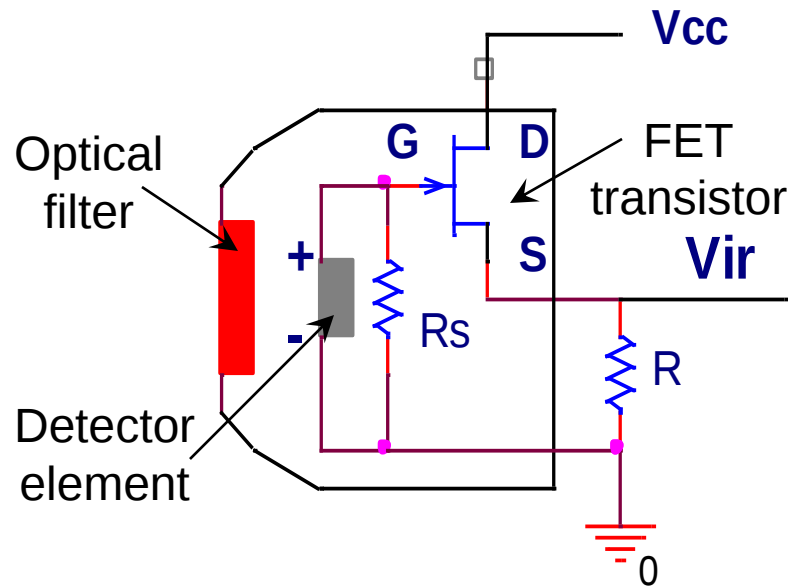


Infrared-Based Motion Sensors

- Objects that radiate heat, radiate infrared.
- Motion sensing feature on most lights and security systems is a passive system that detects infrared (Ir falls between visible light and microwaves).
- These sensors are known as **PIR** (passive infrared) detectors or **pyroelectric** sensors.
- PIR sensors that detect human motions are designed to be sensitive to the temperature of human body.
- Humans have a skin temperature of about 93°F & radiate with a wavelength between $9\mu\text{m}$ & $10\mu\text{m}$.

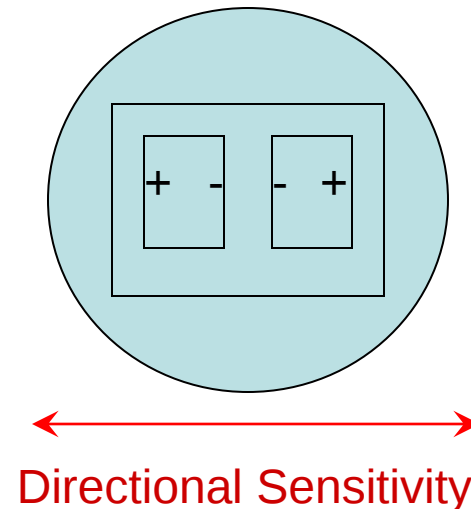
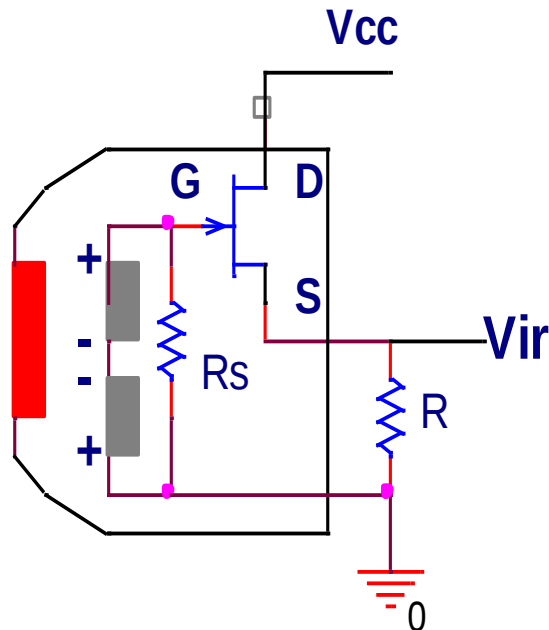
Infrared-Based Motion Sensors - continued

- PIR sensor is made from ceramic material that generate **surface** charge when exposed to Ir.
- This charge is proportional to intensity of Ir radiation.
- Single element PIR detector:



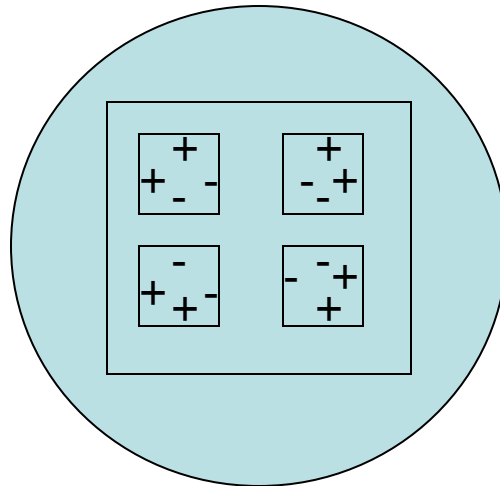
Infrared-Based Motion Sensors - continued

- Single element PIR would be sensitive to static Ir radiation (sunlight) not just dynamic radiation (motion).
- Multiple element PIRs are used to cancel effects of “background noise” (sunlight, vibrations, RF, lighting).
- Two element PIR detector (side and front views):



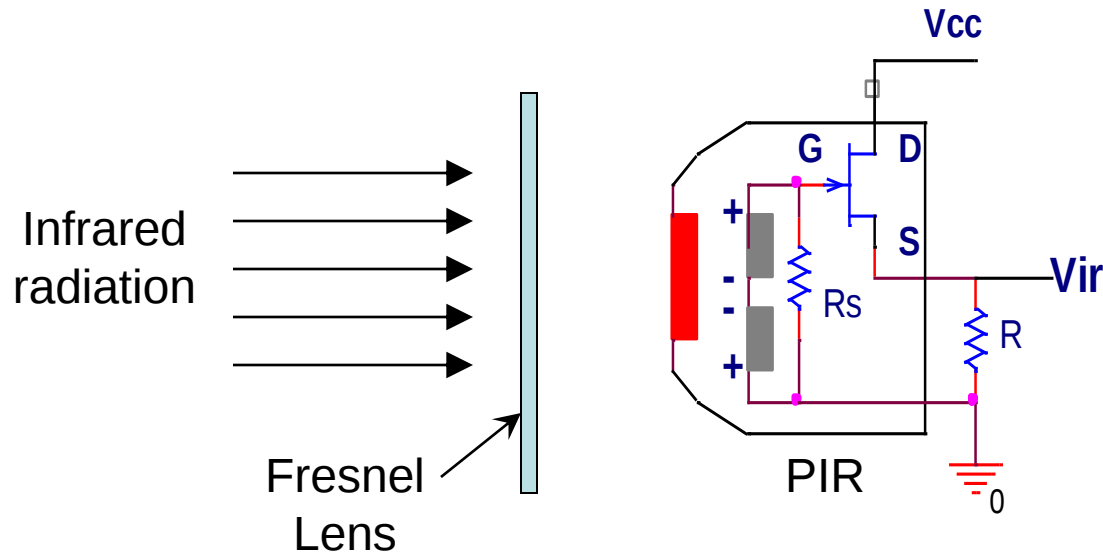
Infrared-Based Motion Sensors - continued

- Quad element PIR are used to detect all directions of motion.
- Quad element PIR layout (front view):



Infrared-Based Motion Sensors - continued

- Fresnel lens can be used to increase sensitivity:



- Vir output:



Infrared-Based Motion Sensors

PIR-325 motion detector design (GloLab):

