



# OPTOELECTRONICS

## Guide to Industrial Applications



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For the most recent list of Optoelectronics devices visit <http://www.vishay.com/optoelectronics>





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### Introduction

As one of the world’s leading suppliers of infrared emitters, photo detectors, optocouplers, and optical sensors, Vishay Intertechnology offers an extraordinarily broad portfolio of optoelectronic products. Whether you require the high speed of a PIN photodiode, the sensitivity of an ambient light sensor, the intensity of a surface emitter, the optical isolation of an optocoupler, or object detection with a reflective or transmissive sensor, Vishay has a solution. Behind these products stands a vertically integrated optoelectronics company with over 30 years of experience in emitter and detector die fabrication and packaging. This guide provides product recommendations for key applications.

### Applications

There are literally thousands of applications that use an infrared emitter, photo detector, or optical sensor. Twelve key applications will be covered in the following pages.

- Illumination
- Smoke and Flame Detectors
- Long-Range Presence and Proximity
- Short-Range Presence and Proximity
- Ambient Light Sensors
- Touch Control
- Safety Barriers / Light Curtains
- Motor Control AC Variable-Speed Industrial Drives
- Remote Control
- Data Transmission
- Isolated Industrial Communications



### Illumination

Security cameras are nearly everywhere, and where they are not, they soon will be. Most crimes are committed after dark. Security cameras need infrared illumination to be effective at night. To illuminate the field of view of the cameras, infrared emitters may be on for up to 16 hours per day. The two critical performance factors used in choosing an infrared emitter are radiant intensity and degradation. High radiant intensity yields longer illumination distance and greater resolution. Low degradation minimizes resolution loss over time. If the emitters degrade, resolution and range are reduced, which makes the cameras less effective.



### Industry's Best Performing 5 mm Emitters

Vishay's TSHG5210 and TSHG5410 infrared emitters outperform the competition in radiant intensity and minimum degradation. Adding to their competitive edge, the TSHG5210 and TSHG5410 can be driven at 100 mA DC, while the competition recommends only 50 mA. The peak wavelength of these emitters is 850 nm, matched to security camera sensors.

|                             | Competitors |     |     | Vishay                   |                          |
|-----------------------------|-------------|-----|-----|--------------------------|--------------------------|
|                             | A           | B   | C   | <a href="#">TSHG5210</a> | <a href="#">TSHG5410</a> |
| Intensity (mW/sr)           | 171         | 107 | 130 | 230                      | 90                       |
| 4000 h Degradation (100 mA) | up to 60 %  |     |     | < 5 %                    | < 5 %                    |

### Closed Circuit TV in HD

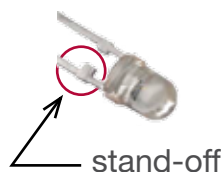
One SurfFlight VSMY7850X01 can replace anywhere from 10 to 20 standard 5 mm emitters currently used in today's cameras. Instead of 40 emitters, security cameras will have only 4. The field of view can remain the same or can be tailored using external lenses to achieve HD resolution.

### Additional Applications

- Automotive
  - Drowsy driver
  - Illumination for heads-up display
- Machine vision

### Emitters

| Mounting     | Package      | Part Number                 | Angle of Half Intensity (±°) | Radiant Intensity (mW/sr) | Rise and Fall Time (ns) | Peak Wavelength (nm) |
|--------------|--------------|-----------------------------|------------------------------|---------------------------|-------------------------|----------------------|
| Through-hole | 5 mm         | <a href="#">TSHG5210</a>    | 10                           | 230                       | 20                      | 850                  |
|              |              | <a href="#">TSHG5410</a>    | 18                           | 90                        | 20                      | 850                  |
|              |              | <a href="#">TSHG6210</a>    | 10                           | 230                       | 20                      | 850                  |
|              |              | <a href="#">TSHG6410</a>    | 18                           | 90                        | 20                      | 850                  |
| SMD          | Dome lens    | <a href="#">VSMY2850</a>    | 10                           | 90                        | 10                      | 850                  |
|              | PLCC-2       | <a href="#">VSMY3850</a>    | 60                           | 150                       | 15                      | 850                  |
|              | Little Star® | <a href="#">VSMY7850X01</a> | 60                           | 170                       | 20                      | 850                  |
|              |              | <a href="#">VSMY7852X01</a> | 60                           | 42                        | 15                      | 850                  |



Stand-offs limit how far the lead can be inserted in the through-hole of the PCB. The TSHG5xxx emitters feature a stand-off.



# OPTOELECTRONICS

## Guide to Industrial Applications

### Smoke and Flame Detection

Depending on the combustible material, a fire emits light in multiple spectrums: ultraviolet (UV), visible, near infrared, and far infrared. Standard smoke detectors used in homes operate on a reflective technology where the smoke particles reflect infrared light that is then received by a photo detector. Consumer smoke detectors use 5 mm emitters with a peak wavelength of 940 nm. Recent studies indicate that the shorter wavelength of 870 nm can be more effective at detecting particles. In industrial applications where the combustible material varies widely, multiple sensing technologies are used.



### TEMD5080X01 Product Focus

For sensing UV, visible, and infrared light, the TEMD5080X01's overall spectral sensitivity range of 350 nm to 1100 nm includes UV radiation, visible light, and near-infrared radiation. The TEMD5080X01 is a PIN photodiode with 300 % higher UV sensitivity at 400 nm compared to standard PIN photodiode chip technology.

### Photo Detectors

#### New Products

##### VSLY5850 – 5 mm emitter

- 850 nm peak wavelength
- $\pm 3^\circ$  angle of half intensity
- 600 mW/sr at 100 mA
- $I_e = 6.0$  mW/sr at 1 A
- $I_v = 55$  mW at 100 mA



##### VBPW34FAS, -SR

- Direct replacement for Osram parts
- Lower forward voltage of 1.0 V
- Wider angle of half sensitivity of  $\pm 65^\circ$



| Mounting     | Package   | Part Number                 | Angle of Half Sensitivity ( $\pm^\circ$ ) | Photo Current | Spectral Sensitivity (nm) | Peak Wavelength (nm) |
|--------------|-----------|-----------------------------|---|---------------|---------------------------|----------------------|
| Through-hole | 5 mm      | <a href="#">BPV10NF</a>     | 20  | 60 mA         | 790 to 1050               | 940                  |
|              |           | <a href="#">BPV22NF</a>     | 60  | 85 ( $\mu$ A) | 790 to 1050               | 940                  |
| SMD          | SMD       | <a href="#">VBPW34FAS</a>   | 65  | 55 ( $\mu$ A) | 780 to 1050               | 950                  |
|              |           | <a href="#">VBP104FAS</a>   |   | 35 ( $\mu$ A) | 780 to 1050               | 950                  |
|              |           | <a href="#">TEMD5080X01</a> |   | 60 ( $\mu$ A) | 350 to 1100               | 940                  |
|              | Dome lens | <a href="#">VEMD2020X01</a> | 12  | 12 ( $\mu$ A) | 750 to 1050               | 950                  |
|              |           | <a href="#">VEMD2000X01</a> | 12  | 12 ( $\mu$ A) | 750 to 1050               | 950                  |



### Emitters

| Mounting     | Package   | Orientation      | Part Number                 | Angle of Half Intensity ( $\pm^\circ$ ) | Radiant Intensity (mW/sr) | Rise and Fall Time ( $\mu$ s) | Peak Wavelength (nm) |
|--------------|-----------|------------------|-----------------------------|---|---------------------------|-------------------------------|----------------------|
| Through-hole | 5 mm      | Top view         | <a href="#">VSLY5850</a>    | 3                                       | 600                       | 20                            | 850                  |
|              |           | Top view         | <a href="#">TSFF5210</a>    | 10                                      | 180                       | 15                            | 870                  |
|              |           | Top view         | <a href="#">TSAL6100</a>    | 10                                      | 130                       | 800                           | 940                  |
| SMD          | Dome lens | Reverse gullwing | <a href="#">VSMB2000X01</a> | 12                                      | 40                        | 15                            | 940                  |
|              |           | Gullwing         | <a href="#">VSMB2020X01</a> | 12                                      | 40                        | 15                            | 940                  |
|              |           | Gullwing         | <a href="#">VSMY2850G</a>   | 10                                      | 100                       | 10                            | 850                  |
|              |           | Reverse gullwing | <a href="#">VSMY2850RG</a>  | 10                                      | 100                       | 10                            | 850                  |



## Data Transmission

Transferring large amounts of data via infrared over long ranges requires an array of high-intensity emitters with extremely fast switching times to enable data communication at speeds up to 16 Mbit/s. Whether the application is infrared payment at toll collect stations like those found in Germany, Singapore, and Malaysia, or sending signals to infrared headphones for the hearing impaired in museums, concert halls, and other public venues, fast switching times are the key product parameter.



### VSMF4720 and TSFF5510 Product Focus

For toll collect systems, Vishay introduced the VSMF4720, an 870 nm SMD infrared emitter with the industry's lowest forward voltage and highest radiant intensity of any such device in the PLCC2 package. In a leaded device, Vishay offers the TSFF5510, which has a viewing angle of  $\pm 38^\circ$ , enabling significantly better performance than standard 5 mm emitters. The combination of a wide viewing angle, high drive currents up to 1 A, and high switching speeds makes the VSMF4720 and TSFF5510 infrared emitters ideal for infrared data, audio, and video transmission.

#### VSMF4720 – PLCC2

- $\pm 60^\circ$  angle of half intensity
- $I_e = 16 \text{ mW/sr}$  at 100 mA
- Switching at 15 ns



#### TSFF5510 – 5 mm

- $\pm 38^\circ$  angle of half intensity
- $I_e = 32 \text{ mW/sr}$  at 100 mA
- Switching at 15 ns



#### New Products

- TSFF5410  $\varphi = \pm 22^\circ$
- TSFF5210  $\varphi = \pm 10^\circ$
- VSMF4710 (870 nm)

## Photo Detectors

| Mounting | Package                   | Part Number                 | Angle of Half Sensitivity ( $\pm^\circ$ ) | Data Rate                   |      | Transmit Range |      | Peak Wavelength (nm) | Spectral Bandwidth (nm) | Photo Current |                  |
|----------|---------------------------|-----------------------------|---|-----------------------------|------|----------------|------|----------------------|-------------------------|---------------|------------------|
|          |                           |                             |   | Low                         | High | Short          | Long |                      |                         |               |                  |
| SMD      | 0805                      | <a href="#">TEMD7100X01</a> | 65  | X                           | X    | X              |      |                      |                         |               |                  |
|          | Dome lens                 | <a href="#">VEMD20..X01</a> |   |                             | X    | X              |      |                      |                         |               |                  |
|          | SMD                       |                             |   | <a href="#">TEMD5110X01</a> |      | X              |      | X                    | 940                     | 790 to 1050   | 55 $\mu\text{A}$ |
|          |                           |                             |   | <a href="#">TEMD5120X01</a> |      | X              |      | X                    | 940                     | 790 to 1050   | 35 $\mu\text{A}$ |
|          |                           |                             |   | <a href="#">VBPW34FAS..</a> |      | X              |      | X                    | 950                     | 780 to 1050   | 55 $\mu\text{A}$ |
|          |                           |                             |   | <a href="#">VBP104FAS..</a> |      | X              |      | X                    | 950                     | 780 to 1050   | 35 $\mu\text{A}$ |
| PLCC-2   | <a href="#">VEMT3700F</a> | 60                          | X   |                             | X    |                | 940  | 850 to 1050          | 0.5 mA                  |               |                  |



## Emitters

| Mounting     | Package   | Part Number                    | Angle of Half Sensitivity ( $\pm^\circ$ ) | Data Rate |      | Transmit Range |      | Peak Wavelength (nm) | Radiant Intensity (mW/sr) | Rise and Fall Time (ns) |
|--------------|-----------|--------------------------------|---|-----------|------|----------------|------|----------------------|---------------------------|-------------------------|
|              |           |                                |   | Low       | High | Short          | Long |                      |                           |                         |
| SMD          | 0805      | <a href="#">VSMB1940X01</a>    | 60  | X         |      | X              |      | 940                  | 6                         | 15                      |
|              |           | <a href="#">VSMY1850</a>       |   | X         |      | X              |      | 850                  | 15                        | 10                      |
|              | PLCC-2    | <a href="#">VSML3710</a>       | 60  | X         |      | X              |      | 940                  | 8                         | 500                     |
|              |           | <a href="#">VSMB3940X01</a>    |   | X         | X    | X              |      | 940                  | 13                        | 15                      |
|              |           | <a href="#">VSMF4710</a>       |   | X         | X    | X              | X    | 870                  | 10                        | 15                      |
|              |           | <a href="#">VSMF4720</a>       |   | X         | X    | X              | X    | 870                  | 16                        | 15                      |
|              | Dome lens | <a href="#">VSMB20..X01</a>    | 12  | X         | X    | X              | X    | 850                  | 40                        | 15                      |
|              |           | <a href="#">VSMG20...X01</a>   | 12  | X         | X    | X              | X    | 850                  | 35                        | 20                      |
|              |           | <a href="#">VSMY2850G, -RG</a> | 10  | X         | X    | X              | X    | 850                  | 100                       | 15                      |
| Through-hole | 5 mm      | <a href="#">TSFF5210</a>       | 10  | X         | X    | X              | X    | 870                  | 180                       | 15                      |
|              |           | <a href="#">TSFF5410</a>       | 22  | X         | X    | X              | X    | 870                  | 70                        | 15                      |
|              |           | <a href="#">TSFF5510</a>       | 38  | X         | X    | X              | X    | 870                  | 32                        | 15                      |



### Infrared Remote Control

Vishay is the world's leading supplier of remote control receivers used in the consumer electronics and light industrial markets. No other supplier offers a similar breadth of products, holders, application and technical support, and overall knowledge of infrared communication. Our customers have confidence that our IR receivers will receive the remote control signals while filtering out noise in the most demanding ambient environments. Vishay's IR receivers are used for remote control, 3D active glasses synchronization, and for transmissive and reflective sensors.



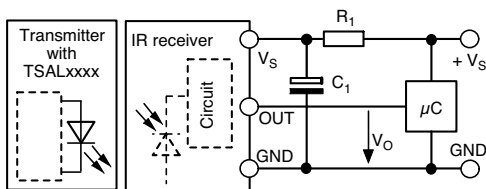
### VSLB3940 and VSLB3948

Every remote control receiver needs an infrared emitter. Vishay has recently introduced a series of 3 mm diameter emitters with performance characteristics comparable to leading 5 mm emitters. The new VSLB3940 and VSLB3948 infrared emitters features an on-axis radiant intensity of 65 mW/sr and optical power of 40 mW at 100 mA — which represents about an 8 % performance improvement over the larger, 5 mm TSAL6200 in a 40 % smaller form factor.

### Emitters

| Part Number                | Peak Wavelength (nm) | Package    | Intensity (mW/sr) | Angle of Half Intensity ( $\pm^\circ$ ) | Rise / Fall Time (ns) |
|----------------------------|----------------------|------------|-------------------|---|-----------------------|
| <a href="#">TSAL6100</a>   | 940                  | 5 mm (T1¾) | 170               | 10                                      | 15                    |
| <a href="#">TSAL6200</a>   | 940                  | 5 mm (T1¾) | 60                | 17                                      | 800                   |
| <a href="#">TSAL4400</a>   | 940                  | 5 mm (T1¾) | 15                | 18                                      | 800                   |
| <a href="#">VSLB3940</a>   | 940                  | 3 mm (T1)  | 70                | 19                                      | 30                    |
| <a href="#">VSMB2948SL</a> | 940                  | Side View  | 20                | 25                                      | 15                    |

A - Forward voltage at 100 mA












$R_1$  and  $C_1$  are recommended for protection against EOS. Components should be in the range of  $33 \text{ W} < R_1 < 1 \text{ kW}$ ,  $C_1 > 0.1 \text{ }\mu\text{F}$ .



## Infrared Remote Control

### IR Receivers for Remote Control

| Code, Applications              | Carrier Freq. (kHz) | Best AGC |  |  |  |  |  |  |  |  |  |
|---------------------------------|---------------------|----------|---|---|---|---|---|---|---|---|---|
|                                 |                     |          | VSOP<br>2.0W x 2.0H<br>x .76D<br>(mm)   | Belobog<br>3.95W x 3.95H<br>x .8D (mm)  | Belobog<br>Shield<br>4.3W x 4.3H<br>x 1.0D<br>(mm)                                | Heimdall<br>No-lens<br>6.8W x 3.0H x<br>2.3D<br>(mm)                              | Heimdall<br>6.8W x 3.0H<br>x 3.2D<br>(mm)   | Panhead<br>7.5W x 5.3H<br>x 4.0D<br>(mm)  | Mold<br>6.0W x 6.95H<br>x 5.6D<br>(mm)  | Minicast<br>5.0W x 6.95H<br>x 4.8D<br>(mm)  | Cast<br>10W x 12.5H x<br>5.8D<br>(mm)   |
| Sony SIRCS<br>15 and 20 bit     | 40                  | 2        |   |   |   | <a href="#">TSOP75S40FW</a>   | TSOP75S40F  |   |   |   |   |
| Sony 12 bit                     |                     | 4        |   |   |   | <a href="#">TSOP75S40FW</a>   | TSOP75S40F  |   |   |   |   |
| RC-5                            | 36                  | 4        |   |   |   | <a href="#">TSOP75436W</a>  | <a href="#">TSOP75436</a>   | <a href="#">TSOP36436</a>   | <a href="#">TSOP34436</a>   | <a href="#">TSOP38436</a>   | <a href="#">TSOP31436</a>   |
| RC-6                            | 36                  |          | <a href="#">VSOP58436</a>   | <a href="#">TSOP37436</a><br><a href="#">TSOP57436</a>                            | <a href="#">TSOP37436H</a><br><a href="#">TSOP57436H</a>                          | <a href="#">TSOP77436W</a>  | <a href="#">TSOP77436</a>   | <a href="#">TSOP6436</a>  | <a href="#">TSOP4436</a>  | <a href="#">TSOP58436</a>   |   |
| Panasonic                       | 36.7                |          |   |   |   |   |   |   |   |   |   |
| NEC                             | 38                  | 4        |   |   |   | <a href="#">TSOP75438W</a>  | <a href="#">TSOP75438</a>   | <a href="#">TSOP36438</a>   | <a href="#">TSOP34438</a>   | <a href="#">TSOP38438</a>   | <a href="#">TSOP31438</a>   |
| Sharp                           |                     |          | <a href="#">VSOP58438</a>   | <a href="#">TSOP37438</a><br><a href="#">TSOP57438</a>                            | <a href="#">TSOP37438H</a><br><a href="#">TSOP57438H</a>                          | <a href="#">TSOP77438W</a>  | <a href="#">TSOP77438</a>   | <a href="#">TSOP6438</a>  | <a href="#">TSOP4438</a>  | <a href="#">TSOP58438</a>   |   |
| r-step                          |                     |          |   |   |   |   |   |   |   |   |   |
| r-step                          | 56                  | 4        |   | <a href="#">TSOP57456</a>   | <a href="#">TSOP37456H</a><br><a href="#">TSOP57456H</a>                          | <a href="#">TSOP75456W</a>  | <a href="#">TSOP75456</a>   | <a href="#">TSOP36456</a>   | <a href="#">TSOP34456</a>   | <a href="#">TSOP38456</a>   | <a href="#">TSOP31456</a>   |
| Thomson RCA                     |                     |          |   |   |   | <a href="#">TSOP77456W</a>  | <a href="#">TSOP77456</a>   | <a href="#">TSOP6456</a>  | <a href="#">TSOP4456</a>  | <a href="#">TSOP58456</a>   |   |
| MCIR                            | 36                  | 3 or 5   | <a href="#">VSOP38336</a>   | <a href="#">TSOP37336</a><br><a href="#">TSOP57336</a>                            | <a href="#">TSOP37336H</a><br><a href="#">TSOP57336H</a>                          | <a href="#">TSOP75536W</a><br><a href="#">TSOP77336W</a>                          | <a href="#">TSOP75536</a><br><a href="#">TSOP77336</a>                            | <a href="#">TSOP36536</a><br><a href="#">TSOP6336</a>                               | <a href="#">TSOP34536</a><br><a href="#">TSOP4336</a>                               | <a href="#">TSOP38536</a><br><a href="#">TSOP58336</a>                              | <a href="#">TSOP31536</a><br><a href="#">TSOP31336</a>                              |
| Mitsubishi                      | 38                  | 3 or 5   | <a href="#">VSOP38338</a>   | <a href="#">TSOP37338</a><br><a href="#">TSOP57338</a>                            | <a href="#">TSOP37338H</a><br><a href="#">TSOP57338H</a>                          | <a href="#">TSOP75538W</a><br><a href="#">TSOP77338W</a>                          | <a href="#">TSOP75538</a><br><a href="#">TSOP77338</a>                            | <a href="#">TSOP36538</a><br><a href="#">TSOP6338</a>                               | <a href="#">TSOP34538</a><br><a href="#">TSOP4338</a>                               | <a href="#">TSOP38538</a><br><a href="#">TSOP58338</a>                              | <a href="#">TSOP31538</a><br><a href="#">TSOP31338</a>                              |
| RECS-80 Code                    |                     | 3 or 5   |   |   |   |   |   |   |   |   |   |
| r-map                           |                     | 3 or 5   |   |   |   |   |   |   |   |   |   |
| XMP-1, XMP-2                    | 38                  | 3        | <a href="#">VSOP38338</a>   | <a href="#">TSOP57338</a>   | <a href="#">TSOP57338H</a>  | <a href="#">TSOP75338W</a>  | <a href="#">TSOP75338</a>   | <a href="#">TSOP36338</a>   | <a href="#">TSOP34338</a>   | <a href="#">TSOP38338</a>   | <a href="#">TSOP31338</a>   |
| Presence sensor<br>(Fixed gain) | 38                  | ---      |   | <a href="#">TSSP57038</a>   | TSSP57038H  |   |   | <a href="#">TSSP6038</a>  | <a href="#">TSSP4038</a>  | <a href="#">TSSP58038</a>   |   |
| Proximity sensor                | 38                  | ---      |   | <a href="#">TSSP57P38</a>   | TSSP57P38H  |   |   | <a href="#">TSSP6P38</a>  | <a href="#">TSSP4P38</a>  | <a href="#">TSSP58P38</a>   |   |
| Code Learning/<br>Repeater      | carrier<br>out      | ---      |   |   |   |   | <a href="#">TSMP77000</a>   | <a href="#">TSMP6000</a>  |   | <a href="#">TSMP58000</a>   |   |
|                                 |                     | ---      |   |   |   |   |   |   | <a href="#">TSMP4138</a>  | <a href="#">TSMP58138</a>   |   |
|                                 |                     | ---      |   |   |   |   |   |   | <a href="#">TSMP4138</a>  |   | <a href="#">TSMP1138</a>  |

Note: Part dimensions shown in millimeter (mm)

## Meters

Electric, gas, and water meters use optoelectronic components to measure usage by monitoring an encoding wheel to detect tampering through the use of tilt sensors, and to read the meter and perform maintenance diagnostics. Smart meters are replacing the traditional electric meter in many countries. A smart meter is an advanced meter that identifies consumption in more detail than a conventional meter and often communicates that information via some network back to the local utility for monitoring and billing purposes. Smart meters measure not only total consumption but also when the energy was consumed. Many smart meters still include encoding wheels. They also provide for real-time diagnostics using infrared communication.



### VBPW34FAS, -SR

- Direct replacement for Osram parts
- Low forward voltage of 1.0 V
- Wide angle of half-sensitivity of  $\pm 65^\circ$
- Also available in reverse gullwing



### Dome Lens Portfolio

- Low off-axis deviation of radiation
- Current portfolio includes angle of  $\pm 15^\circ$
- Qualified for automotive applications
- Improved power performance



## Emitters

| Mounting | Orientation | Package   | Part Number                 | Angle of Half Sensitivity ( $\pm^\circ$ ) | Radiant Intensity (mW/sr) | Peak Wavelength (nm) | Rise and Fall Time (ns) |
|----------|-------------|-----------|-----------------------------|---|---------------------------|----------------------|-------------------------|
| SMD      | Top view    | Dome lens | <a href="#">VSMB20..X01</a> | 12  | 40                        | 940                  | 15                      |
|          |             |           | <a href="#">VSMG20..X01</a> | 12  | 35                        | 850                  | 20                      |
|          |             |           | <a href="#">VSMY2850</a>    | 10  | 100                       | 850                  | 10                      |
|          |             | PLCC-2    | <a href="#">VSMB1940X01</a> | 60  | 6                         | 940                  | 15                      |
|          |             |           | <a href="#">VSMB3940X01</a> | 60  | 13                        | 940                  | 15                      |
|          |             |           | <a href="#">VSML3710</a>    | 60  | 8                         | 940                  | 500                     |



## Photo Detectors

| Mounting | Type             | Orientation | Package   | Part Number                 | Angle of Half Sensitivity ( $\pm^\circ$ ) | Peak Wavelength (nm) | Spectral Bandwidth (nm) | Rise and Fall Time (ns) |
|----------|------------------|-------------|-----------|-----------------------------|---|----------------------|-------------------------|-------------------------|
| SMD      | PIN Photodiode   | Top view    | Dome lens | <a href="#">VEMD20..X01</a> | 15  | 940                  | 750 to 1050             | 12                      |
|          |                  |             | 0805      | <a href="#">TEMD7100X01</a> | 60  | 950                  | 750 to 1050             | 3                       |
|          |                  |             | SMD       | <a href="#">VBPW34FAS..</a> | 65  | 950                  | 780 to 1050             | 55                      |
|          |                  |             |           | <a href="#">VBP104FAS..</a> | 65  | 950                  | 780 to 1050             | 35                      |
|          |                  |             | Dome lens | <a href="#">VEMD25..X01</a> | 15  | 940                  | 750 to 1050             | 12                      |
|          | Photo-transistor | Top view    | Dome lens | <a href="#">VEMT20..X01</a> | 15  | 860                  | 790 to 970              | 6000                    |
|          |                  |             | PLCC-2    | <a href="#">VEMT3700F</a>   | 60  | 950                  | 850 to 1050             | 500                     |



## Ordering Information

| Widebody High Isolation and High Speed Optocouplers |           |                        |   |
|---|-----------|------------------------|---|
| Part Number   | Data Rate | Package                | Key Features  |
| <a href="#">VOW137</a><br><a href="#">VOW2611</a>   | 10 MBd    | Widebody, DIP-8, SMD-8 | <ul style="list-style-type: none"> <li>• Creepage &gt; 10 mm</li> <li>• <math>V_{IORM} = 1414</math> V</li> <li>• <math>V_{IORM} = 8000</math> V</li> </ul> |
| <a href="#">VOW135</a><br><a href="#">VOW136</a>    | 1 MBd     | Widebody, DIP-8, SMD-8 | <ul style="list-style-type: none"> <li>• Creepage &gt; 10 mm</li> <li>• <math>V_{IORM} = 1414</math> V</li> <li>• <math>V_{IORM} = 8000</math> V</li> </ul> |

### VOWXX Widebody, High Isolation and High Creepage Couplers

- Widebody package with > 10 mm clearance and creepage distance
- High working voltage up to 1414 V
- High transient voltage 8000 V
- Data rate of 1 MBd and 10 MBd
- High operating temperature up to 100 °C
- Extreme high common mode transient immunity up to 40 kV/  $\mu$ s typ
- Fulfills IEC/EN 61010-1 overvoltage protection category requirement

## Safety Guards, Industrial Automation

Light curtains include an array of infrared transmitters that emit modulated and pulsed light, and a corresponding array of photo detectors to receive the light. When an object interrupts or breaks one or more beams, the control logic of the light curtain sends a stop signal to the guarded machine. A similar transmissive or interrupter arrangement is used for automatic gates and garage doors or in industrial automation where product position, fill levels, and conveyor operation are monitored.



### Light Curtain

The new AEC-Q101-qualified VEMD20x0X01 PIN photodiodes and VEMT20x0X01 phototransistors feature an operating temperature range of -40 °C to +100 °C, are available in 1.8 mm gullwing and reverse gullwing surface-mount packages, and have a matching emitter in the recently introduced high-intensity, high-speed VSMB20x0X01.

### VEMx20x0X01

- 4-week floor life without baking
- 1 nA dark current
- Matched emitter pairing



### Photo Detectors

| Mounting  | Type             | Orientation                   | Package                       | Part Number                 | Angle of Half Sensitivity (±°) | Peak Wavelength (nm) | Spectral Bandwidth (nm) | Photo Current |
|-----------|------------------|-------------------------------|-------------------------------|-----------------------------|--------------------------------|----------------------|-------------------------|---------------|
| SMD       | PIN Photodiode   | Top view                      | Dome lens                     | <a href="#">VEMD20..X01</a> | 15                             | 940                  | 750 to 1050             | 12 µA         |
|           |                  |                               | 0805                          | <a href="#">TEMD7100X01</a> | 60                             | 950                  | 750 to 1050             | 3 µA          |
|           |                  |                               | SMD                           | <a href="#">VBPW34FAS..</a> | 65                             | 950                  | 780 to 1050             | 55 µA         |
|           |                  |                               |                               | <a href="#">VBP104FAS..</a> | 65                             | 950                  | 780 to 1050             | 35 µA         |
|           | Dome lens        | <a href="#">VEMD25..SLX01</a> | 15                            | 940                         | 750 to 1050                    | 12 µA                |                         |               |
|           | Photo-transistor | Top view                      | Dome lens                     | <a href="#">VEMT20..X01</a> | 15                             | 860                  | 790 to 970              | 6 mA          |
|           |                  |                               | PLCC-2                        | <a href="#">VEMT3700F</a>   | 60                             | 950                  | 850 to 1050             | 35 µA         |
| Dome lens |                  |                               | <a href="#">VEMT25..SLX01</a> | 15                          | 860                            | 790 to 970           | 6 mA                    |               |

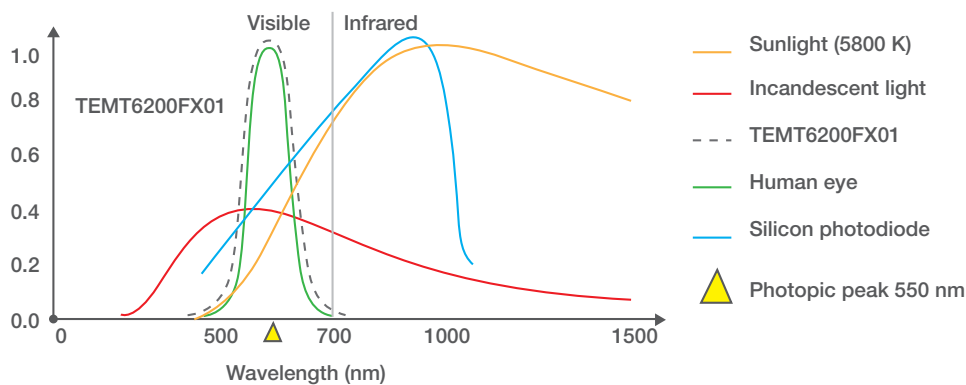


### Emitters

| Mounting | Orientation | Package                    | Part Number                 | Angle of Half Intensity (±°)  | Radiant Intensity (mW/sr) | Peak Wavelength (nm) | Rise and Fall Time (ns) |
|----------|-------------|----------------------------|-----------------------------|-------------------------------|---------------------------|----------------------|-------------------------|
| SMD      | Top view    | Dome lens                  | <a href="#">VSMB20..X01</a> | 12                            | 40                        | 940                  | 15                      |
|          |             |                            | <a href="#">VSMG20..X01</a> | 12                            | 35                        | 850                  | 20                      |
|          |             |                            | <a href="#">VSMY2850</a>    | 10                            | 100                       | 850                  | 10                      |
|          |             | 0805                       | <a href="#">VSMB1940X01</a> | 60                            | 6                         | 940                  | 15                      |
|          |             |                            | <a href="#">VSMB3940X01</a> | 60                            | 13                        | 940                  | 15                      |
|          |             | PLCC-2                     | <a href="#">VSML3710</a>    | 60                            | 8                         | 940                  | 500                     |
|          | Side view   |                            | Dome lens                   | <a href="#">VSMB2943SLX01</a> | 25                        | 20                   | 940                     |
|          |             | <a href="#">VSMY2853SL</a> |                             | 28                            | 35                        | 850                  | 10                      |

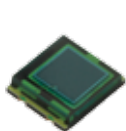
## Ambient Light Sensors

Optimizing the backlight intensity of a display based on the ambient light ensures that operators get a clear view of a machine's status. Meter reading equipment and ruggedized hand-held sensors are used in direct sunlight conditions as well as in dark utility tunnels. An ambient light sensor helps optimize the visibility of the display while extending the battery life by controlling LCD intensity. As cities and municipalities around the world begin to implement solid-state lighting, these lights will also feature ambient light sensors. Not only will the sensors be used to turn on and turn off the lights, they will also be used to ramp up the intensity and slowly dim the lights during dusk and dawn.

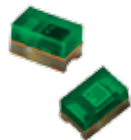
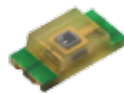


## Phototransistors and Photodiodes

| Output          | Part Number                  | Mounting | Size (mm)        | Peak Wavelength (nm) | Bandwidth (nm) | Angle of Half Sensitivity (±°) | Light Current Standard A (μA) |
|-----------------|------------------------------|----------|------------------|----------------------|----------------|--------------------------------|-------------------------------|
| Phototransistor | <a href="#">TEMT6200FX01</a> | SMD      | 1.2 x 2.0 x 0.85 | 550                  | 450 to 610     | 60                             | 12                            |
|                 | <a href="#">TEMT6000X01</a>  | SMD      | 2.0 x 4.0 x 1.0  | 570                  | 430 to 800     | 60                             | 50                            |
|                 | <a href="#">TEPT5700</a>     | Leaded   | 5 mm, flat top   | 570                  | 430 to 800     | 50                             | 75                            |
|                 | <a href="#">TEPT5600</a>     | Leaded   | 5 mm             | 570                  | 430 to 800     | 20                             | 350                           |
|                 | <a href="#">TEPT4400</a>     | Leaded   | 3 mm             | 570                  | 430 to 800     | 30                             | 200                           |
| Photodiode      | <a href="#">TEMD6010FX01</a> | SMD      | 2.0 x 4.0 x 1.0  | 540                  | 430 to 610     | 60                             | 0.04                          |
|                 | <a href="#">TEMD5510FX01</a> | SMD      | 4.2 x 5.0 x 1.1  | 540                  | 430 to 610     | 65                             | 1                             |
|                 | <a href="#">TEMD6200FX01</a> | SMD      | 1.2 x 2.0 x 0.85 | 540                  | 430 to 610     | 60                             | 0.04                          |
|                 | <a href="#">BPW21R</a>       | Leaded   | TO5 - 8 mm       | 565                  | 420 to 675     | 50                             | 0.9                           |



TEMD5510FX01


 TEMT6200FX01  
TEMD6200X01

 TEMD6010FX01  
TEMT6000X01


TEPT5600



TEPT4400



TEPT5700



BPW21R

## Integrated Proximity and Ambient Light Sensors



VCNL3020, VCNL4020

VCNL4020X01

VCNL4010

The VCNL4010, VCNL4020, and VCNL4020X01 are fully integrated proximity and ambient light sensors. Fully integrated means they contain the infrared emitter and photo detector for proximity, an ambient light sensor, a signal processing IC, and I<sup>2</sup>C communication interface. VCNL4020X01 is qualified for automotive applications. It has a maximum operating temperature of 105 °C. The VCNL3020 supports only proximity sensing; it does not contain an ambient light sensor. With full 16-bit resolution for both the proximity and ambient features, user-defined interrupt levels, and multiple packaging options, the VCNL portfolio will fulfill your requirements.

### Features

- Proximity function
  - 16-bit resolution
  - Excellent crosstalk immunity
  - Programmable LED drive current from 10 mA to 200 mA in 10 mA steps
  - Programmable measurement rate from 1 Hz to 250 Hz
  - Proximity distance up to 20 cm (8 in.)
  - Includes driver for an external emitter for increased range
- Ambient light function
  - Built-in ambient light PIN photodiode with close to human eye sensitivity characteristic
  - 16-bit dynamic range for ambient light detection from 0.25 lx to 16 klx
  - 100 Hz and 120 Hz flicker noise rejection

### Applications

- Smart phone display control
- Digital camera display control
- Monitor sleep / wake function for displays on ATMs and Vending machines
- Touchless light switch
- Refrigerator water / ice dispenser
- Paper towel dispenser
- Soap dispenser
- Automatic toilet flushing
- Automatic water faucet
- Industrial door or latch switch
- Proximity guide for pick and place equipments



GESTURE CONTROL



SMARTPHONES



REARVIEW MIRROR



LCD DISPLAY



SOAP DISPENSER



TOWEL DISPENSER



TOUCHLESS LIGHT SWITCH

### VCNL Product Family

| PART NUMBER                 | PACKAGE     |             | INTEGRATED COMPONENTS |                    |                      | OPERATING TEMP RANGE (°C) | AEC-Q101 |
|-----------------------------|-------------|-------------|-----------------------|--------------------|----------------------|---------------------------|----------|
|                             | L X W (mm)  | HEIGHT (mm) | INFRARED EMITTER      | PROXIMITY DETECTOR | AMBIENT LIGHT SENSOR |                           |          |
| <a href="#">VCNL4020X01</a> | 4.90 x 2.40 | 0.83        | •                     | •                  | •                    | -40 to 105                | •        |
| <a href="#">VCNL3020</a>    | 4.90 x 2.40 | 0.83        | •                     | •                  | x                    | -25 to 85                 | x        |
| <a href="#">VCNL4010</a>    | 3.95 x 3.95 | 0.75        | •                     | •                  | •                    | -25 to 85                 | x        |
| <a href="#">VCNL4020</a>    | 4.90 x 2.40 | 0.83        | •                     | •                  | •                    | -25 to 85                 | x        |

### Gesture Recognition

In applications in which safety might be compromised, such as when a user must find a knob or push a specific button, a user can operate a machine through gestures in a wide active field where gross movements can replace fine movements for a simple and more intuitive interface with the machine.

A streamlined method of adding touch-less swipe right, swipe left, proximity and tap control to any device by using a VCNL4020 and two discrete infrared emitters. The VCNL4020 Gesture Control Sensor Board is the ideal tool to quickly prove a design concept and to start initial hardware and software gesture control development.

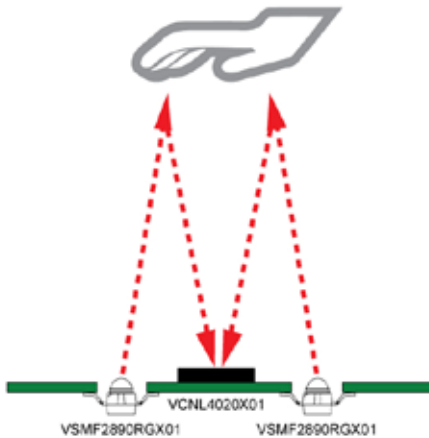
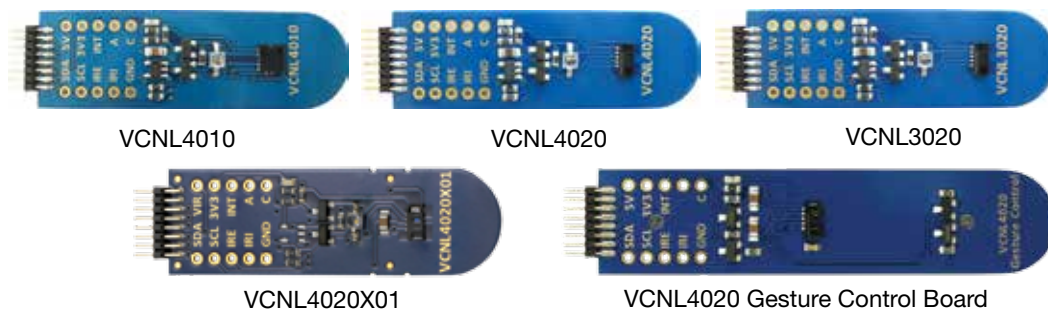


Fig.1: Vishay's gesture-control system consists of just two IR LEDs and a single proximity sensor

The detection of gestures using the gesture control sensor board is accomplished by comparing the signal of infrared light coming from each of the VSMF2890RGX01 emitters. The emitted infrared light is reflected from an object, for example a hand, and then detected by the VCNL4020 proximity sensor. In order to differentiate between the signals coming from either emitter, the emitters are multiplexed, meaning they are pulsed one after the other in quick succession. The proximity signal is then read out between each pulse via the I2C bus interface. When a hand is in the proximity of the board, it will reflect more signal from the emitter it is directly located over. If the hand is then moved across the board, the signal from one emitter will increase before the other. It is this time difference of signal strength that is analyzed to determine if a swipe gesture was made and in which direction.

### Evaluation Kits

An evaluation kit is available, along with an add-on demo board for each of the sensors. Contact any catalog distributor or a local Vishay sales representative to purchase the Sensor Starter Kit. Please contact [sensorstechsupport@vishay.com](mailto:sensorstechsupport@vishay.com) in order to receive the VCNL4010, VCNL4020X01, VCNL3020, or VCNL4020 gesture control add-on boards.



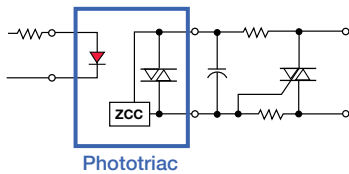
## Phototriacs for Motor Control

The photo detector in a phototriac is a photo sensitive TRIAC, sometimes called an optotriac. Phototriacs are used to switch on and off AC loads. Turning on the infrared emitting diode allows current to flow to the AC load. Phototriacs are primarily used as a silicon-controlled rectifier (SCR) or as a pre-driver to a TRIAC. They are commonly found in industrial applications such as in motor control. As optocouplers, they isolate the low-voltage control circuitry and people from the high-voltage mains.

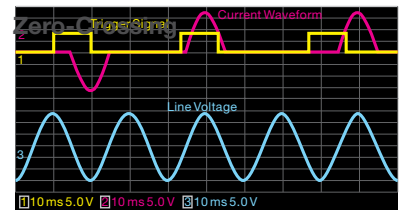
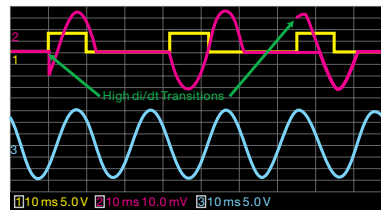


### Phototriacs

Phototriacs can be zero-crossing and non-zero-crossing. This simply describes when the output current turns on. In a non-zero-crossing phototriac, the output current turns on when the infrared emitting diode turns on, regardless of the AC voltage phase. In the diagrams below, the yellow line is the input current and the fuscia line is the output current. Note that when the input current goes high (on), the output current turns on immediately. For a zero-crossing phototriac, the output turns on when the infrared diode turns on and when the AC voltage crosses zero. In the diagram, when the yellow input current goes high, the output does not immediately turn on. Only when the AC voltage crosses zero does the output go high. Both turn off when the infrared emitter turns off and the AC line crosses zero.



Non-Zero-Crossing



|                                     | Part Number                   | Package        | $V_{ISO}$<br>( $V_{RMS}$ ) | $I_{FT}$<br>(mA) | $V_{DRM}$<br>(V) | dV/dt min.<br>(V/ $\mu$ s) | Operating<br>Temperature<br>(°C) |            |
|-------------------------------------|-------------------------------|----------------|----------------------------|------------------|------------------|----------------------------|----------------------------------|------------|
| Zero-Crossing                       | <a href="#">IL410/IL4108</a>  | DIP-6<br>SMD-6 | 5300                       | 2                | 600              | 10 000                     | - 40 to 100                      |            |
|                                     | <a href="#">VO4154 Series</a> |                |                            | 1.6, 2, 3        |                  | 5000                       |                                  |            |
|                                     | <a href="#">VO3062</a>        |                |                            | 10               |                  | 1500                       |                                  |            |
|                                     | <a href="#">VO3063</a>        |                |                            | 5                |                  | 1500                       |                                  |            |
| <a href="#">IL420/IL4208</a>        | 2                             |                |                            | 10 000           |                  |                            |                                  |            |
| <a href="#">VO4254 Series</a>       | 1.6, 2, 3                     |                |                            | 5000             |                  |                            |                                  |            |
| Non-Zero-Crossing<br>(Random Phase) | <a href="#">VO3052</a>        |                |                            | 10               | 1500             |                            |                                  |            |
|                                     | <a href="#">VO3053</a>        |                |                            | 5                | 1500             |                            |                                  |            |
|                                     | <a href="#">K3101</a>         |                |                            | 15               | 250              | 10                         |                                  | - 40 to 85 |
|                                     | <a href="#">K3020</a>         |                |                            | 30               | 500              | 10                         |                                  | - 40 to 85 |
|                                     | <a href="#">VOM3052</a>       | SOP-4          | 3750                       | 10               | 600              | 1500                       | - 40 to 100                      |            |
|                                     | <a href="#">VOM3053</a>       |                |                            | 5                |                  | 1500                       |                                  |            |
|                                     | <a href="#">VOM160R/P/T</a>   |                |                            | 5, 7, 10         |                  | 500                        |                                  |            |
|                                     |                               |                |                            |                  |                  |                            |                                  |            |



### Long-Range Presence and Proximity Sensors

Long-range sensors from many suppliers adjust their detection threshold depending on the amount of ambient light and optical noise present in the environment. When noise is present, the gain of the amplifier is reduced to avoid false detections. When exposed to lower light levels, the adjustable gain makes the receiver too sensitive. It will detect reflected or stray light.



#### Digital Output

Vishay's TSSP4038, TSSP6038, and TSSP58038 eliminate these problems by featuring a *fixed gain*. With a fixed gain, the detection threshold and resulting detection distance is fixed. Once the design of the optical parameters, such as the intensity of the emitter, the aperture in front of the receiver, and the alignment of emitter and detector are determined, the sensor will have stable, repeatable performance under all lighting conditions. *The output is a simple digital state indicating a detection.*

#### Analog Output: Proximity

Many applications require a reflective sensor that detects not only presence but also the strength or weakness of the reflected signal. Instead of a fixed detection threshold, analog information from the sensor is needed. This is possible with Vishay's infrared sensors with variable gain, also called the "P" or proximity sensors: TSSP4P38, TSSP6P38, and TSSP58P38.

#### Fast Response Time

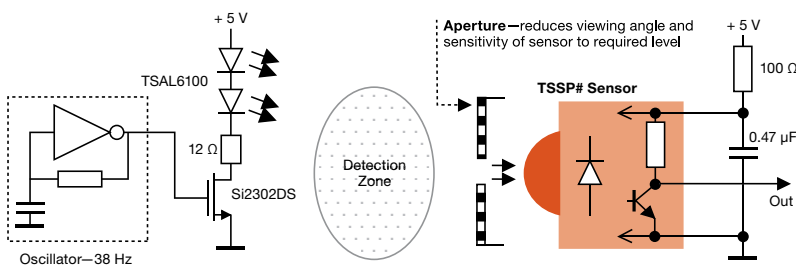
People's lives depend on light curtains and perimeter guards having fast reaction times. Unfortunately, some sensors require the infrared beam to be interrupted for up to 5 ms before detection. The 300 μs response time of Vishay's sensors is much faster. For the fastest response time, a continuous 38 kHz signal should be used. For the longest distance, we recommend driving the TSAL6100 infrared emitter using a 38 kHz burst.

| Part Numbers*   |   | Supply Current (mA) | Supply Voltage (V) | Response Time (μs) | Light curtain Range (m) | Reflective Range (m) |
|---|---|---------------------|--------------------|--------------------|-------------------------|----------------------|
| Presence (Digital Out)  | Proximity (PWM Out)   |                     |                    |                    |                         |                      |
| <a href="#">TSSP4038</a><br><a href="#">TSSP58038</a><br><a href="#">TSSP6038</a><br><a href="#">TSSP77038</a><br><a href="#">TSSP57038</a> | <a href="#">TSSP4P38</a><br><a href="#">TSSP58P38</a><br><a href="#">TSSP6P38</a><br><a href="#">TSSP77P38</a><br><a href="#">TSSP57P38</a> | 0.7                 | 2.5 to 5.5         | 300                | 30                      | 0.2 to 2             |

|  |  |  |  |  |
|--|--|--|--|--|
| <p><b>TSSP4038</b><br/><b>TSSP4P38</b></p> | <p><b>TSSP58038</b><br/><b>TSSP58P38</b></p> | <p><b>TSSP77038</b><br/><b>TSSP77P38</b></p> | <p><b>TSSP6038</b><br/><b>TSSP6P38</b></p> | <p><b>TSSP57038</b><br/><b>TSSP57P38</b></p> |
|--|--|--|--|--|

\* 38 kHz sensors; other modulation frequencies available by request





# OPTOELECTRONICS

## Guide to Industrial Applications

### 0603 ChipLED Indicator LEDs

Just as they are used in the unlimited power supply panel to the right, 0603 ChipLED LEDs are commonly used as indicators in backlighting applications.



#### VLMx1300

- Small size – 1.6 mm x 0.8 mm x .55 mm
- Wide viewing angle - 135°
- Exceptional brightness



| 0603 Part Number          | Color        | Dominant Wavelength (nm) |        |              | Luminous Intensity (mcd) |     |     | at I <sub>F</sub> (ma) |
|---------------------------|--------------|--------------------------|--------|--------------|--------------------------|-----|-----|------------------------|
|                           |              | Min (x)                  | Typ    | Max (y)      | Min                      | Typ | Max |                        |
| <a href="#">VLMS1300</a>  | Super red    | –                        | 631    | –            | 18                       | 54  | –   | 20                     |
| <a href="#">VLMO1300</a>  | Soft orange  | –                        | 605    | –            | 45                       | 90  | –   | 20                     |
| <a href="#">VLMY1300</a>  | Yellow       | 584                      | –      | 597          | 28                       | –   | 180 | 20                     |
| <a href="#">VLMG1300</a>  | Yellow green | 567                      | –      | 576          | 18                       | 35  | –   | 20                     |
| <a href="#">VLMTG1300</a> | True green   | 520                      | –      | 535          | 71                       | –   | 450 | 20                     |
| <a href="#">VLMB1300</a>  | Blue         | 465                      | –      | 475          | 28                       | –   | 180 | 20                     |
| <a href="#">VLMB1310*</a> | Blue         | 465                      | –      | 475          | 28                       | –   | 180 | 20                     |
| <a href="#">VLMW1300</a>  | White        | .274 to .334             | 6 bins | .226 to .343 | 45                       | –   | 180 | 5                      |

\* With ESD protection diode



# OPTOELECTRONICS

## Guide to Industrial Applications

### Motion Control Reflective and Interrupter Sensors

In manufacturing environments, applications for optoelectronics products are virtually endless. Here we list a few examples where Vishay’s reflective and transmissive sensors are used.



#### Application Examples

- Control the speed of a spinning shaft
- Limit the slack in a drive belt
- Enable controlled shutdown of an auto loom machine when a thread breaks
- Monitor the revolutions in a gas or water meter
- Monitor fluid levels in an overflow tank
- Check the direction and speed of a spinning wheel
- Sense stack height
- Guide a movable stage
- Check contents of a package
- Check packaging seats
- Monitor adhesive dispensing
- Industrial optical switch
- Interface to encoding wheels and strips
- Detect the status of a door or panel, inserted coin, or credit or ATM card
- Printers, copier, scanners, computer servers, networking equipment, vending machines, ATM machines

#### Benefits

- Fully AEC-Q101 qualified
- Released for high operating temperatures up to 125 °C
- Moisture sensitivity level (MSL): 1 (Unlimited floor life)
- Available in different dome heights for additional mechanical tolerance.

#### Reflective Sensors, Analog Output

| Part Number <sup>(1)(3)</sup>          | Package    |        | Peak Operating Range <sup>(2)</sup> (mm) | Peak Operating Distance (mm) | Typical Output Current (mA) |
|--|------------|--------|--|------------------------------|-----------------------------|
|  | L x W (mm) | H (mm) |  |                              |                             |
| <a href="#">TCND5000<sup>(3)</sup></a> | 6.0 x 4.3  | 3.75   | 2 to 25                                  | 6.0                          | 0.0015                      |
| <a href="#">TCRT1000/1010</a>          | 7.0 x 4.0  | 2.5    | 0.2 to 4.0                               | 1.0                          | 0.5                         |
| <a href="#">TCRT5000(L)</a>            | 10.2 x 5.8 | 7.0    | 0.2 to 15                                | 2.5                          | 1                           |
| <a href="#">CNY70</a>                  | 7.0 x 7.0  | 6.0    | 0 to 5.0                                 | 0                            | 1                           |

Notes: <sup>(1)</sup> All optical sensors have phototransistor output except where noted  
<sup>(2)</sup> Relative collector current > 20 %  
<sup>(3)</sup> TCND5000 has a PIN photodiode output



## Transmissive Sensors, Analog Output

| Part Number <sup>(1)(3)</sup>                 | Package    |        | Gap (mm) | Aperture (mm) | Typical Output Current (mA) | On / Off Time<br>$t_{on} / t_{off}$ (μs) | Operating Temp. Max. |
|---|------------|--------|----------|---------------|-----------------------------|--|----------------------|
|   | L x W (mm) | H (mm) |          |               |                             |  |                      |
| <a href="#">TCPT1300X01</a>                   | 5.5 x 4.0  | 4.0    | 3.0      | 0.3           | 0.6                         | 20 / 30                                  | +105 °C              |
| <a href="#">TCUT1300X01</a> <sup>(2)</sup>    | 5.5 x 4.0  | 4.0    | 3.0      | 0.3           | 0.6                         | 20 / 30                                  | +105 °C              |
| <a href="#">TCPT1350X01</a>                   | 5.5 x 4.0  | 4.0    | 3.0      | 0.3           | 1.6                         | 9 / 16                                   | +125 °C              |
| <a href="#">TCUT1350X01</a> <sup>(2)</sup>    | 5.5 x 4.0  | 4.0    | 3.0      | 0.3           | 1.6                         | 9 / 16                                   | +125 °C              |
| <a href="#">TCPT1600X01</a> <sup>(4)</sup>    | 5.5 x 4.0  | 5.7    | 3.0      | 0.3           | 1.6                         | 9 / 16                                   | +105 °C              |
| <a href="#">TCUT1600X01</a> <sup>(2)(4)</sup> | 5.5 x 4.0  | 5.7    | 3.0      | 0.3           | 1.6                         | 9 / 16                                   | +105 °C              |
| <a href="#">TCST1030</a>                      | 8.3 x 4.7  | 8.15   | 3.1      | none          | 2.4                         | 15 / 10                                  | +85 °C               |
| <a href="#">TCST1103</a>                      | 11.9 x 6.3 | 10.8   | 3.1      | 1.0           | 4.0                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST1202</a>                      | 11.9 x 6.3 | 10.8   | 3.1      | 0.5           | 2.0                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST1230</a>                      | 9.2 x 4.8  | 5.4    | 2.8      | 0.5           | 2.0                         | 15 / 10                                  | +85 °C               |
| <a href="#">TCST1300</a>                      | 11.9 x 6.3 | 10.8   | 3.1      | 0.25          | 0.5                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST2103</a>                      | 24.5 x 6.3 | 10.8   | 3.1      | 1.0           | 4.0                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST2202</a>                      | 24.5 x 6.3 | 10.8   | 3.1      | 0.5           | 2.0                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST2300</a>                      | 24.5 x 6.3 | 10.8   | 3.1      | 0.25          | 0.5                         | 10 / 8                                   | +85 °C               |
| <a href="#">TCST5250</a>                      | 14.3 x 6.0 | 9.5    | 2.7      | 0.5           | 1.5                         | 15 / 10                                  | +85 °C               |

Notes: <sup>(1)</sup> All optical sensors have phototransistor output

<sup>(2)</sup> Dual channel

<sup>(3)</sup> Products ending in "X01" are AEC-Q101 qualified

<sup>(4)</sup> Pending release



TCPT13x0X01



TCUT13x0X01



TCST1030



TCST1230



TCST1x0x



TCST2x0x



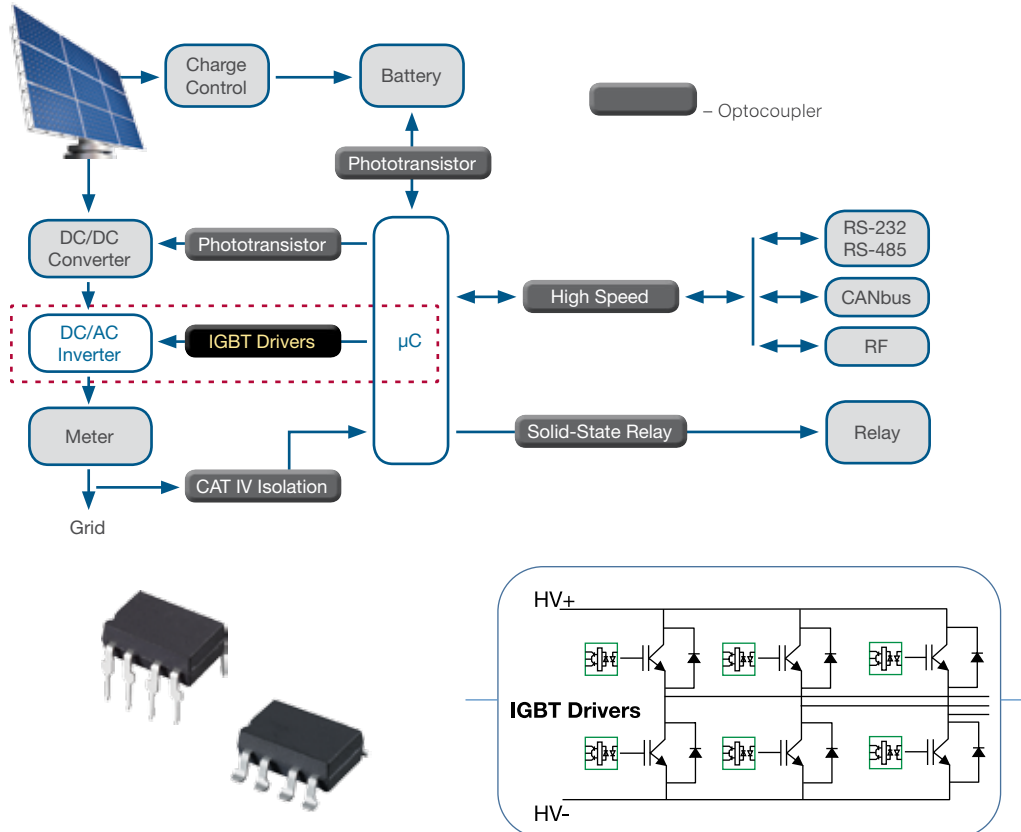
TCPT1600X01



TCUT1600X01

## Solar and Wind IGBT Drivers

Optically isolated IGBT drivers are used to isolate the high-voltage stage of a DC/AC inverter from the low-voltage control circuitry. Isolation is required for safety purposes because string inverters are inverting a high-voltage DC output from the solar panels to a high-voltage output that will be fed to the utility grid. This high voltage must be isolated from the user accessible low-voltage circuitry. Optically isolated IGBT drivers also allow the designers to separate low-noise control circuitry from noisy high-voltage and high-current circuitry, which improves performance, shrinks product size, and simplifies the design process.



### Optically Isolated IGBT Drivers

| Part Number             | Output Current, $I_o$ (A) | Operating Voltage Range, $V_{CC}$ (V) | Pulse Width Distortion, PWD max ( $\mu$ s) | Supply Current, $I_{CC}$ (mA) | Common Mode Rejection, CMR min. (kV/ $\mu$ s) | $V_{IORM}$ ( $V_{RMS}$ ) | External Creepage Distance (mm) |
|-------------------------|---------------------------|---------------------------------------|--|-------------------------------|---|--------------------------|---------------------------------|
| <a href="#">VO3120</a>  | 2.5                       | 15 to 32                              | 0.2  | 2.5                           | 25  | 890                      | 8                               |
| <a href="#">VO3150A</a> | 0.5                       |                                       |  |                               |   |                          |                                 |
| <a href="#">VOL3120</a> | 2.5                       |                                       |  |                               | 48  | 1050                     | 8                               |
| <a href="#">VOW3120</a> | 2.5                       |                                       |  |                               | 25  | 1414                     | 10                              |

### Optical Isolation - Low Input Current ( $I_F$ ) Optocouplers

Optocouplers are designed to protect sensitive control circuitry and people from high-voltage transients or spikes. They isolate the low- and high-voltage sides by using an infrared emitter to transmit the control signal to a photo detector. There is no way for the voltage spike get from one side to the other; they are galvanically isolated. The 4-pin couplers are the most commonly used optocouplers. Low input current, high isolation voltage, long creepage and long distance through the insulation, and competitive pricing are features of Vishay's 4-pin optocoupler portfolio.



#### Application Examples

##### Power Supplies

- Isolated DC converters
- SMPS
- AC adapters
- DC/DC bricks

##### Industrial I/O

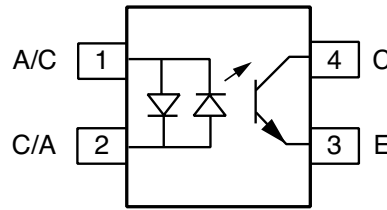
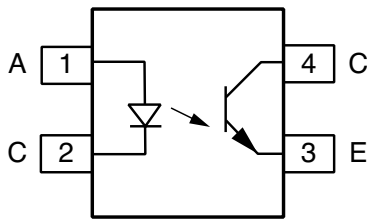
- Isolated 4 mA to 20 mA control loops
- Isolated serial communications

##### Smart Grids

- Grid voltage detection
- ZC detection
- Communication isolation

##### Industrial Automation

- Switching supply
- I/O isolation
- Feedback control loops



AC Input



#### Input Current of 5 mA

| $I_F = 5 \text{ mA}$        |  | Part Number             | CTR Range (%) | Isolation Voltage | Creepage Distance   | Temperature Range |
|-----------------------------|--|-------------------------|---------------|-------------------|---------------------|-------------------|
| DIP-4, SMD-4                |  | <a href="#">VO617A</a>  | 50 to 600     | 5300 $V_{RMS}$    | $\geq 7 \text{ mm}$ | -55 °C to +110 °C |
| SOP-4 miniflat              |  | <a href="#">VOM617A</a> | 50 to 600     | 3750 $V_{RMS}$    | $\geq 5 \text{ mm}$ | -55 °C to +110 °C |
| LSOP-4 long creepage        |  | <a href="#">VOL617A</a> | 50 to 600     | 5000 $V_{RMS}$    | $\geq 8 \text{ mm}$ | -55 °C to +110 °C |
| SSOP-4 half-pitch, miniflat |  | <a href="#">VOS617A</a> | 50 to 600     | 3750 $V_{RMS}$    | $\geq 5 \text{ mm}$ | -55 °C to +110 °C |





<sup>1</sup>See datasheets for binning and part ordering information



# OPTOELECTRONICS




## Guide to Industrial Applications

### Input Current of 1 mA

| $I_F = 1 \text{ mA}$           |   | Part Number             | CTR Range (%) | Isolation Voltage     | Creepage Distance | Temperature Range |
|--------------------------------|---|-------------------------|---------------|-----------------------|-------------------|-------------------|
| DIP-4,<br>SMD-4                |  | <a href="#">VO618A</a>  | 50 to 600     | 5300 V <sub>RMS</sub> | ≥ 7 mm            | -55 °C to +110 °C |
| SOP-4<br>miniflat              |  | <a href="#">VOM618A</a> | 50 to 600     | 3750 V <sub>RMS</sub> | ≥ 5 mm            | -55 °C to +110 °C |
| LSOP-4<br>long creepage        |  | <a href="#">VOL618A</a> | 50 to 600     | 5000 V <sub>RMS</sub> | ≥ 8 mm            | -55 °C to +110 °C |
| SSOP-4<br>half-pitch, miniflat |  | <a href="#">VOS618A</a> | 50 to 600     | 3750 V <sub>RMS</sub> | ≥ 5 mm            | -55 °C to +110 °C |

<sup>1</sup>See datasheets for binning and part ordering information

### AC Input

| Forward Current                  | Package                           |   | Part Number             | CTR Range (%) | Isolation Voltage     | Creepage Distance | Temperature Range |
|----------------------------------|-----------------------------------|---|-------------------------|---------------|-----------------------|-------------------|-------------------|
| $I_F = 5 \text{ mA AC}$<br>input | SSOP-4<br>half-pitch<br>miniflat  |  | <a href="#">VOS627A</a> | 50 to 600     | 3750 V <sub>RMS</sub> | ≥ 5 mm            | -55 °C to +110 °C |
| $I_F = 1 \text{ mA AC}$<br>input | LSOP-4<br>long creepage           |  | <a href="#">VOL628A</a> | 50 to 600     | 5000 V <sub>RMS</sub> | ≥ 8 mm            | -55 °C to +110 °C |
|                                  | SSOP-4<br>half-pitch,<br>miniflat |  | <a href="#">VOS628A</a> | 50 to 600     | 3750 V <sub>RMS</sub> | ≥ 5 mm            | -55 °C to +110 °C |

<sup>1</sup>See datasheets for binning and part ordering information



# OPTOELECTRONICS

## Guide to Industrial Applications

### Industrial Solid-State Relay, Single-Component Solutions Off-the-Shelf Integrated SSR Solutions

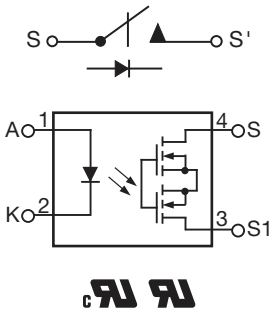
Vishay has a wide range of integrated solid state relay solutions. These are available in DIP, SDIP (DIP with SMD lead forms), and SMD packages. They range in output voltage from 60 V to 400 V, and in current from 100 mA to 2 A.






#### Application Examples

- Programmable logic controller I/O relays
- High-voltage mechanical relay replacement
- Industrial testers
- Integrated industrial sensor modules
- Welding equipment
- Heater controllers

#### Features

- Low output leakage current (> 1  $\mu$ A)
- Load voltage = load DC voltage
- No moving parts
- Small form factor
- No contact arcing
- High isolation voltage (up to 5300 V)
- Available in through-hole and SMD packages



|                        |  |  |  |  |  |
|------------------------|---|---|--|---|---|
|                        | <b>LH1546AT</b>   | <b>LH1546AD</b>   | <b>LH1525AT</b>  | <b>VO14642AT</b>  | <b>LH1526XX</b>   |
| <b>Load current</b>    | 120 mA  | 120 mA  | 250 mA   | 2000 mA   | 125 mA  |
| <b>Load voltage</b>    | 350 V   | 350 V   | 400 V  | 60 V  | 400 V   |
| <b>V<sub>ISO</sub></b> | 3750 V  | 5300 V  | 5300 V   | 5300 V  | 5300 V  |
| <b>R<sub>ON</sub></b>  | 35 $\Omega$   | 35 $\Omega$   | 36 $\Omega$  | 0.25 $\Omega$   | 36 $\Omega$   |

## MOSFET High-Power Solid-State Relay Solutions

### PV MOSFET Driver-Based High-Power Solid-State Relay Solutions

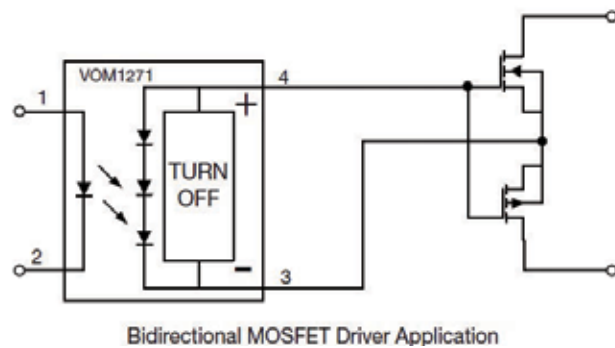
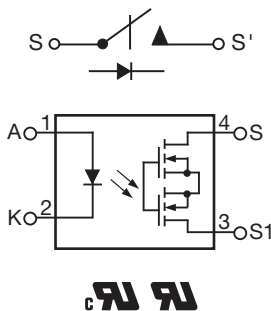
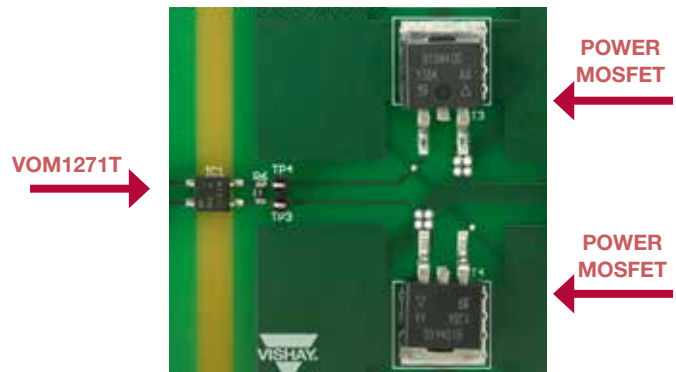
Vishay's portfolio of standalone PV MOSFET drivers allow customers to economically implement board-level solid-state replacements to high-power mechanical SSRs, with the greatest degree of simplicity and minimum number of parts. This makes the replacement of high-power mechanical parts possible for applications that would otherwise require costly high-power industrial relay modules.



#### Application Examples

- Industrial motor controls
- "Hockey puck" SSR replacements
- Heater controllers
- Fan controllers
- Pump controllers
- Solenoid drivers

#### Features

- No need for secondary side driver supply
- Small form factor
- Single-component power MOSFET driver solution



|                                | <br><b>VOM1271T</b> | <br><b>VO1263</b> |
|--------------------------------|--|--|
| $I_{SC} (I_F = 20 \text{ mA})$ | 30 $\mu\text{A}$   | 21.0 $\mu\text{A}$   |
| $V_{OC} (I_F = 20 \text{ mA})$ | 8.7 V  | 14.7 V   |
| $V_{ISO}$                      | 4500 V   | 5300 V   |

### AC Variable-Speed Industrial Drives

Vishay’s portfolio allows customers to cost-effectively isolate the power stages of high-power switching stages. The isolation provided by these parts can be used to design circuits that are both safe and robust to electrical noise interference.



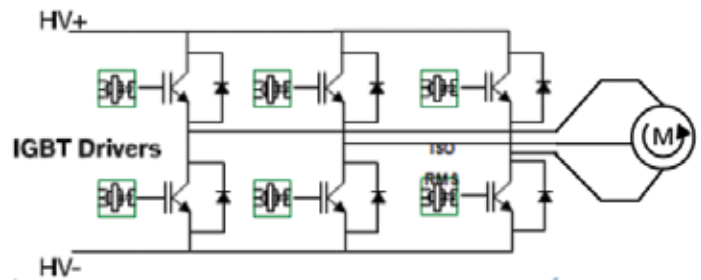
#### Application Examples

- PWM industrial AC variable speed drives
- PWM heater controllers
- PWM fan controllers
- PWM solenoid drivers

#### Optically Isolated IGBT / MOSFET

##### Features

- Low propagation delay
- High  $V_{CC}$  operation
- Low quiescent current
- High output current drive
- High noise isolation
- High working and transient voltage isolation



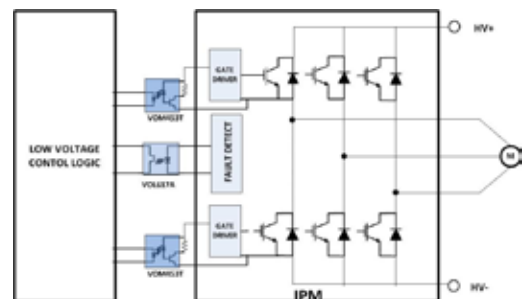
|             | VO3120     | VO3150A | VOL3120 | VOW3120 |  |
|-------------|------------|---------|---------|---------|--|
| <br>20530_1 | $I_{OUT}$  | 2.5 A   | 0.5 A   | 2.5 A   |  |
|             | $I_{CC}$   | 2.5 mA  | 2.5 mA  | 2.5 mA  |  |
|             | $V_{IORM}$ | 890 V   | 890 V   | 1050 V  |  |
|             | Package    |         |         |         |  |

#### IPM Drivers

##### Features

- High noise isolation
- High voltage Isolation
- Flexible output configuration
- Low propagation delay

|             | VOM452T / VOM453T |                  |
|-------------|-------------------|------------------|
| <br>20409-2 | Data Rate         | 1 MBd            |
|             | $V_{ISO}$         | 3750 V           |
|             | CMTI              | 15000 V/ $\mu$ s |
|             | Package           |                  |



## Isolated Industrial Communications High-Speed Optocouplers

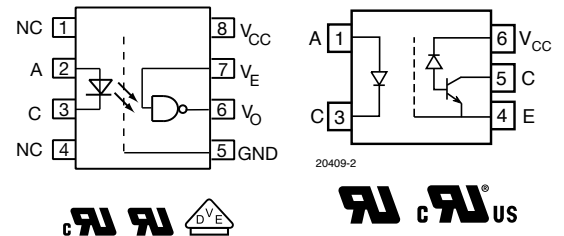
Vishay's portfolio of high-speed opto-isolators allows designers to isolate industrial communications busses such as RS485, Profibus, SPI buses, etc... It not only provides bullet-proof safety isolation but also provides extremely effective noise isolation, which is common in industrial environments.

### Application Examples

- Isolated RS485
- Isolated Profibus
- Isolated CAN
- Isolated SPI
- Isolated 4 mA to 20 mA com loops
- Smart metering

### Features



- Up to 10 Mbps data speed
- High noise isolation
- High working and transient voltage isolation
- Wide variety of packages
- Open collector and totem pole outputs








| Part Number              | Data Rate | V <sub>IORM</sub> | CMR       | Creepage |                |                |               |       |       |       |        |
|--------------------------|-----------|-------------------|-----------|----------|----------------|----------------|---------------|-------|-------|-------|--------|
|                          |           |                   |           |          | DIP-8 Widebody | SMD-8 Widebody | DIP-8 400 mil | DIP-8 | SMD-8 | SOP-5 | SOIC-8 |
| <a href="#">6N1135</a>   | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">6N1136</a>   | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">6N135</a>    | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">6N136</a>    | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6135</a>  | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6136</a>  | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6325</a>  | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6326</a>  | 1 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6345</a>  | 1 MBd     | 890 V             | 15 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VOM452T</a>  | 1 MBd     | 707 V             | 15 kV/μs  | 5 mm     |                |                |               |       |       | √     |        |
| <a href="#">VOM453T</a>  | 1 MBd     | 707 V             | 15 kV/μs  | 5 mm     |                |                |               |       |       | √     |        |
| <a href="#">VOW135</a>   | 1 MBd     | 1414 V            | 1 kV/μs   | 10 mm    | √              | √              |               |       |       |       |        |
| <a href="#">VOW136</a>   | 1 MBd     | 1414 V            | 1 kV/μs   | 10 mm    | √              | √              |               |       |       |       |        |
| <a href="#">SFH6701</a>  | 5 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6702</a>  | 5 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6705</a>  | 5 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6711</a>  | 5 MBd     | 890 V             | 2.5 kV/μs | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6712</a>  | 5 MBd     | 890 V             | 2.5 kV/μs | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6720T</a> | 5 MBd     | 560 V             | 1 kV/μs   | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">SFH6721T</a> | 5 MBd     | 560 V             | 10 kV/μs  | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">SFH6731</a>  | 5 MBd     | 890 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">SFH6732</a>  | 5 MBd     | 890 V             | 10 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">6N137</a>    | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO2601</a>   | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO2611</a>   | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO2630</a>   | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO2631</a>   | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO4661</a>   | 10 MBd    | 890 V             | 25 kV/μs  | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">6N137A</a>   | 10 MBd    | 630 V             | 1 kV/μs   | 8 mm     |                |                | √             | √     | √     |       |        |
| <a href="#">VO0600T</a>  | 10 MBd    | 560 V             | 1 kV/μs   | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VO0601T</a>  | 10 MBd    | 560 V             | 5 kV/μs   | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VO0611T</a>  | 10 MBd    | 560 V             | 1 5kV/μs  | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VO0630T</a>  | 10 MBd    | 560 V             | 1 kV/μs   | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VO0631T</a>  | 10 MBd    | 560 V             | 5 kV/μs   | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VO0661T</a>  | 10 MBd    | 560 V             | 15 kV/μs  | 4 mm     |                |                |               |       |       |       | √      |
| <a href="#">VOW137</a>   | 10 MBd    | 1414 V            | 10 kV/μs  | 10 mm    | √              | √              |               |       |       |       |        |
| <a href="#">VOW2611</a>  | 10 MBd    | 1414 V            | 25 kV/μs  | 10 mm    | √              | √              |               |       |       |       |        |

## Through-Hole Emitters and Detectors

### Emitters

| Wavelength<br>$\lambda$ (nm) | Radiant Power<br>$\Phi_E$ (mW) | Radiant Intensity<br>$I_e$ (mW/sr) |        | On/Off<br>$t_r$ $t_f$ (ns) |   |                          |                          |                          |                            |                       |
|------------------------------|--------------------------------|------------------------------------|--------|----------------------------|---|--------------------------|--------------------------|--------------------------|----------------------------|-----------------------|
|                              |                                | 100 mA                             | 100 mA |                            | 1 A   | 3 mm                     |                          |                          |                            |                       |
|                              |                                |                                    |        |                            |   | $\phi = \pm 22^\circ$    | $\phi = \pm 4^\circ$     | $\phi = \pm 10^\circ$    | $\phi = \pm 18 - 22^\circ$ | $\phi = \pm 38^\circ$ |
| 830                          | 50                             | 70                                 | 700    | 15                         |   |                          |                          | <a href="#">TSHG8400</a> |                            |                       |
|                              |                                | 160                                | 1600   | 15                         |   |                          | <a href="#">TSHG8200</a> |                          |                            |                       |
|                              | 55                             | 32                                 | 320    | 15                         |   |                          |                          |                          | <a href="#">TSHG5510</a>   |                       |
| 850                          | 55                             | 90                                 | 900    | 20                         |   |                          |                          | <a href="#">TSHG5410</a> |                            |                       |
|                              |                                |                                    |        |                            |   |                          |                          | <a href="#">TSHG6410</a> |                            |                       |
|                              |                                | 230                                | 2300   | 20                         |   |                          | <a href="#">TSHG5210</a> |                          |                            |                       |
|                              |                                | 450                                | 4.5    | 20                         |   | <a href="#">VSLY5850</a> |                          |                          |                            |                       |
| 870                          | 55                             | 32                                 |        | 15                         |   |                          |                          |                          | <a href="#">TSFF5510</a>   |                       |
|                              | 50                             | 70                                 | 700    | 15                         |   |                          |                          | <a href="#">TSFF5410</a> |                            |                       |
|                              | 50                             | 180                                | 1800   | 15                         |   |                          | <a href="#">TSFF5210</a> |                          |                            |                       |
| 890                          | 40                             | 10                                 | 100    | 30                         |   |                          |                          |                          |                            |                       |
|                              | 48                             | 65                                 | 650    | 30                         |   |                          |                          | <a href="#">TSHF5410</a> |                            |                       |
|                              | 48                             | 140                                | 1400   | 30                         |   |                          | <a href="#">TSHF5210</a> |                          |                            |                       |
| 940                          | 40                             | 32                                 | 320    | 15                         | <a href="#">TSAL4400</a>  |                          |                          |                          |                            |                       |
|                              | 40                             | 65                                 |        | 15                         | <a href="#">VSLB3940</a>  |                          |                          |                          |                            |                       |

### Photo Detectors

| Output Type       | Filter            | Wavelength<br>$\lambda$ (nm) |      |                          |                          |                          |                       |
|-------------------|-------------------|------------------------------|--|--------------------------|--------------------------|--------------------------|-----------------------|
|                   |                   |                              | Side View  | 5 mm Flattop             | 5 mm                     | 3 mm                     | Flat, Top View        |
|                   |                   |                              | $\phi = \pm 60^\circ$  | $\phi = \pm 50^\circ$    | $\phi = \pm 20^\circ$    | $\phi = \pm 25^\circ$    | $\phi = \pm 65^\circ$ |
| PIN Photo diode   | None              | 900                          | <a href="#">BPW46</a>  |                          | <a href="#">BPV10</a>    |                          | <a href="#">BPW34</a> |
|                   | Daylight blocking | 950                          | <a href="#">BPV20F</a><br><a href="#">BPV21F</a>   |                          | <a href="#">BPV10NF</a>  |                          | <a href="#">BP104</a> |
| Photo-transistor  | None              | 850                          |  |                          | <a href="#">BPW96C</a>   | <a href="#">BPW85B</a>   |                       |
|                   | Daylight blocking | 920                          |  |                          |                          | <a href="#">TEFT4300</a> |                       |
|                   |                   | 940                          | <a href="#">BPV22NF</a><br><a href="#">BPV23NF</a>   |                          |                          |                          |                       |
|                   |                   | 950                          | <a href="#">BPV22F</a><br><a href="#">BPV23F</a>   |                          |                          |                          |                       |
| Infrared blocking | 570               |                              | <a href="#">TEPT5700</a>   | <a href="#">TEPT5600</a> | <a href="#">TEPT4400</a> |                          |                       |



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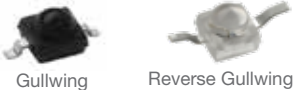
## Guide to Industrial Applications

### Small-Angle, Surface-Mount Emitters and Detectors



#### Emitters with ± 10° Angle of Intensity

| Part Number                   | Package Form     | Peak Wavelength (nm) | Radiant Intensity (mΩ/sr) | Angle of Half Intensity (±°) | Rise Time (ns) |
|-------------------------------|------------------|----------------------|---------------------------|------------------------------|----------------|
| <a href="#">VSMY2850RG</a>    | Reverse gullwing | 850                  | 100                       | 10                           | 10             |
| <a href="#">VSMY2850G</a>     | Gullwing         | 850                  | 100                       | 10                           | 10             |
| <a href="#">VSMG2020X01</a>   | Gullwing         | 850                  | 40                        | 12                           | 20             |
| <a href="#">VSMG2000X01</a>   | Reverse gullwing | 850                  | 40                        | 12                           | 20             |
| <a href="#">VSMF2890RGX01</a> | Reverse gullwing | 890                  | 40                        | 12                           | 30             |
| <a href="#">VSMF2890GX01</a>  | Gullwing         | 890                  | 40                        | 12                           | 30             |
| <a href="#">VSMB2020X01</a>   | Gullwing         | 940                  | 40                        | 12                           | 15             |
| <a href="#">VSMB2000X01</a>   | Reverse gullwing | 940                  | 40                        | 12                           | 15             |



#### Photo Detectors With ± 15° Angle of Sensitivity

| Part Number                 | Output Type     | Package Form     | Peak Wavelength (nm) | Spectral Bandwidth (nm) | Output Current | Angle of Sensitivity (±°) |
|-----------------------------|-----------------|------------------|----------------------|-------------------------|----------------|---------------------------|
| <a href="#">VEMD2500X01</a> | PIN Photodiode  | Reverse gullwing | 900                  | 350 to 1120             | 12 μA          | 15                        |
| <a href="#">VEMD2520X01</a> | PIN Photodiode  | Gullwing         | 900                  | 350 to 1120             | 12 μA          | 15                        |
| <a href="#">VEMD2000X01</a> | PIN Photodiode  | Reverse gullwing | 940                  | 750 to 1050             | 12 μA          | 15                        |
| <a href="#">VEMD2020X01</a> | PIN Photodiode  | Gullwing         | 940                  | 750 to 1050             | 12 μA          | 15                        |
| <a href="#">VEMT2000X01</a> | Phototransistor | Reverse gullwing | 860                  | 790 to 970              | 6 mA           | 15                        |
| <a href="#">VEMT2020X01</a> | Phototransistor | Gullwing         | 860                  | 790 to 970              | 6 mA           | 15                        |
| <a href="#">VEMT2500X01</a> | Phototransistor | Reverse gullwing | 850                  | 470 to 1090             | 6 mA           | 15                        |
| <a href="#">VEMT2520X01</a> | Phototransistor | Gullwing         | 850                  | 470 to 1090             | 6 mA           | 15                        |

## Large-Angle, Surface-Mount Emitters and Detectors

### Emitters With $\pm 60^\circ$ Angle of Intensity

| Part Number                 | Package Form | Peak Wavelength (nm) | Radiant Intensity (mW/sr) | Angle of Half Intensity ( $\pm^\circ$ ) | Rise Time (ns) |
|-----------------------------|--------------|----------------------|---------------------------|---|----------------|
| <a href="#">VSMG2720</a>    | PLCC-2       | 830                  | 14                        | 60                                      | 15             |
| <a href="#">VSMG2700</a>    | PLCC-2       | 830                  | 10                        | 60                                      | 20             |
| <a href="#">VSMY3850</a>    | PLCC-2       | 850                  | 17                        | 60                                      | 10             |
| <a href="#">VSMG3700</a>    | PLCC-2       | 850                  | 10                        | 60                                      | 20             |
| <a href="#">VSMY7852X01</a> | Little Star  | 850                  | 42                        | 60                                      | 8              |
| <a href="#">VSMY7850X01</a> | Little Star  | 850                  | 170                       | 60                                      | 15             |
| <a href="#">VSMY1850X01</a> | 0805         | 850                  | 10                        | 60                                      | 10             |
| <a href="#">VSMF4720</a>    | PLCC-2       | 870                  | 16                        | 60                                      | 15             |
| <a href="#">VSMF4710</a>    | PLCC-2       | 870                  | 10                        | 60                                      | 15             |
| VSMF9700                    | PLCC-2       | 890                  | 8                         | 60                                      | 50             |
| <a href="#">VSMF3710</a>    | PLCC-2       | 890                  | 10                        | 60                                      | 30             |
| <a href="#">VSML3710</a>    | PLCC-2       | 940                  | 8                         | 60                                      | 800            |
| <a href="#">VSMB3940X01</a> | PLCC-2       | 940                  | 13                        | 60                                      | 15             |
| <a href="#">VSMB1940X01</a> | 0805         | 940                  | 6                         | 60                                      | 15             |
| <a href="#">VSMS3700</a>    | PLCC-2       | 950                  | 4.5                       | 60                                      | 800            |



PLCC



0805



Little Star™

### Emitters With $\pm 65^\circ$ Angle of Sensitivity

| Part Number                | Output Type    | Package Form     | Peak Wavelength (nm) | Spectral Bandwidth (nm) | Output Current ( $\mu\text{A}$ ) | Angle of Sensitivity ( $\pm^\circ$ ) |
|----------------------------|----------------|------------------|----------------------|-------------------------|----------------------------------|--------------------------------------|
| <a href="#">VBP104FAS</a>  | PIN Photodiode | Gullwing         | 950                  | 780 to 1050             | 35                               | 65                                   |
| <a href="#">VBP104FASR</a> | PIN Photodiode | Reverse gullwing |                      |                         |                                  |                                      |
| <a href="#">VBP104S</a>    | PIN Photodiode | Gullwing         | 940                  | 430 to 1100             | 35                               | 65                                   |
| <a href="#">VBP104SR</a>   | PIN Photodiode | Reverse gullwing |                      |                         |                                  |                                      |
| <a href="#">VBPW34FAS</a>  | PIN Photodiode | Gullwing         | 950                  | 780 to 1050             | 55                               | 65                                   |
| <a href="#">VBPW34FASR</a> | PIN Photodiode | Reverse gullwing |                      |                         |                                  |                                      |
| <a href="#">VBPW34S</a>    | PIN Photodiode | Gullwing         | 940                  | 430 to 1100             | 55                               | 65                                   |
| <a href="#">VBPW34SR</a>   | PIN Photodiode | Reverse gullwing |                      |                         |                                  |                                      |



Gullwing Visible Filter



Reverst Gullwing with Visible Filter



Reverse Gullwing



Gullwing



# OPTOELECTRONICS

## Guide to Industrial Applications

### Medium-Angle, Surface-Mount Emitters and Detectors



Reverse Gullwing



Gullwing



Side View

#### Emitters With $\pm 25^\circ$ and $\pm 28^\circ$ Angle of Intensity

| Part Number                   | Package Form     | Peak Wavelength (nm) | Radiant Intensity (mW/sr) | Angle of Half Intensity ( $\pm^\circ$ ) | Rise Time (ns) |
|-------------------------------|------------------|----------------------|---------------------------|---|----------------|
| <a href="#">VSMY2853RG</a>    | Reverse gullwing | 850                  | 35                        | 28                                      | 10             |
| <a href="#">VSMY2853G</a>     | Gullwing         | 850                  | 35                        | 28                                      | 10             |
| <a href="#">VSMY2853SL</a>    | Side view lens   | 850                  | 35                        | 28                                      | 10             |
| <a href="#">VSMF2893RGX01</a> | Reverse gullwing | 890                  | 20                        | 25                                      | 30             |
| <a href="#">VSMF2893GX01</a>  | Gullwing         | 890                  | 20                        | 25                                      | 30             |
| <a href="#">VSMF2893SLX01</a> | Side view lens   | 890                  | 20                        | 25                                      | 30             |
| <a href="#">VSMB2943RGX01</a> | Reverse gullwing | 940                  | 20                        | 25                                      | 15             |
| <a href="#">VSMB2943GX01</a>  | Gullwing         | 940                  | 20                        | 25                                      | 15             |
| <a href="#">VSMB2948SL</a>    | Side view lens   | 940                  | 20                        | 25                                      | 15             |
| <a href="#">VSMB2943SLX01</a> | Side view lens   | 940                  | 20                        | 25                                      | 15             |

#### Photo Detectors With $\pm 35^\circ$ Angle of Sensitivity

COMING SOON!



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## Guide to Industrial Applications

### Notes



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