Optoelectronics

Guide to Industrial Applications

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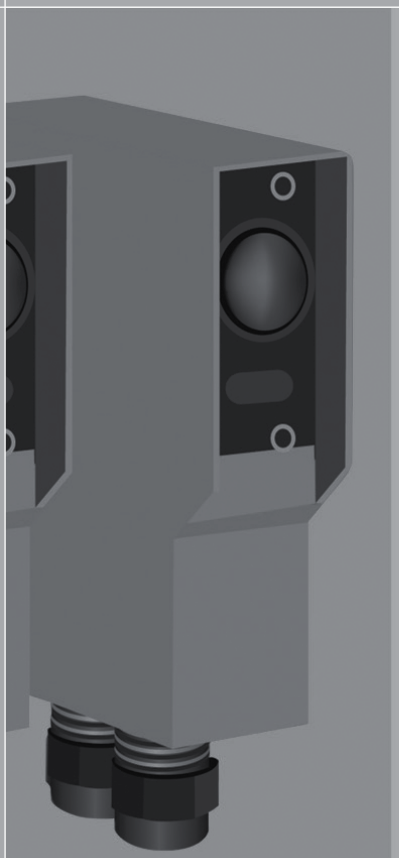

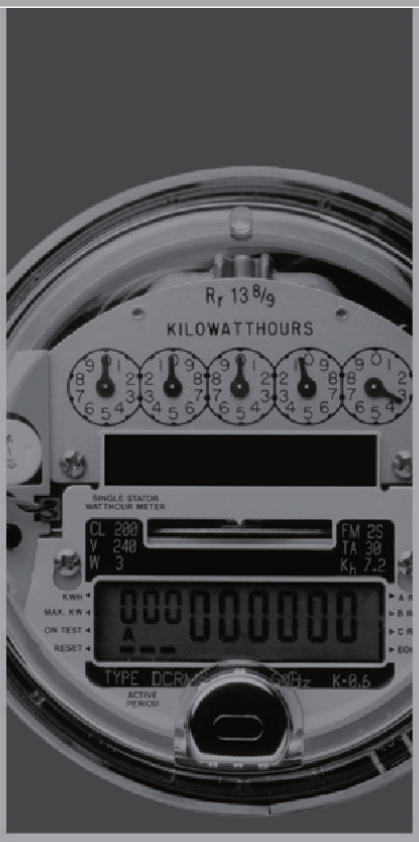

TTI, Inc. - Never Short on Solutions

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TTI is the largest authorised Passive, Interconnect, Discrete, Relay & Switch specialist.

TTI's European headquarters in Maisach Gernlinden occupies 13,000m^2, with 10,000m^2 of dedicated warehouse space on three levels. We provide local service in 36 sales locations across Europe.

Our suppliers are the most innovative and capable in the electronics industry. Together with them, we put emphasis on product knowledge, inventory and logistics to provide our customers with industry leading service support and value.

Our focused product line and comprehensive supply chain management solutions have made TTI the supplier of choice for our OEM and CEM customers world wide.

By focusing on new product introductions, high technology products and working with Mouser, we provide our customer and supplier with unparalleled design-in support, ensuring the best and newest parts are always available.

TTI is known as specialist for Passive and Interconnect components. We also extend our focus on discrete semiconductors.

We offer to our customers a broad line of discrete semiconductors from our key supplier Vishay Semiconductor. This line up includes Standard Diodes, Zener, ESD Protection and TVS Diodes, Rectifiers, MOSFETs and a broad offering on Opto-Electronic devices like visible LEDs for General Lighting Applications as well as Opto Couplers, Sensors, Infrared Emitters and Detectors which are rounding up the offering.

TTI and Vishay are offering the right product, latest technologies and a broad product expertise on discrete semiconductors

Why buy from TTI?

TTI concentrates on the basic strategy of focusing on our products and striving to be the best at what we do. No other company offers the unique combination of benefits we provide:

- Specialist I, P&E
- Deepest & Broadest Inventory
- Best in Class Support
- Leading Global Suppliers
- Focused Line Card
- Technology Leader
- Only Distributor with Catalogue Division - Mouser
- Opportunity to Consolidate Supplier Base
- Reduced Lead-Times
- Specialist Local Support
- World Class Supply Chain Programs
- Reduced Total Cost of Acquisition

OPTOELECTRONICS

Guide to Industrial Applications

Introduction




As the world´s leading supplier of infrared emitters, photo detectors, and optical sensors, Vishay 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, 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 know-how. This guide provides product recommendations for key applications. Most of the die used in these packages are also available in chip or bare die form.

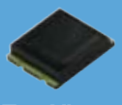
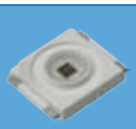
Applications

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
- 3DTV Optical Solutions
- Remote Control
- Data Transmission
- Motor Control

Packaging Summary Table

The majority of applications covered use packages shown in the table below. Parts which are qualified to the automotive AEC-Q101 standard are identified by an “X01” extension. A wide variety of leaded and surface-mount devices are available.

	 5 mm	 0805	 Dome lens	 PLCC-2	 SMD	 Top View SMD	 Little Star
Dimension	5.0 x 8.0	2.0 x 1.2 x 0.85 H	2.3 x 2.3 x 2.8 H	3.5 x 2.8 x 1.7 H	4.0 x 3.9 x 1.3 H	5.0 x 4.4 x 1.1 H	6.0 x 6.0 x 1.4 H
AEC-Q101 Qualified	No	Yes	Yes	Yes	No	Yes	Yes
Angle of Half Intensity	Various	± 60°	± 12°, ± 15°	± 60°	± 65°	± 65°	± 60°
Emitter	TSH5xxx TSFF5xxx	VSMB1940X01	VSMB20.X01	VSMB3940 VSMG2720			
Surface Emitter[1]	VSLY5850	VSMY1850	VSMY2850	VSMY3850			VSMY7850X01[1]
Detector	BPV10	TEMT7000X01 TEMD7000X01	VEMT25..X01 VEMD25..X01	VEMT3700 VEMT4700	VBPW34S VBP104S	TEMD5010X01 TEMD5020X01	
Detector (blocks visible light)	BPV10NF	TEMT7100X01 TEMD7100X01	VEMT20.X01 VEMD20.X01	VEMT3700F	VBPW34FAS VBP104FAS	TEMD5110X01 TEMD5120X01	
Detector (blocks infrared)	TEPT5600 TEPT5700	TEMT6200FX01 TEMD6200FX01				TEMD5510FX01	

[1] Under development

Illumination

Security cameras are 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 Performance

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 competitors recommend only 50 mA. The peak wavelength of these emitters is 850 nm, matched to security camera sensors.

	Competitors			Vishay	
	A	B	C	TSHG5210	TSHG5410
Intensity (mW/sr)	171	107	130	230	90
Degradation at 4000 hours (at 100 mA)	up to 60 %			< 5 %	< 5 %

Additional Applications

- Automotive
  - Drowsy Driver
  - Illumination for Heads-up Display
- Machine Vision

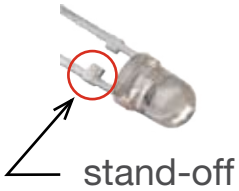
Emitters

Mounting	Package	Part Number	Angle of Half Intensity (± °)	Radiant Intensity[1] (mW/sr)	Rise and Fall Time (ns)	Peak Wavelength (nm)
Through Hole	5 mm	TSHG5210	10	230	20	850
		TSHG5410	18	90	20	850
		TSHG6210	10	230	20	850
		TSHG6410	18	90	20	850
SMD	Dome Lens	VSMY2850	10	90	10	850
	PLCC-2	VSMY3850	60	150	15	850
	Little Star	VSMY7850X011	60	170	15	850




[1] Under development





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

Smoke and Flame Detection

Depending on the combustible material, a fire emits light in multiple spectrums: 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 ultraviolet (UV) sensitivity at 400 nm compared to standard PIN photodiode chip technology.

New Products

VSLY5850 – 5 mm Emitter

- 850 nm peak wavelength
- ± 3° angle of half intensity
- 600 mW/sr @ 100 mA
- I_e = 6.0 mW /sr @ 1 A
- I_V = 55 mW @ 100 mA

VBPW34FAS, -SR

- Direct replacement for Osram parts
- Lower forward voltage of 1.0 V
- Wider angle of half sensitivity of ± 65°

Photo Detectors

Mounting	Package	Part Number	Angle of Half Sensitivity (± °)	Photo Current (µA)	Spectral Sensitivity (nm)	Peak Wavelength
Through Hole	5 mm	BPV10NF	20	60 mA	790 to 1050	940
		BPV22NF	60	85	790 to 1050	940
SMD	SMD	VBPW34FAS	65	55	780 to 1050	950
		VBP104FAS		35	780 to 1050	950
		TEMD5080X01		60	350 to 1100	940
	Dome Lens	VEMD2020X01	12	12	750 to 1050	950
		VEMD2000X01	12	12	750 to 1050	950

Emitters

Mounting	Package	Part Number	Angle of Half Sensitivity (± °)	Photo Current (µA)	Spectral Sensitivity (nm)	Peak Wavelength
Through Hole	5 mm	VSLY5850	3	600	20	850
		TSFF5210	10	180	15	870
		TSAL6100	10	130	800	940
SMD	Dome Lens	VSMB20..X01	12	40	15	940
		VSMY2850	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 ± 38°, 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

- ± 60° angle of half intensity
- I_e = 16 mW/sr at 100 mA
- Switching at 15 ns

TSFF5510 – 5 mm

- ± 38° angle of half intensity
- I_e = 32 mW/sr at 100 mA
- Switching at 15 ns

New Products

- TSFF5410 φ = ± 22°
- TSFF5210 φ = ± 10°
- VSMF4710 (870 nm)

Photo Detectors

Mounting	Package	Part Number	Angle of Half Sensitivity (± °)	Data Rate		Transmit Range		Peak Wavelength (nm)	Spectral Bandwidth (nm)	Photo Current (µA)
				Low	High	Short	Long			
SMD	0805	TEMD7100X01		X	X	X				
	Dome Lens	VEMD20..X01			X	X				
	SMD	TEMD5110X01	65		X		X	940	790 to 1050	55 µA
		TEMD5120X01			X		X	940	790 to 1050	35 µA
		VBPW34FAS..			X		X	950	780 to 1050	55 µA
		VBP104FAS..			X		X	950	780 to 1050	35 µA
	PLCC-2	VEMT3700F	60	X		X		940	850 to 1050	0.5 mA

Emitters

Mounting	Package	Part Number	Angle of Half Sensitivity (± °)	Data Rate		Transmit Range		Peak Wavelength (nm)	Radiant Intensity (mW/sr)	Rise and Fall Time (ns)
				Low	High	Short	Long			
SMD	0805	VSMB1940X01	60	X		X		940	6	15
		VSMY1850		X		X		850	15	10
	PLCC-2	VSML3710	60	X		X		940	8	500
		VSMB3940X01		X	X	X		940	13	15
		VSMF4710		X	X	X	X	870	10	15
		VSMF4720		X	X	X	X	870	16	15
	Dome Lens	VSMB20..X01	12	X	X	X	X	850	40	15
		VSMB20..X01	12	X	X	X	X	850	40	15
		VSMG20...X01	12	X	X	X	X	850	35	20
		VSMY2850	10	X	X	X	X	850	100	15
Through Hole	5 mm	TSFF5210	10	X	X	X	X	870	180	15
		TSFF5410	22	X	X	X	X	870	70	15
		TSFF5510	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, for 3D active glasses synchronization, and for transmisive 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.

VSMB2000X01– Gull Wing

- ± 12° angle of half intensity
- I_e = 40 mW/sr at100 mA
- AEC-Q1010 qualified
- 940 nm

Emitters

Part Number	Peak Wavelength (nm)	Package	Intensity (mW/sr)	Angle of Half Intensity (± °)	Rise / Fall Time (ns)
TSAL5100	940	5 mm (T1¾)	130	10	800
TSAL6200	940	5 mm (T1¾)	60	17	800
TSAL7300	940	5 mm (T1¾)	45	22	800
TSAL4400	940	5 mm (T1¾)	15	18	800
VSLB3940	940	3 mm (T1)	70	19	30

A - Forward voltage at 100 mA

IR Receivers for Remote Control

Remote Code or Application	Carrier Freq. (kHz)	Best AGC	 5.0 x 4.5 x 1.3H	 6.8 x 3.0 x 2.3H	 6.8 x 3.0 x 3.2H	 8.0 x 3.3 x 2.7H	 7.5 x 5.3 x 4.0H	 6.0 x 5.6 x 6.9H	 5.0 x 4.8 x 6.9H
Sony SIRCS 15 and 20 bit	40	2	TSOP85240AP5	TSOP77240W	TSOP77240	TSOP85240	TSOP6240	TSOP4840	TSOP58240
Sony 12 bit	40	4	TSOP85240AP5	TSOP77440W	TSOP77440	TSOP85240	TSOP6440	TSOP4840	TSOP58440
RC-5	36	4	TSOP85436AP5	TSOP75436W	TSOP75436	TSOP85436	TSOP35436	TSOP34436	TSOP38436
RC-6	36	4							
Panasonic	36.7	4		TSOP77436W	TSOP77436		TSOP6436	TSOP4436	TSOP58436
NEC	38	4	TSOP85438AP5	TSOP75438W	TSOP75438	TSOP85438	TSOP35438	TSOP34438	TSOP38438
Sharp	38	4		TSOP77438W	TSOP77438		TSOP6438	TSOP4438	TSOP58438

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 developing 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 ± 65°
- Also available in reverse gullwing

Dome Lens Portfolio

- Low off-axis deviation of radiation
- Current portfolio includes angle of ± 15°
- Qualified for automotive applications
- Improved power performance

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	VSMB20..X01	12	40	940	15
			VSMG20..X01	12	35	850	20
			VSMY2850	10	100	850	10
		0805	VSMB1940X01	60	6	940	15
		PLCC-2	VSMB3940X01	60	13	940	15
			VSML3710	60	8	940	500
	Side View	Dome Lens	VSMB2940..SLX011	15	40	940	15
		Dome Lens	VSMY2850..SLX011	10	100	850	10

[1] Under development



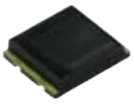
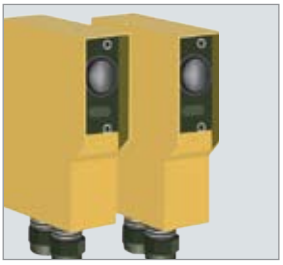




Photo Detectors

Mounting	Type	Orientation	Package	Part Number	Angle of Half Intensity (± °)	Peak Wavelength (nm)	Spectral Bandwidth (nm)	Rise and Fall Time (ns)
SMD	Photo PIN Diode	Top View	Dome Lens	VEMD20..X01	15	940	750 to 1050	12
			0805	TEMD7100X01	60	950	750 to 1050	3
			SMD	VBPW34FAS..	65	950	780 to 1050	55
				VBP104FAS..	65	950	780 to 1050	35
		Side View	Dome Lens	VEMD25..SLX01	15	940	750 to 1050	12
	Photo Transistor	Top View	Dome Lens	VEMT20..X01	15	860	790 to 970	6000
			PLCC-2	VEMT3700F	60	950	850 to 1050	500
		Side View	Dome Lens	VEMT25..SLX01	15	860	790 to 970	6000

[1] Under development

Safety Guards, Industrial Automation



Light curtains include an array of infrared transmitters which 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 interrrupter 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

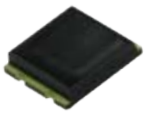
The new AEC-Q101-qualified VEMD20x0X01 PIN photodiodes and VEMT20x0X01 phototransistors feature an operating temperature range of - 40 °C to + 100 °C, are available in 1.8 mm gullwing and reverse gullwing surface-mount packages and have a matching emitter in the recently introduced high-intensity, high-speed 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 Intensity (± °)	Peak Wavelength (nm)	Spectral Bandwidth (nm)	Photo Current (µA)
SMD	Photo Pin Diode	TOP View	Dome Lens	VEMD20..X01	15	940	750 to 1050	12 µA
			0805	TEMD7100X01	60	950	750 to 1050	3 µA
			SMD	VBPW34FAS..	65	950	780 to 1050	55 µA
				VBP104FAS..	65	950	780 to 1050	35 µA
		Side View	Dome Lens	VEMD25..SLX01	15	940	750 to 1050	12 µA
	Photo Transistor	TOP View	Dome Lens	VEMT20..X01	15	860	790 to 970	6 mA
			PLCC-2	VEMT3700F	60	950	850 to 1050	35 µA
		Side View	Dome Lens	VEMT25..SLX01	15	860	790 to 970	6 mA



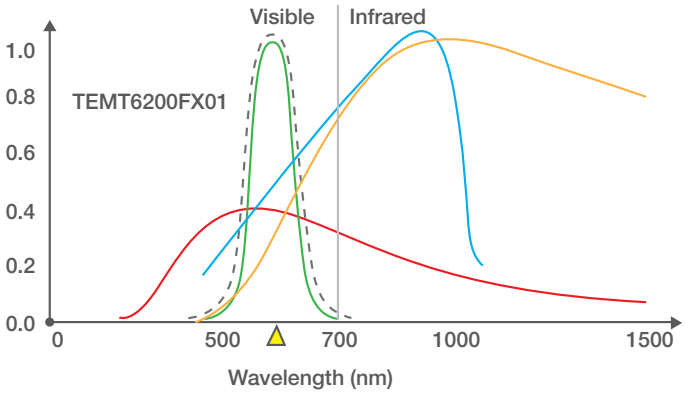
Emitters

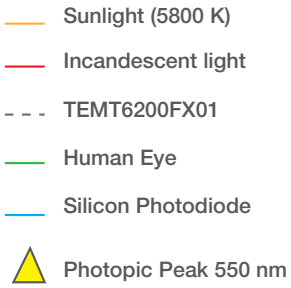
Mounting	Orientation	Package	Part Number	Angle of Half Intensity (± °)	Radiant Intensity (mW/sr)	Peak Wavelength (nm)	Rise and Fall Time (ns)
SMD	TOP View	Dome Lens	VSMB20..X01	12	40	940	15
			VSMG20..X01	12	35	850	20
			VSMY2850	10	100	850	10
		0805	VSMB1940X01	60	6	940	15
		PLCC-2	VSMB3940X01	60	13	940	15
			VSML3710	60	8	940	500
	Side View	Dome Lens	VSMB2940..SLX011	15	40	940	15
			VSMY2850..SLX011	10	100	850	10

[1] Under development

Ambient Light Sensors

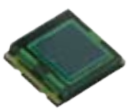
Optimizing the backlight intensity of a display based on the ambient light ensures that operators get a clear view of machine status. Meter reading equipment and ruggedized hand-held sensors are used in direct sunlight conditions as well as in dark utility tunnels. An ambient light sensor helps optimize 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.

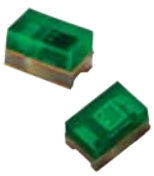


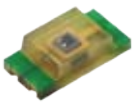


Phototransistors and Photodiodes

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


TEMD5510FX01

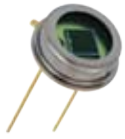

TEMT6200FX01
TEMD6200X01


TEMD6010FX01
TEMT6000X01


TEPT5600

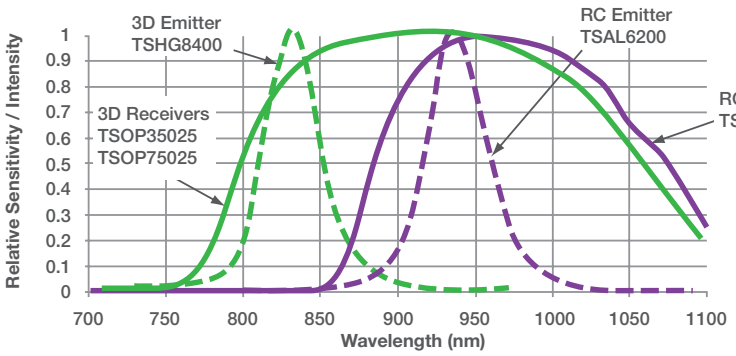

TEPT4400


TEPT5700


BPW21R

3DTV – Active Glasses Synchronization

The infrared emitter in the TV and the IR receiver in the glasses play a critical role in 3DTV. The infrared emitter transmits a signal to the glasses. The IR receiver in the glasses receives this signal. The signal keeps the alternating image on the screen in synchronization with the opening and closing of the left and right eye LCD shutter in each lens of the glasses. The 3D synchronization system must be immune to optical interference. The TV remote control and 3D systems must not interfere with one another. Fluorescent, CFL, and plasma light sources must not disrupt the signal. Noise immunity is possible by using a Vishay IR receiver with a 25 kHz carrier frequency and an 830 nm or 850 nm emitter.



TV remote controls operate at a wavelength of 940 nm. The TSAL6200 emitter is shown in the dashed purple line and the the TSOP58xxx IR receiver is shown in the solid purple line. To eliminate interference to the TV remote control system, 3D systems should use a different wavelength for the emitter in the TV, such as 830 nm. (green dashed line). Note that the IR receiver for the TV is insensitive to these wavelengths, eliminating any interference. The TSOP35- and TSOP75D25 shown in the solid green line are sensitive to 830 nm or 850 nm wavelengths.

IR Receivers

Part Number	Carrier Frequency (kHz)	Dimensions L x W x H (mm)	Sensitivity (mW/m²)	Range[1] (m)
TSOP35D25	25	6.8 x 3.0 x 3.2	0.15	26
TSOP75D25		7.5 x 5.3 x 4.0	0.15	26

[1] TSAL6200, I_F = 200 mA, I_e = 100 mW/sr
Only one emitter was used

IR Emitters

Peak Wavelength (nm)	Part Number	Package	Radiant Intensity[1] (mW/sr)	Angle of Half Intensity (°)	Rise, Fall Time (ns)
830	TSHG8400	5 mm (T1¾)	70	± 22	20
	VSMG2720	PLCC2	14	± 60	15
850	TSHG6400	5 mm (T1¾)	70	± 22	20
	TSHG6410	5 mm (T1¾)	90	± 18	20
	VSMG3700	PLCC2	10	± 60	15

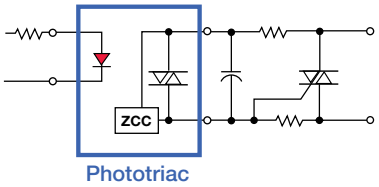
[1] I_F=100 mA

Phototriac for Home Applications

In the home, phototriacs are quite prevalent. Starting in the kitchen, a phototriac can be used to switch on and off the refrigerator blower motor; control the valves and pumps in the dishwasher, and control the plate spinner in the microwave. In the laundry room, a phototriac can be used to control the valves, pumps and spin motors in the washing machine. In the family room, a phototriac can be used to control the alarm siren through a connection to the control panel. And in the dining room, a phototriac can be used in the light dimmer.

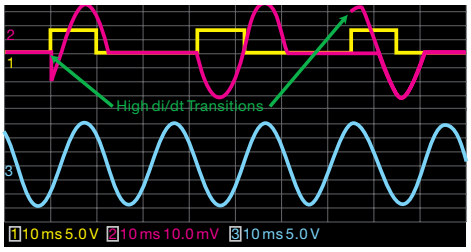
Phototriac

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 SCR or as a pre-driver to a TRIAC. 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 diagram, 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.

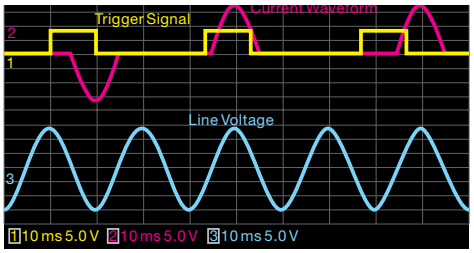


Phototriac

Non-zero Crossing



Zero Crossing



Phototriacs

Crossing	Part Number	Package	I_{FT} (mA)	dV/dt min (V/µs)	V_{ISO} (V_{RMS})	V_{DRM} (V)	Operating Temp (°C)
Zero Crossing	VO3062, -63	6-pin DIP or SMD	5, 10	1500	5300	600 - 800	- 40 to 100
	IL410/IL4108		2	10000			
Non-zero Crossing	VO3052, -53	6-pin DIP or SMD	10, 5	1500	5300	600	- 40 to 100
	IL420/IL4208		2	10000		600 - 800	- 40 to 100
	K30 Series		5, 10, 15	10		250 - 400	- 40 to 85
Power Phototraic	VO2223	8-pin DIP	10	210	5300	600	- 40 to 85

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 TSOP4038, TSOP5038, and TSOP58038 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

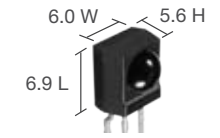
Many applications require a reflective sensor that detects not only presence but also the strength or weakness of the reflected signal. Instead of a fixed detectiion threshold, analog information from the sensor is needed. This is possible with Vishay's infrared sensors with variable gain, also called the "P" or proximity sensors: TSOP4**P**38, TSOP5**P**38 and TSOP58**P**38.

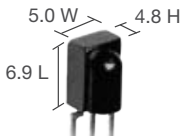
Fast Response Time

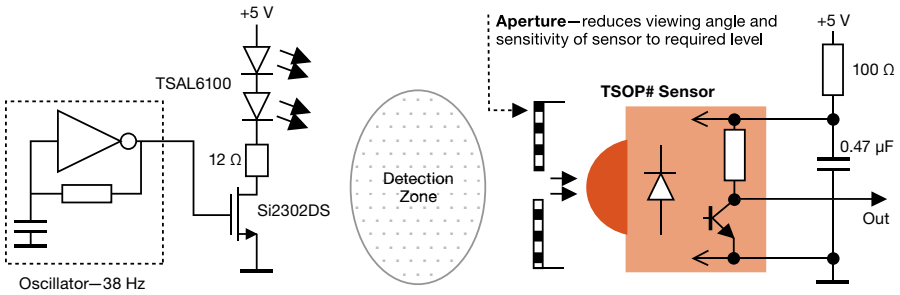
People's lives depend on light curtains and perimeter guards having fast reaction times. Unfortunately, some sensors require the infrared beam to be interrupted for up to 5 ms before detection. The 300 µs response time of Vishay's sensors is much faster. For the fastest response time, a continuous 38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

Receivers

Presence (Digital Out)	Proximity (Analog Out)	Supply Current (mA)	Supply Voltage (V)	Viewing Angle (°)	Response Time (µs)	Light Curtain Range[1] (m)	Reflective Range (m)
TSOP4038	TSOP4P38	0.85	2.7 to 5.5	± 45°	300	30	0.2 to 3.0
TSOP58038	TSOP58P38						
TSOP5038	TSOP5P38						







Plant Floor Process Control
Reflective and Interrupter Sensors, IGBT Drivers

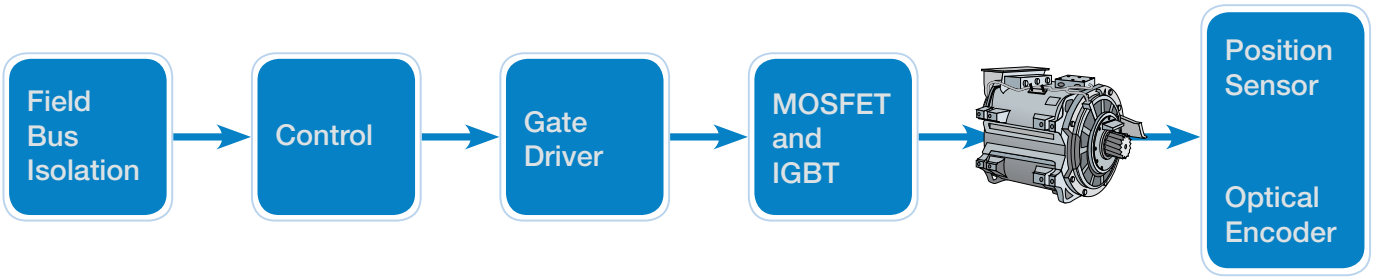
In manufacturing environments, applications for optoelectronics products are virtually endless. Here we list a few examples of where Vishay sensors and IGBT drivers are used, and some of the benefits these devices provide.

Application examples:

- Control the speed of a spinning shaft
- Limit the slack in a drive belt
- Enabled controlled shutdown of a auto loom machine when a thread breaks
- Monitor the revolutions in a gas or water meter
- Monitor fluid levels in an overfill tank
- Check the direction and speed of a spinning wheel
- Sensing stack height
- Guiding a movable stage
- Checking contents of a package
- Checking packaging seats
- Monitoring adhesive dispensing

Key features/benefits

- Operate in temperatures up to 125 °C
- Add flexibility to production planning with a moisture sensitivity level of MSL 1
- Allows design-in of reflective sensor in limited space
- Allow for mechanical tolerances with a wide-gap interrupter sensor



IGBT Drivers

VO3120 and VO3150A

- Widest operating voltage range from 15 V to 32 V
- 2.5 A or 0.5 A output current
- Compatible to competitor's

New Reflective Sensor

TCND2000

- Operating distance up to 5 mm
- Low profile, surface mount
- Lowest degradation of any emitter

New Transmissive Sensor

TCPT- and TCUT1300X01

- AEC-Q101 qualified
- Operating temperature up to 125 °C
- Dual channel for speed and direction

Transmissive Sensors

Mounting	Type	Channel(s)	Part Number[1]	Gap	Aperture
Surface Mount	Transmissive	Dual	TCUT1300X01	3 mm	0.3 mm
		Single	TCPT1300X01		

Reflective Sensors

Mounting	Type	Channel	Part Number	Optimal working distance	Operating range
Surface Mount	Reflective	Single	TCND5000	8.0 mm	2 mm to 40 mm
	Reflective	Single	TCNT2000a	0.75 mm	0.25 mm to 2 mm
Through Hole	Reflective	Single	TCRT1000	1.0 mm	1 mm to 2 mm
	Reflective	Single	TCRT5000	2.5 mm	1 mm to 8 mm

[a] In Development

IGBT Drivers

Mounting	Package	Part Number	Output Current	Supply Voltage	Temprature range
Surface Mount and Through Hole	DIP 8	VO3120	2.5 A	15 V to 32 V	– 40 °C to + 110 °C
		VO3150A	0.5 A		

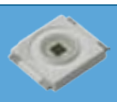
Focus Products – Infrared Emitters

Through-Hole

Wavelength λ (nm)	Radiant Power Φ_E (mW)	Radiant Intensity I_e (mW/sr)		On/Off t_f t_r (ns)	 3 mm	 5 mm			
	100 mA	100 mA	1 A		φ = ± 22°	φ = ± 4°	φ = ± 10°	φ = ± 18-22°	φ = ± 38°
830	50	70	700	15				TSHG8400	
		160	1600	15			TSHG8200		
	55	32	320	15					TSHG5510
850	55	90	900	20				TSHG5410	
								TSHG6410	
		230	2300	20			TSHG5210		
							TSHG6210		
		450	4.5	20		VSLY5850a			
870	55	32		15					TSFF5510
	50	70	700	15				TSFF5410	
	50	180	1800	15			TSFF5210		
890	40	10	100	30					
	48	65	650	30				TSHF5410	
	48	140	1400	30			TSHF5210		
940	40	32	320	15	TSAL4400				
	40	65		15	VSLB3940				

[a] In Development

Surface-Mount

Wavelength λ (nm)	Radiant Power Φ_E (mW)	Radiant Intensity I_e (mW/sr)		On/Off t_f t_r (ns)	 0805	 Dome Lens	 PLCC-2	 Little Star
	100 mA	100 mA	1 A		φ = ± 60°	φ = ± 10-16°	φ = ± 60°	φ = ± 60°
830	50						VSMG2700	
		160	1600	15			VSMG2720	
850	40	10	100	20			VSMG3700	
		35	350	20		VSMG20..X01		
	50	12	110	10	VSMY1850			
		100	900	15		VSMY2850..		
			170	30				VSMY7850X01a
870	40	10	100	10			VSMF4710	
	50	16	150	15			VSMF4720	
890	50	10	100	30			VSMF3710	
890	40	6	60	15	VSMB1940X01			
	35	8	80	500			VSML3710	
	40	13	130	15			VSMB3940X01	
	40	32	320	15				
	40	40	400	15		VSMB20..X01		
940	40	65		15			VSMS3700	

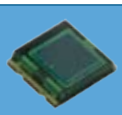
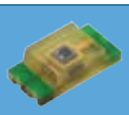
[a] In Development

Focus Products – Photo Detectors

Through-Hole

Output Type	Filter	Wavelength λ (nm)	 Side View ϕ = ± 60°	 TO-18 ϕ = ± 12°	 5-mm Flattop ϕ = ±50 °	 5 mm ϕ = ± 20 °	 3 mm ϕ = ± 25 °	 x ϕ = ± 65 °
PIN Photo Diodes	None	900	BPW46	BPW24R		BPV10		BPW34
	Daylight Blocking	950	BPV20F BPV21F			BPV10NF		BP104
Photo Transistor	None	850		BPW76B BPW77NB		BPW96C	BPW85B	
	Daylight Blocking	920					TEFT4300	
		940	BPV22NF BPV23NF					
		950	BPV22F BPV23F					
	Infrared Blocking	570			TEPT5700	TEPT5600	TEPT4400	

Surface-Mount

Output Type	Filter	Wave-length λ (nm)	 1.9 mm ϕ = ± 15°	 PLCC-2 ϕ = ± 60°	 Top View Gull ϕ = ± 65°	 Top View ϕ = ± 65°	 1206 ϕ = ± 60°	 0805 ϕ = ± 60°
PIN Photo Diodes	None	900	VEMD25..X01a		VPBW34S, -R	TEMD5010X01		TEMD7000X01
					VBP104S, -R	TEMD5020X01		
		940				TEMD5080X01		
	Daylight Blocking	950	VEMD20...X01		VPBW34FAS. -R	TEMD5110X01		TEMD7100X01
					VBP104FAS, -R	TEMD5120X01		
Photo Transistor	None	850	VEMT25..X01	VEMT4700				
				VEMT3700				TEMT7000X01
	Daylight Blocking	950	VEMT20...X01	VEMT3700F				TEMT7100X01
	Infrared Blocking	540					TEMT6000X01	
								TEMT6200FX01
Photo Diode	Infrared Blocking	540				TEMD5510FX01	TEMD6010FX01	TEMD6200FX01
AEC-Q101 Qualified Part (-X01)			Yes	Yes	No	Yes	Yes	Yes

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