

13

Photodetectors and Solar Cells

- 13.1 INTRODUCTION
- 13.2 PHOTOCONDUCTOR
- 13.3 PHOTODIODES
- 13.4 AVALANCHE PHOTODIODE
- 13.5 PHOTOTRANSISTOR
- 13.6 CHARGE-COUPLED DEVICE (CCD)
- 13.7 METAL-SEMICONDUCTOR-METAL PHOTODETECTOR
- 13.8 QUANTUM-WELL INFRARED PHOTODETECTOR
- 13.9 SOLAR CELL

13.1 INTRODUCTION

Photodetectors are semiconductor devices that can detect optical signals through electronic processes. The extension of wavelength of coherent and incoherent light sources into the far-infrared region on one hand and the ultraviolet region on the other has increased the need for high-speed, sensitive photodetectors. The operation of a general photodetector includes basically three processes: (1) carrier generation by incident light, (2) carrier transport and/or multiplication by current-gain mechanism if present, and (3) extraction of carriers as terminal current to provide the output signal.

Photodetectors are important in optical-fiber communication systems operated in the near-infrared region (0.8 to 1.6 μm). They demodulate optical signals, that is, convert the optical variations into electrical variations, that are subsequently amplified and further processed. For such applications the photodetectors must satisfy stringent requirements such as high sensitivity at operating wavelengths, high response speed, and minimum noise. In addition, the photodetector should be