Optoelectronics

March 2026

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Optoelectronics – Product Groups

Infrared Emitters

High-power emitters in thru-hole and surface-mount packages

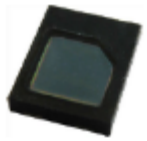


Photo Detectors

Broad selection of photodiodes and phototransistors for detecting infrared and visible light

Optical Sensors

Reflective and interrupter sensors in thru-hole and SMD packages

Digital Sensors

Light sensors and proximity sensors

Optocouplers

A global leader with a very broad selection of packages and functions

Solid-State Relays

Leader in SSR for the telecommunications industry

Digital Isolators

Isolation amplifiers and IGBTs

www.vishay.com/optoelectronics

Infrared Receivers

Global leader in remote control receivers for consumer electronics

IRDC Transceivers

Industry's smallest and fastest transceivers for wireless communication

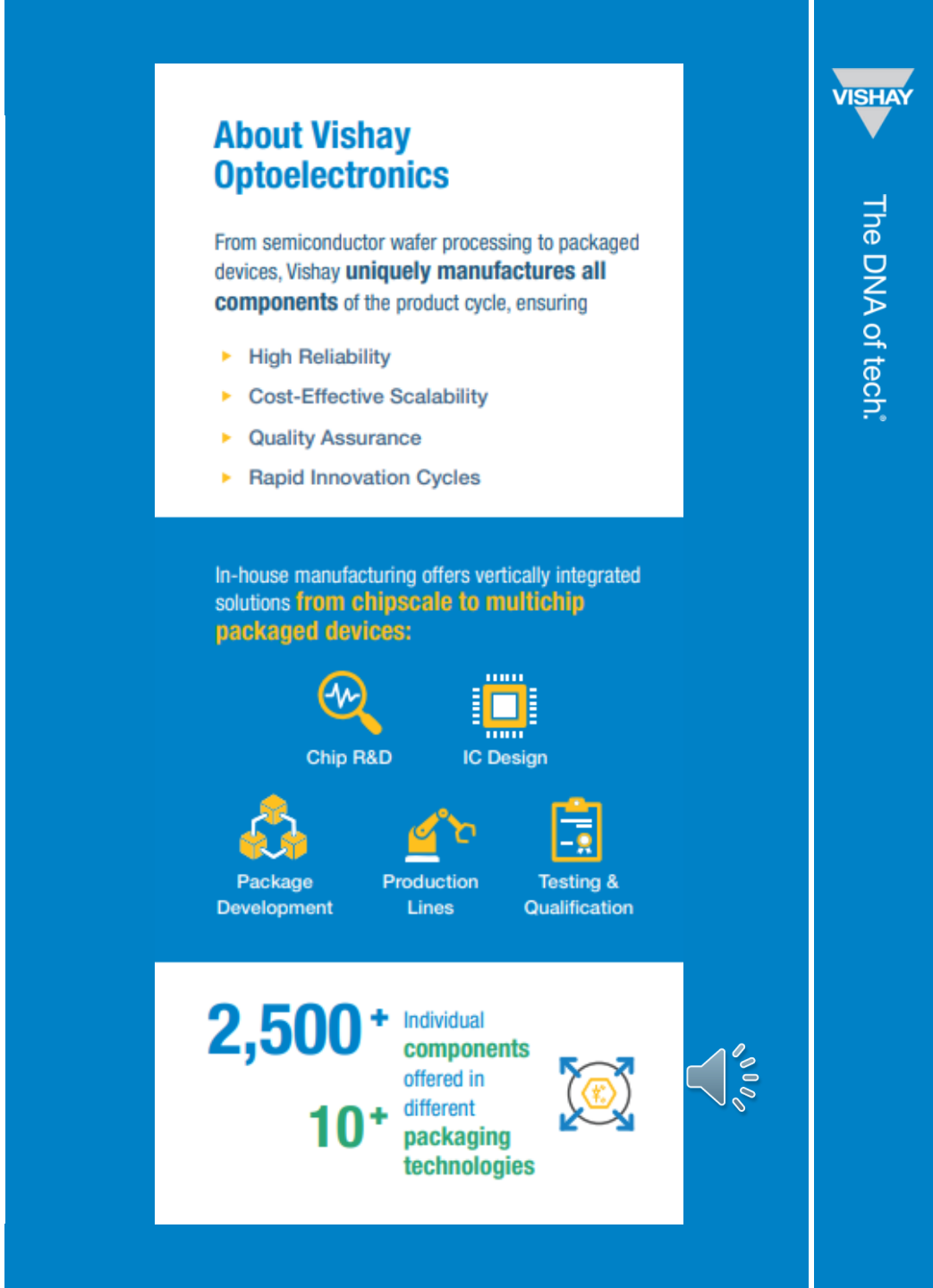
Visible LED

High bright (HB) and smallest SMD packaging, available in all colors

Why Vishay Optoelectronics?

We Are a Partner – not "Just" a Supplier

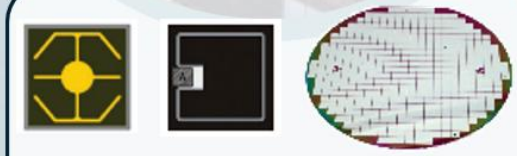
- ✓ Fundamental know-how of optoelectronic design and manufacturing with over 50 years experience
- ✓ Broad product portfolio embracing optoelectronic component ranges from visible LEDs and IR receivers, isolators, IR emitters, and photodetectors to analog and digital sensors
- ✓ Vertically integrated → in-house supply chain from chip design to assembly and test and characterization
- ✓ Sustainable and controlled product life cycles
- ✓ Reference designs
  - ✓ In-house developed solutions
  - ✓ µC-partners (Intel, Qualcomm, TI, Mediatek, Nvidia, etc.)
- ✓ Strong application support (basis of globally acting application engineers)



Core Competencies

- Chip R&D
- IC Design
- Package Development
- Production Lines
- Testing & Qualification

Chip Production
Heilbronn, Germany



IR Emitters, Photodiodes

IC & Filter Design
Taipei, Taiwan

In House IC Design, manufacturing @ TSMC

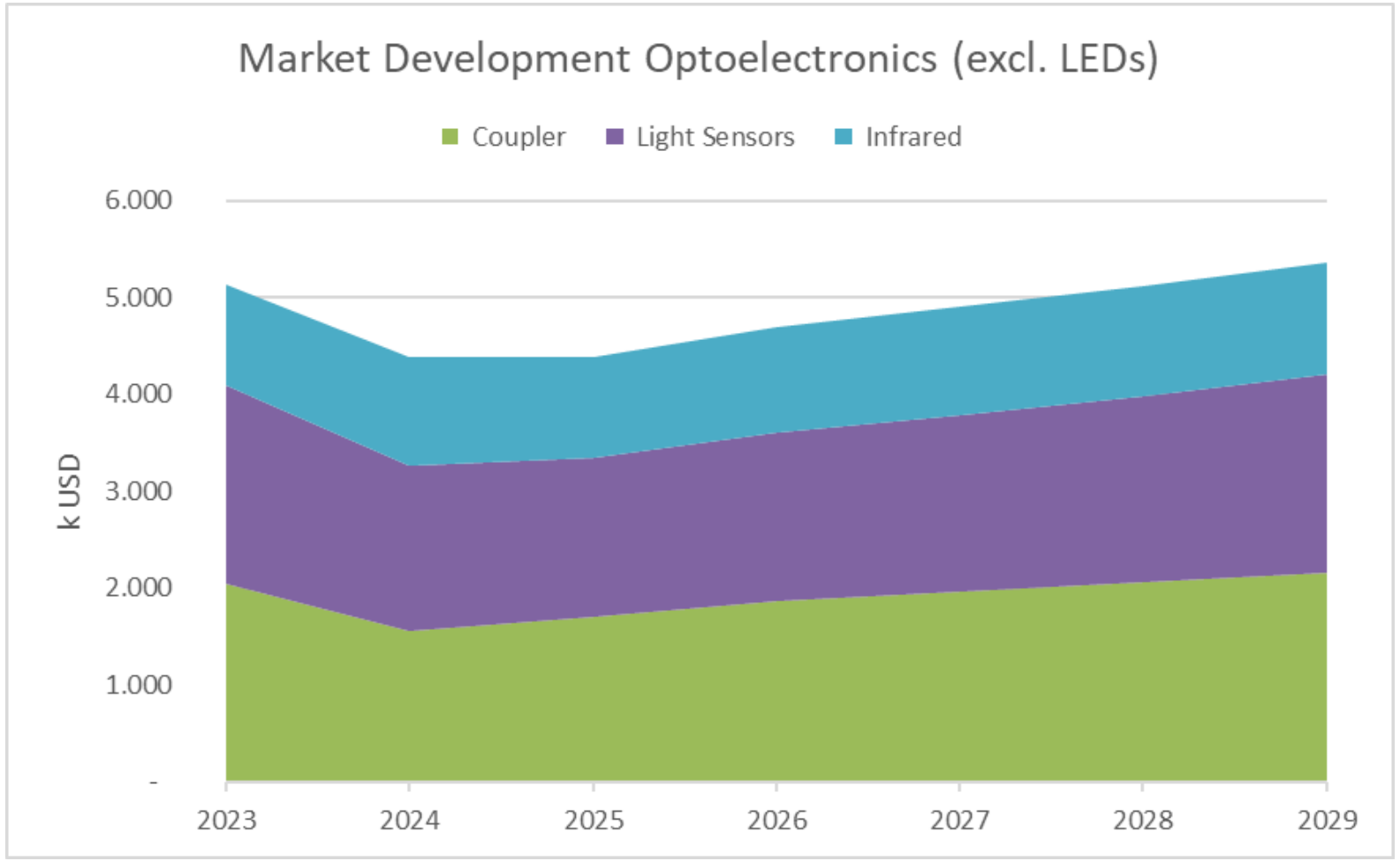
Packaging Facilities
Krubong, Malaysia & Manila, Philippines

Wide range of packaging capabilities

*Example of VCNL3025 Development

In – House Development & Production

Market Development for Optoelectronics



WSTS, Aug. 2025

CAGR 25-29: 5 %

- Couplers: 6 %
- Light Sensors: 6 %
- Infrared: 3 %

Driven by megatrends for focus products with double-digit growth:

Capacity Investments

Specific Investments for Key Product Lines

- ✓ Expanded FAM technology line in Malaysia
- ✓ Expanded high power IR emitter line in Manila
- ✓ Expanded optocoupler SOP-4 line in Krubong
- ✓ Expanded optocoupler SSR line in Krubong
- ✓ Expanded linear optocoupler line in Krubong
- ✓ Releasing subcon to add capacity for 0805 PCB
- ✓ Released new GaAs factory in HN --> expanded capacity for GaAs emitter chips

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Optoeletronic Sessions

Isolators

- High Performance Triacs
- Photovoltaic MOSFET Drivers
- Isolation Amplifiers

Sensors

- Automotive Proximity Sensors
- Automotive Ambient Light Sensors
- Automotive High Power Infrared Emitters
- Design Resources

Consumer Sensors

- Short Distance Proximity Sensors
- Long Distance Proximity Sensors
- Design Resources

Isolators

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High Performance Triacs

IL410, IL420

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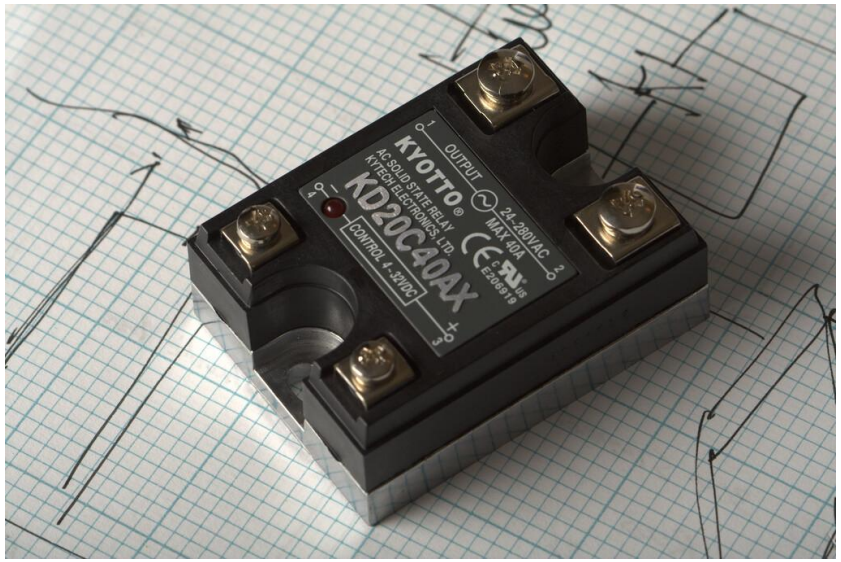
LIGHTING

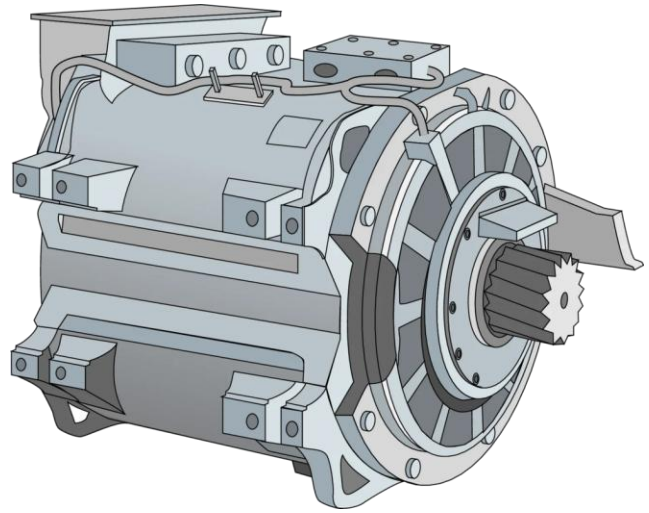
Major US lighting brands use IL4x triacs for LED and halogen lamp dimmers

SOLID-STATE RELAYS



Leading solid-state relay manufacturers use IL4x triacs to ensure galvanic isolation and prevent false triggering

MOTOR CONTROL

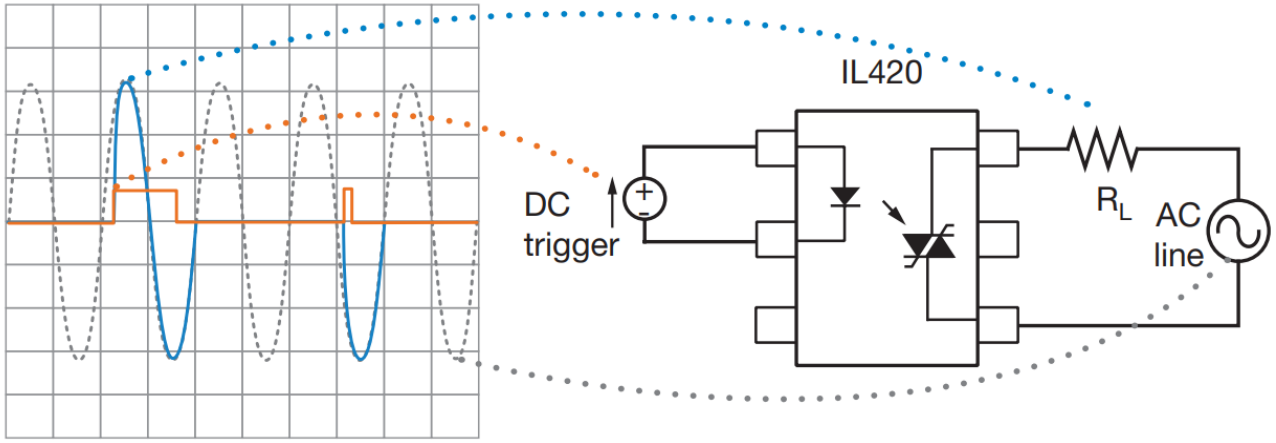


Motor drive producers apply IL4x triacs to switch AC loads under conditions where voltages change rapidly

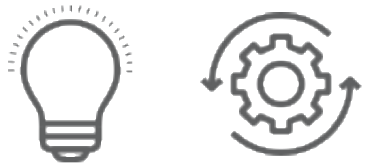
High Performance Triacs

How the Product Works

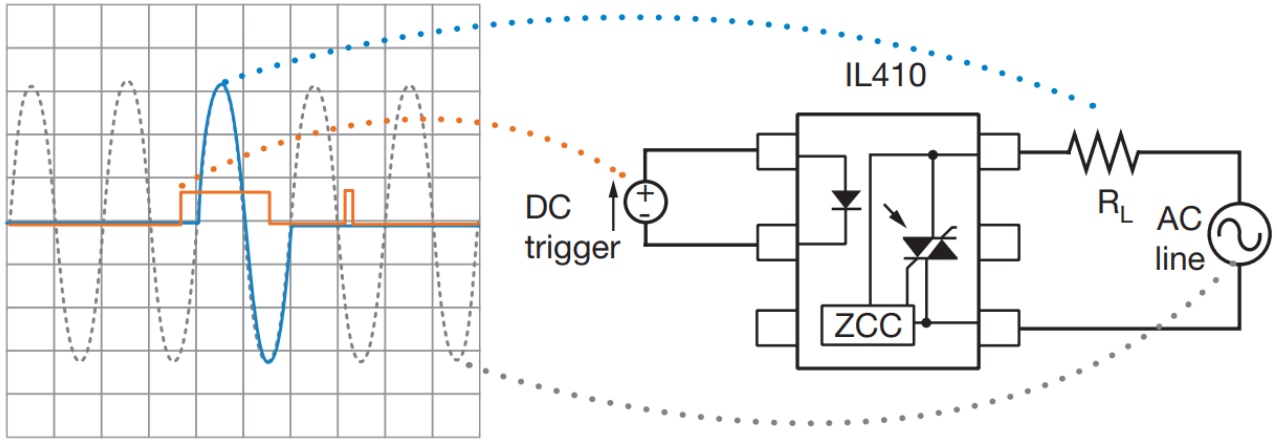
Non-Zero Crossing Phototriac Example



Typical Applications:
light dimmers, motor control



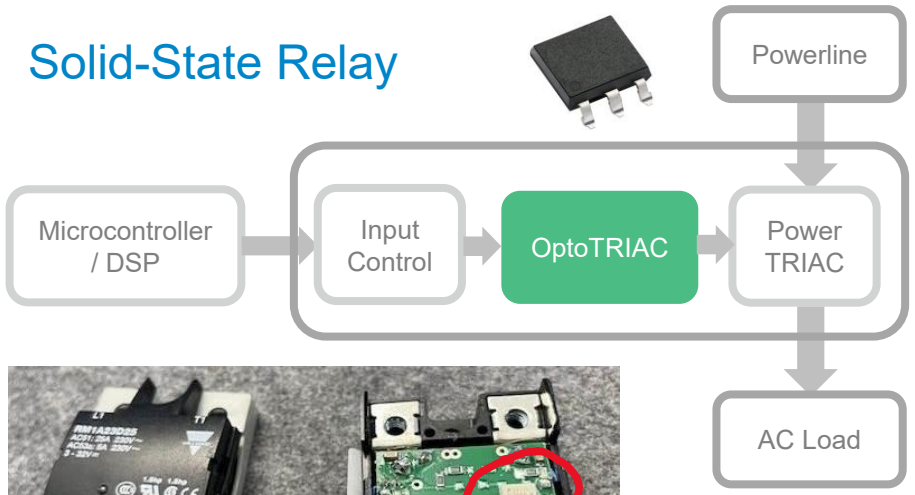
Zero Crossing Phototriac Example



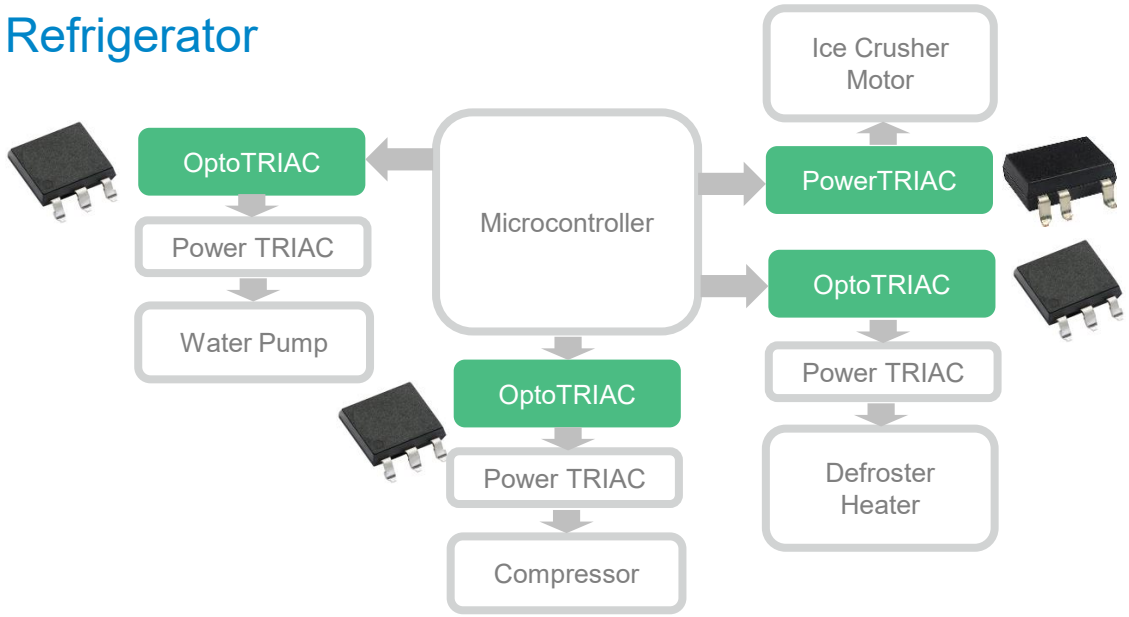
Typical Applications:
heaters, valves

What Is the Application? How Does Our Solution Stand Out?

Solid-State Relay



Refrigerator



Advantages

- High static dV/dt ≥ 10 000 V/µs for excellent noise immunity, saves external snubber network and lowers system costs
- High dV/dt is essential in harsh environments where strong electrical transients or fast voltage changes can occur
- Low trigger current saves additional driver stage
- 800 V output support up to 3-phase 380 V_{AC} applications
- Excellent safety and noise isolation through optical barriers

Applications

- 24 V_{AC}, 110 V_{AC} / 220 V_{AC}, 380 V_{AC} / 400 V_{AC} systems
- Customized SSRs, mechanical relay replacement
- 1 A direct drive for medium AC loads
- kW power loads with additional power TRIAC
- Motor soft starters, white goods, aircons, water boilers, heating controllers

How to Win?

With IL410, IL420 High Performance Triacs

1

Performance

- High static dV/dt ≥10 000 V/µs
- Very low trigger currents
- Up to 800 V load voltage

2

Limited Competition

- Exclusive competition vs. Fairchild / OnSemi
- FOD 410/4108
- FOD 420/4208

3

Non-China Supply Chain

Frontend: Germany

Backend: Malaysia

Photovoltaic MOSFET Drivers

VOM1271, VOMDA1271, VODA1275

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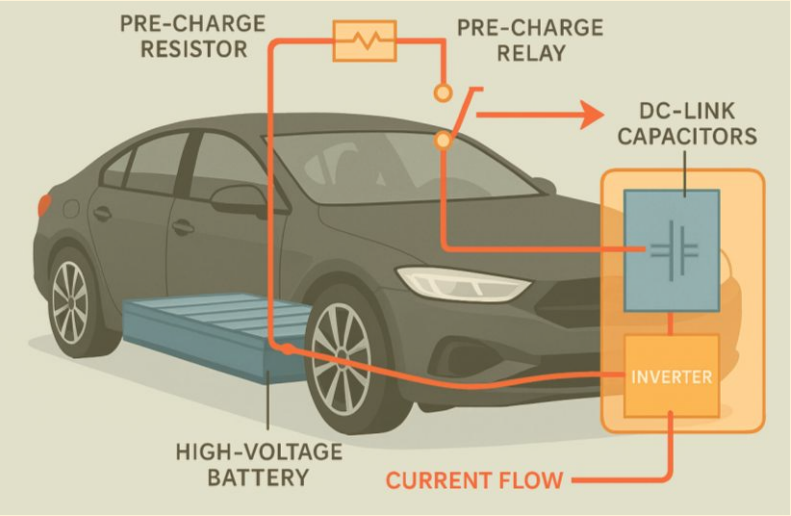
PRE-CHARGE



Turns on a small, controlled current to pre-charge the DC-Link capacitor before the main contactor closes

ENERGY STORAGE

Ensures robust gate control with low standby power and no mechanical wear for long service life and stable operation

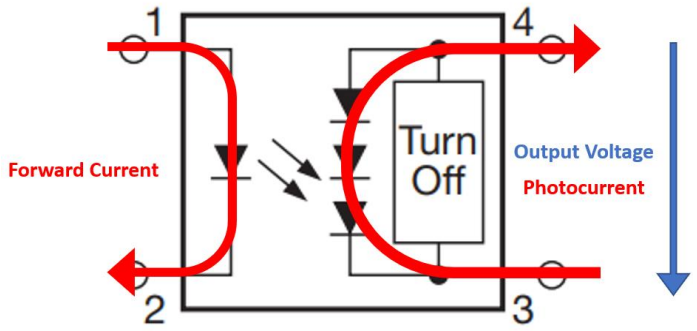
TURN-ON SIGNAL

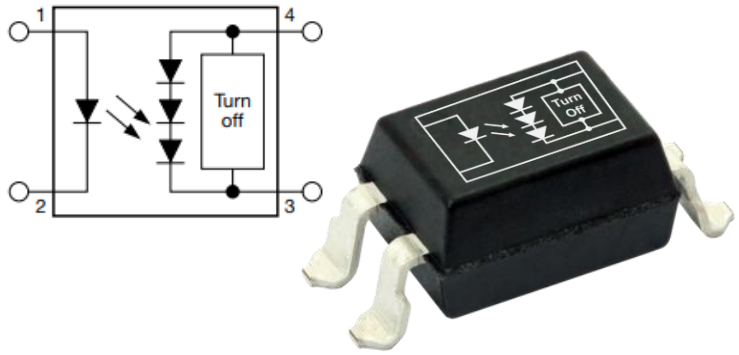
Enables the MOSFET that turns on the display when the TV powers up

Photovoltaic MOSFET Driver

How the Product Works

- The part consists of an infrared LED (IRED), a photodiode array, and an additional fast turn-off circuit
- The IRED emits light that generates a photocurrent in the photodiode array, producing current and voltage
- The additional fast turn-off circuit ensures rapid gate discharge for precise switching
- All required driving current is obtained from the IRED on the low voltage, primary side of the isolation barrier

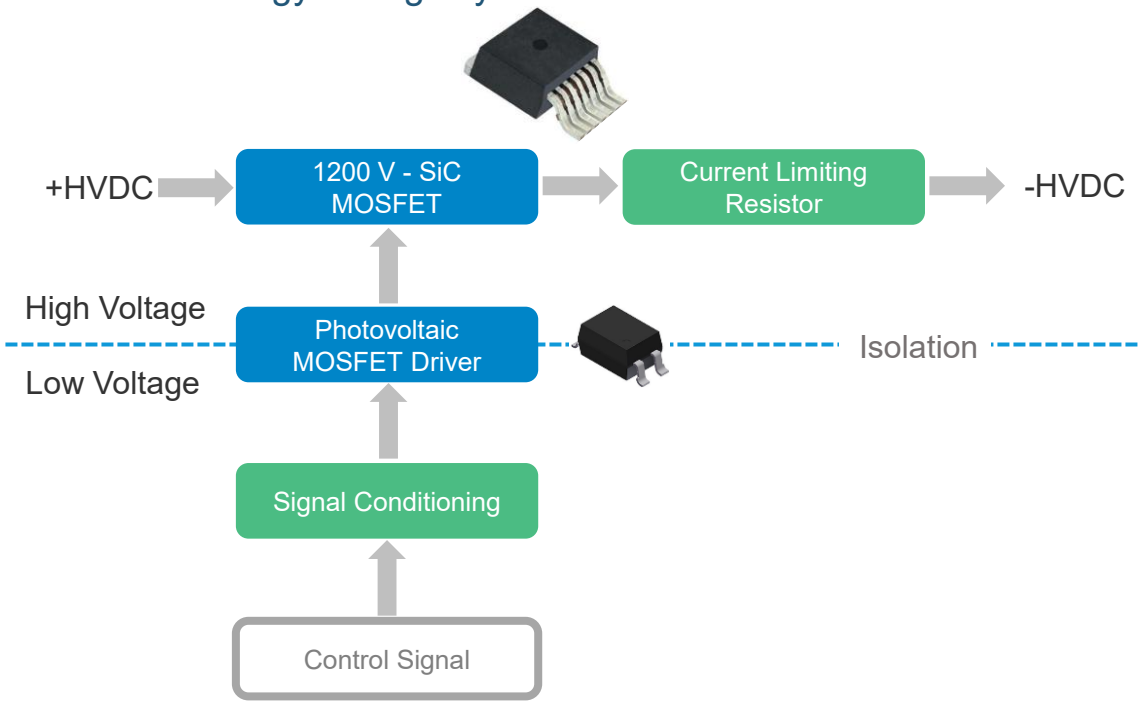




What Is the Application? How Does Our Solution Stand Out?

800 V - Pre-Charge Relay

A pre-charge relay is used in high voltage systems to charge capacitors, preventing high inrush currents and ensuring a controlled start-up, protecting sensitive components in electrical vehicles or energy storage systems.



VODA1275 - Advantages

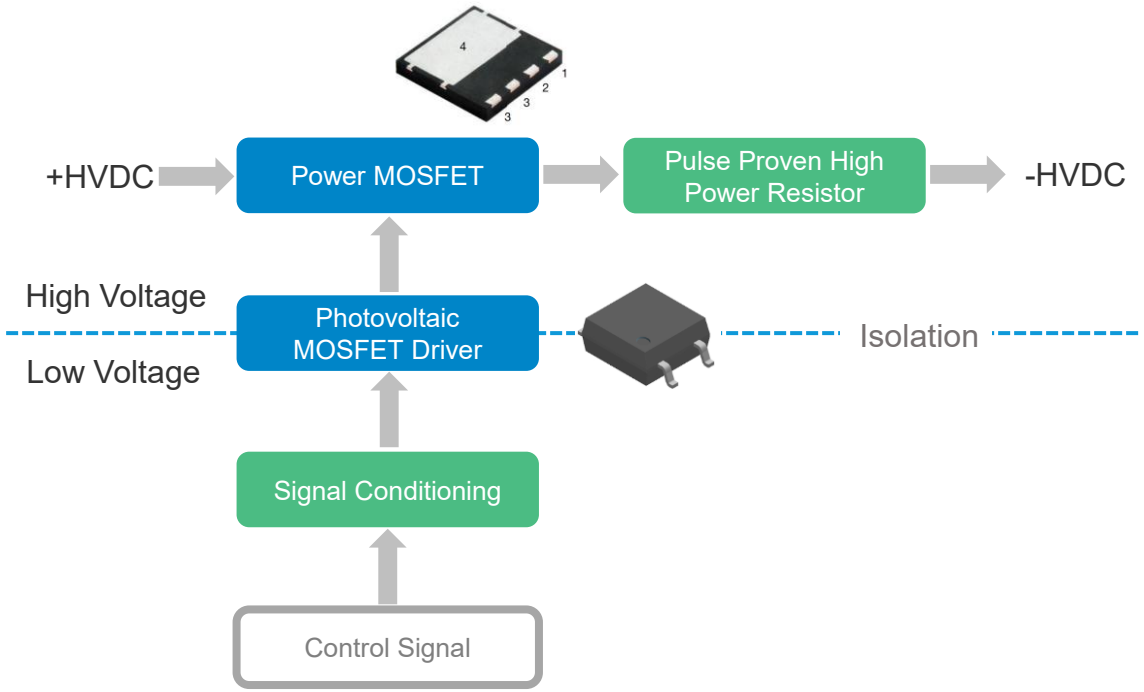
- Self-powered MOSFET driver - no external supply needed
- High output voltage / current : 20 V / 20 µA
  - Supporting SiC MOSFETs
  - Supporting IGBTs
- Extended temperature range: up to 125 °C
  - AEC-Q102 qualified
- Compact design: small SMD-4 package with 8 mm creepage
  - 4.04 mm x 11 mm required PCB area
- High insulation capability: CTI 600, DTI ≥ 0.4 mm, VDE certification
  - Supporting reinforced isolation
  - 800 V battery systems

Vishay Discrete Semiconductors
Vishay Passives
External

What Is the Application? How Does Our Solution Stand Out?

Active Discharge Relay

An active discharge relay is used to safely discharge stored energy from capacitors when a high voltage system is powered down or enters a fault condition in electrical vehicles or energy storage systems.



VOMDA1271 - Advantages

- Self-powered MOSFET Driver - no external supply needed
- High output voltage / current : 8.5 V / 15 µA
  - Supporting Si MOSFETs
- Extended temperature range: up to 125 °C
  - AEC-Q102 qualified
- Compact design: small SOP-4 package with 5 mm creepage
  - 3.44 mm x 7.4 mm required PCB area
- Insulation capability: DTI ≥ 0.4 mm, VDE certification
  - Supporting reinforced isolation
  - 400 V battery systems

- Active Discharge Relay for 400 V Systems
- Active Discharge Circuit for 800 V Systems

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External

How to Win

With Photovoltaic MOSFET Drivers

1

Do you need to drive MOSFETs from an isolated controller?

Working voltage up to 1260 Vpeak

2

Reference Designs

Pre-charge and active discharge

3

Avoid the need for isolated DC/DC

Directly turn on power MOSFETs from the control side, no supply voltage on the output side required

Isolation Amplifiers

VIA2000SD, VIA0250DD, VIA0050DD

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INDUSTRIAL AUTOMATION

- Accurate signal transfer across isolation barrier
- Motor current & voltage sensing
- Reliable control for HVAC, drives, PLCs

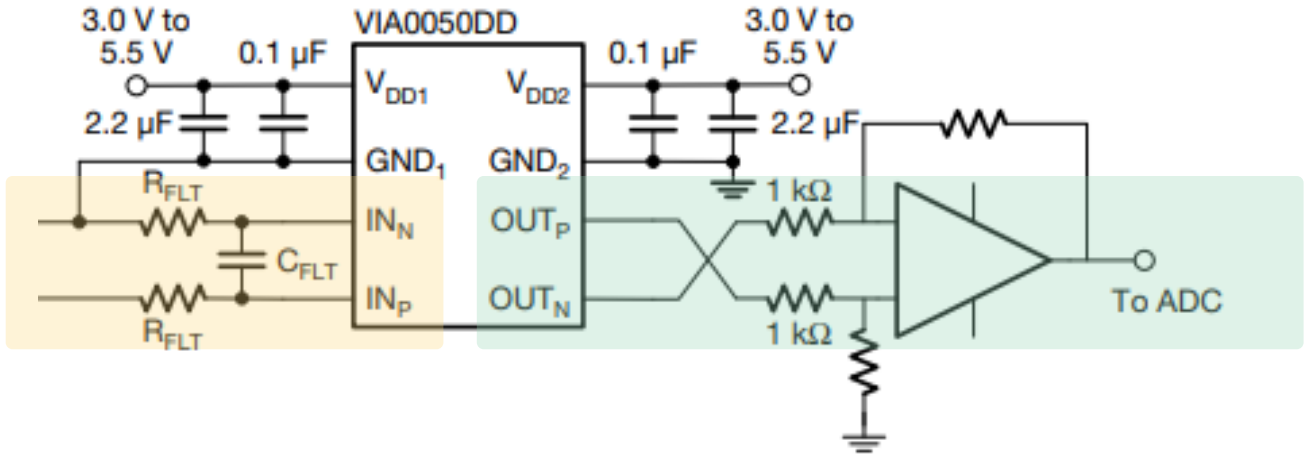
ENERGY STORAGE

- Safe isolation for PV inverters
- Precise sensing in AC/DC converters
- 3-phase motor current monitoring

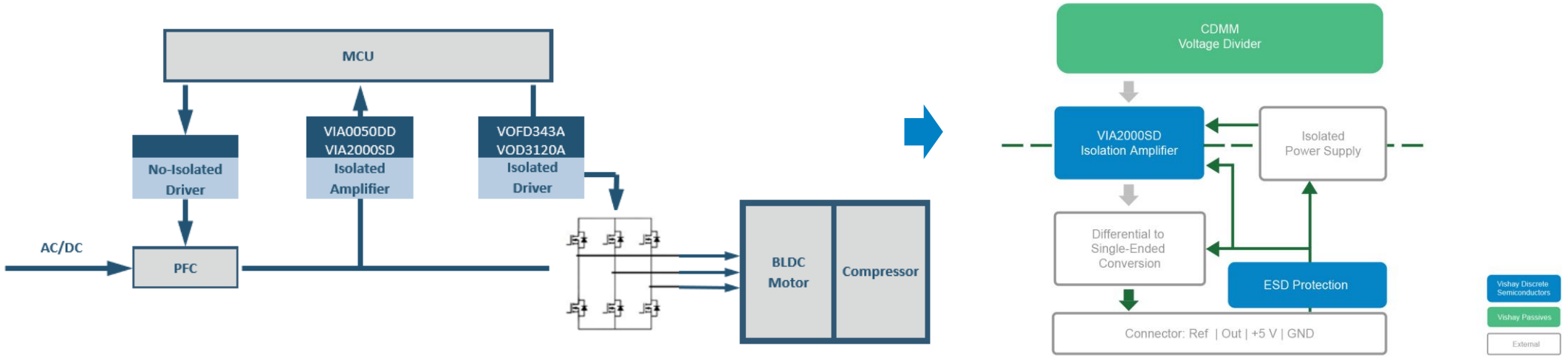
Isolation Amplifiers

How the Product Works

- The operation is very similar to that of standard operation amplifiers (OPA)
- The analog differential input is sampled by a modulator, which converts the analog signal to a digital signal
- The digital signal is transfered over the capacitive isolation barrier and converted back into analog output, which is comparable to the differential input



What Is the Application? How Does Our Solution Stand Out?



Application

- An isolation amplifier is used for isolated current and voltage measurements in critical, unstable, and noisy environments such as UPS, AC/DC inverters, servo motor control systems, and commercial HVAC
- Majorly used for motor current and voltage measurement systems in the above mentioned applications

Advantages

- We promote Vishay as a one-stop solution = Vishay isolation amplifier + Vishay shunt or potential divider, available reference designs
- Key benefits: true second source to TI, extremely reliable (high temperature stability) and precise compared to opto isolation amplifiers from Broadcom and Toshiba

Vishay Discrete Semiconductors

Vishay Passives

External

How to Win

With Isolated Amplifiers

1

Identify the need for isolated current or voltage sensing

2

Promote Vishay as a one-stop solution

Vishay isolation amplifier + Vishay shunt or potential divider

3

Direct Cross to TI AMC series

True second source for TI, extremely reliable (high temperature stability) and precise

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Sensors

Overview

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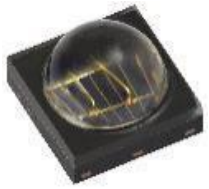
Sensors – Product Groups



Infrared Emitters

High power emitters in thru-hole and surface-mount packages

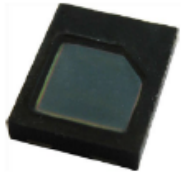


Photo Detectors

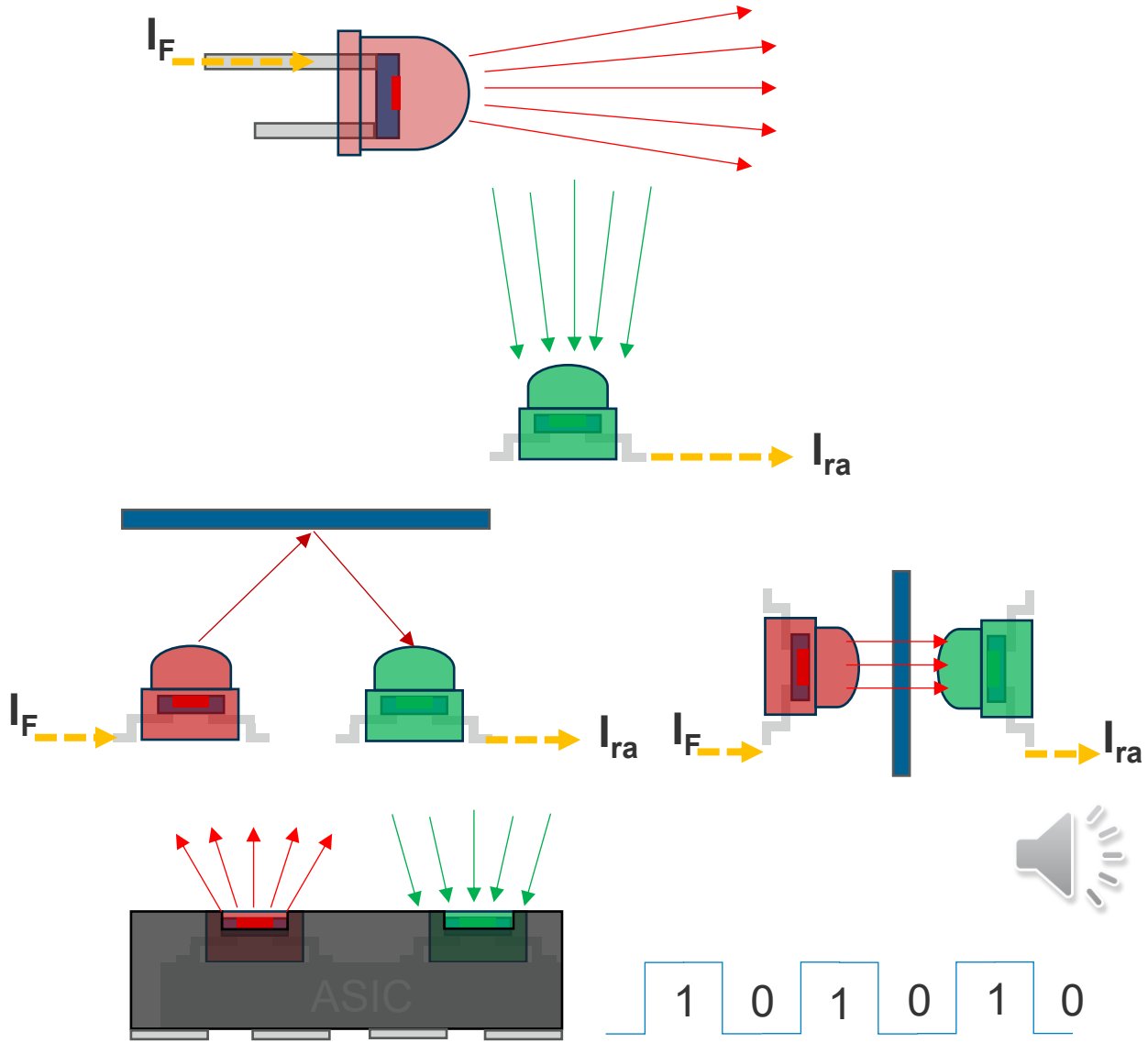
Broad selection of photodiodes and phototransistors for detecting infrared and visible light

Optical Sensors

Reflective and interrupter sensors in thru-hole and SMD packages

Digital Sensors

Light sensors and proximity sensors



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Outline

Automotive Proximity Sensors

- How the product works
- Applications
- Success stories
- How to win
- Focus products

Automotive Ambient Light Sensors

- How the product works
- Applications
- Success stories
- How to win
- Focus products

Automotive High Power Infrared Emitters

- How the product works
- Applications
- Success stories
- How to win
- Focus products

Design Resources

- Demo
- App notes
- Reference designs

Automotive Proximity Sensors

VCNL Series

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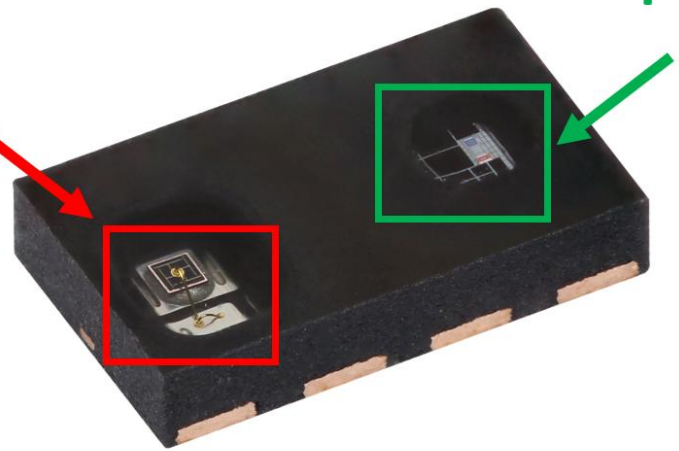
Digital Proximity Sensors

Emitter (IR LED / VCSEL)

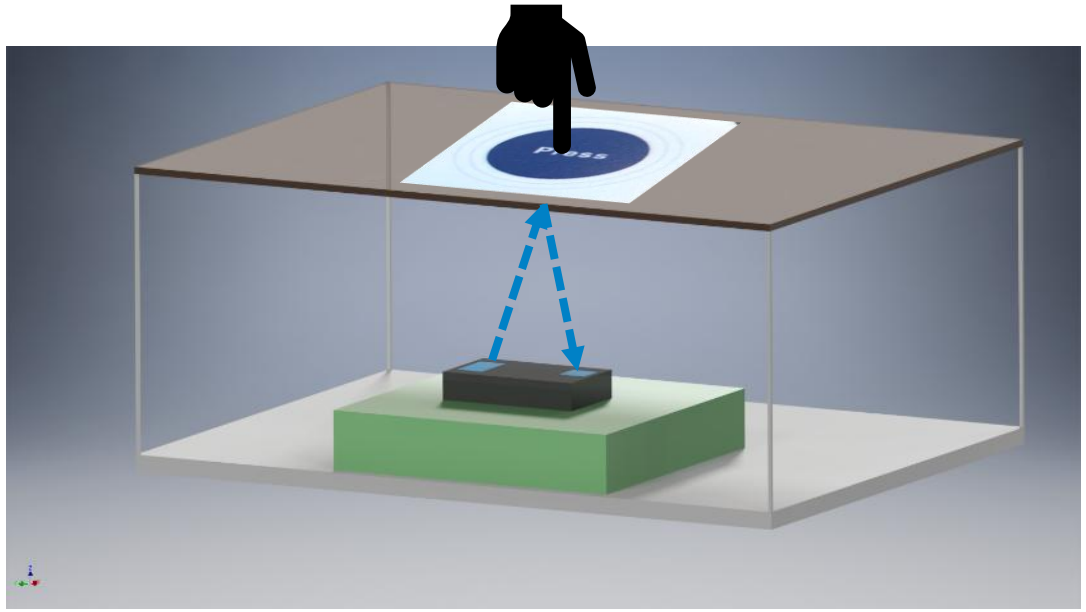
Photodiode + ASIC

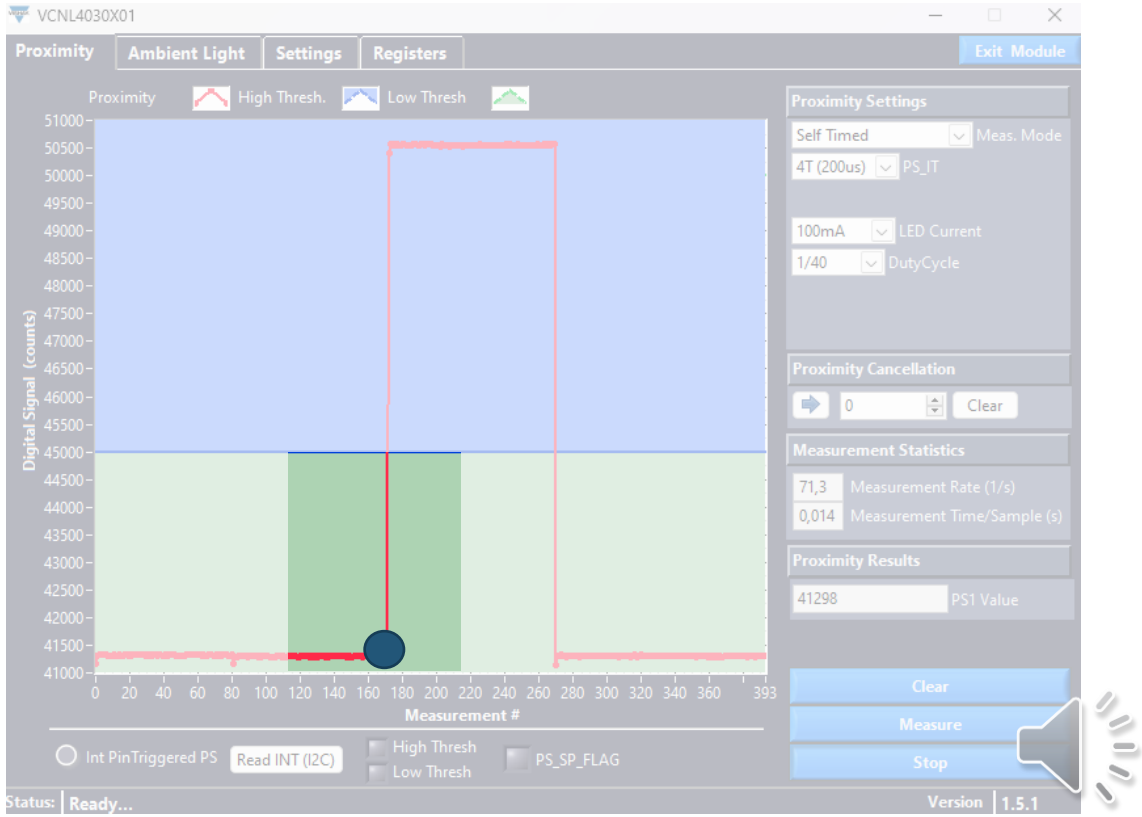


VCNLXXXX

Force Sensing – How the Product Works

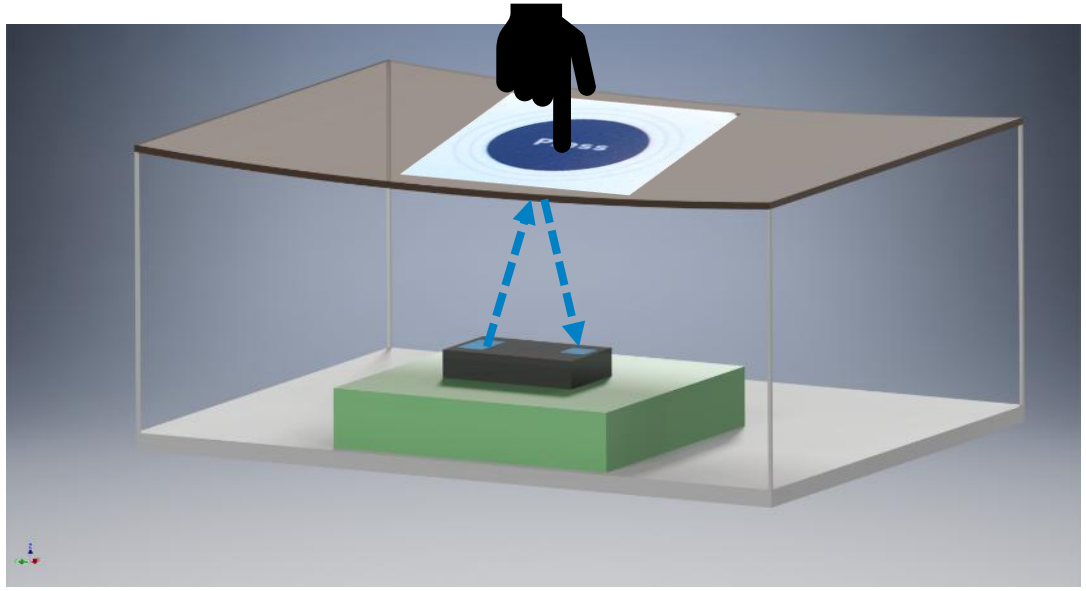
Initial position

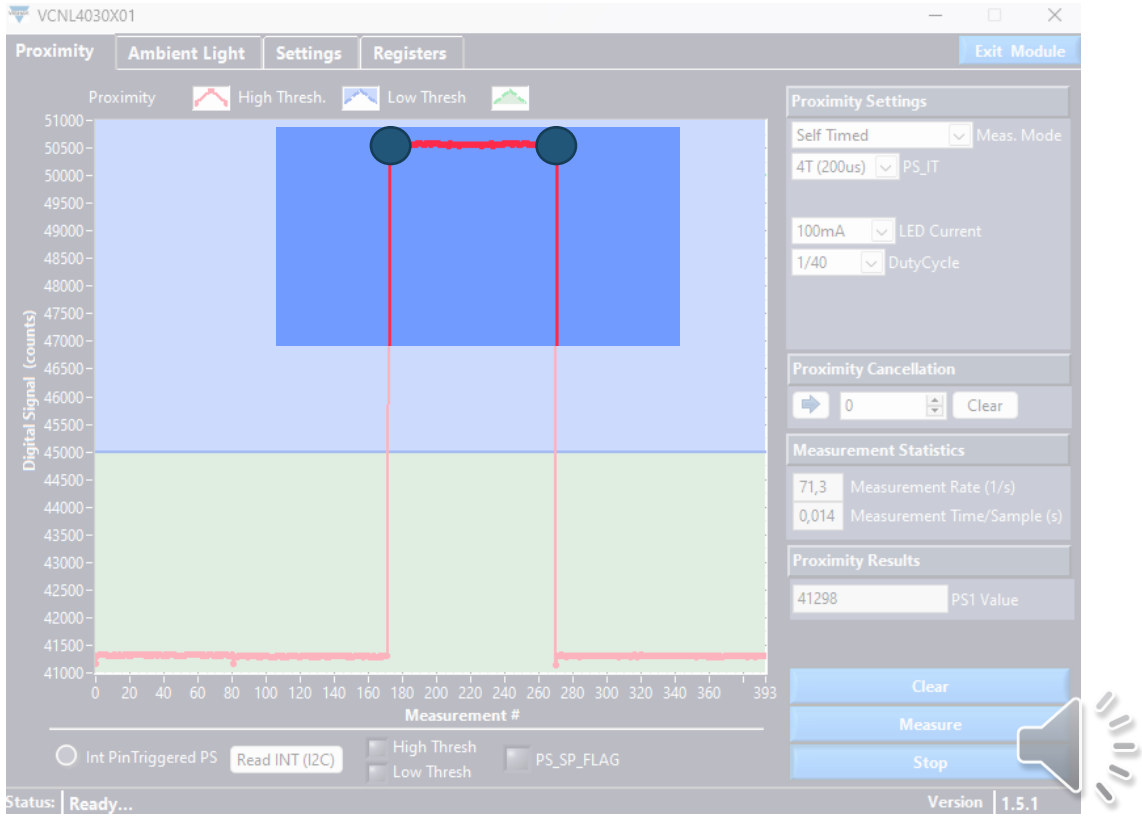




Force Sensing – How the Product Works

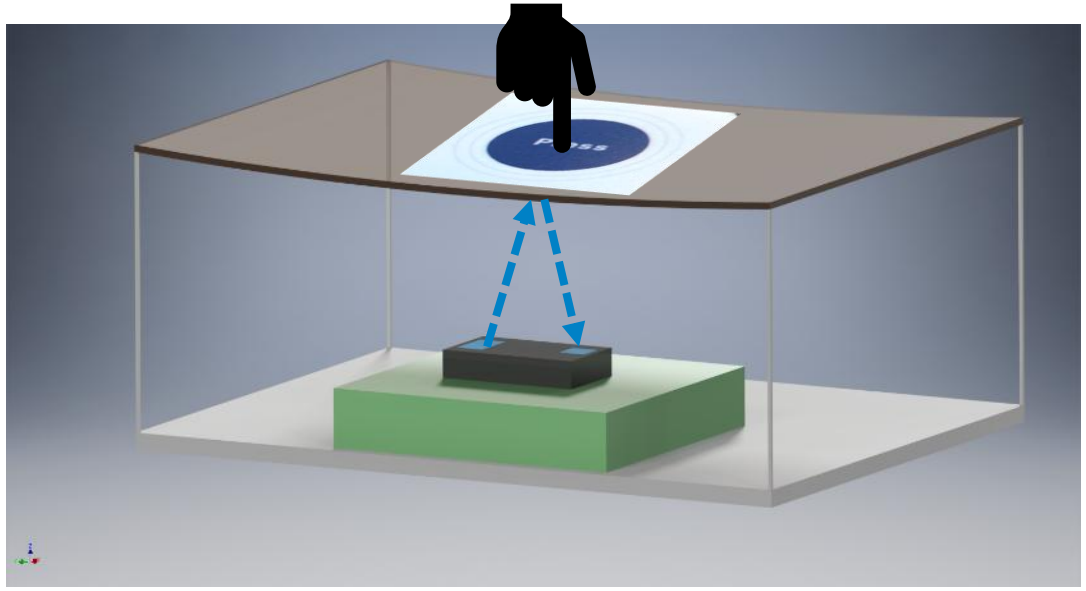
Button being pressed – signal increases

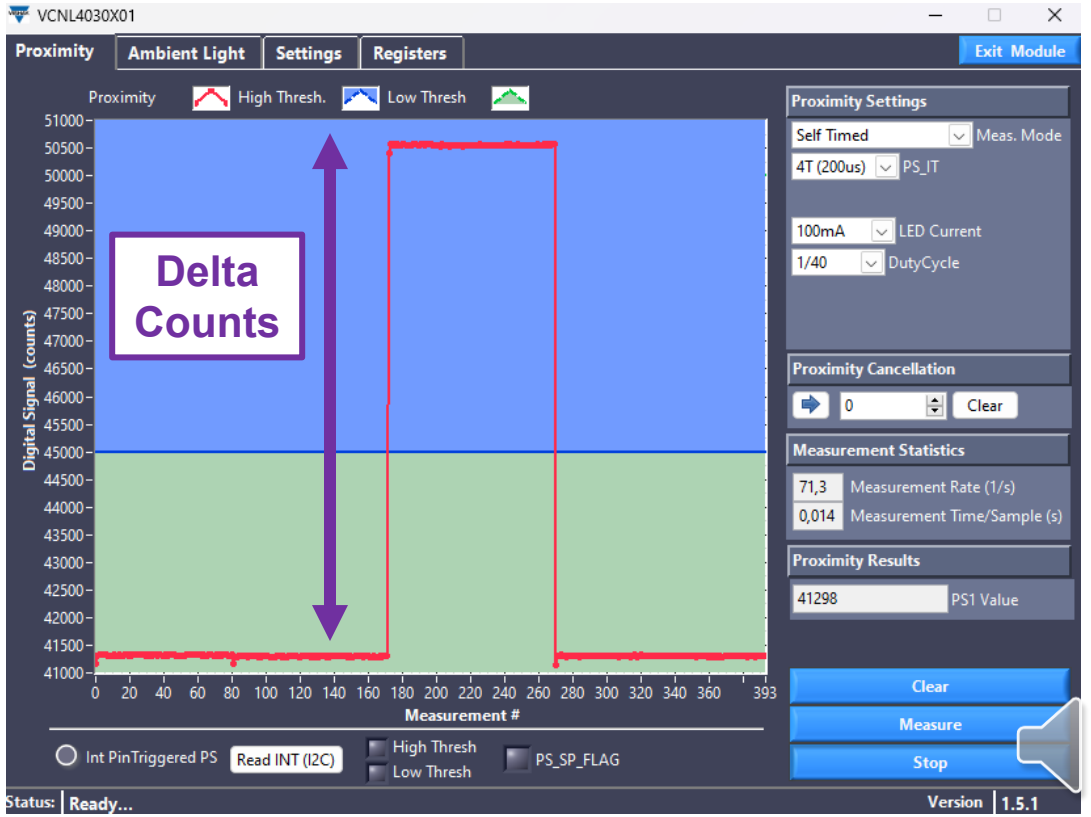




Force Sensing – How the Product Works

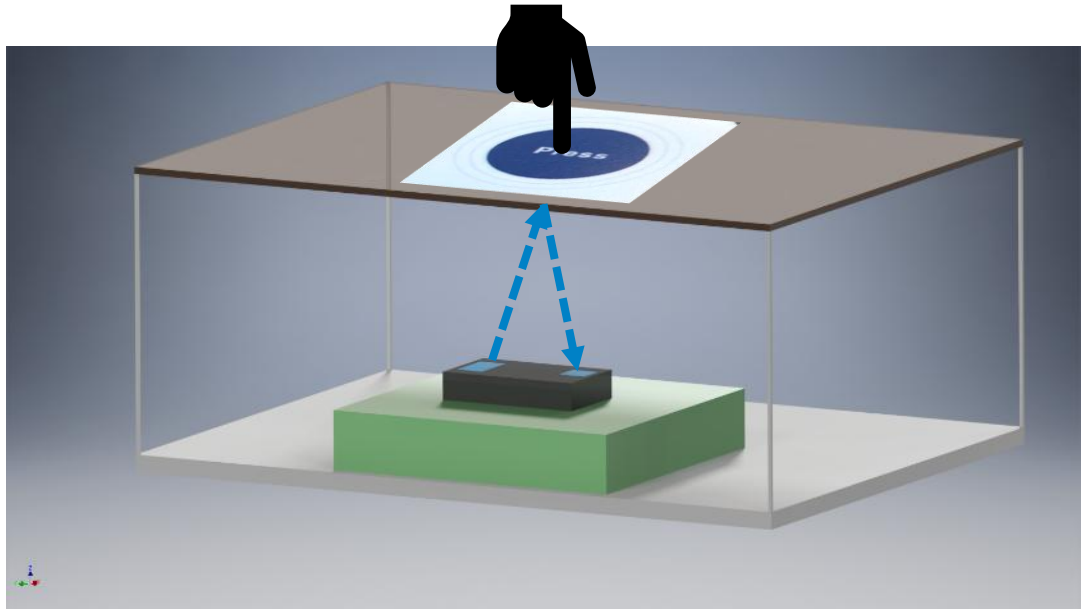
Read sensor delta counts

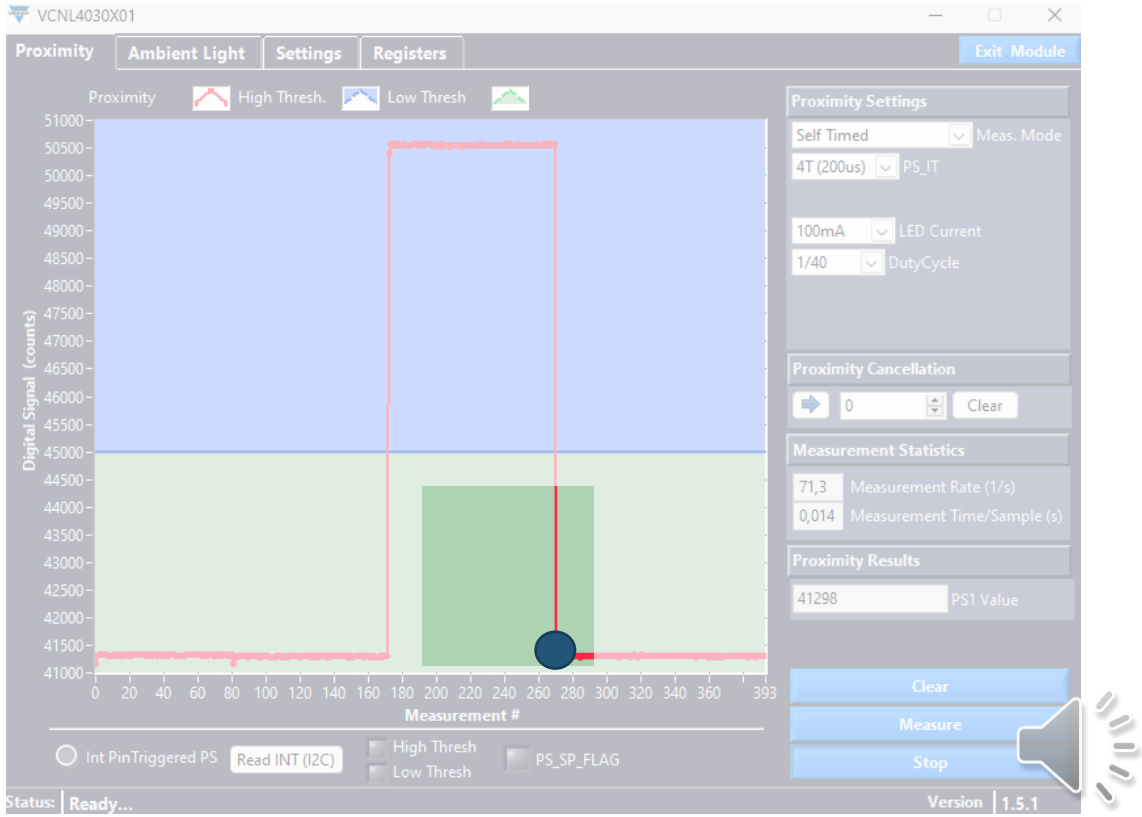




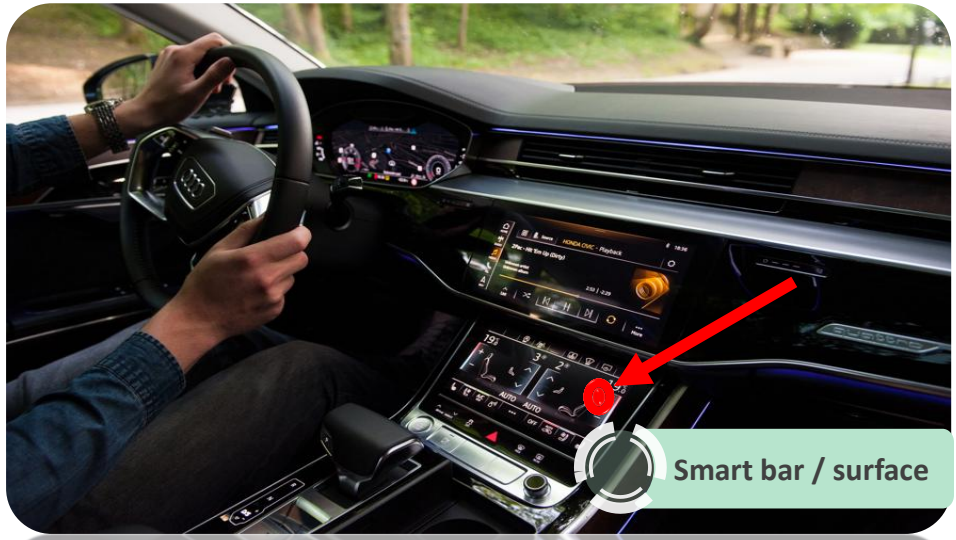
Force Sensing – How the Product Works

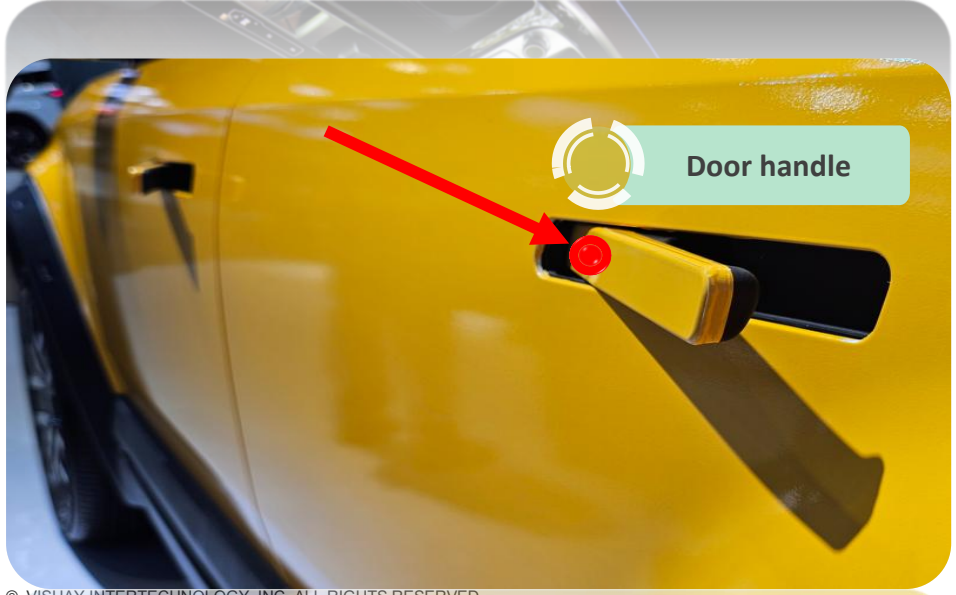
Button being released – signal back to baseline





Applications





How to Win

With Vishay Proximity Sensors

1

Performance

- High resolution offers precise measurements
- Low tolerances

2

Limited Competition

- ONLY automotive-qualified proximity sensor in the market

3

Solution selling

VCNL + IPHT actuator for force feedback solution

Key Argument 1 – No False Trigger

Force Feedback / Sensing

No false trigger

Capacitive

Susceptible to false trigger

Key Argument 2 – Responsiveness

Force Feedback / Sensing

Not impacted by gloves or dry skin

Capacitive

Impacted by gloves or dry skin

Key Argument 3 – User Experience

Force Feedback

Haptic feedback improves user experience

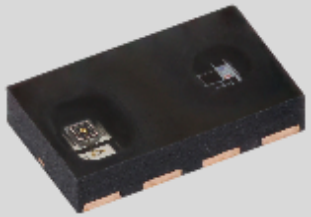
Mechanical

Lack of feedback to confirm selection

Force Feedback vs Force Sensing

Solution Selling

Force Feedback



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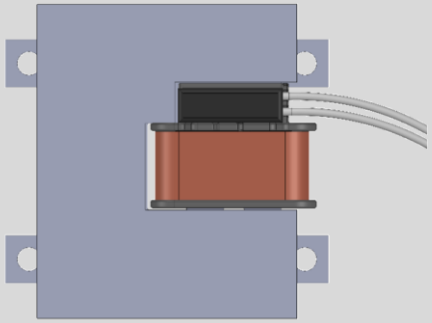
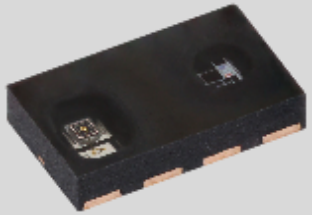


Sensor + Actuator

Force Sensing

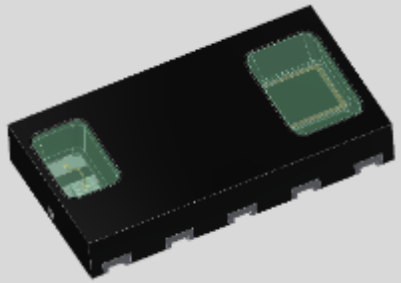


Only Sensor

Proximity Sensors – Focus Product

VCNL3025X02

Proximity Sensor + IR Emitter



(5.4 mm x 2.97 mm x 0.83 mm)

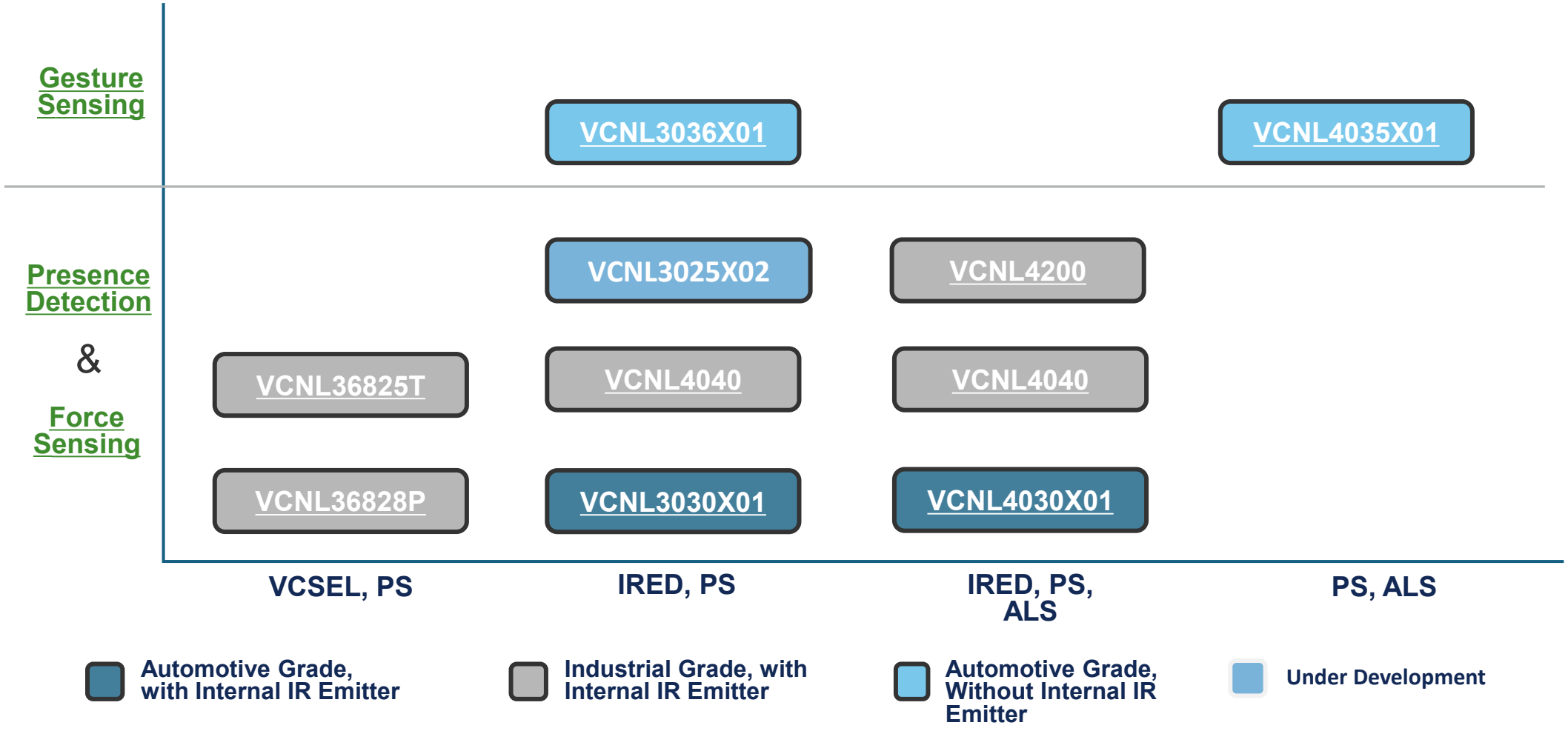
Focus Applications:

- Display wake-up and touch screen locking
- Force sensing: steering controls, smart bars, touchpads

Key Benefits

- Wettable flanks in FAM package
- Up to four I^2C addresses, can be chosen by external resistor
- Support diagnostic function: gives customers an option to check the signal path integrity (compare actual vs expected response)
- Trimming: improved part to part tolerance vs previous generation
- Sunlight cancellation: 150 klx
- -40 °C to +110 °C
- AEC-Q102-003 qualified
- Engineering samples: Q4 2025
- Planned product release: Q3 2026

Proximity Sensors – Summary



Automotive Ambient Light Sensors

VEML Series

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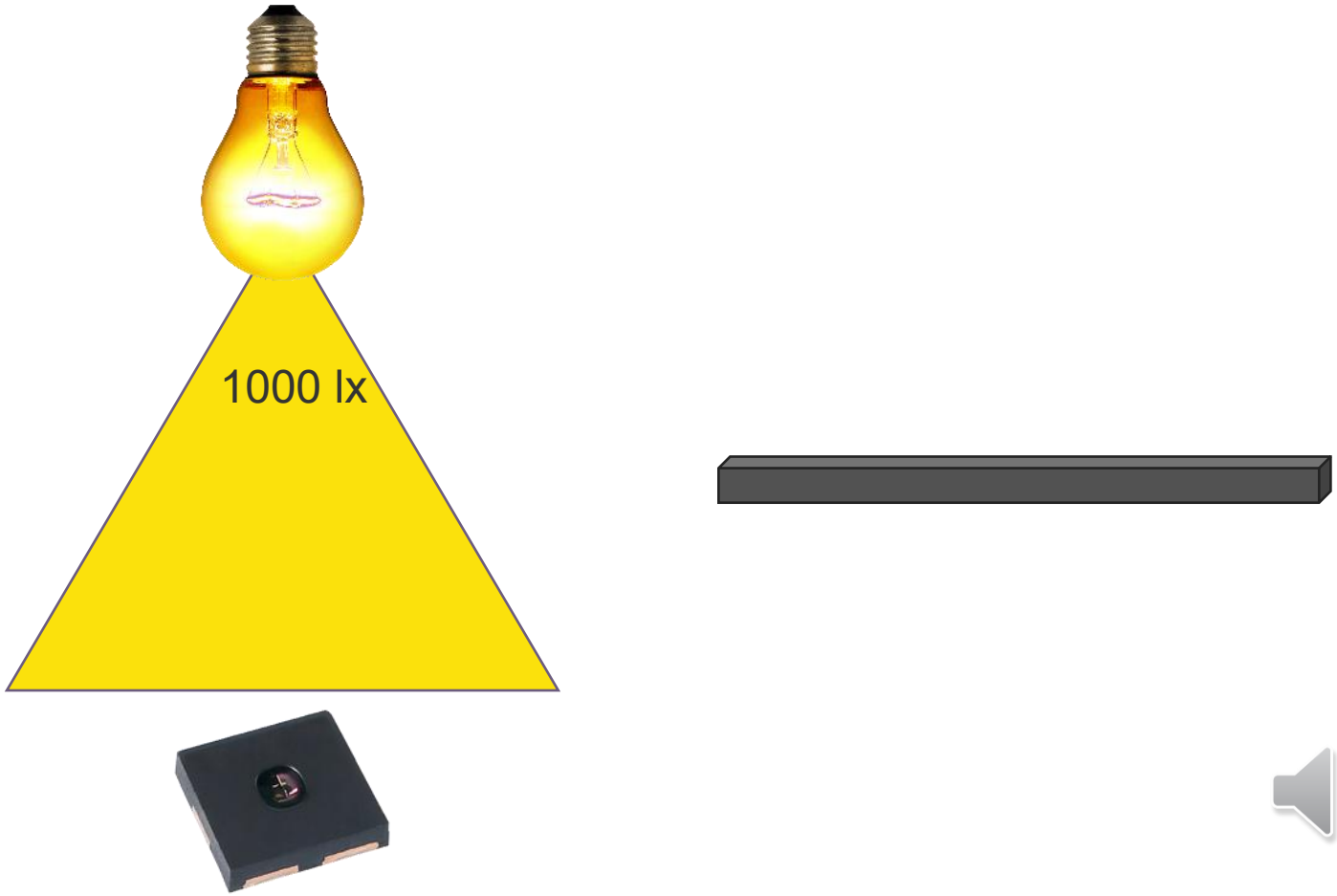
Ambient Light Sensor– How the PRODUCT WORKS

Resolution: 0.0206 lux/cts

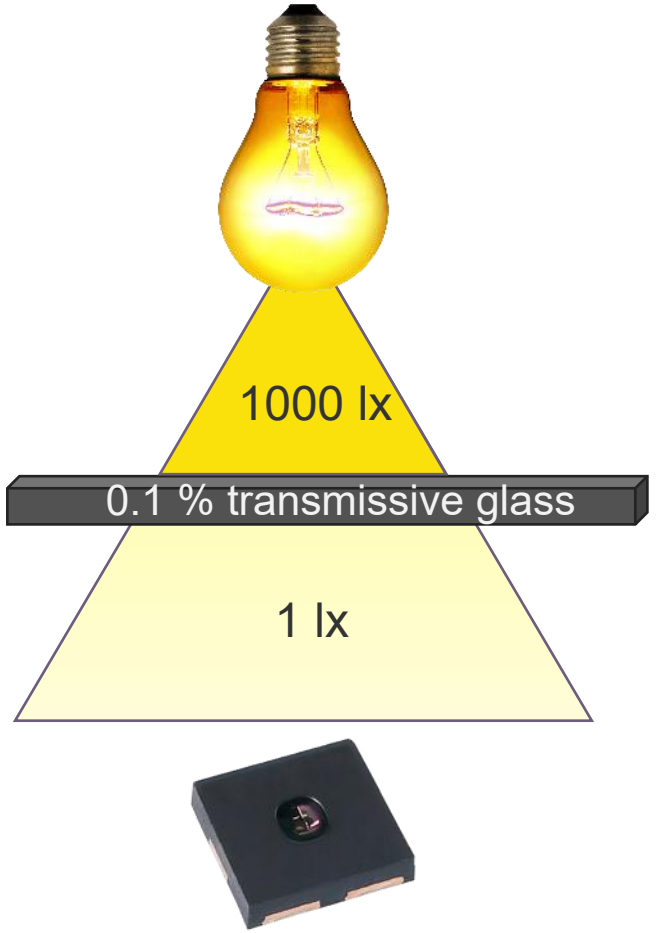
Total counts @ 1000 lux : 48 543



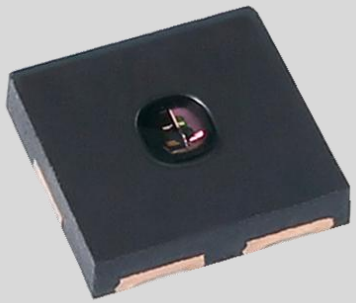
Ambient Light Sensor– How the PRODUCT WORKS

Resolution: 0.0034 lux/cts

Total counts @ 1 lux: 294



Digital ALS



VEML6031X00 **VEML4031X00**

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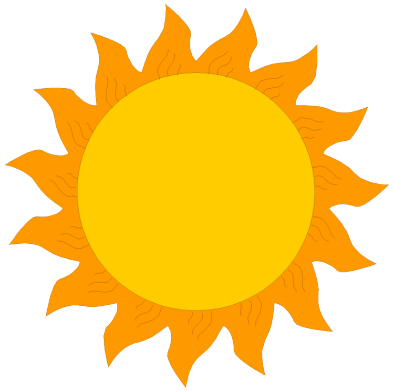

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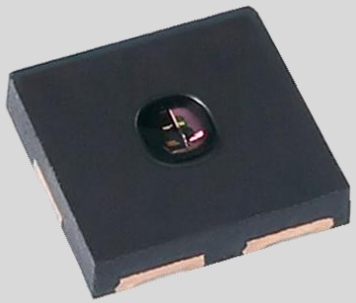

VEML6031X00 **VEML4031X00**

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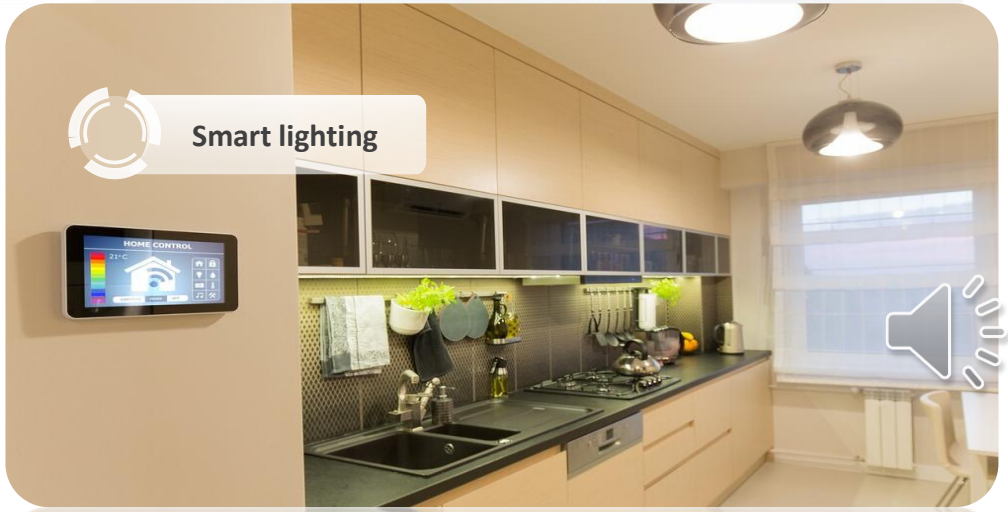
Applications



How to Win

With Vishay Proximity Sensors

1

Performance

- High sensitivity
- High detectable maximum illuminance
- Unique package design

2

Limited Competition

- Cross to TI's OPT series

3

Low Cost

- Cost competitive options for industrial and lighting markets

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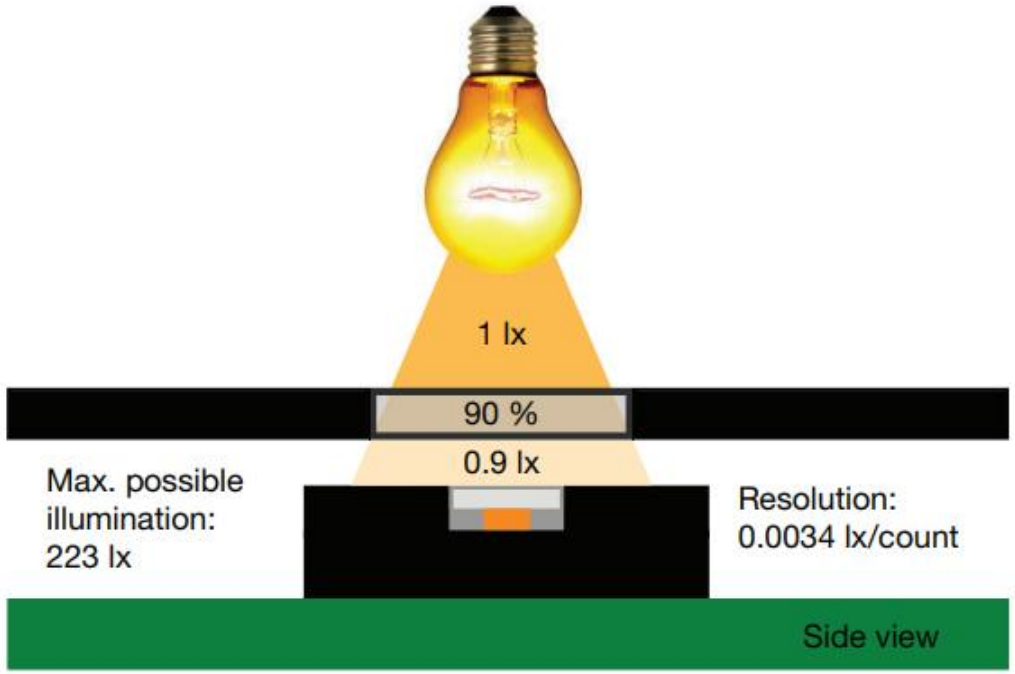
Key Argument – Dark Glass

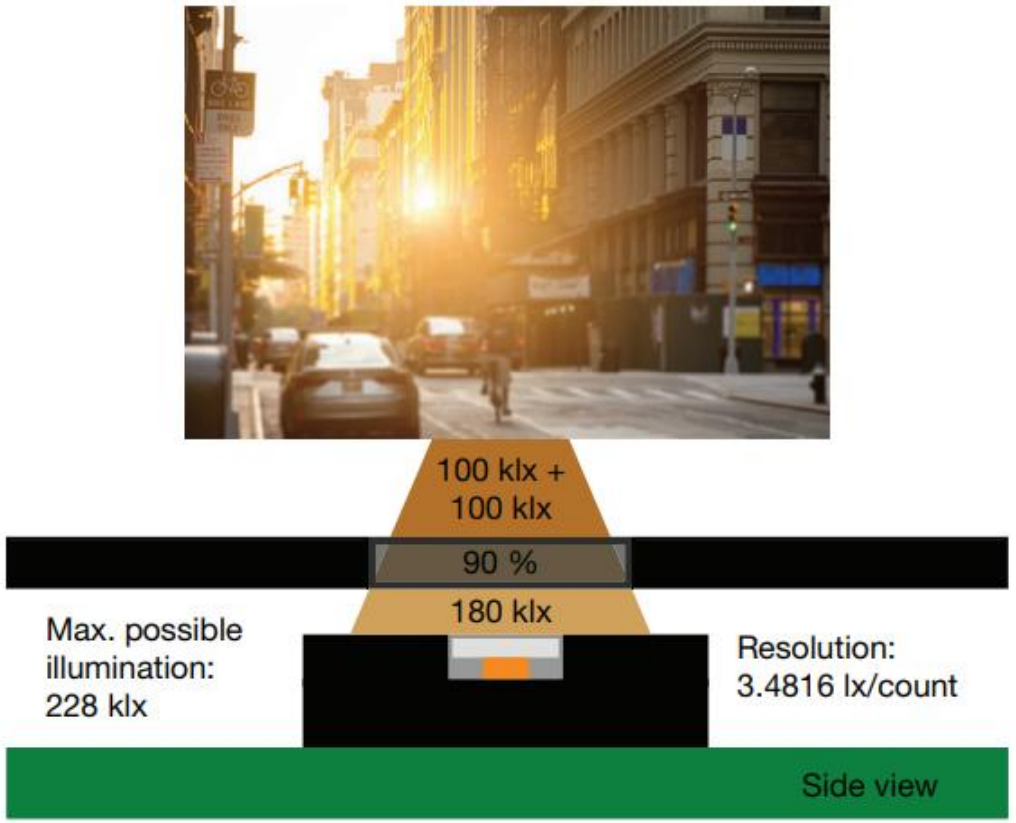
High resolution – suitable for dark glass

Key Argument – Two Extreme Light Conditions

Low Light Condition



Double Sun Condition

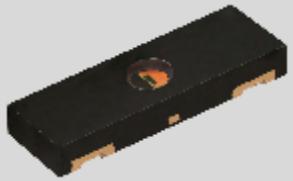


High performance at both low light and double sun

Automotive Light Sensors – Focus Product

VEML4031X00

Ambient light sensor



(3.48 mm x 1.45 mm x 0.6 mm)

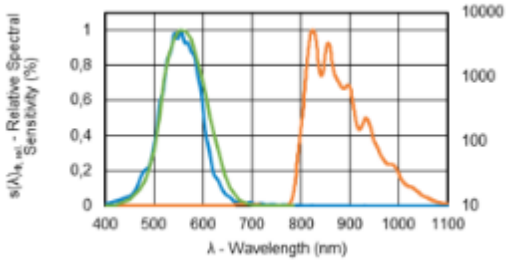
Focus Applications:

- Ambient light sensor in automotives for
  - Display backlight controls
  - Infotainment systems
  - Rear view mirror dimming
  - Interior lighting control systems
  - Heads-up displays

Key Benefits

- AECQ-100 qualified
- Operation temperature range

  -40 °C to + 110 °C (MSL 2a)
- FAM package (with wettable flanks)
- No scattered light
- Integrated modules (2 channels): ALS+IR
- Improved linearity: ± 1 %
- Perfect IR suppression
- High ALS sensitivity with minimum detectable intensity of 0.0026 lx/cnt
- Selectable integration time: broad range from 3.125 ms to 400 ms



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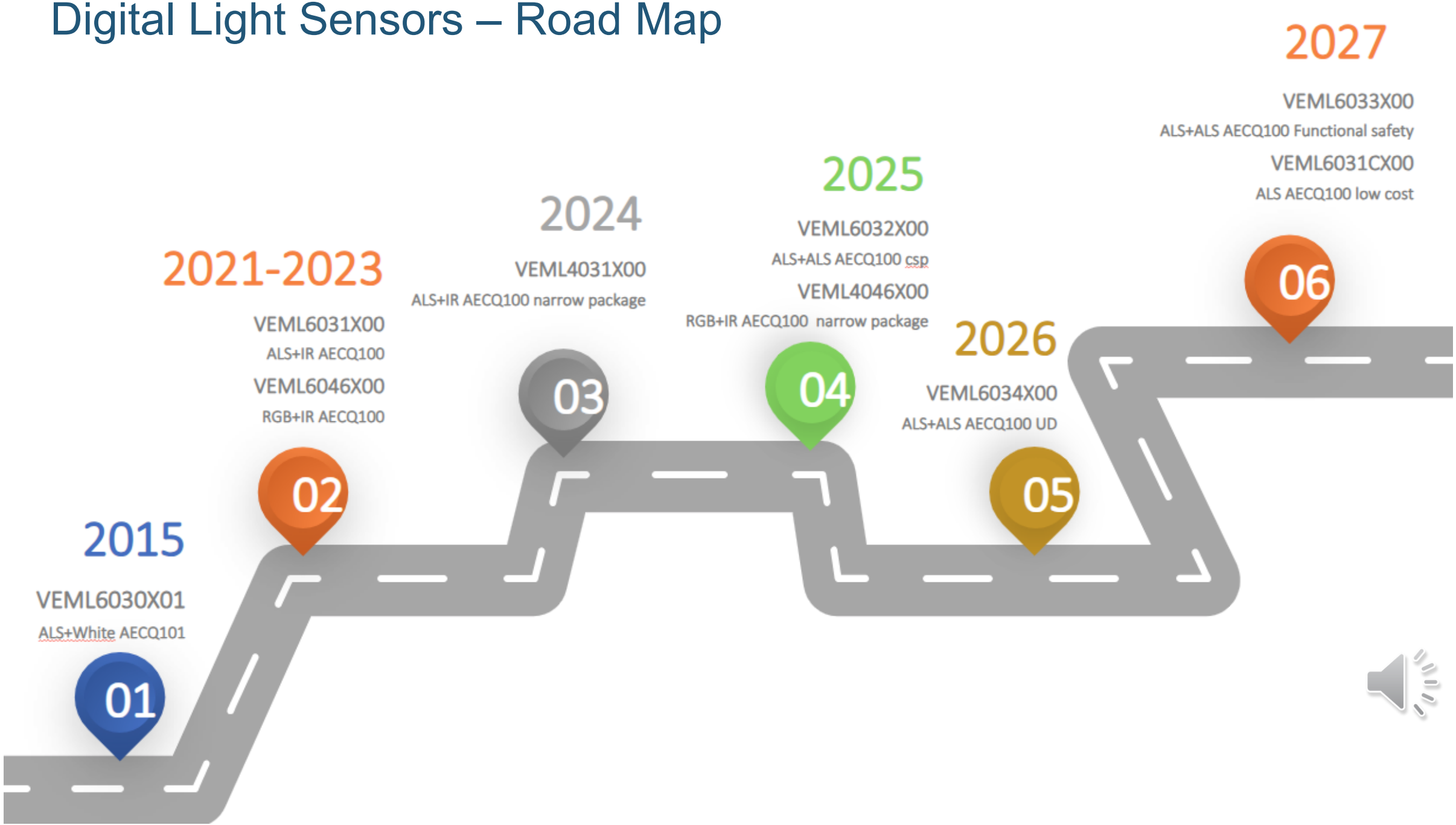
Digital Light Sensors – Road Map



Automotive High Power Infrared Emitter

VSMA Series

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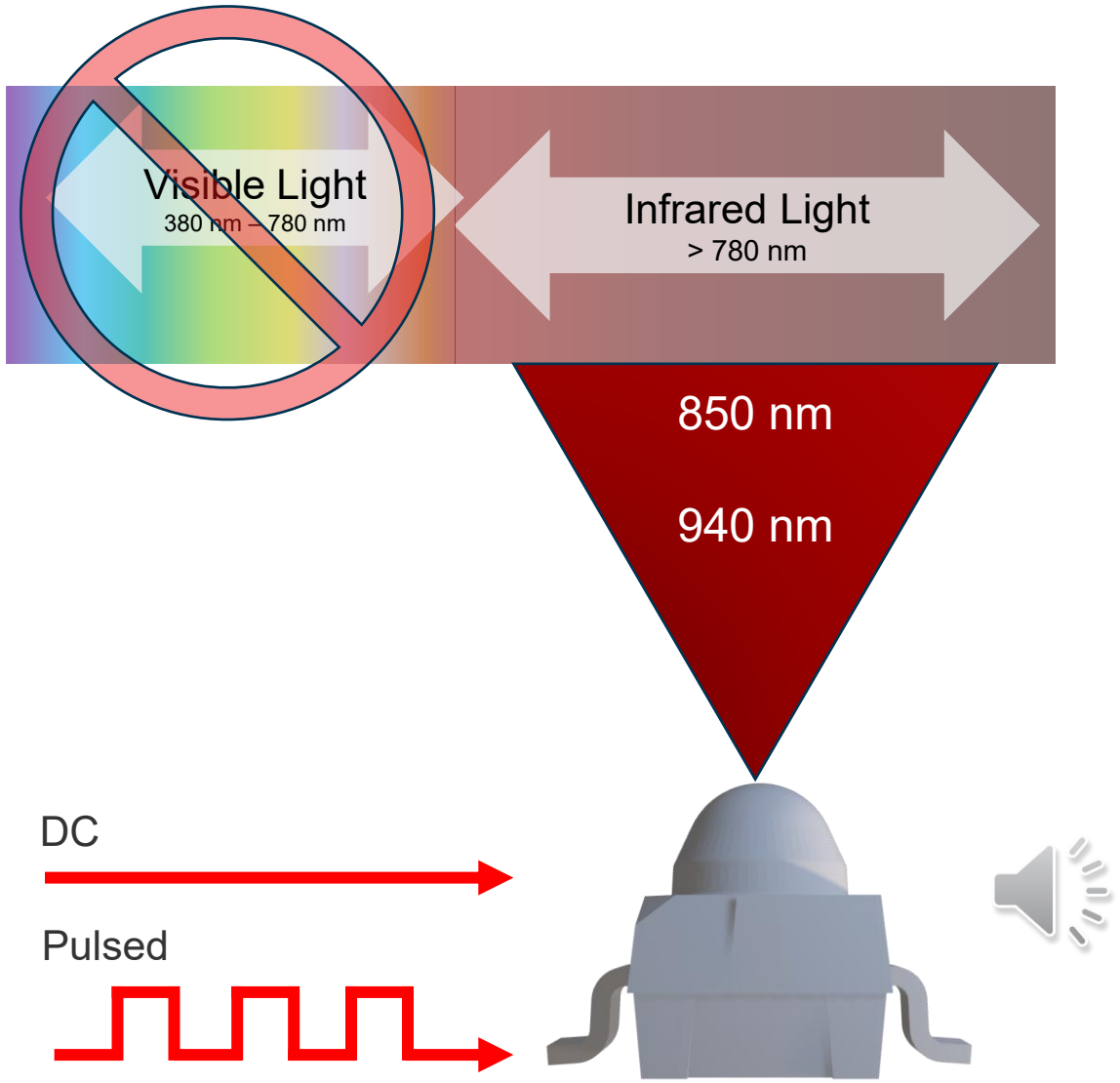
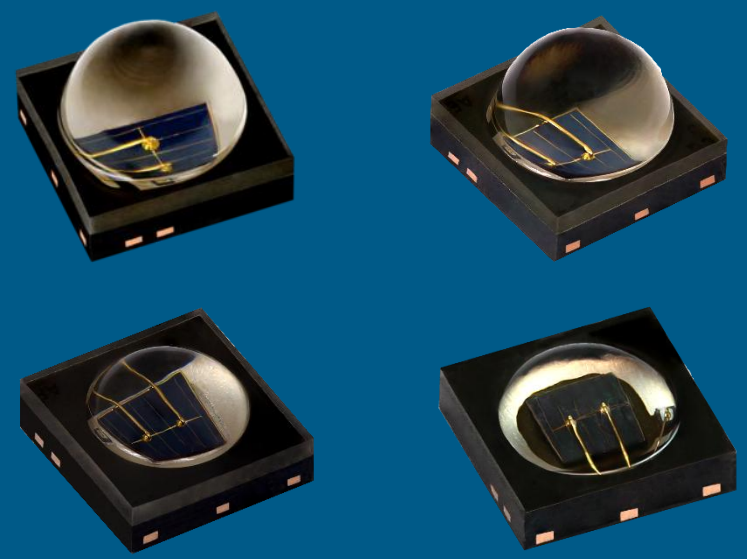
Infrared Emitters: How the Product Works

- IR emitters are driven by a forward current and emit near infrared light
- Both the total amount of light emitted (Optical power, $\Phi_{opt.}$) as well as the amount of light per unit area (Intensity, I_e) can be defining factors in an application
- The emitted light will be defined by its peak wavelength
- Can be both DC- and pulsed-driven

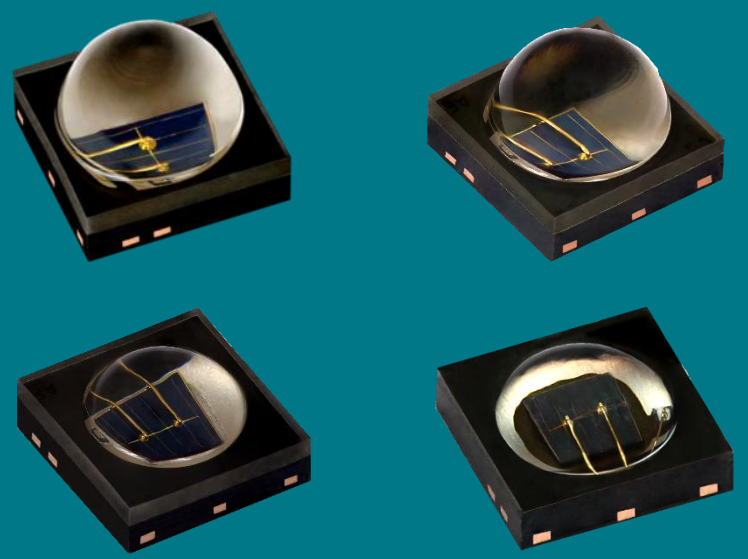


Astral Series – Wavelength

850 nm

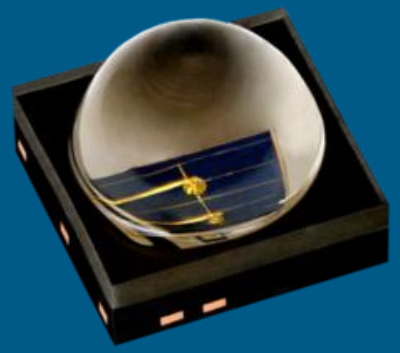


940 nm

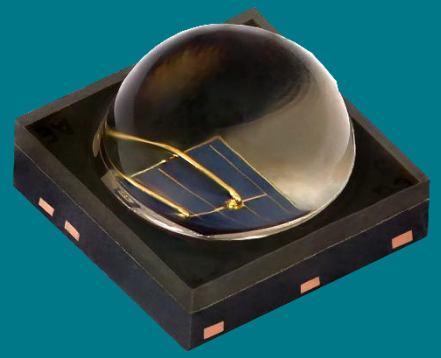


Astral Series – Package

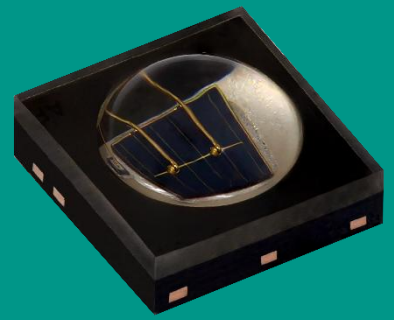
± 28°



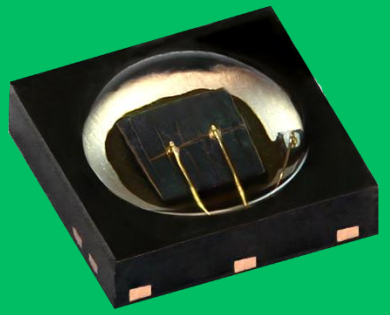
± 40°



± 60°



± 75°



Applications

How to Win

With Vishay High Power Infrared Emitters

1

Performance

- Customized binning options
- Red glow suppression
- Low thermal resistance
- Complete portfolio
  - Two wavelength options & four different FOV

2

True Second Source

- True second source to ams OSRAM' SFH series

3

Non-China Supply Chain

Frontend: Germany

Backend: Philippines

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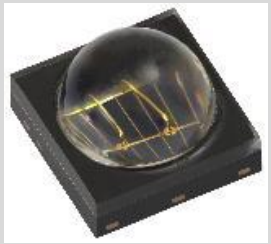
IR Emitters – Focus Product

Astral Series
VSMA1294xxx(X02)



Key Benefits: Higher Radiant Intensities

- High power infrared emitter with 10 % - 15 % higher radiant intensity than previous generations
- Extracts significantly more radiant intensity while keeping the radiant power
- 850 nm, 940 nm, and 940 nm reduced red glow
- ESD sensitivity of 10 kV
- Emission angle options:
  ± 28° , ± 38° ,± 55° , ± 71°
- AEC-Q102 qualified and consumer version
- **SOP Q4 / 2025**
- **Samples available**

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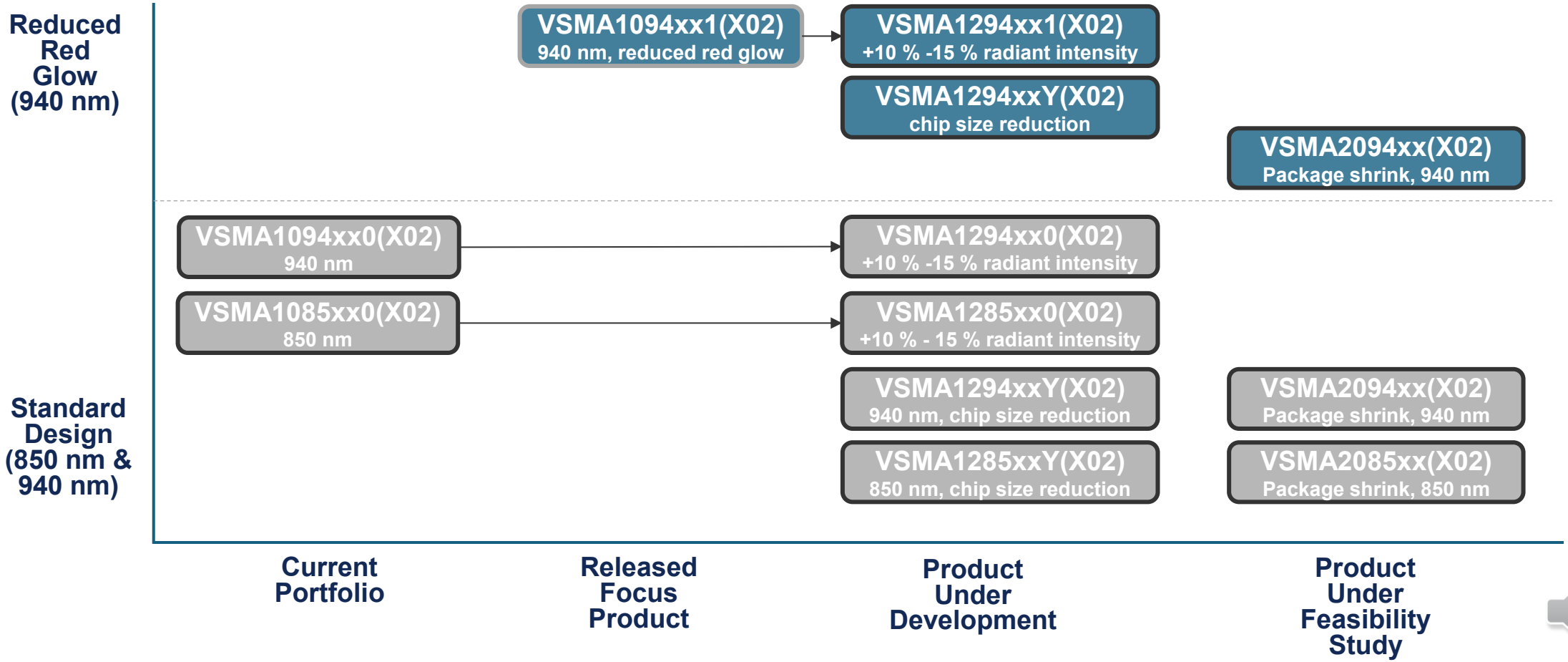
Astral Series: High Power IR Emitter (Four FOV Available) – Summary



Design Resources and Selling Tools

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Application Notes, Technical Notes, Instructions, etc.

Circuit Design

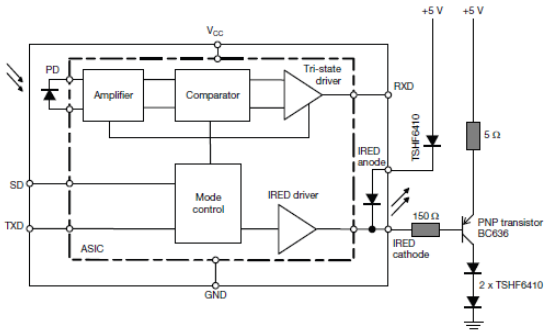
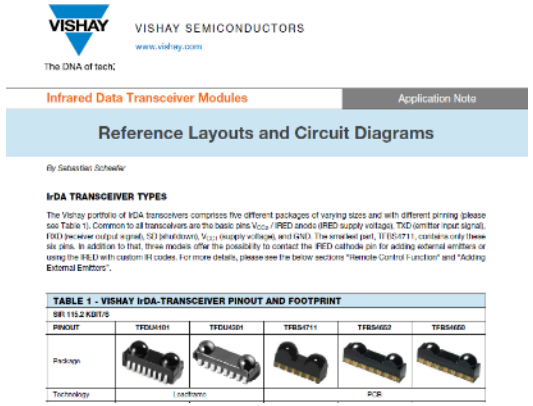


Fig. 8 - TFDU4101 With Three External Emitters



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Infrared Data Transceiver Modules | Application Note

Reference Layouts and Circuit Diagrams

By Sebastian Scheller

IrDA TRANSCEIVER TYPES

The Vishay portfolio of IrDA transceivers comprises five different packages of varying sizes and with different pinning (please see Table 1). Common to all transceivers are the basic pins V_{CC} / IRED anode (IRED supply voltage), TXD (emitter input signal), RXD (receiver output signal), SD (shutdown), V_{LED} (supply voltage), and GND. The smallest part, TFBS4711, contains only these six pins. In addition to that, three models offer the possibility to contact the IRED cathode pin for adding external emitters or using the IRED with custom IR codes. For more details, please see the below sections "Remote Control Function" and "Adding External Emitters".

TABLE 1 - VISHAY IrDA-TRANSCEIVER PINOUT AND FOOTPRINT

SIR 115.2 KBIT/S

PINOUT	TFDU4101	TFDU4301	TFBS4711	TFBS4653	TFBS4650
Package					
Technology	Leadframe		PCB		

Physical Background

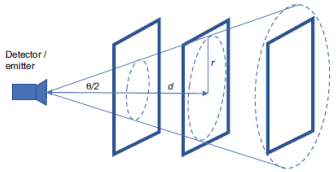

Fig. 5 - Illustration of how the Fraction of the Radiating Reflector Area Seen by the Detector Increases With the Distance *d* Until the Receiver's Field of View Becomes Larger Than the Reflector Size

At short distances and with large reflecting objects, an interesting effect can lead to a different behavior and thus to a new distance law. As illustrated in Fig. 6, in close proximity to the detector the illuminated object might extend over the detector's field of view *θ*. Consequently, the circular radiating area seen by the detector increases with increasing distance to the reflector. The increasing area compensates the intensity loss due to the inverse square law, and the irradiance of the back reflected light no longer falls off as predicted by the $1/d^2$ law. In this case the irradiance of the circular Lambert reflector can be expressed as:

$$E_d = \pi L_s \sin^2 \frac{\theta}{2}$$

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Infrared Remote Control Receivers | Application Note

Vishay Infrared Receivers for Presence Sensor Applications

By Dr. Sebastian Schäfer

INTRODUCTION

The presence detection function utilized in such applications as smart bins, gate access, soap dispensers, and parking lot sensors is often based on optical sensors in a reflection geometry design (Fig. 1). These sensors usually contain an IR emitter and a photodetector mounted side by side in a common housing facing in the same direction (Fig. 2, Left). The light transmitted from the emitter can only return to the detector if it is reflected on the surface of an obstacle. In the simplest kind of presence detection, the output state of the receiver will indicate only if an obstacle is in front of the sensor or not.

Fig. 1 - Examples of Reflective Sensor Applications

The signal strength of the receiver is not only a function of the distance to the object, but it also depends on the properties of the object, such as size, shape, color, and surface roughness (Fig. 2, Right). The ability to reflect light or radiation can also be expressed in units of reflectivity. The reflectivity of the object is a crucial point, since in many applications the target objects are diverse and not well defined.

Design-in Support

one can program 2, 4, or even 8 pulses. This leads to a longer IRED on-time for each proximity measurement, which also results in a higher detection range.

But these eight pulses instead of just one could already be long enough that the possible IRED current needs to be reduced. The reduction is now also dependent on the duty ratio. This duty ratio stays identical, whether it is just one or up to eight pulses that are programmed.

With PS_IT = 9T, which leads to about 270 µs single pulses, the pulses will occur quickly after each other eight times (please see scope screenshots below). Keep in mind the above mentioned integration times tolerances of ± 20 %, which result in the slight variations of the measured integration times.

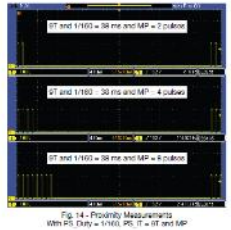

Fig. 14 - Proximity Measurements
With PS_Duty = 1/160, PS_IT = 9T and MP

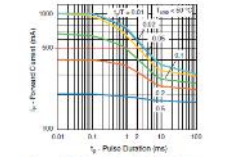

Fig. 15 - Pulse Forward Current vs. Pulse Duration

An extremely power-efficient way to execute proximity measurements is to apply a PS active force mode (register: PS_CONF3, command: PS_AF = 1).

If only a single proximity measurement needs to be done, PS_AF is set to "1" and then PS_SD = 0 – active. Setting PS_Trig = 1 will then execute just one single measurement.

In this mode, only the I2C interface is active. In most consumer electronic applications this sensor will spend the majority of time in sleep mode; it only needs to be woken up for a proximity or light measurement. In standby mode the power consumption is about 0.2 µA.

APPLICATION NOT

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Optical Sensors | Application Note

Designing the VCNL4200 Into an Application

By Reinhard Schaar

INTRODUCTION AND BASIC OPERATION

The VCNL4200 is a fully integrated proximity and ambient light sensor. It combines an infrared emitter and photodiode for proximity measurement, ambient light sensor (ALS), and signal processing IC in a single package with a 16 bit ADC for ALS and a 12 bit / 16 bit ADC for proximity ADC. The device provides ambient light sensing to support conventional backlight and display brightness auto-adjustment, and proximity sensing to recognize objects up to a distance of 1.5 m (5").

This stand-alone component greatly simplifies the use and design in of a proximity sensor (PS) in consumer and industrial applications, because the embedded IRED and photodiode are exactly matched to each other. The VCNL4200 features a miniature, surface-mount 5.0 mm by 3.0 mm leadless package (LLP) with a height of 1.6 mm. The

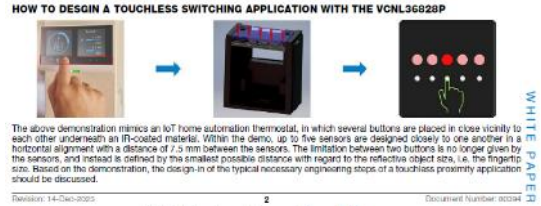
Fig. 2 - VCNL4200 Bottom View

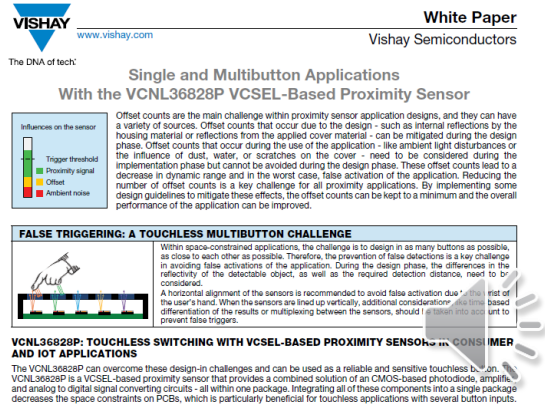
COMPONENTS (BLOCK DIAGRAM)

The major components of the VCNL4200 are shown in the block diagram.

In addition to the ASIC with the ambient light and proximity photodiode, the infrared emitter is also implemented. Its cathode needs to be connected to the driver externally (see Fig. 6).

Application Examples





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White Paper
Vishay Semiconductors

Single and Multibutton Applications With the VCNL36828P VCSEL-Based Proximity Sensor

Offset counts are the main challenge within proximity sensor application designs, and they can have a variety of sources. Offset counts that occur due to the design - such as internal reflections by the housing material or reflections from the applied cover material - can be mitigated during the design phase. Offset counts that occur during the use of the application - like ambient light disturbances or the influence of dust, water, or scratches on the cover - need to be considered during the implementation phase but cannot be avoided during the design phase. These offset counts lead to a decrease in dynamic range and in the worst case, false activation of the application. Reducing the number of offset counts is a key challenge for all proximity applications. By implementing some design guidelines to mitigate these effects, the offset counts can be kept to a minimum and the overall performance of the application can be improved.

FALSE TRIGGERING: A TOUCHLESS MULTIBUTTON CHALLENGE

Within space-constrained applications, the challenge is to design in as many buttons as possible, as close to each other as possible. Therefore, the prevention of false detections is a key challenge in avoiding false activations of the application. During the design phase, the differences in the reflectivity of the detectable object, as well as the required detection distance, need to be considered.

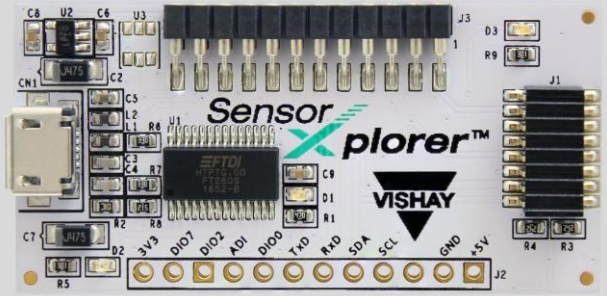
A horizontal alignment of the sensors is recommended to avoid false activation due to the finger of the user's hand. When the sensors are lined up vertically, additional considerations like time based differentiation of the results or multiplexing between the sensors, should be taken into account to prevent false triggers.

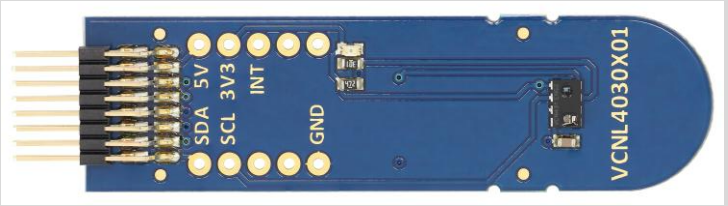
VCNL36828P: TOUCHLESS SWITCHING WITH VCSEL-BASED PROXIMITY SENSORS IN CONSUMER AND IOT APPLICATIONS

The VCNL36828P can overcome these design-in challenges and can be used as a reliable and sensitive touchless button. VCNL36828P is a VCSEL-based proximity sensor that provides a combined solution of an CMOS-based photodiode, amplifier, and analog to digital signal converting circuits - all within one package. Integrating all of these components into a single package decreases the space constraints on PCBs, which is particularly beneficial for touchless applications with several button inputs.

Application Support – Summary

Evaluation Kit



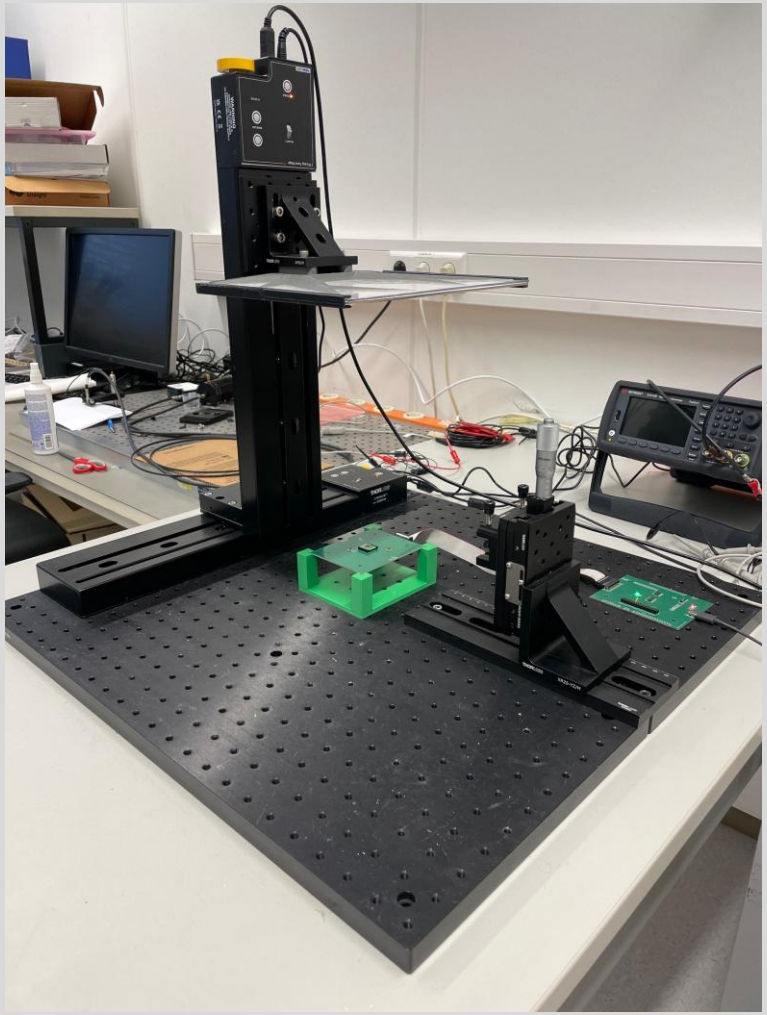


Reference Design

Lab Measurement

Application Support – Lab Measurement

Lab Measurement



We have a lab setup to characterize proximity sensors, perform application measurement, and replicate customer application problems

Optoelectronics - Mobile Sensors

Date

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Outline

Short Distance Proximity Sensors

- How the product works
- Applications
- Success stories
- How to win
- Focus products

Long Distance Proximity Sensors

- How the product works
- Applications
- Success stories
- How to win
- Focus products

Design Resources

- Demo
- App notes
- Reference designs

Short Distance Proximity Sensor

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Proximity Sensor Mega Trend

The mega trend in optical proximity sensors is their rapid integration into smart environments — driven by automation, miniaturization, and AI-powered sensing across industries.

Explosion of Consumer Electronics

- **Wearables, and AR / VR devices** increasingly rely on optical proximity sensors for gesture control, screen dimming, and user presence detection
- **Miniaturization** of sensors enables seamless integration into ultra thin devices
- **SAM**: *$500–$700 million*
- **Included Devices**:
  - Smart TVs, tablets, laptops
  - Wearables, AR / VR headsets
  - Smart speakers and home hubs

- **Trend**: Growth driven by gesture control, ambient light sensing, and user presence detection in non-phone devices

[Optical Proximity Sensor Market Research Report 2033]

IoT Smart Infrastructure

- Optical proximity sensors are embedded in **smart homes**, **smart cities**, and **connected buildings** for lighting control, security, and energy optimization
- Their ability to detect **motion, presence, and ambient conditions** makes them central to IoT ecosystems
- **SAM Estimate**: *$500–$700 million*
- **Applications**:
  - Smart buildings: lighting, HVAC, access control
  - Smart cities: traffic monitoring, public safety, energy optimization

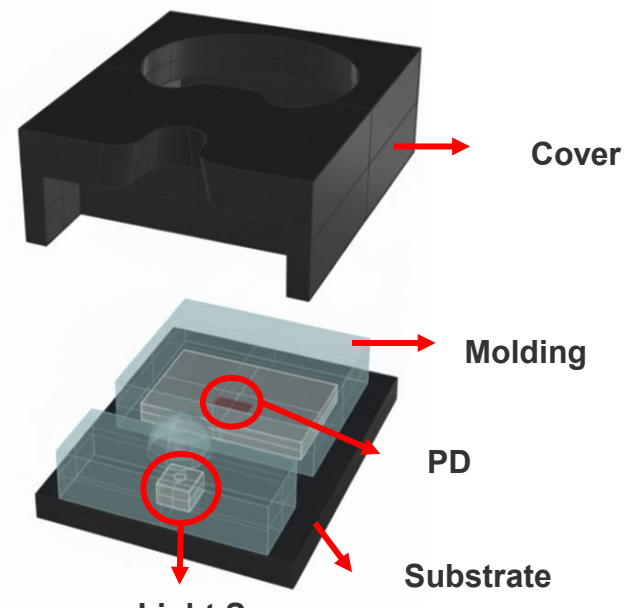
- **Trend**: Urbanization and sustainability initiatives are accelerating deployment

[Optical Proximity Sensor Market Analysis (2035)]

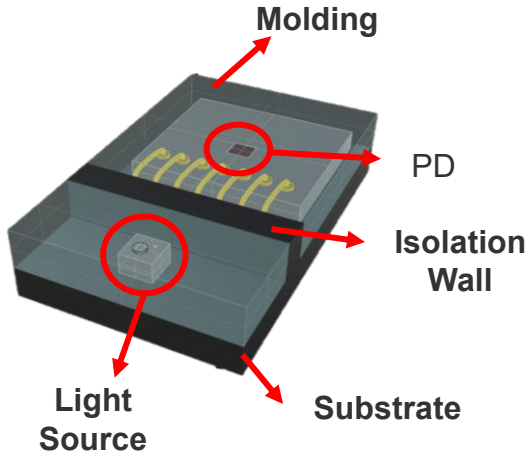
Short Distance Proximity Sensor

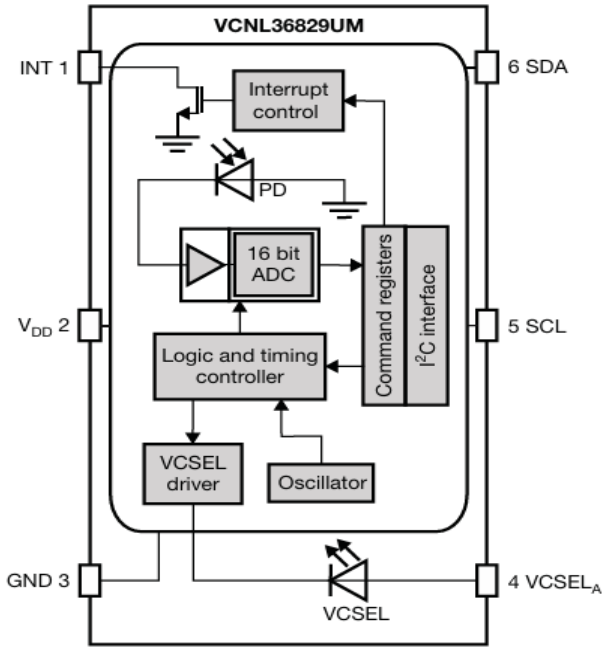
How the Product Works

VCNL36826M



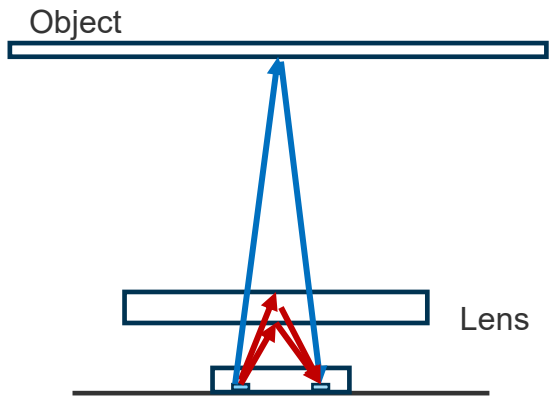
VCNL36829UM



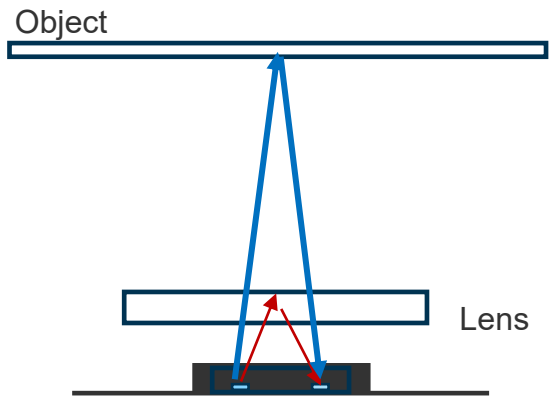


- An optical proximity sensor consists of several key components, including an application-specific integrated circuit (ASIC) with an integrated sensing area (PD, or photodiode), and an emitter side composed of either a vertical-cavity surface-emitting laser (VCSEL) or IR LED. An isolation wall is constructed between the ASIC and the emitter to minimize optical crosstalk. Both dies are mounted on a common substrate, with a clear molding and LCP cover attached on top of these components.

What Is the Application?



Poor SNR



Better SNR

Crosstalk (Noise)

Signal

$$\mathrm{SNR} = \frac{Signal}{(Crosstalk + Signal)}$$

Applications

- Smartphones: detect face proximity during calls
- Industrial automation: object counting, position sensing
- Consumer electronics: gesture control, lid detection
- Smart home: presence detection for lighting or HVAC

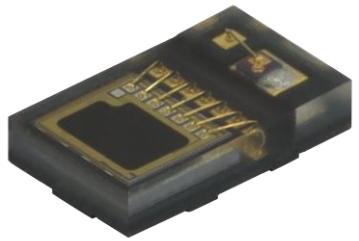
Advantages

- Vishay opto mobile sensors offer compact profile products with superior signal to noise performance, proprietary intellectual property (IP), and customized development tailored to customer requirements
- By leveraging Vishay's strong global sales channel coverage and combining it with an experienced technical team, we provide comprehensive support across hardware, software, and optical system design

How Does Our Solution Stand Out?

Key Parameters Comparison

	VCNL36826M	VCNL36829UM	JSA12xx
Function	Proximity Sensor+VCSEL	Proximity Sensor+VCSEL	Proximity Sensor+VCSEL
Package	2.55x2.05x1.0 mm	1.6x1x0.35 mm	2.05x1.05x0.5
Pin assignment	Unique	Pin to pin compatible with TMD 263x	Pin to pin compatible with TMD 263x
Detection Distance	20 cm	5 cm	n/a
Sensitivity	1x	16x	8x
(1)Power Consumption	15.25uA	10.80uA	33uA(Avg=0)
Low Power Mode	Available	Available	Available
Slave Address	x1	x2	x1
(2)Center to Center	1.08mm	0.85 mm	1.01
(3)Lens aperture (Dia.)	1.8mm	1.6mm	1.8
(4)Proximity Sensor SNR	4000%	180%	<150%
Proximity Sensor Resolution	12Bit	14bit	12Bit
(5)Code Vibration (Max-Min)	5	5	>300
Dynamical Range	1x, 2x	1x, 2x, 4x, 8x, 16x, 32x	x1~x8
Sunlight Protection	>200K Lux	>200K Lux	<90Klux
Proximity Sensor output code Rising under Sunlight	20%	4%	N/A



VCNL36829UM
Ultra thin package

Note: 1. Based on datasheeet and application note information.

2. Proximity Sensor Photodiode center to VCSEL die center

3. Consider the assembly tolerance +/-0.3mm, Photodiode size and the position of the VCSEL aperture.

4. SNR = (PS white card 3cm + Crosstalk) / Crosstalk ; Proximity Sensor test with a window cover.

5. Test under maximum gain

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AMERICAS SALES CONFERENCE

Success Stories

- Product categories: handheld devices, tablets, wearables, smart speakers, gaming consoles, smart accessories (soap dispensers, smart mirrors, displays, meters, lighting), TWS, e-cigarettes, doorbells, AR / VR / AI glass devices

- Customers including Samsung TWS VCNL36826x $5M (25M pcs), Meta VR VCNL36687S $6M (25M pcs), VCNL4040 (CM36686) $30M (100M pcs shipped) at Samsung, ASUS, Hisense, HTC, Lenovo, Acer, BENQ, Simple Human, Zebra, Sensus, Verkada, Valve, Meituan, Huawei, Eternity, Sony, Sharp, Xiaoyuan, and more

How to Win

1

Approaching New Requirements

What type of proximity detection do you need? (Near range 0-20cm, long range >20 cm, human presence or object recognition)

What environment will the sensor operate in? (indoor\Outdoor)

What mechanical or design constraints should the sensor support? (under glass, acrylic plastic...)

What performance characteristics are important for your application? (high detection accuracy, fast response time...)

2

Identify the Specification

What is the target detection distance? (< 20 cm-> SDPS, > 20 cm medium or LDPS)

Need an ambient light sensor? What's the view angle?

Package dimension, supply voltage, current consumption, sunlight condition check

3

Involve Strong Support Team

Optical simulation:
Mechanical design conditions including air gap in between sensor and lens, aperture dimension (optical simulation supported)

Software:
MCU \ CPU \ operation system, software driver requirements (driver development supported)

Focus Products

Consumer Electronic

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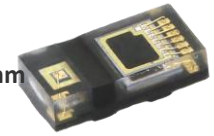
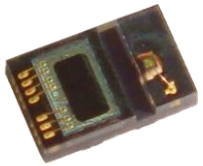
Short Distance Proximity Sensor Focus Products

	High SNR	Low power mode	High sunlight protection > 100K lux	3.3 V supply voltage	1.8 V supply voltage	1.8 V I²C I/O	1.2 V I²C I/O	Product positioning
VCNL36829UM 1.6 mm x 1.0 mm x 0.35 mm 		✓	✓		✓	✓	✓	World's smallest package for compact mechnical designs
VCNL36828P 2.0 mm x 1.0 mm x 0.5 mm 		✓	✓		✓	✓	✓	Competetively priced solution
VCNL36825T 2.0 mm x 1.25 mm x 0.5 mm 		✓	✓	✓		✓		3.3 V small package for multiple applications
VCNL36826M 2.55 mm x 2.05 mm x 1 mm 	✓	✓	✓	✓		✓		Best SNR performance, supports critial mechnical design and 20 cm detection distance

Note: All above products detection distance 5cm except VCNL36826M.

Applications

Wearing Detection

Wearing Detection

Indicator Light Blockage Detection

Wearing Detection

AI Glasses

Wearing Detection

Proximity Safety Protection

Hand Detection

Tobacco Stick Presence Detection

Proximity Sensing for Call Handling

Long Distance Proximity Sensors

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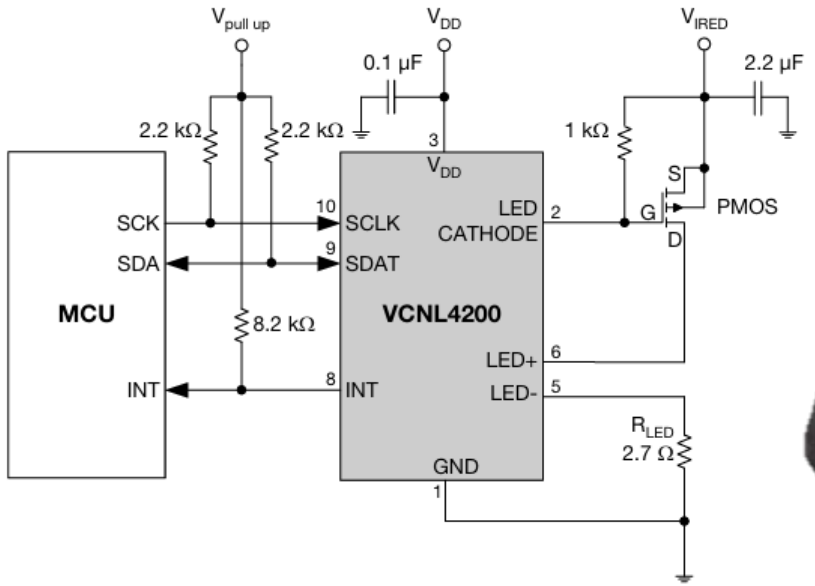
Long Distance Proximity Sensors

How the Product Works

- The long distance proximity sensor follows the same design concept as the short distance version. In most cases, it uses an IR LED instead of a VCSEL emitter to enable higher driving current, which supports longer detection distances. The package dimensions have been increased to significantly improve the signal to noise ratio (SNR), although lens design must also be considered

- In our design, higher driving current enables longer detection ranges. The ASIC supports an external driving current of up to 800 mA, allowing the sensor to achieve a detection distance of 1.5 meters. This makes it suitable for applications requiring extended proximity sensing capabilities



Dimensions (L x W x H in mm): 8.0 x 3.0 x 1.8

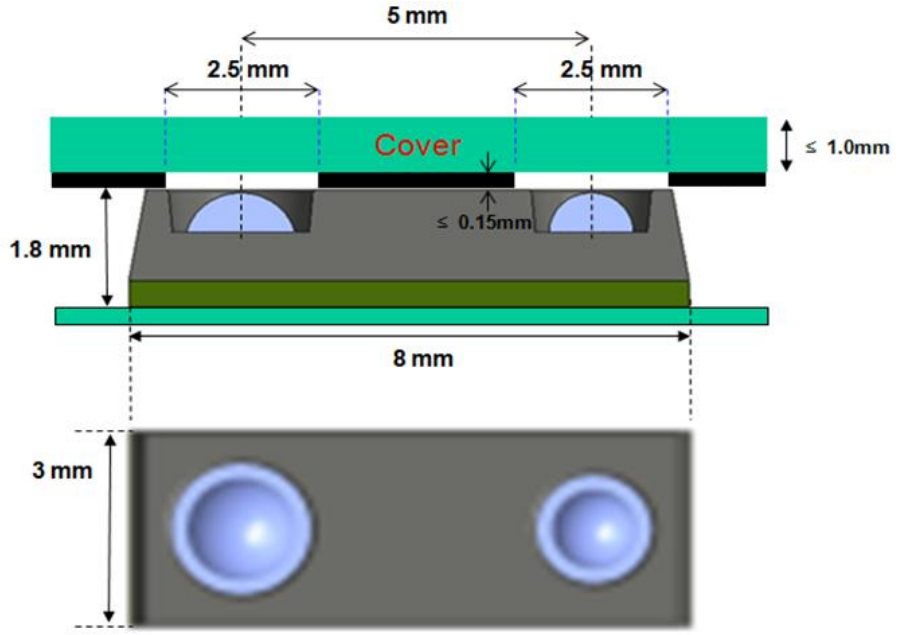
What Is the Application?

Applications

- Handheld \ tablet devices: detect face proximity for eye safety
- Industrial automation: object counting, position sensing
- Consumer electronics: human presence
- Smart home: presence detection for lighting or HVAC

Advantages

- Vishay is the only supplier offering long distance detection solutions in a single package with options to integrate light and color sensing functions
- In-house product portfolio provides wide flexibility for custom application solutions with external emitters
- By leveraging Vishay's strong global sales channel coverage and combining it with an experienced technical team, we provide comprehensive support across hardware, software, and optical system designs



How Does Our Solution Stand Out?

Key Parameters Comparison

	VCNL4040	VCNL4200	VCNL36758
Function	Ambient Light and Short Distance Proximity Sensor with IR LED	Ambient Light and Long Distance Proximity Sensor with IR LED	Medium Distance Proximity Sensor with IR LED
Package size	4 x 2 x 1.1 mm	8 x 3 x 1.8 mm	5 x 2 x 1.5 mm
Channels	Ambient Light, Clear, Proximity	Ambient Light, Clear, Proximity	Proximity
Supply voltage	3.3V	3.3V	3.3V
Supply current(IC) ALS (Ambient Light Sensor) PS (Proximity Sensor)	ALS 260uA PS 200uA ALS, PS 300uA	RGB, C, IR 213uA PS 300uA RGB, C, IR, PS 350uA	PS 300uA
Low power mode	n/a	n/a	n/a
Shut down current	<2uA	<2uA	<2uA
I2C voltage	3.3V	1.8V	1.8V
Slave address(7 bit)	0x60 (HEX)	0x51 (HEX)	0x60 (HEX)
ALS view angle	+-45 degree	+-30 degree	n/a
ALS(RGB) resolution	16 bit	16 bit	16 bit
Proximity Sensor detection distance(meter)	0.2M	1.5M	0.6M
LED driving current (maximum current)	200mA	800mA	200mA
Proximity Sensor external MOSFET	no need	Yes	no need
Proximity Sensor external MOSFET support	n/a	Yes	Yes or n/a
Proximity Sensor resolution	16-bit	16-bit	16-bit
Sunlight protection level	100Klux	60Klux	50Klux

LDPS VCNL4200
(Detection Distance ~ 150 cm)

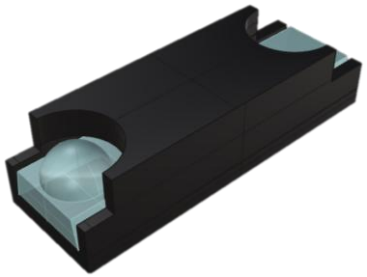
MDPS VCNL36758
(Detection Distance ~ 60 cm)

SDPS VCNL4040
(Detection Distance < 20 cm)

How Does Our Solution Stand Out?

Key Benefits

- Optimized ambient light sensor with a ± 45° viewing angle and high signal to noise ratio for proximity sensing, integrated in a 6.1 mm x 2.0 mm x 1.5 mm mold with cap-enhanced package
- Digital temperature sensor enables advanced safety monitoring across multiple applications
- Built-in current sink driver eliminates the need for external components
- Extended detection range achievable with the addition of an external MOSFET
- Robust immunity to outdoor environments exceeding 100K lux
- Compatible with low transmittance (dark) lens designs
- Detection distance of over 80 cm



VCNL36790 MDPS

VCNL36791 MDPS+RGB

VCNL36792 MDPS+ALS

Medium Distance Proximity, Ambient Light \ RGB and Temperature Sensor (plan to release in Q2, 2026)

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AMERICAS SALES CONFERENCE

Success Stories

- Product categories: rear-projecting TVs, monitors, laptops, tablets, smart speakers, home appliances (smart home displays, soap dispensers, smart mirrors, wall displays, electronic lock keypads, meters, lighting), industrial, AIOT devices

- LDPS customers including MSI, BENQ, TPV, Simple Human, Zebra, Sensus, Verkada, Valve, Vivint, Assa Abloy, BOE, NEC, Xiaoyuan, and more with the VCNL4200 (CM36781) $15M (20M pcs shipped)

How to Win

1

Approaching New Requirements

What type of proximity detection do you need? (Near range 0-20cm, long range >20 cm, human presence or object recognition)

What environment will the sensor operate in? (indoor\Outdoor)

What mechanical or design constraints should the sensor support? (under glass, acrylic plastic...)

What performance characteristics are important for your application? (high detection accuracy, fast response time...)

2

Identify the Specification

What is the target detection distance? (< 20 cm-> SDPS, > 20 cm medium or LDPS)

Need ambient light sensors? What your view angle?

Package dimensions, supply voltage, current consumption, sunlight condition check

Indoor \ outdoor \ sunlight conditions

3

Involve Strong Support Team

Optical simulation:
Mechanical design conditions including air gap in between the sensor and lens, and aperture dimension (optical simulation supported)

Software:
MCU \ CPU \ operation systems, software driver requirements (driver development supported)

Focus Products

Home Appliance and Industrial

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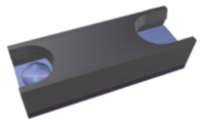
Long Distance Proximity Sensor Products

		Detection distance	Low power mode	High sunlight protection >100K lux	1.8 V supply voltage	External MOSFET	ALS View angle	Temperature sensor	Product positioning
VCNL36792 ALS+Proximity+Temperature Sensor+IR LED 6.1mm x 2.0 mm x 1.5 mm		>80 CM	✓	✓	✓		± 45°	✓	Next-generation long distance solution available for outdoor environments, low current consumption, and multiple applications
VCNL36758 Proximity+IR LED 5.0 mm x 2.0 mm x 1.0 mm x 1.5 mm		60 CM		50K Lux	✓		No ALS function		Medium distance proximity sensor solution with smaller package dimensions
VCNL4200 ALS+Proximity Sensor + IR LED 8.0 mm x 3.0 mm x 1.8 mm		100 – 150 CM		60K Lux		Must Need	± 30°		Curret main stream LDPS product with proven record
VCNL4040 ALS+Proximity+IR LED 4.0mm x 2.0 mm x 1 mm		20 CM		✓			± 45°		Small package for multiple applications for 20 CM detection distance request

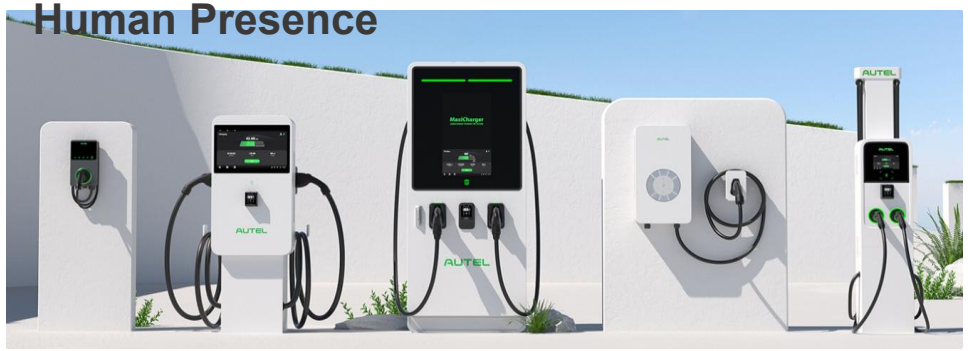
Note: VCNL4040 belongs to short distance proximity sensor in terms of detection distance point of view..

Applications

Human Presence Detection

Human Presence Detection

Cabinet Tamper Detection
Human Presence



Pet Presence Detection

Human Presence Detection

Human Presence Detection

More Mobile Sensors Products

Ambient Light, RGB, and Custom Under Display Sensors

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Ambient Light, RGB, and Under Display Sensors

TV

CM3232
2.95 mm x1.5 mm x1.5 mm
ALS side view

VEML3235
2.95 mm x 1.5 mm x 1.5 mm
ALS side view
OTP by customers

VEML3329
2.95 mm x1.5 mm x1.5 mm
RGB side view
OTP 32 bit (6.5 V)

VEML33293
2.95 mm x 1.5 mm x 1.5 mm
RGB side view
OTP 64 bit (6.5 V)

VEML33295
2.95 mm x 1.5 mm x 1.5 mm
RGB side view
MTP 64bits (3.3 V)

NB
Tablet

CM32181E
Low Power
0.04 lx/bit INT
2.35 mm x 1.8mm x 1mm
Tol ± 10 %
Intel ISS BOM

CM32183
Vdd 1.7 V ~ 3.6 V
0.003 lx/bit (100 ms) INT
2.35 mm x 1.8 mm x1 mm /
2 mm x 1.25 mm x 1 mm
Tol ± 10 %
Intel Catalog C1 pass

VEML3235O
Vdd 3 V
0.017 lx/bit (100 ms)
2 mm x 1.25 mm x 1 mm
Tol ± 5 %
Intel Catalog C2 pass

VEML32186
Low current consumption
ALS

VEML3328
R, G, B, C, and IR channels
Sensitivity 0.0125 lx/bit
Max detection 70K lx
2 mm x1.25 mm x 1 mm
Intel Catalog C1 pass

VEML33292P
R, G, B, C, IR channels
Sensitivity 0.0125 lx/bit
2 mm x1.25 mm x 1 mm
Intel Catalog C2 pass

VEML3330
X, Y, Z, IR channels
Sensitivity 0.045 lx/bit
2 mm x1.25 mm x 1 mm
Diffuser type package
Run for Intel Catalog test

Under Display

VCNL36892T
ALS+Proximity+VCSELs
Under display
5.5 mm x 2.4 mm x 1 mm

VEML32191\VEML33191
Low cost ALS\RGB
Under displah
3.34 mm x 1.36 mm x0.6 mm

Design Resources and Selling Tools

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Design Resources & Selling Tools

•Promotion Materials

Infographics (Optical)	Keyword and Part Number Search Results | Vishay
Data sheet/ pplication Note (VCNL36826M)	Keyword and Part Number Search Results | Vishay
Did you know (Optical)	Keyword and Part Number Search Results | Vishay
Did You Know? Dual Slave Address Function: SWAP	https://www.vishay.com/docs/47032/ms40309318_dual-slave-address-function-swap.pdf
Did You Know? Low Power - 6 µA Proximity Sensing	https://www.vishay.com/docs/48814/ms27275316_didyouknow_low_power_proximity_sensing.pdf
Did You Know? VCNL36828P Key Benefits and Applications	https://www.vishay.com/docs/48932/ms33513572-25xx-did_you_know-vcnl36828p.pdf
Did You Know - Window Design for Optical Sensors	https://www.vishay.com/docs/49890/_ms7505.pdf
Did You Know? The Importance of Optical Simulation	https://www.vishay.com/docs/47034/ms40309167_importance_of_optical_simulation.pdf
Did You Know? - Optical Switching Solutions	https://www.vishay.com/docs/48813/ms27697797_optical_switching_solutions.pdf

•Sample Boards, Design Kits, etc

Optical Sensors	https://www.vishay.com/en/optical-sensors/
Optical Sensors - Proximity	https://www.vishay.com/en/optical-sensors/reflective-outputis-16/
Sensor Xplorer	https://www.vishay.com/en/landingpage/SensorXplorer/
Sample and Sensor Board- Inventory Search (VCNL4200)	https://www.vishay.com/search/?type=inv&query=VCNL4200

Design Resources and Selling Tools

Optical Simulation Support

TracePro

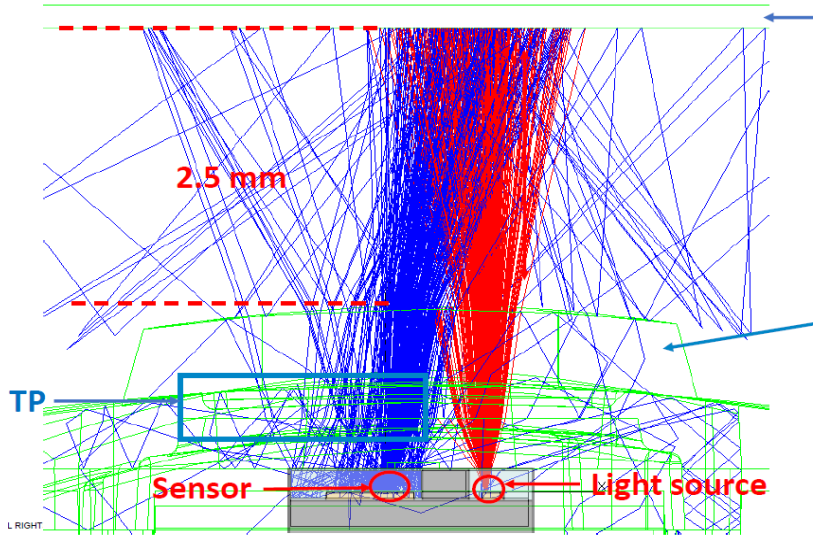
Software for design and analysis of illumination and optical systems.

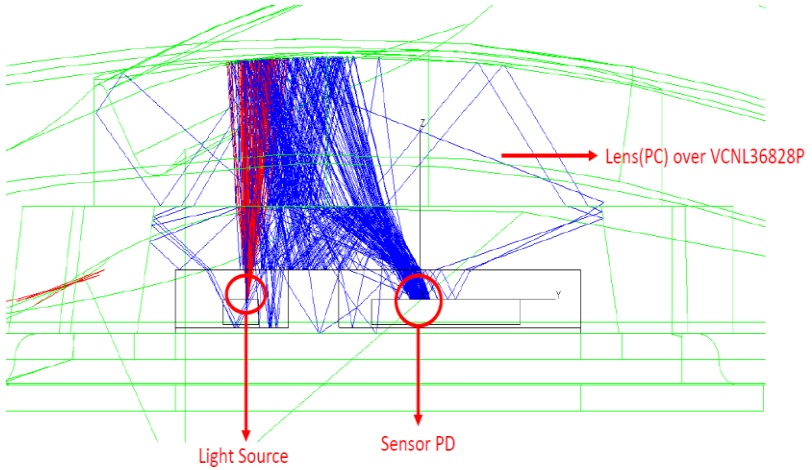
Software: TracePro

Request: 3D file.
STEP (.stp / .step).
IGES (.igs / .iges)

Nice to have: Material & surface properties
(refraction, reflection, absorption, wavelength, scattering)

Did You Know - The importance of Optical Simulation
https://www.vishay.com/docs/47034/ms40309167_importance_of_optical_simulation.pdf

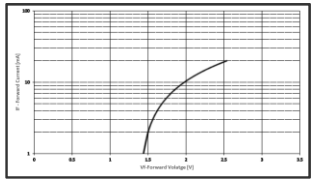




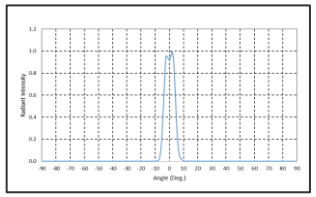
Technical Support Tools

Proximity Sensor Equipment for Emitter Test

VCSEL & LED IV curve

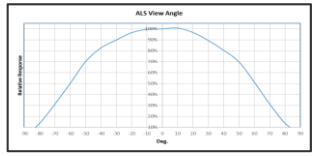



LED / VCSEL Profile

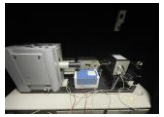
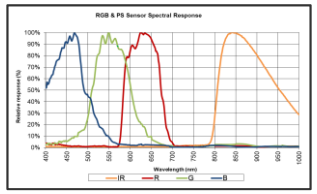



Proximity Sensor Equipment Test for Receiver Test

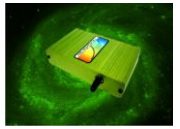
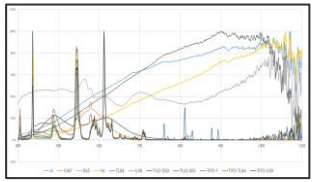
PD view angle

PD spectrum

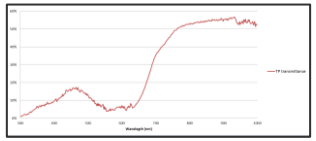
Light source spectrum

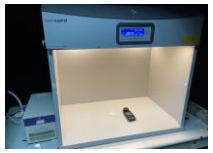
Proximity Sensor Equipment for Application Test

Transmittance



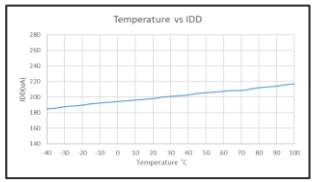


Light box and lux meter



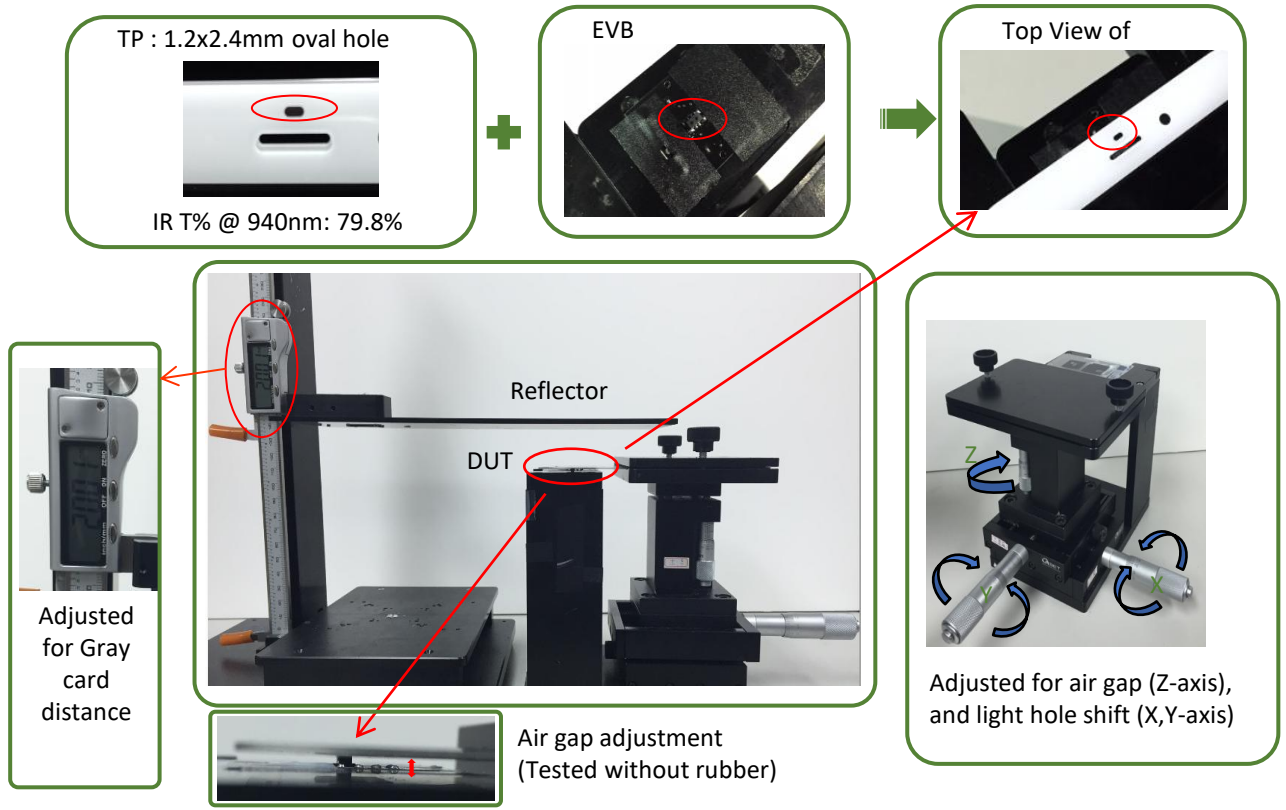
Provide 7 light sources
TL84 / D65 / A / U30
CWF / HZ / UVA

Temperature test

Technical Support Tools

Proximity Sensor Equipment for SNR Test



Air Gap	Crosstalk	PS (Gray @30mm)	30mm PS Code (THD_L)	THD_L SNR >125%	PS (Gray @20mm)	20mm PS Code (THD_H)	THD_H SNR >200%
0.1mm	36	171	135	475%	332	296	922%
0.2mm	51	187	136	367%	349	298	684%
0.3mm	69	203	134	294%	368	299	533%
0.4mm	86	221	135	257%	383	297	445%
0.5mm	105	238	133	227%	395	290	376%

Mobile Sensors Application Board

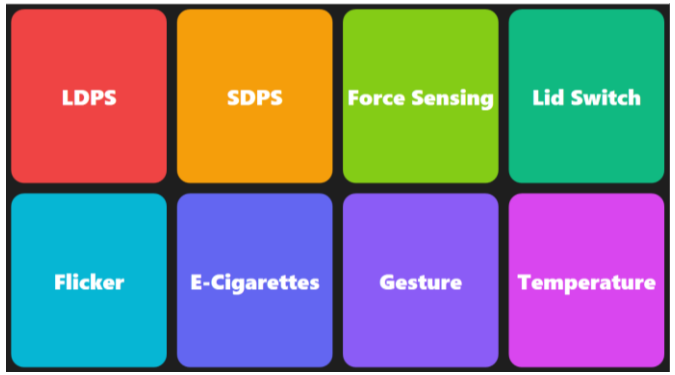
The **Application Board** offers a comprehensive, one-stop shopping experience for our customers, showcasing a wide range of consumer sensor applications. These include:
•Long distance proximity
•Short distance proximity
•Force sensing
•Lid switch
•Flicker detection
•E-cigarettes
•Gesture recognition
•Temperature sensing

Each function is supported by interchangeable product daughter boards, and individual functions can be independently controlled via a notebook PC through a bridge interface. This provides maximum flexibility for product demonstration and promotion.

The Application Board is ideal for branding, ODM / OEM, and innovative customers who are interested in designing diverse features across multiple applications. It is designed to meet a wide range of requirements in one platform.

We received **positive feedback** from the **training held in Shanghai, China on July 15**, which included attendees from the following distributors:
Future, Avnet, Arrow, TTI, Weikeng, Galaxy/WT/PNS/Comtech, Zenitron, and Holder.

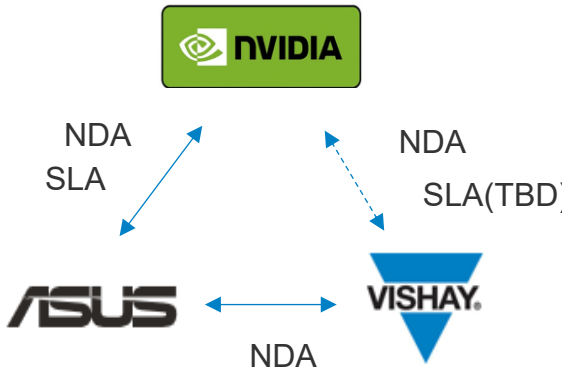
The training focused on supporting **regional marketing managers, sales, and distributor engineers** who are dedicated to or interested in promoting consumer sensor products. The goal is to build an extended technical support team to drive more design wins and grow business opportunities.

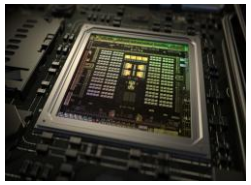


Global Consumer Sensors Reference Design for AI Projects

Project name	H7407BA/ H7607BA	N7607BA	H7407IA/ H7607IA	S5406IA	N7607IA	HT7407IA
Part number	VEML3328	VEML3328	VEML3328	VEML3328	VEML3328	VEML33292P
Design team	In house	ODM IEC	In house	ODM Pegatron	ODM IEC	In house
Platform	N1x	N1x	N1	N1	N1	N1
Status	*ER build expected on end of Jun.	ME review ok	ME review ok	ME review ok	ME review ok	ME review ok

*Due to Nvidia platform have some issue, the project MP schedule expected delayed to 26Q1.





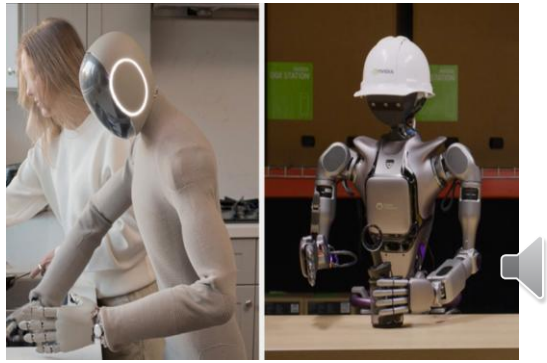
(Image credit: Nvidia)

NVIDIA is collaborating with **MediaTek** on this new endeavor—high end N1x and mid-tier N1 (non-X) chipsets are reported to be built on Team Green's recent **Blackwell** architecture.

The mobile sensor team is working with Asustek to port the VEML3328 / VEML3392P driver / tool to Nvidia's new platform to get more Nvidia laptop opportunity.

In the meantime, Vishay and Nvidia will try to establish direct contact for further cooperation.
(Processing the NDA with Nvidia. Targeting to sign software license agreement (SLA) for more reliable sensor partnership)

NVIDIA Platform	Form Factor	Primary Use/Application Areas
GeForce RTX (30/40)	GPU (discrete in PCs/laptops)	AI notebooks, Consumer AI (LLMs, image gen), Gaming + Creation
NVIDIA Studio	Software stack (on RTX GPUs)	Content creators using AI tools, AI-enhanced video/image/animation
RTX A-Series (e.g., A2000–A5000)	Mobile & desktop workstation GPUs	Engineering, simulation, Portable AI dev, CAD, ML prototyping
Jetson Nano / Orin / Xavier	SoC/dev board (embedded)	IoT & Edge AI, Smart cameras, Robotics, drones, Light sensor apps
NVIDIA N1 / N1X (w/ MediaTek)	Arm SoC for laptops/desktops	AI PC (Windows-on-ARM), Efficient mobile inference, OEM AI laptops
NVIDIA DRIVE	Automotive platform (SoC + SW)	Autonomous vehicles (ADAS), Sensor fusion, In-cabin AI
NVIDIA IGX	Industrial AI edge module	Factory automation, Industrial vision, High-reliability AI edge compute
NVIDIA Grace / Grace Hopper	Data center/server CPU-GPU	AI supercomputing, Model training (LLMs), Cloud inference
NVIDIA BlueField (DPUs)	SmartNIC / DPU for data centers	Secure cloud networking, Zero-trust data movement, AI-based telemetry



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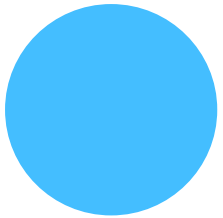

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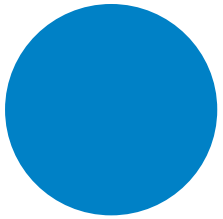

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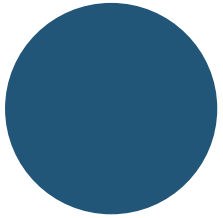

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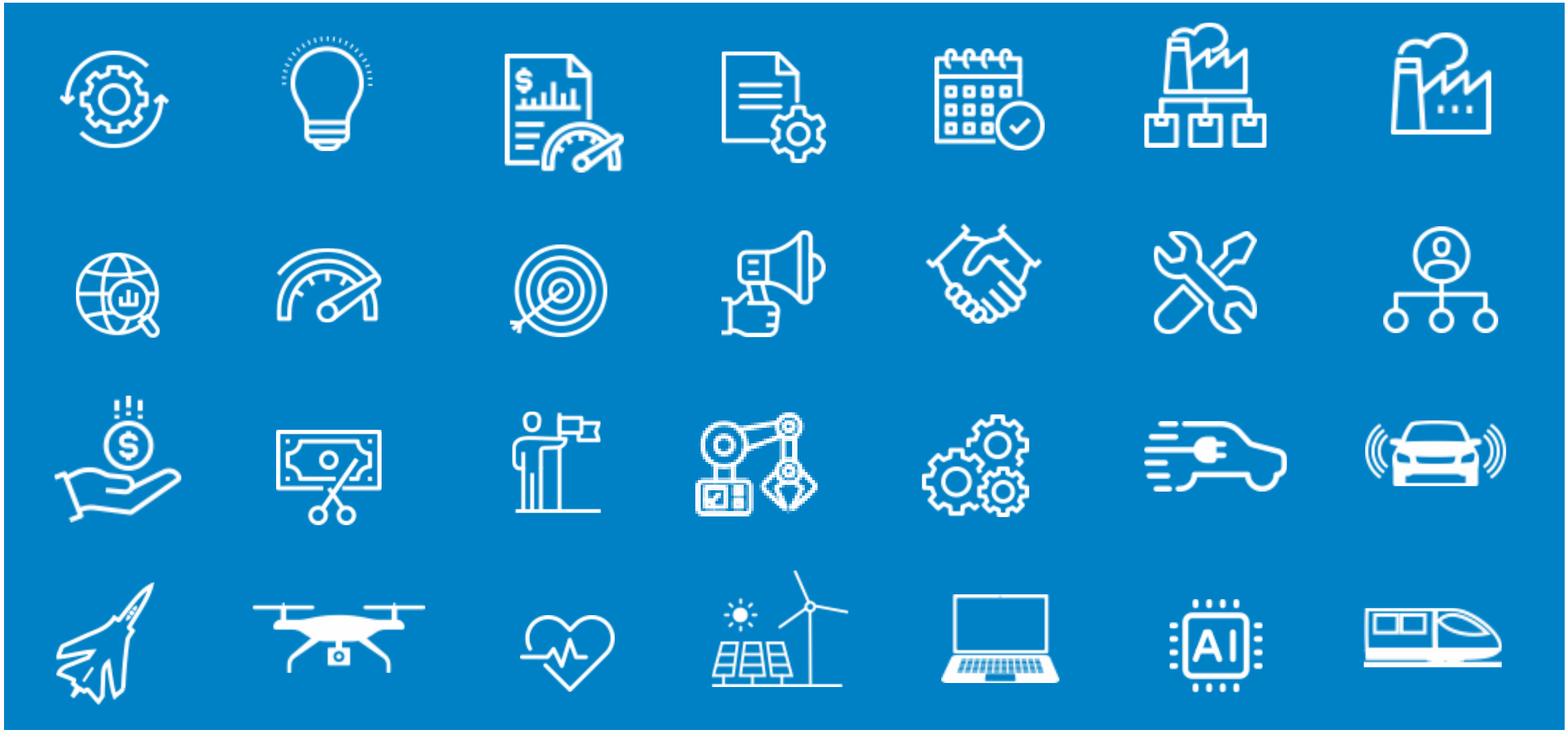

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