



The DNA of tech.™

Explore Vishay's sensor solutions

Juergen Gewinner Field Application Engineer

Juergen.Gewinner@Vishay.com

0049 171 67 989 12

Agenda

- Introduction and Motivation
- State of plant: Growth, Health, Size, Color, etc.
- State of ambient: Temperature, Soil, Humidity, Illumination, etc.
- Sensor Examples:
 - Light/ Optical Sensors
 - Humidity Sensors
 - Temperature Sensors
 - Mechanical Sensors
- Outlook:
 - Integrated, self sustaining IOT-Sensor

Introduction and Motivation

Why?

- Greenhouses, Horticulture and Smart Farming... Optimized input of water, fertilizer, heat and light is mandatory for efficient growth. Explore Vishay's sensor solutions – optical, mechanical and customized temperature sensors
- Heavy price pressure on farmers
- Increasing environmental standards
- Lack of workers
- Lack of fertilizer
- Efficient use of water

Optimize Input

Optimize ambient

- Temperature monitoring:
 - Soil and Air ⇔ Thermistors
- Humidity:
 - Soil and Air ⇔ Humidity sensors and Electrical Conductivity
- Illumination
 - Wavelengths ⇔ Optical sensors

Monitor plant

- Colour:
 - NIR ⇔ IR-Illumination
 - Colour Sensors
- Growth Rate:
 - Size ⇔ Mechanical Size

Possible Sensors

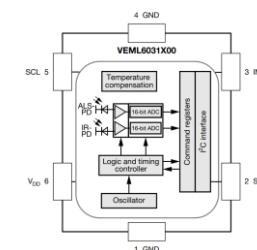
Overview

- Temperature ↔
- Humidity ↔
- Light ↔
- Colour ↔
- Mechanical Dimension ↔

[Thermistors | Vishay](#)

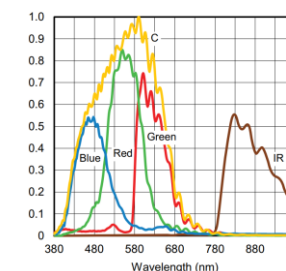


VCNS1100X01



[AMBIENT LIGHT SENSORS | Optical Sensors | Vishay](#)

[Color Sensors | Optical Sensors | Vishay](#)



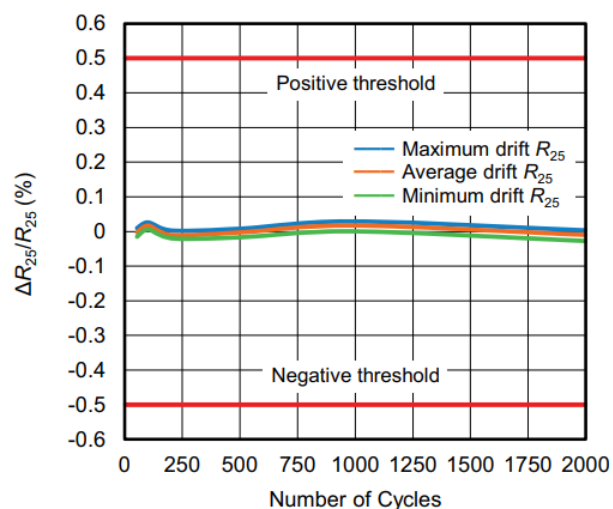
<https://www.vishay.com/sensors/list/product-57115/>



Sensors

NTC- Thermistors

- SMD:
 - Standard cases
 - 0402
 - 0603
 - 0805



- Leaded:
 - NTCLE1xx
 - NTCLE2xx
 - NTCLE3xx
 - NTCLE4xx

- Cable Assembly:
 - NTCAxxx
 - Flagship in flexibility and customization

Custom Capabilities NTC LUG

Custom Capabilities NTC LUG Ring Tongue

RoHS COMPLIANT

CAPABILITIES

- For different screw sizes: M2 to M8
- For different screw sizes: SMD41 to #6/16
- Cable cross sections AWG44 down to AWG482
- Different cable length for available
- Minimum breakdown voltages 500 V_{AC} up to 3 000 V_{AC}
- Insulated cables or non insulated wires
- Copper or nickel conductors, tin or silver plated
- Special designs for high temperature operation for example: -55°C to 200°C

www.vishay.com/doc?29161

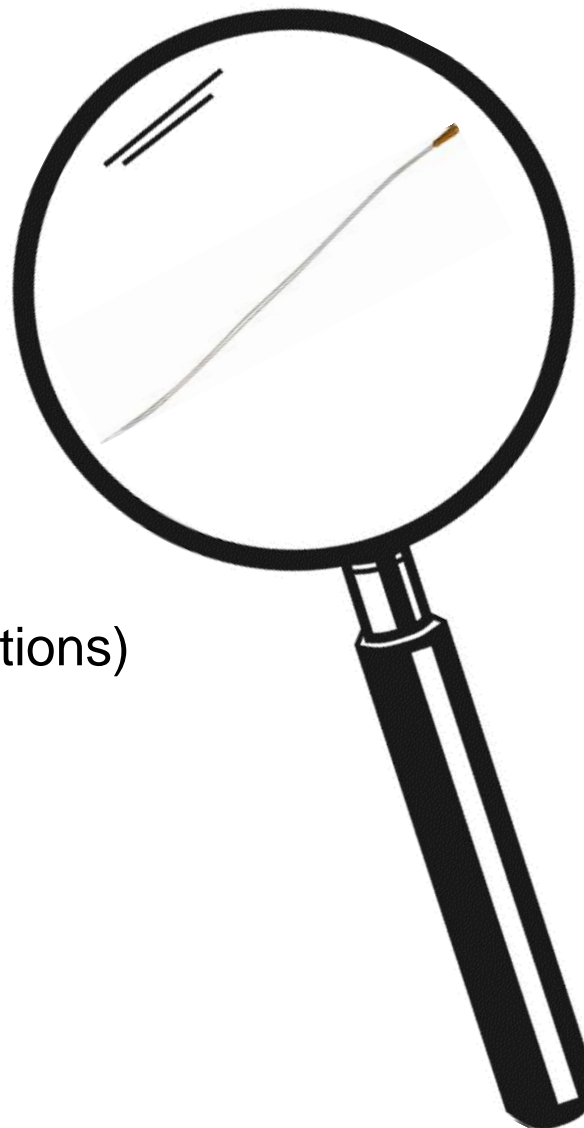
NTCLE317 Series in Focus



NEW

Features

- Peek insulated NiFe wire
- R_{25} of 10 K Ω
- $B_{25/85}$ of 3984K
- Lead length up to 230 mm
- Maximum operating temperature 150°C
- RoHS compliant (no exemptions)
- AEC-Q200



USPs/Benefits

- **LOWEST thermal conductivity (10mK/K)**
- Superior to copper-wire products (thermal gradient)
- **Accurately measures hotspot temperature ($\pm 0.5^{\circ}\text{C}$) with very limited heat loss**
- Small size bead (1.6 mm diameter max.) excellent response (< 3 secs. in air)
- Excellent performance in high humidity applications 85/85

Vishay NTC- Customization example

CONNECTORS

Few examples :

- JST XHP-2,
- EHR-2,
- SCN-2P,
- VHR-2N,
- SMR-02V,
- SMR04V, ...
- Tyco AMP 172165-1,
- 917698-1,
- 170361-1,
- “Ultrafast”, ...
- “Mate-N-Lock”,
- “Mini-Mate-N-Lock”,
- ...
- IDC rast 2.5 mm Connectors:
- Tyco AMP Duoplug
- (3-4-6-7-8 poles)
- With or without rastings & locking
- Stocko MFMP (2-3-6 ... poles)
- ...

WIRES

Sizes: AWG#30 to AWG#24
 Length: 40mm ... 3 000mm
 * PVC insulated, UL2468 (85°C) UL2651 (105°C)
 Colours: Black, Yellow, White, Blue, ...
 * FRPEX polyolefin (125°C)



HOUSINGS:

e.g.

- * BRASS
- * Nickel plated BRASS
- * Chrome plated BRASS
- * Stainless steel
- * ABS (plastic)

Dimensions:

- Ø 3.2 x 15mm
- Ø 4 x25, Ø 4.62 x15, Ø 5 x20, Ø 5x25*,
- Ø 5.5x25, Ø 5.5x30,
- Ø 6x25*, Ø 6x30*, Ø 7x25
- ABS: Ø 7x25, Ø 8x30, Ø 9x30, Ø 9x49
- ABS: rectangular 7.5x7x25

SHRINKABLE TUBES

- Polyolefin (125°C) Black (dia 4, 5, 6.4),
- White (5, 6, 7.4, ...),
- With inner glue (dia 4.8, 6.4)

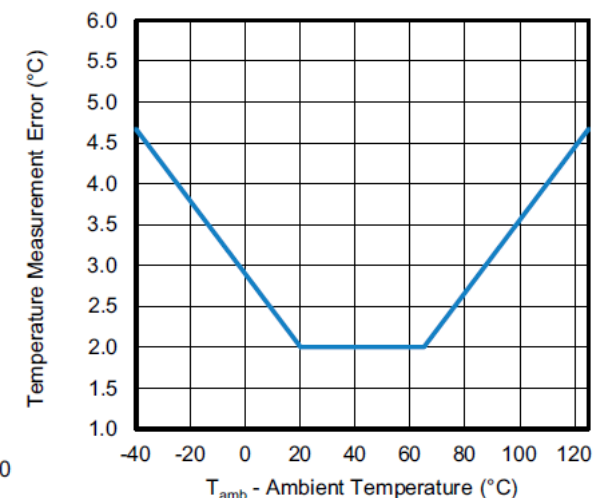
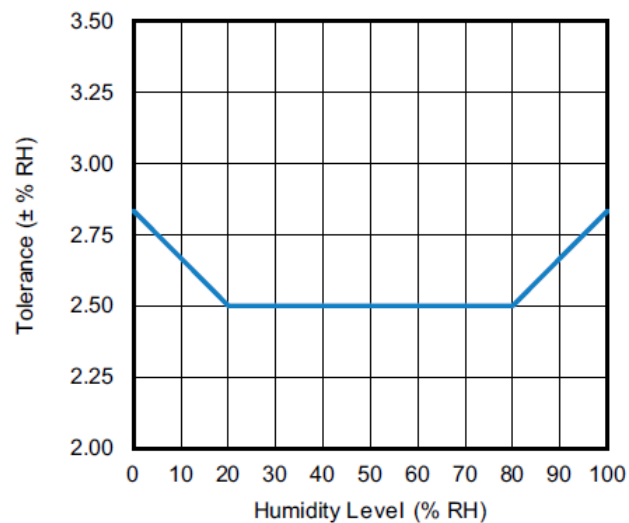
PROTECTION TUBES:

- * PVC Tubes (105°C) Translucid or black, diam 3.3, 4.2, 4.7, 5.2, 4.2 yellow, ...
- * Silicone dia3, 3.5
- * Glass fiber dia 5, etc...

Relative Humidity Sensor

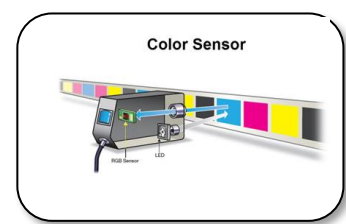
Available Soon

- Humidity in Green-houses
- Irrigation
- Evaporation/ Transpiration



- Integrated modules: Relative humidity sensor, Temperature sensor, and signal conditioning IC
- Compact package: 2.5 x 2.5 x 0.75 mm
- AEC-Q101 qualified
- Temperature range: -40°C to +125°C
- Relative Humidity Sensor:
 - ± 2.5 % RH (maximum at 20 % RH to 80 % RH)
- Temperature Sensor:
 - ±2°C accuracy (typical @ 20 to 60°C)
- Integrated on-chip heater
- Samples: Available
- Planned Product release: Q1/2022

Ambient Light Sensors



Vishay position :

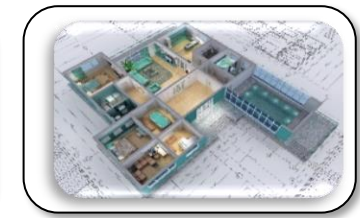
- Technology leader for digital solutions by Filtron™ technology
- Strong market player with analog solutions
- available for automotive, industrial and consumer

Benefits :

- Vishay can offer full range of solutions
- Analog & Digital
- Analog : Photo Pin Diodes and transistors
- Digital : 16 bit / I2C interface

ALS	ALS	ALS	ALS	ALS	ALS	ALS	ALS	ALS
2.0 x 2.0 x 0.85	2.7 x 2.5 x 0.6	2.0 x 1.25 x 1.0	2.0 x 2.0 x 0.4	2.0 x 1.25 x 0.85	2.0 x 1.25 x 0.7	5.0 x 4.0 x 0.9	5.0 x 4.0 x 0.9	5.0 x 4.0 x 0.9
Digital	Digital	Digital	Digital	Analog	Analog	Analog	Analog	Analog
VEML6030	VEML6031X00	VEML3235 VEML3235SL	VEML6035	TEMD6200FX01 TEMD6200FITX01 TEMT6200FX01	VEMD4200FX01	VEMD5510C VEMD5510CF	VEMD5510C VEMD5510CF	VEMD5510FX01
2uA operation current						SOP 2021		

Digital light sensors



Vishay position :

- Technology leader for digital solutions by Filtron
- SensorXplorer Demo boards available



SensorXplorer™

Benefits :

- Vishay can offer full range of solutions
- High accuracy
- I2C interface and 16 bit resolution
- Parallel measurement for multi channel devices



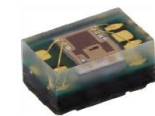
RGB

VEML6040



RGB

VEML6046X00
SOP 2022



RGBC & IR

VEML3328



RGBC & IR

VEML3328SL

Sense: Digital ALS

VEML6031X00



PRODUCT SUMMARY						
PART NUMBER	OPERATING VOLTAGE RANGE (V)	I ² C BUS VOLTAGE RANGE (V)	AMBIENT LIGHT RANGE (lx)	AMBIENT LIGHT RESOLUTION (lx)	OUTPUT CODE	ADC RESOLUTION PROXIMITY / AMBIENT LIGHT
VEML6031X00	2.5 to 3.6	1.7 to 3.6	0 to 181 000	0.0027	16 bit, I ² C	- / 0.0027

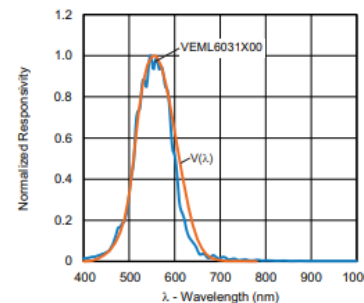


Fig. 5 - Spectral Response

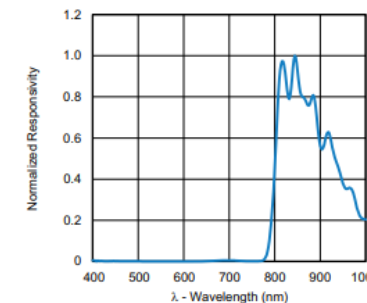


Fig. 6 - IR Channel Response

Applications :

- Ambient Light sensing
- RLS, HuD, Front sensor
- Rear Mirror dimming
- Dashboard dimming
- Car infotainment

Benefits :

- AECQ-100 qualification is targeted
- Operation temperature range -40 to + 125°C
- No scattered light by FAM package
- Improved linearity: ±1%
- Separate IR channel

Features:

- MSL level 3
- High ALS sensitivity with minimum detectable intensity of 0.0023 lx/cnt
- Selectable integration time: 3.125ms to 400ms
- Detectable maximum illuminance: 200 klx
- Package : 2.67 x 2.45 x 0.6 mm

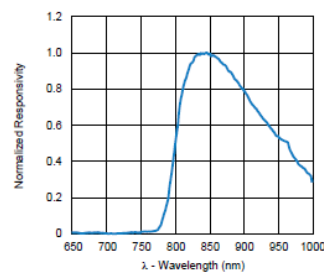
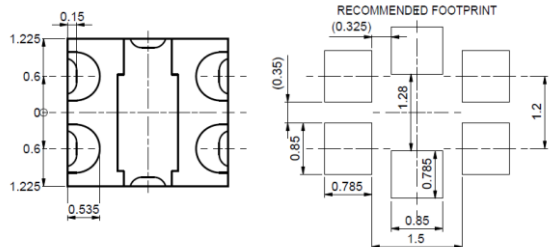


Fig. 6 - IR Channel Response

Sense : Digital ALS sensor

- VEML3235 : TOP View
- VEML3235SL : Side View



PRODUCT SUMMARY						
PART NUMBER	OPERATING VOLTAGE RANGE (V)	I ² C BUS VOLTAGE RANGE (V)	AMBIENT LIGHT RANGE (lx)	AMBIENT LIGHT RESOLUTION (lx)	OUTPUT CODE	ADC RESOLUTION PROXIMITY / AMBIENT LIGHT
VEML3235	2.6 to 3.6	1.7 to 3.6	0.0021 to 17 867	0.034	16 bit, I ² C	- / 16 bit

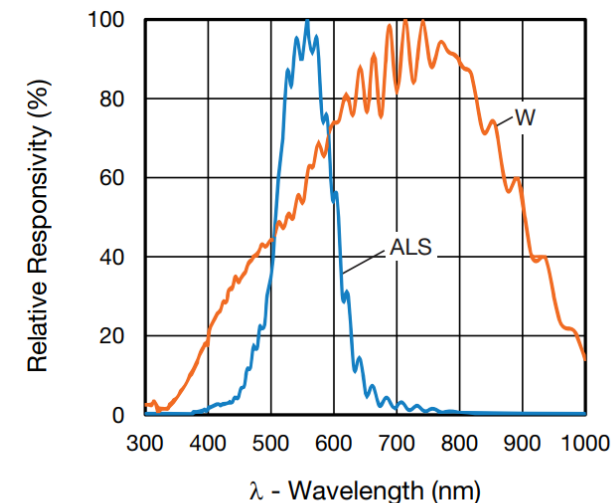


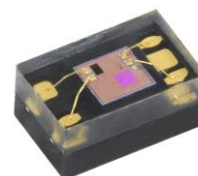
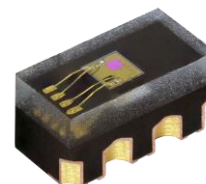
Fig. 5 - Normalized Spectral Response

Applications :

- Lighting control

Timing :

- Samples available
- running product



Benefits :

- Small package 2.0 x 2.0 x 0.8 mm
- Exceptional performance cost ratio
- Max of 17k Lux

Features :

- VDD: typ. 3.3 V
- ALS resolution 0.034 lx/step
- ALS output tolerance ≤ 10% for diff. sources

Sense : Digital RGB & IR sensor

- VEML3328 / VEML3328SL

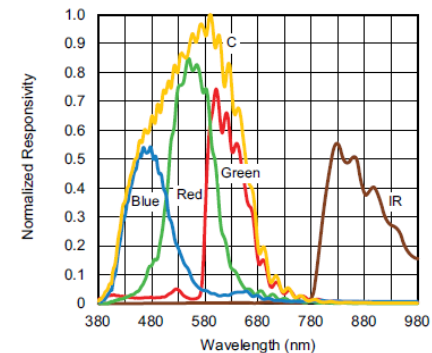
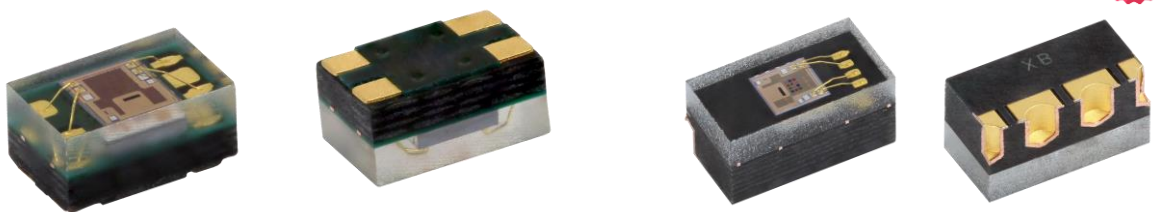


Fig. 4 - Normalized Responsivity vs. Wavelength

- Compact SIDE LOOKING package: 2.95 x 1.5 x 1.5 mm
- Compact TOP LOOKING package: 2.35 x 1.8 x 1.0 mm

Applications :

- Automatic white balancing of digital cameras
- Eliminate unsightly blue or orange color casts
- Adjust the backlight of an LCD display conditions
- Control the color output of LEDs
- Differentiate indoor from outdoor environments

Datasheets :

- [VEML3328](#)
- [VEML3328SL](#)

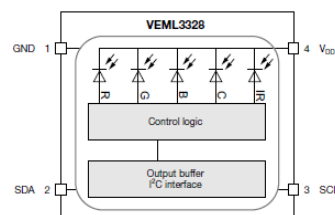


Fig. 1 - VEML3328 Block Diagram

Benefits :

- RGB sensor with IR and clear channel with very good CCT performance
- Device can differentiate indoor from outdoor lighting environments.

Features :

- 4 separate channel, each 16 bit
- Parallel measurement
- Senses color Red, Green, Blue, Clear and IR
- Excellent temperature compensation

IR-Illumination

Near – Infrared – Spectroscopy

- Double Stack Technology ⇔ Higher Light Output
- 950nm and 860nm
- 28° , 40° and 60° half angle
- 5A maximum pulse current
- - 40°C up to 125°C

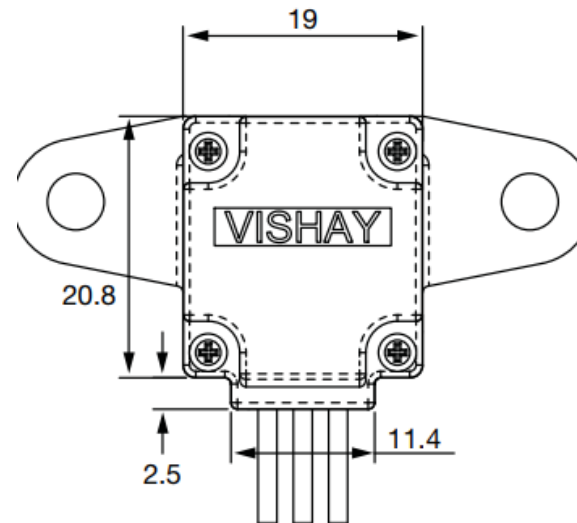


		VSMA1094250	VSMA1094400	VSMA1094600	
Angle of half	φ	± 28	± 40	± 60	°
Dimensions	L x W x H	3.4 x 3.4 x 2.9	3.4 x 3.4 x 2.45	3.4 x 3.4 x 1.8	mm
Radiant Intensity	$I_F = 1.0 A$	1.250	850	460	mW/sr
Radiant Intensity	$I_F = 1.5 A$	1.800	1.225	670	mW/sr
Radiant Intensity	$I_F = 5.0 A$	5.300	3.600	1.950	mW/sr
Forward Voltage	$I_F = 1.0 A$	2.90			V
Forward Voltage	$I_F = 1.5 A$	3.05			V
Forward Voltage	$I_F = 5.0 A$	3.70			V

Mechanical Position Sensors

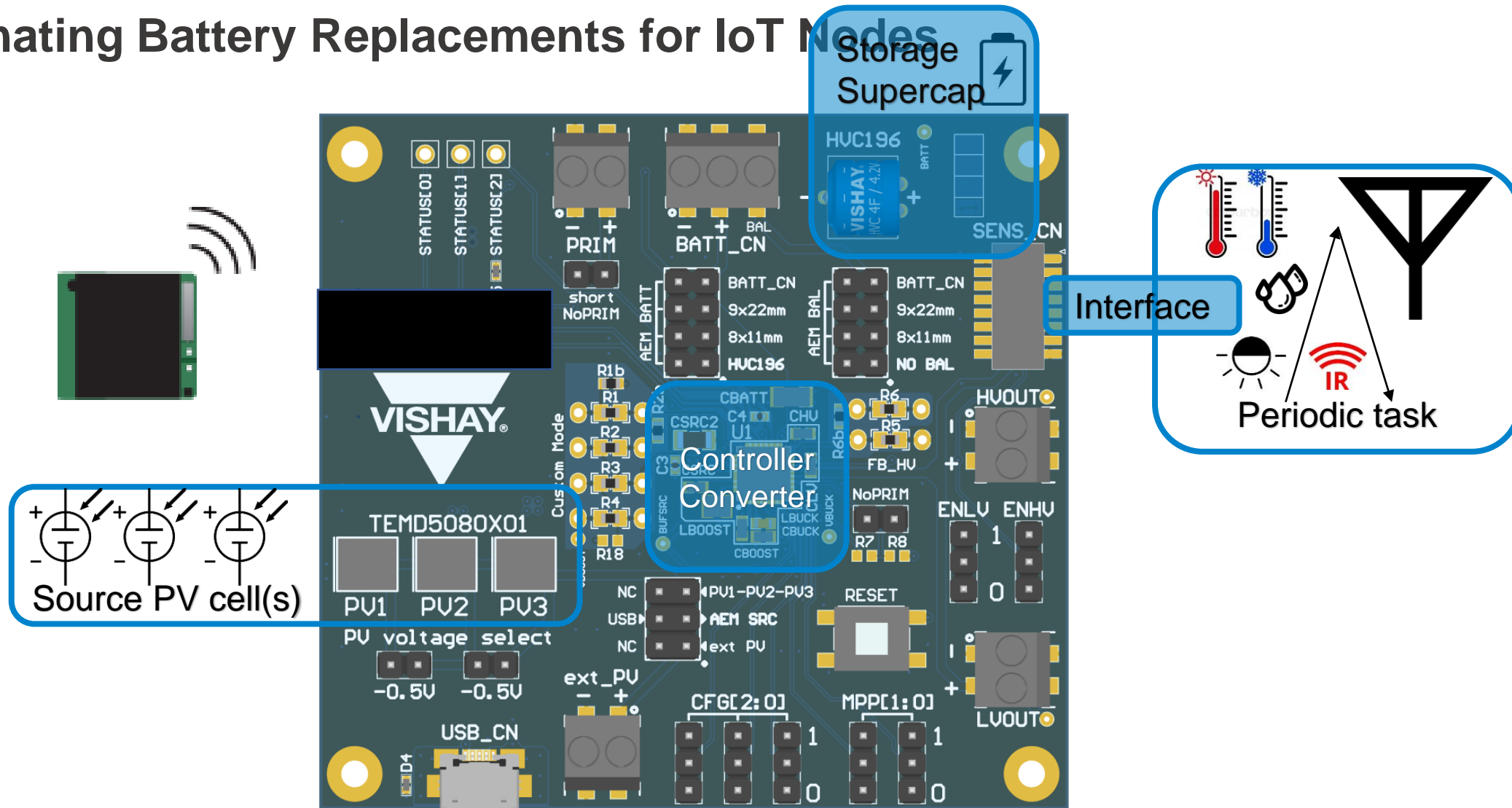
Linear Encoders

- Hall-Effect or Resistive Sensor
 - 10mm electrical travel
 - output: Analog or PWM
 - >10Million cycles
 - Immune to external noise
 - Spring return
 - IP51 or higher
 - Customization of wires, Sealing, Length



Outlook: ENERGY HARVESTING

Eliminating Battery Replacements for IoT Nodes



VISHAY Key Components



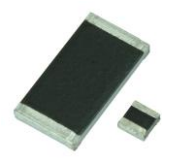
Buck storage Inductor:
IHLP1008



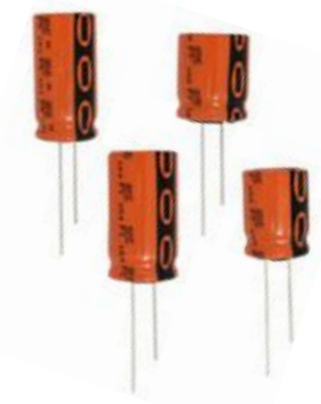
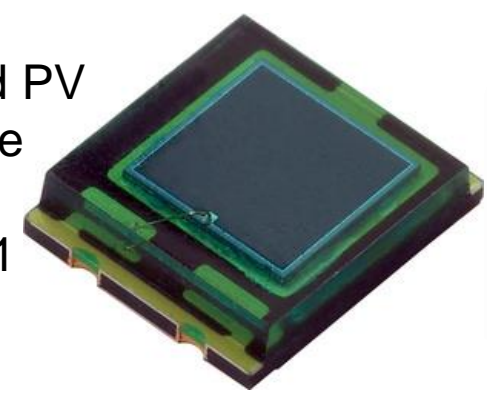
HVC 196
7.5mm x 2.6mm
coin cell type



High Ohmic voltage divider
0402 1% $\geq 20M\Omega$



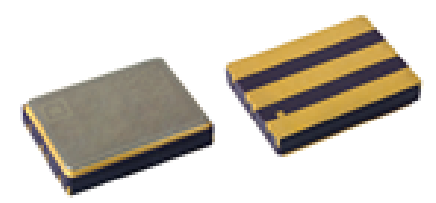
Blue enhanced PV
PIN Photodiode
5x4mm
TEMD5080X01



EDLC 220-235
for 10mm
diameter
embodiments



Switching dual
MOSFETS
PPAK SC 70
SIA517



EDLC 238 for
reflow soldering
and hermetically
sealed



Thank you so much for your attention
Questions?