CY3236A-PIRMOTION: Pyroelectric Infrared (PIR) Motion Detection Evaluation Kit (EVK)

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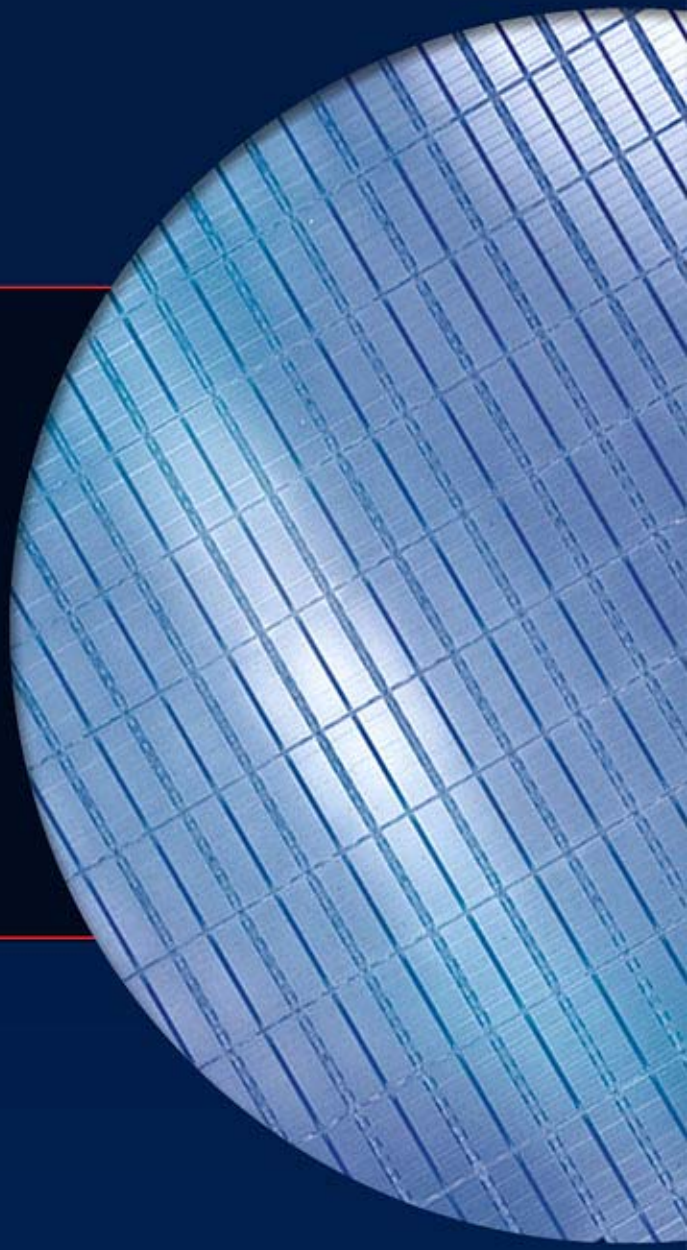
Agenda

- PIR Theory
- PIR Motion Detection—The PSoC Way

PIR Theory



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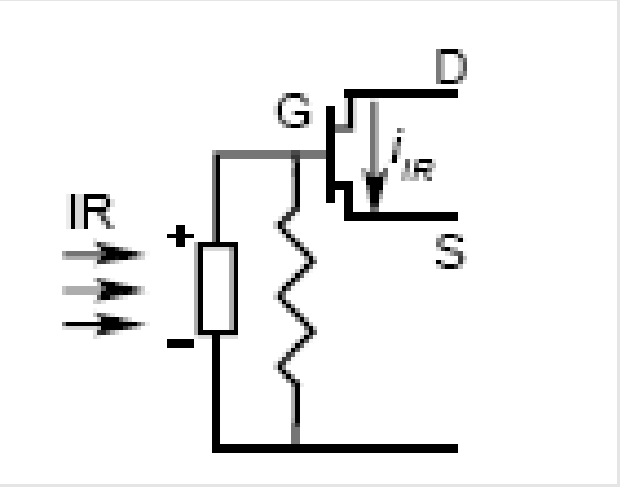
PIR Theory - Basics

- Humans at normal body temperature radiate most strongly in the infrared spectrum at an approximate wavelength of 10uM
- To detect this signal, a transducer is required that converts the infrared signal to current or voltage

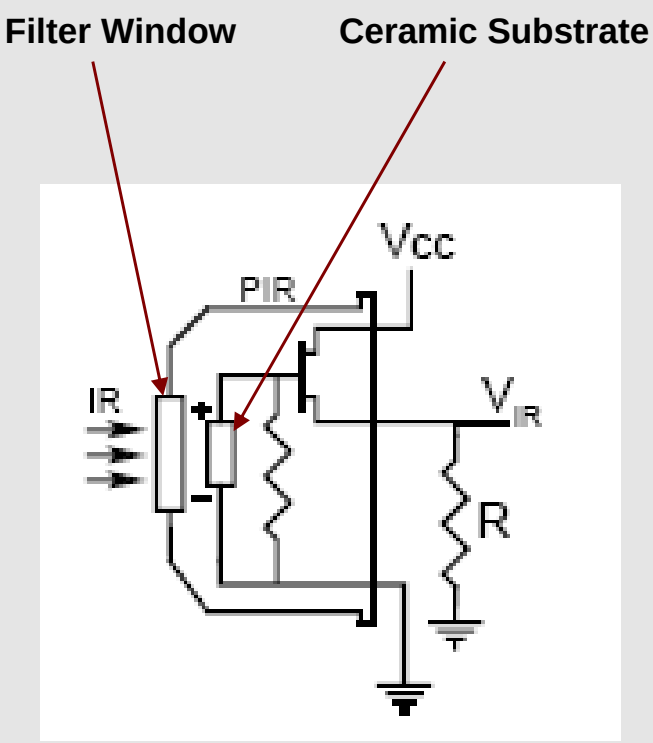
PIR Theory – PIR Sensors

- A PIR sensor is made of ceramic material that generates surface charge when exposed to infrared radiation
- As the amount of radiation increases, the surface charge generated increases
- A FET is used to buffer this signal



PIR Theory – PIR Sensors

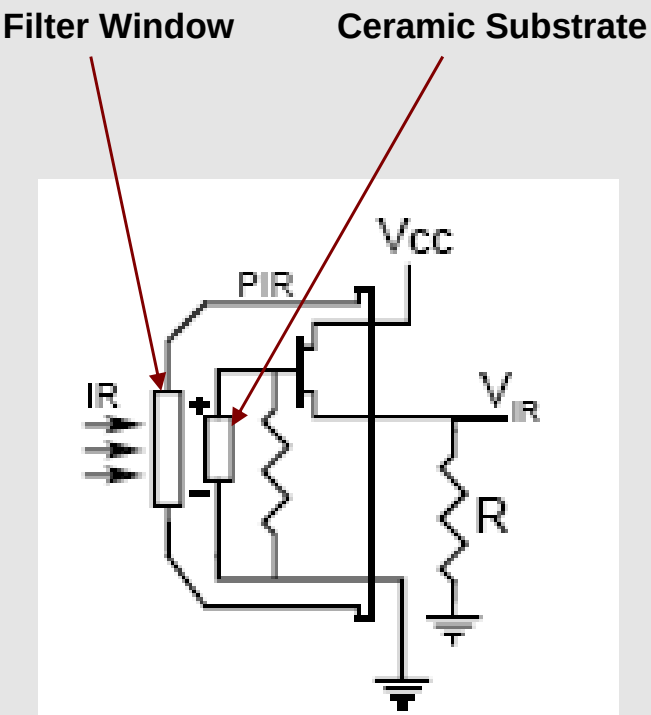
- As the sensor is sensitive to a wide range of radiation, a filter window is added
- This window limits the infrared rays falling on the ceramic pickup to 8um-14um range
- Also, a resistor is added to the source of the FET to convert the charge to voltage



PIR Theory – PIR Sensors

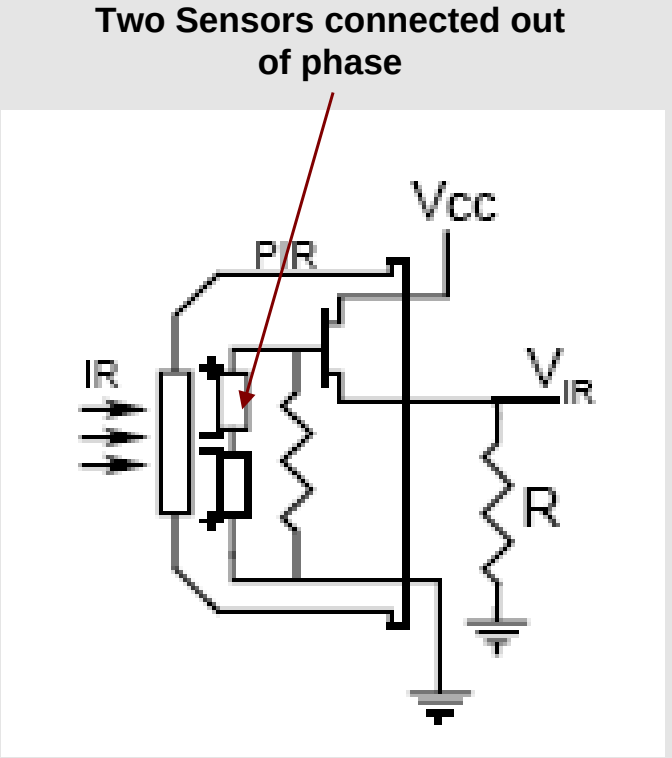
- The output of the sensor is the function of infrared radiation
- But the output is also affected by vibration, radio interference, sunlight etc

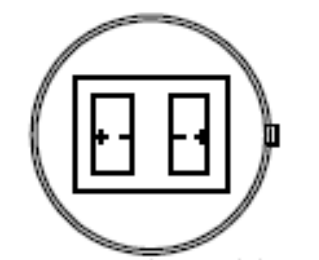
What is the solution?



PIR Theory – PIR Sensors

- Dual Sensors are used
- Both sensors are connected out of phase such that any excitation that is common to both the sensors cancel out
- A body passing before the sensors excites first one and then the other sensor

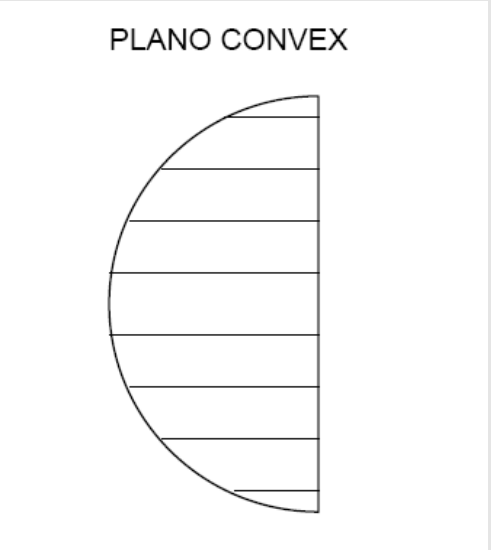


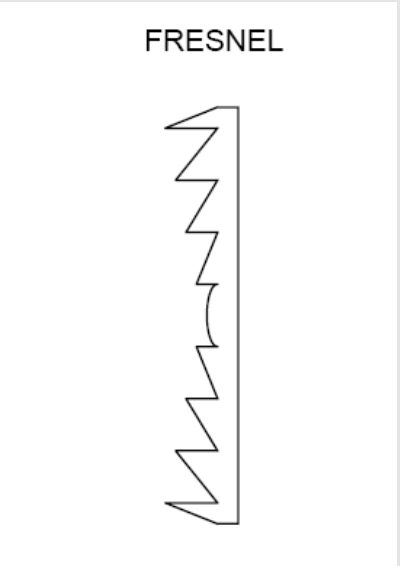


Physical Construction of a dual sensor

PIR Theory – Fresnel Lens

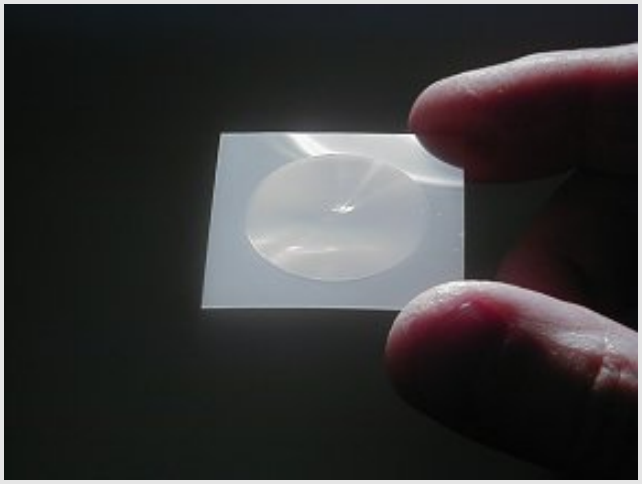
- To improve the range and detection angle, Fresnel Lens are used
- A Fresnel lens is a plano convex lens that has been collapsed on itself to form a flat lens that retains its optical characteristics, but is thinner and has lesser absorption losses





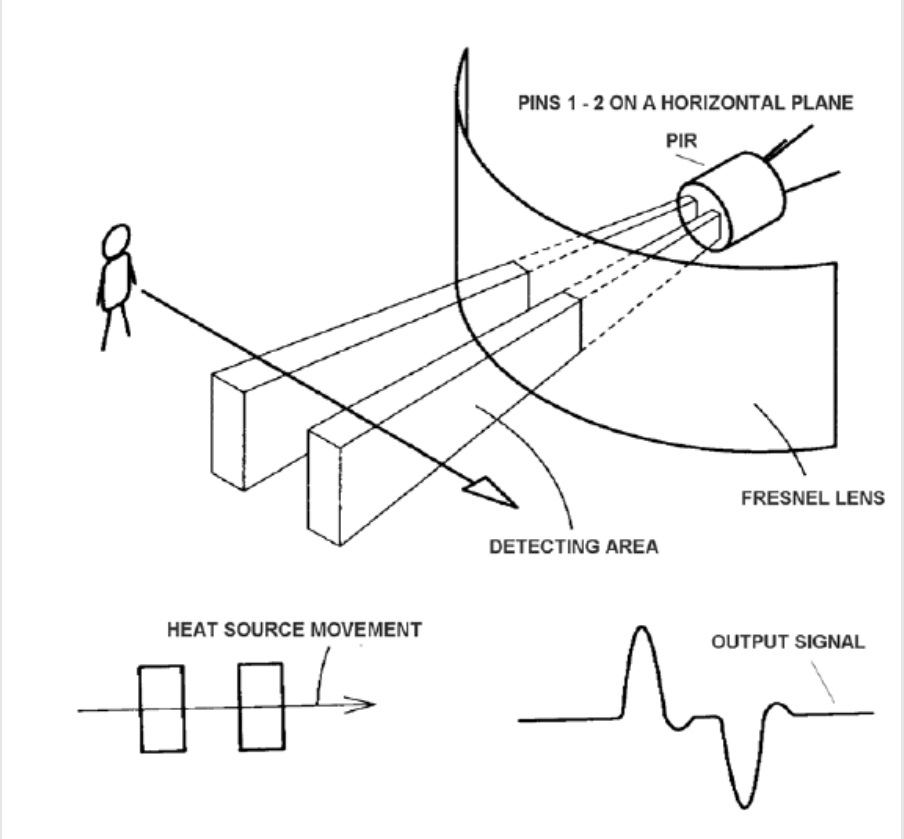
PIR Theory – Fresnel Lens

- There are many types of Fresnel Lens available, each having a different angle of coverage, focal length etc

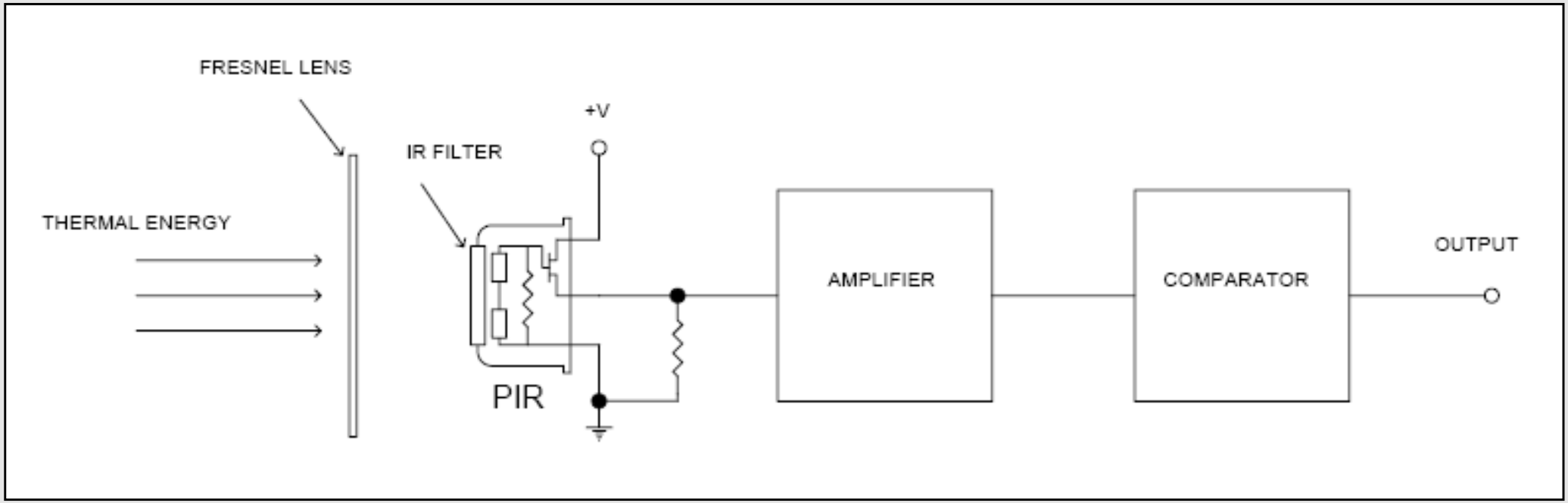


PIR Theory – Detection

- When an object moves in front of the sensor, the dual elements are excited one after other
- The resultant output is a +ve signal followed by a –ve signal



PIR Theory – Detection

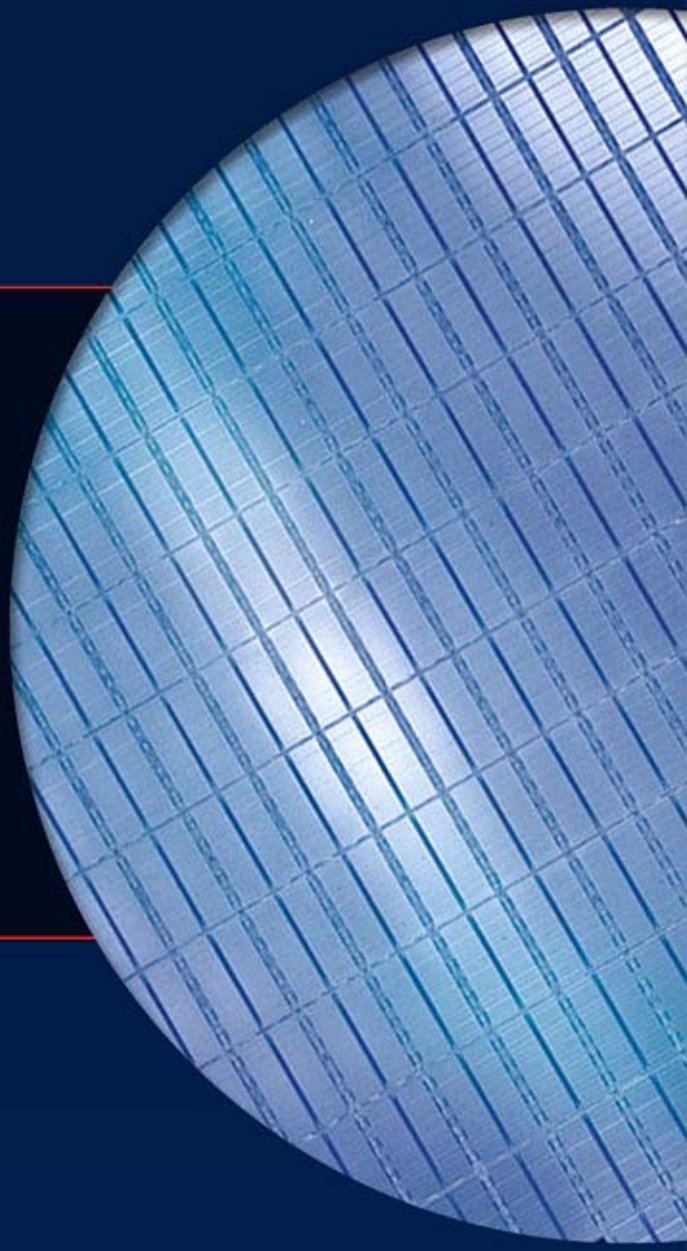


- The signal is first amplified using an amplifier and then fed to a comparator
- The comparator produces an output when the sensor detects a movement
- This comparator output can be further processed to control electrical loads

PIR Motion Detection Applications

- Automatic Lighting Controls
- Automatic Door Openers
- Security Systems
- Activating Wireless Cameras

PIR Motion Detection—The PSoC Way



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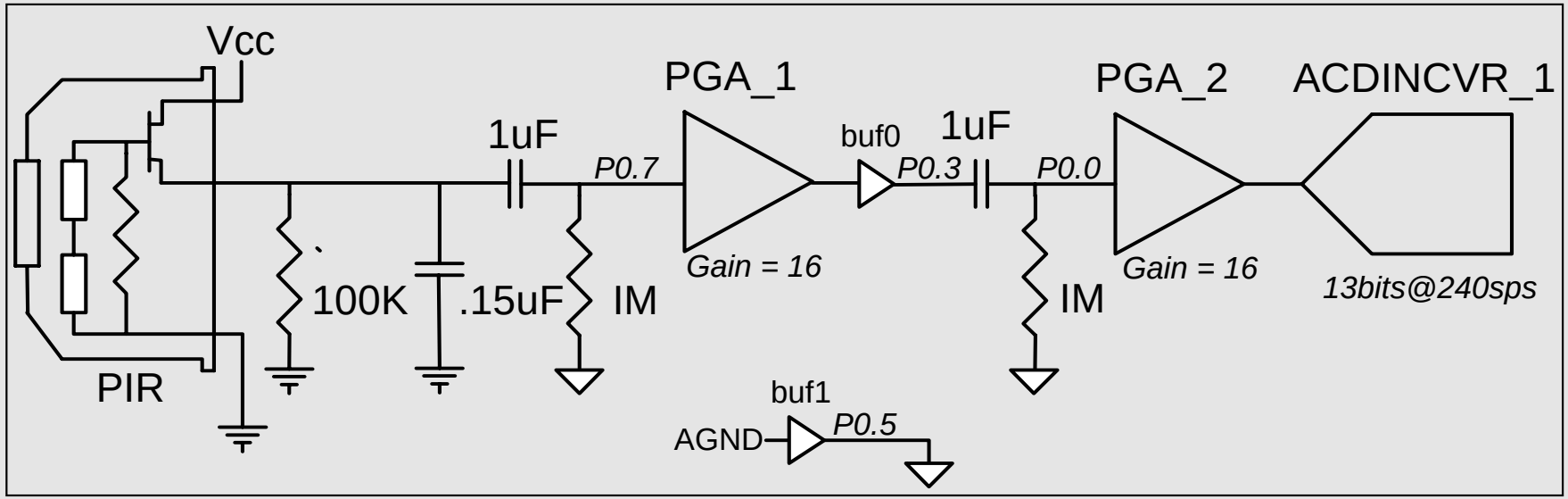
PIR Detection – The PSoC Way



- The Amplifier is implemented in 2 stages with capacitive coupling between stages
- ADC measures the output of amplifier stage

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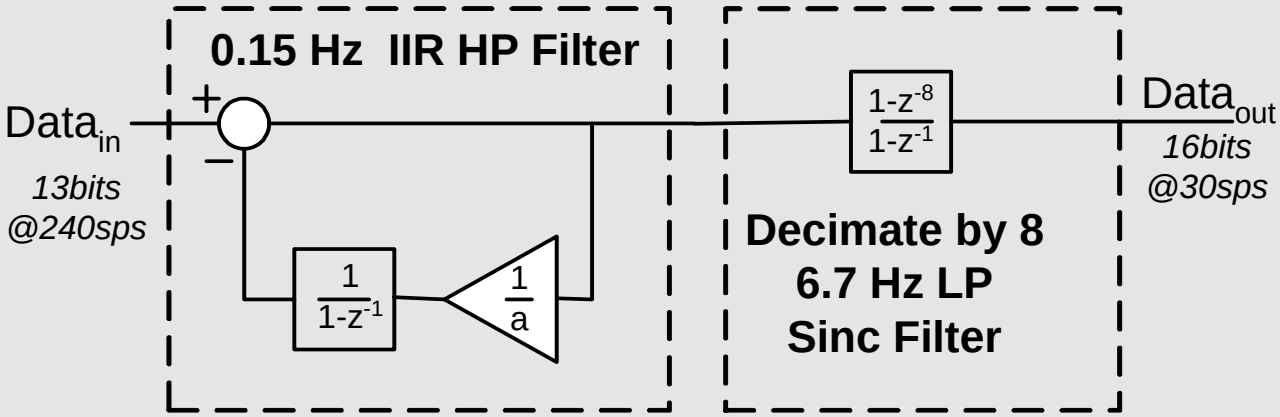
PIR Detection – The PSoC Way



- Digital High Pass Filter and Decision logic in firmware
- All Hardware and Firmware implemented in **One PSoC Device**

Refer to AN2105 on www.cypress.com/designresources