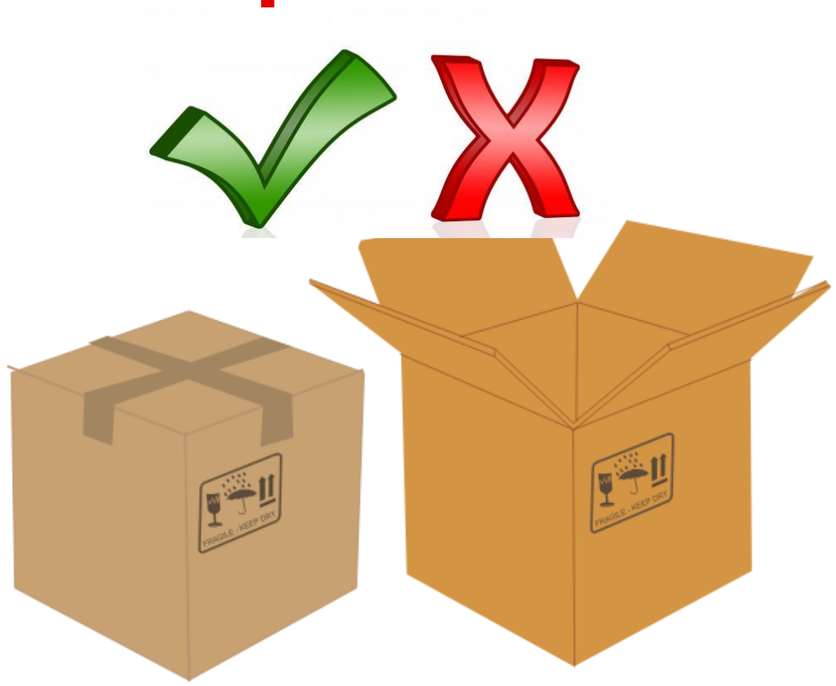
Tamper Detection

TI Precision Labs – Light Sensors

Presented by Rahland Gordon

Prepared by Rahland Gordon

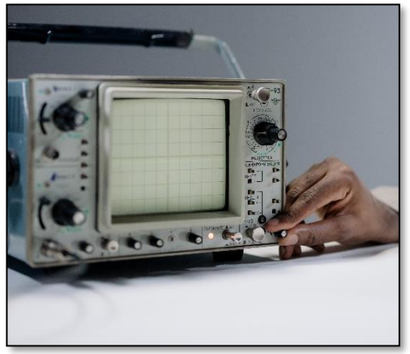
Tamper Detection Use Case and Applications



Type of Tampering

- Case open
- Broken seal
- External element affecting measurement precision

Applications



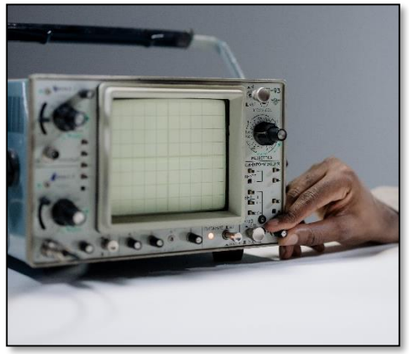
Tamper Detection Use Case and Applications

Appropriate use:

- Safety-critical need to shut off a portion of product
- Possibility that a device will be damage once tampered with
- Potential that user may alter device functionality

Applications

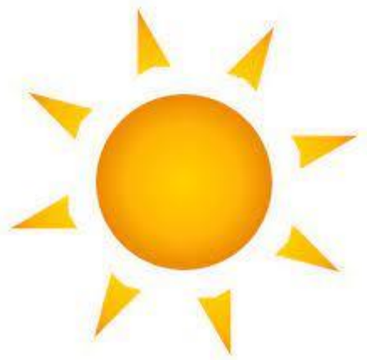


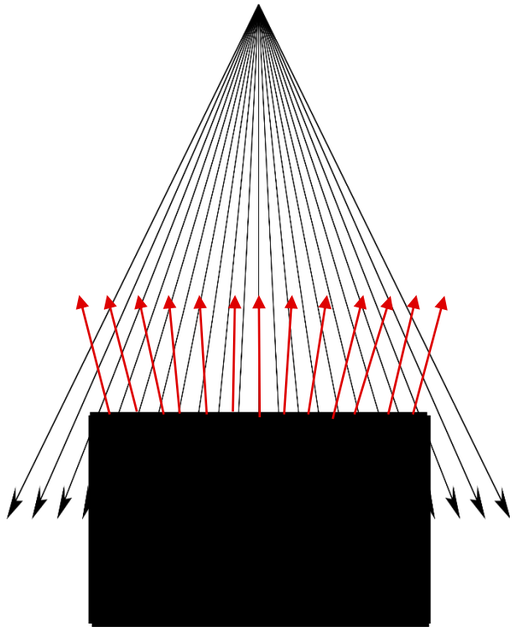





Using a Light Sensor for Tamper Detection

- Determine a change in illumination
- Design must have a known amount of light at the PCB





Advantages

- Simple design complexity
- Low power consumption
- Low cost solution

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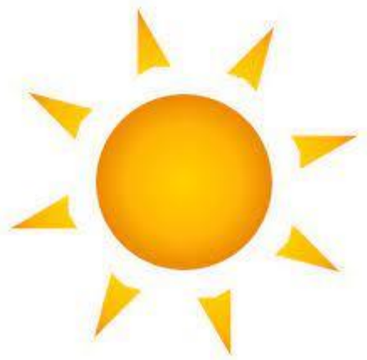

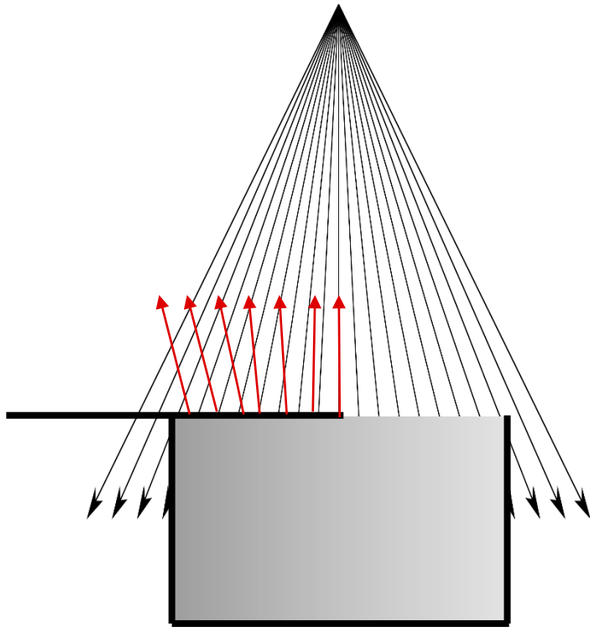

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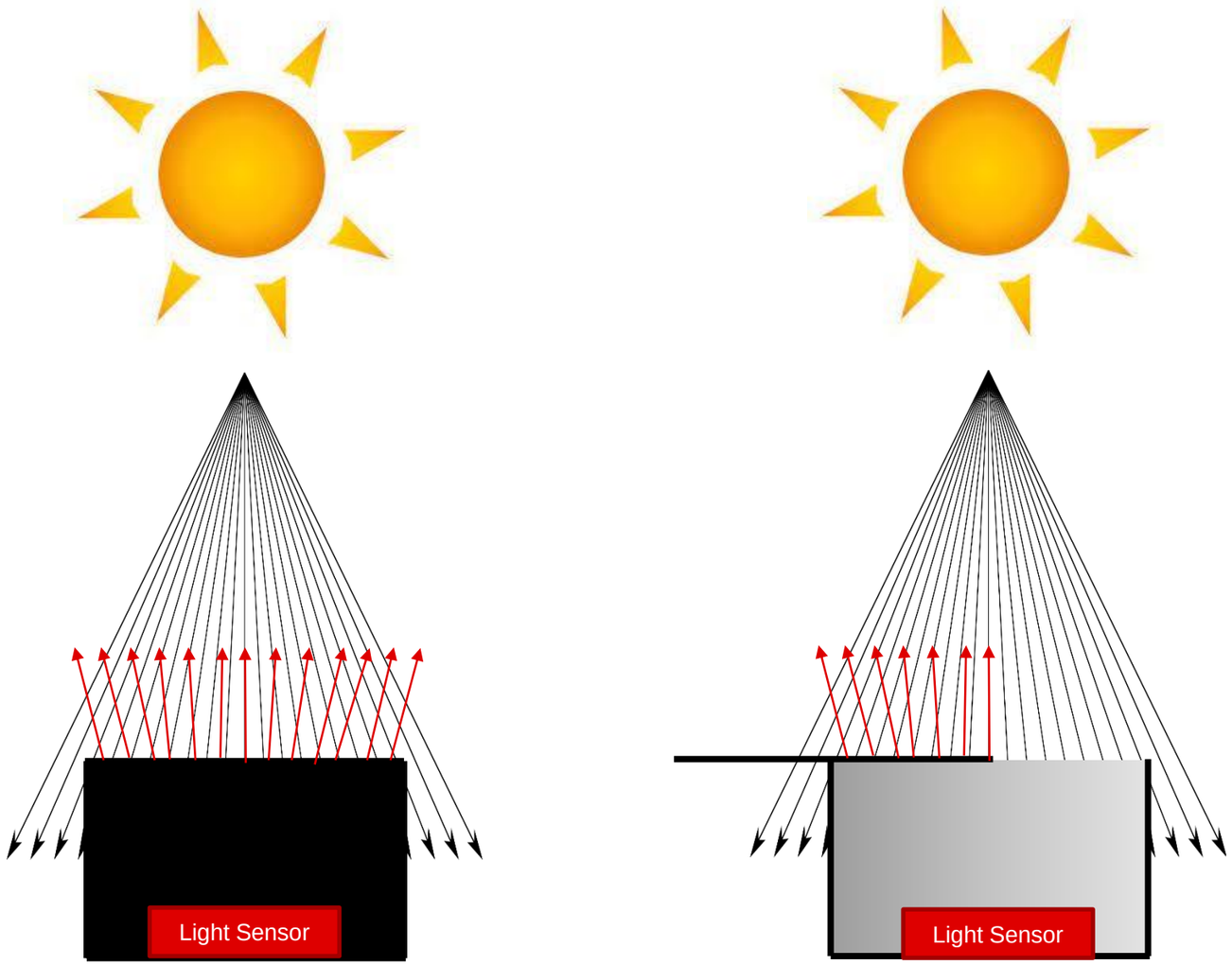
Light Sensor
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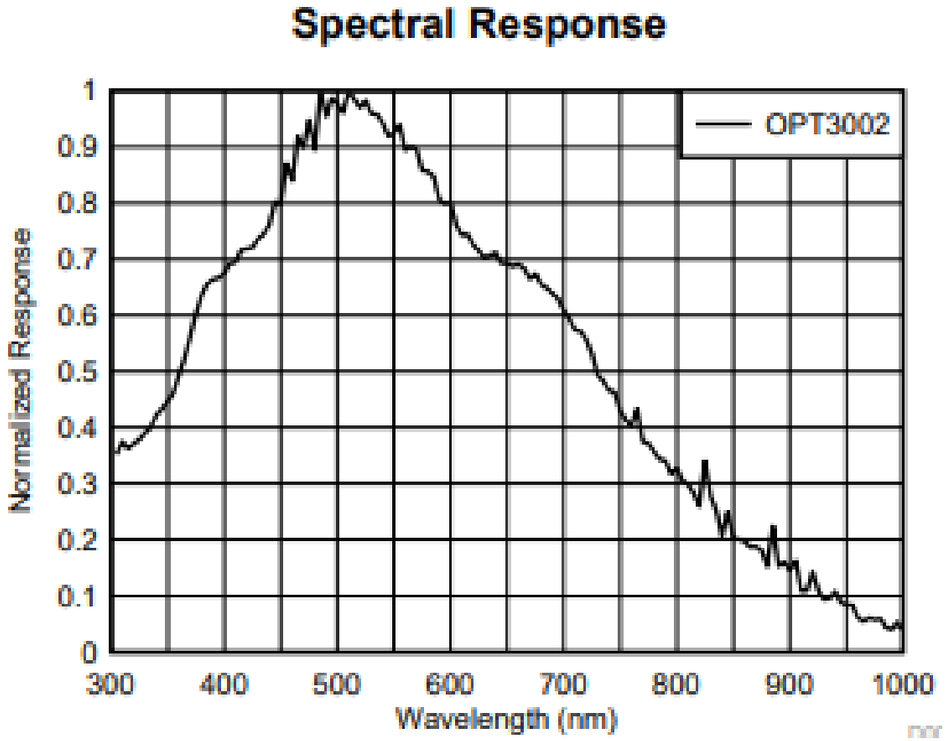

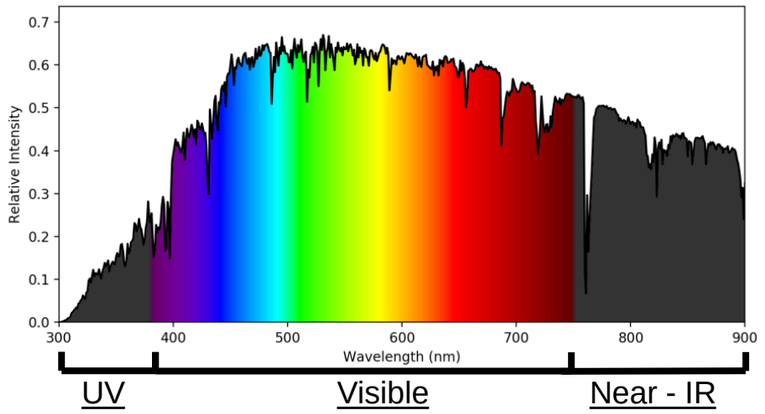

Measurement Levels

- Sensor measurement level will effect the minimum light level and minimum change detectable
- Low measurement level range will detect low amounts of optical power
  - System can be alerted even with small amounts of light

Photometric	Photometric Units	Radiometric	Radiometric Units	Radiometric Description
Illuminance	lux $\left(\frac{lm}{m^2}\right)$	Irradiance	$\frac{W}{m^2}$	Power incident on a surface

OPT3002

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
OPTICAL						
	Peak irradiance spectral responsivity			505		nm
	Resolution (LSB) at 505 nm	Lowest full-scale range (FSR), RN[3:0] = 0000b(1)		1.2		nW/cm²(2)
	Full-scale illuminance at 505 nm			10.064		mW/cm²(2)
	Measurement output result	505-nm LED stimulus, FSR setting = 628,992 (nW/cm²), 153.6 (nW/cm²) per ADC code (RN[3:0] = 0111)(1)		384,000		nW/cm²(2)
				2500		ADC codes
		2 klux white LED stimulus, FSR setting = 628,992 (nW/cm²), 153.6 (nW/cm²) per ADC code (RN[3:0] = 0111)(1)(3)	2250	2500	2750	ADC codes
	Relative accuracy between gain ranges(4)			0.2%		
	Infrared response (850 nm) relative to response at 505 nm(3)			20%		

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Power Consumption

- Battery powered applications require low power
- Consider light sensors with very low power draw

Quiescent current	Dark	Active, V_{DD} = 3.6 V	1.8	2.5	µA
		Shutdown (M[1:0] = 00)[2], V_{DD} = 3.6 V	0.3	0.47	µA
	Full-scale lux	Active, V_{DD} = 3.6 V	3.7		µA
		Shutdown, (M[1:0] = 00)[2]	0.4		µA

Interrupts and Power

- Without interrupt function MCU needs to continuously read from sensors and compare to threshold
- Some light sensors allow comparison to be offloaded from MCU to the sensor
- Allows MCU to sleep until light crosses threshold
  - MCU power draw replaced with sensor lower power draw

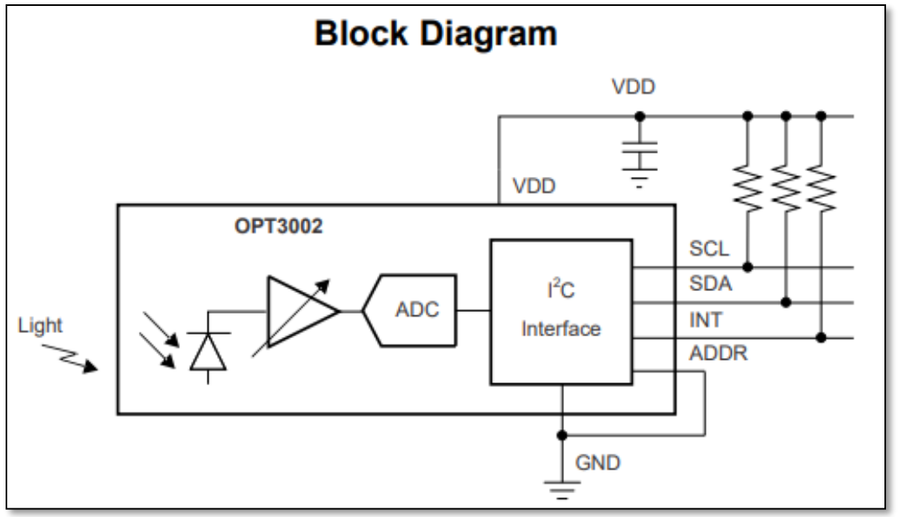

Table 8-3. Transparent Hysteresis-Style Comparison Mode: Flag Setting and Clearing Summary(2) (4)

OPERATION	FLAG HIGH FIELD	FLAG LOW FIELD	INT PIN(1)	CONVERSION READY FIELD
The result register is above the high-limit register for fault count times. See the *Result Register* and the *High-Limit Register* for further details.	1	0	Active	1
The result register is below the low-limit register for fault count times. See the *Result Register* and the *Low-Limit Register* for further details.	0	1	Inactive	1

To find more light sensor technical resources and search products, visit TI

Thanks for your time!
Please try the quiz.

Quiz

1. Why might you want to use a light sensor with an interrupt feature for tamper detection? (select all that apply)
   a) This feature allows the microprocessor to sleep and only wake up to take action when the light level crosses the threshold set, thus saving power
   b) This feature adds to the sensitivity of a light sensor
   c) This feature allows you to take advantage of a single digital signal that indicates whether the light is above or below the levels of interest
   d) This feature will enable a faster response to a change in light level

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