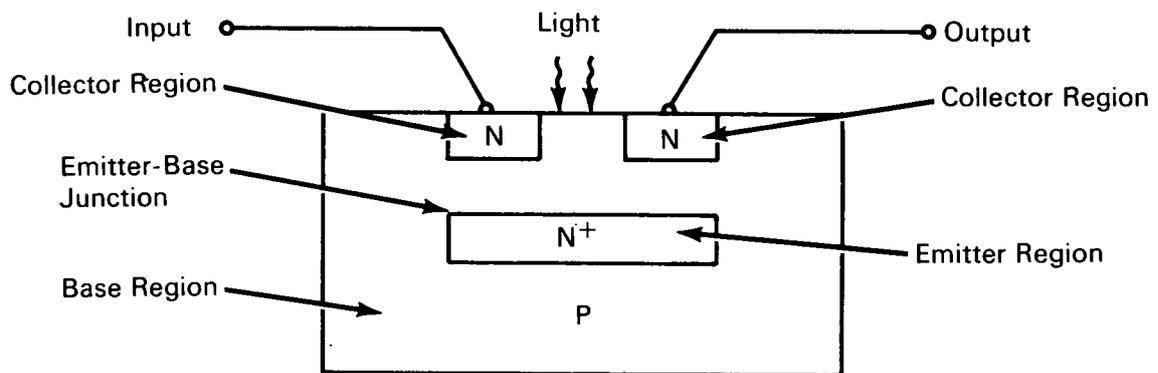


# NASA TECH BRIEF



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## Photoelectric Semiconductor Switch Operates with Low Level Inputs



**The problem:** It is frequently desirable to have a photoelectric switch operate at very low input levels while providing adequate gain. Previous devices have exhibited high-leakage current across the emitter-base junction which causes poor operation at low input levels.

**The solution:** A photoelectric semiconductor switch that exhibits high emitter-to-collector transport efficiency beta at low signal levels.

**How it's done:** An  $N^+$ -type emitter region is buried in a P-type wafer that serves as the base region of the switch. Properly spaced N-type collector regions are diffused into the surface of the base region above the emitter region and are electrically connected as input and output for the device being controlled.

Light reaching the upper surface of the switch passes through the base region and strikes the buried emitter region. Minority carriers are then released by the emitter region and travel through the intervening portion of the base region to the collector regions thus establishing a low-impedance path between the input and output connections. Because the emitter region is

buried, high-leakage currents across the emitter-base junction are avoided and it functions more like an ideal emitter than one which operates at the surface of the device. The emitter-base junction being inherently passivated results in emitter-to-collector transport efficiency beta higher than that of prior photoelectric semiconductor switches, especially at low signal levels.

### Notes:

1. This device could find broad application in the automotive, alarm, instrumentation, and process control industries.
2. The switch could be used to switch city street lights on and off as daylight passed preselected thresholds.
3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
 Jet Propulsion Laboratory  
 4800 Oak Grove Drive  
 Pasadena, California, 91103  
 Reference: B65-10033

(continued overleaf)

**Patent status:** NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: International Business Machines under contract to Jet Propulsion Laboratory (JPL-SC-068)