Orleans, LA, 1987) with permission by © 1987 IEEE

oxide layer was found to produce very good surface passivation, which further reduced recombination. Many high-efficiency cell concepts such as the UNSW PERL (Passivated Emitter Rear Localized) cell [28] adopted these concepts to attain their performance. Solar TPV was found to have serious practical drawbacks, however. These included (1) ancillary absorption problems such as from radiator support mounts, (2) the difficulty of the very high concentration required (over 10 000X), and (3) material problems from the very high radiator temperatures of over 2000°C. The resulting high performance of point-contact TPV cells in normal sunlight was very compelling, however, and so in 1980 EPRI elected to abandon solar TPV and began developing normal high-concentration systems in which the sunlight impinges directly on the cell. The point-contact cell was further developed and reconfigured with all contacts on the back. These cells eventually reached a conversion efficiency of 28% [29]. Having all contacts on the back of the cell provides two main advantages. First, the shadowing of the top surface is eliminated. Second, the metal may be made to cover the entire back, reducing series resistance considerably (a particular advantage in concentrator cells).

EPRI funded the development of systems based on the point-contact cell starting in 1980. The initial system conceptual design work was performed by Black & Veatch. Figure 11.14 shows the resulting design. The design concentration ratio was 500X; geometric and reflective secondaries were used in a Fresnel module consisting of a 6×6 array of Fresnel lenses, each lens being 18 cm on a side [30].

Several large test arrays were built to check the mechanical and thermal performance of the structure. Unfortunately, these were not populated with cells because the point-contact cell was found to be unstable. The problem was traced to the generation of interface recombination centers at the $Si-SiO_2$ interface by ultraviolet photons. Several