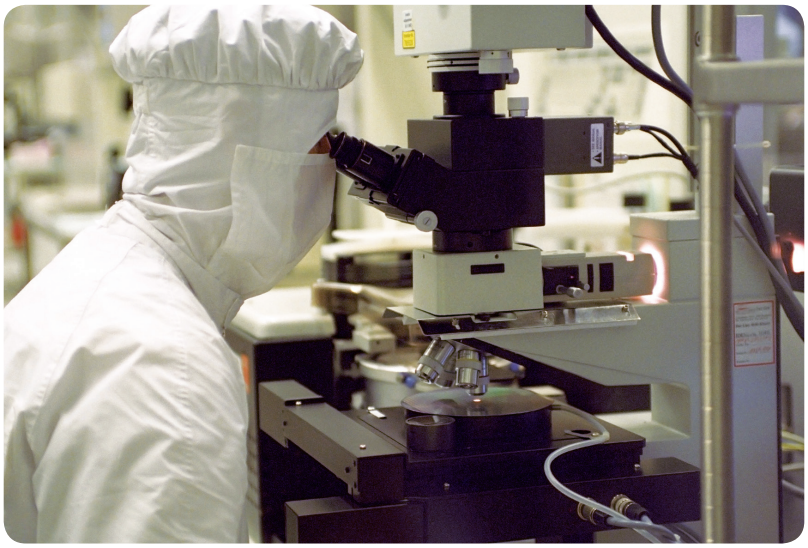
Optoelectronics Bare Die Portfolio
Infrared Emitters and Photo Detectors



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RESOURCES

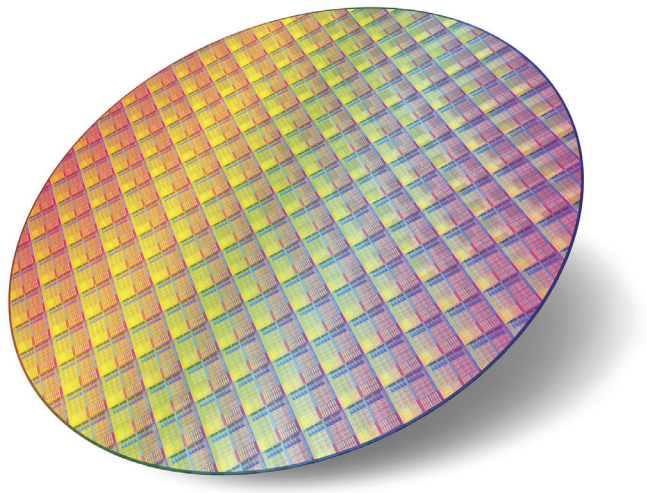
- Infrared emitter bare die product portfolio - www.vishay.com/die-wafer/ir-emitting-diodes/
- Photo detector bare die product portfolio - www.vishay.com/die-wafer/photo-detectors/
- For technical support contact - emittertechsupport@vishay.com or detectortechsupport@vishay.com
- Sales contacts - www.vishay.com/doc?99914

A WORLD OF SOLUTIONS™

Introduction

Benefits of using bare die

- High design flexibility without package limitations
- High level of integration
- Temperature management with chip-on-board (COB) technology
- Highly accurate die placement
- Reduced system cost
- Customer specific design
- Possible process flow modification



Vishay service

- Design assistance
- Assembly assistance
- Die handling assistance

Wafer processing duty

- Wafer mapping/wafer inking
- Wafer thinning
- Wafer dicing
- Die sorting
- Visual inspection

Packaging and shipping methods

- Unsawn wafer: the wafers are delivered in a sealed bag and die are not singulated
- Sawn wafer on loose foil: the wafers are sawn and supplied on blue tape
- Sawn wafer on discoframe: the wafers are sawn and supplied on a blue tape in a plastic frame

Die Usage Basic Guidelines

Bare die products require careful handling and storage as well as optimized assembly processes and tools to avoid damage and deviations from the expected performance. The following guidelines are based on Vishay's many years of experience of manufacturing and assembling semiconductor devices.

Die Handling

To avoid contamination and damage die or wafers should never be handled by bare hands. Mechanical pressure has to be limited and special tweezers have to be used for grabbing a die from the packing.

Storage time for wafers in sealed condition shall not exceed 6 months (storage ambient conditions: T_A = 15...30 °C; relative humidity: < 60 %).

Die Attach

To assure optimal electrical conductivity between silicon and copper, Vishay wafers are coated on the back side with two or three metallic solderable layers which are suitable for a wide range of solders, ranging from solder alloys to conductive epoxies. Fluxes are not recommended for solders because residuals can contaminate the surface of the die, and cause voids under the die, thus compromising heat dissipation and electrical performance.

Vishay experts are happy to advise you on which assembly materials are best suited to your specific requirements..

Wire Bonding

Vishay does not define absolute bonding parameters, since bonding equipment and materials vary greatly. Customers are advised to optimize bonding parameters according to their specific equipment.

Upon request, Vishay is ready to assist you in optimizing your wirebonding process.

Bare Die Naming Rules for Infrared Emitters

T	B	94	14	VA	SF	F
Telefunken	**Technology**	**Wavelength**	**Chip Size**	**Internal**	**Package Form**	**Status**
(Now part of Vishay)	B: Bulk Emitter S: Surface Emitter	94: 940 nm 89: 890 nm 87: 870 nm 85: 850 nm 83: 830 nm	08: 08 mil 11: 11 mil 14: 14 mil 17: 17 mil	V: Emitter A: Version / Type	S: Sawn Wafer F: Placed on Foil	F: Finished Good

Bare Die Naming Rules for Photo Detectors

T	11	10	P6	SD	F
Telefunken	**Technology**	**Size**	**Type**	**Package Form**	**Status**
(Now part of Vishay)	11: Homogeneous 15: Epitaxial	Internal Classification	P: Photodetector 6: Internal Classification	S: Sawn Wafer D: Mounted on Discoframe	F: Finished Good

Infrared Emitters

Vishay offers a wide variety of high-power, high-speed infrared emitter chips for a broad range of applications. Vishay offers broad range of surface emitters that deliver the highest radiant intensities; and highly efficient bulk emitters.

All Vishay emitter chips satisfy the requirements of AEC Q101.

Portfolio

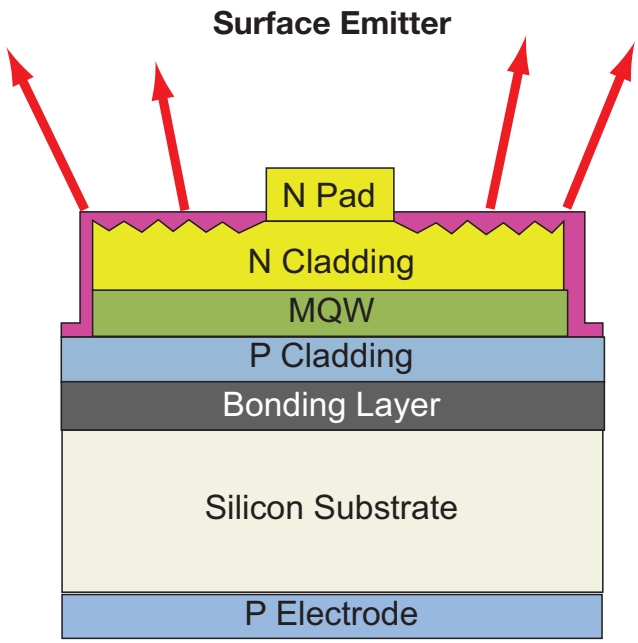
Vishay offers a wide selection of chips, emitting at 850 nm, 890 nm, 940 nm.

Typical Applications

- IR touch display based devices such as printer displays, ebook reader, smart phones, tablets, and ultrabooks
- Navigation devices
- Automotive dashboard displays
- Data communication
- Illumination for cameras

Available Technologies

- Metal Organic Vapor Phase Epitaxy (MOVPE):
  - High-power surface emitter
  - Bulk emitter



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Bare Die

IR Surface Emitters

Part Number	Product Image	Type	Chip Dimensions L x W x H (mm)	Peak Wavelength (nm)	Radiant Power (mW)	Angle of Half Intensity (±°)	Surge Forward Current (A at t_p = 100 µs)	Rise Time (ns)
TS8914VA		Surface	0.355 x 0.355 x 0.17	890	40[C]	60	1	10
TS8514VB		Surface	0.355 x 0.355 x 0.17	855	38[C]	60	1	10
TS8510VB		Surface	0.260 x 0.260 x 0.17	855	18[E]	60	0.5	10
TS9414VB		Surface	0.355 × 0.355 × 0.17	940	40[C]	60	1	10
TS9410VB		Surface	0.260 x 0.260 x 0.17	940	20[E]	60	0.5	10
TB9414VA		Bulk	0.37 x 0.37 x 0.19	940	21[C]	80	1	15
TB9408VA		Bulk	0.2 x 0.2 x 0.19	940	22[C]	80	0.5	15

Note
*The measurements are based on samples of die which are mounted on TO-18 gold header without resin coating.
A I_F=1A, B I_F=250mA, C I_F=100mA, D I_F=70mA, E I_F=50mA

Photo Detectors

Vishay offers the broadest selection of high-speed, low dark current PIN photodiode chips. They are specially designed to achieve excellent sensitivity together with high reliability. Vishay phototransistors are extremely sensitive and fast compared to other such devices on the market.

Portfolio

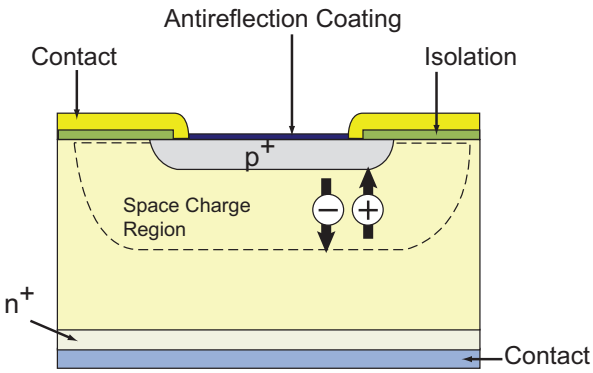
- Vishay offers the broadest selection of photo detector chips suitable for ambient light and IR detection
- Available technologies:
  - Epitaxial
  - Homogeneous

Typical Applications

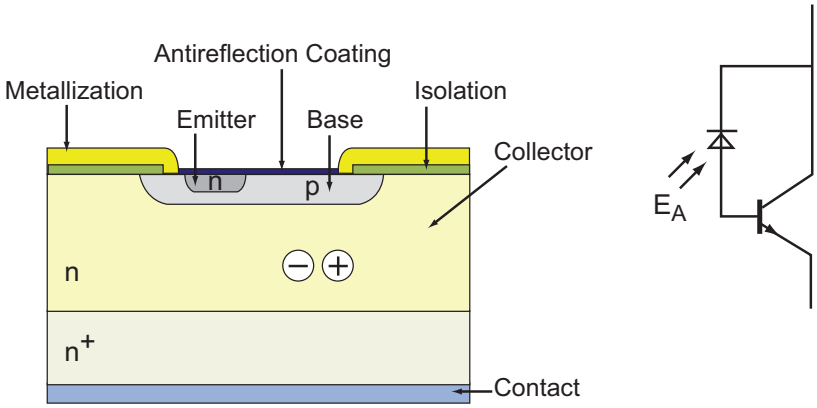
- IR touch display based devices
- High-speed data transfer
- Light barriers
- Position sensing
- Alarm and safety equipment

Cross Section of PIN Photodiode and Phototransistor

PIN Photodiode



Phototransistor



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Bare Die

PIN Photodiodes

Part Number	Product Image	Chip Dimensions L x W x H (mm)	Peak Wavelength (nm)	Spectral Bandwidth (nm) (50%)	Reverse Light Current (E_A = 1 mW/cm² λ = 950 nm V_R = 5 V)	Reverse Dark Current (nA)	Angle of Half Sensitivity (± °)	Rise Time/ Fall Time (ns)	Photo Sensitive Area (mm²)
T1112P		3.05 x 2.1 x 0.28	970	640 to 1070	44 µA	0.1	60	130/130	5.5
T1113P		2.97 x 2.97 x 0.28	960	660 to 1050	55 µA	2	60	100/100	7.5
T1116P		2.97 x 2.97 x 0.28	940	500 to 1050	43 µA	2	60	40/40	7.7
T1110P6		2.97 x 2.97 x 0.28	940	600 to 1050	55 µA	2	60	100/100	7.5
T1120P		2.37 x 2.37 x 0.28	940	600 to 1050	35 µA	2	60	100/100	4.4
T1172P		1.47 x 1.07 x 0.28	960	640 to 1060	8.7 µA	< 1	60	625/670	1.06
T1170P		1.17 x 1.17 x 0.28	920	600 to 1040	7 µA	< 1	60	100/100	0.88
T330P		0.67 x 0.67 x 0.28	900	600 to 1050	2.3 µA	0.1	60	4/4	0.23
T337P		0.67 x 0.67 x 0.28	970	610 to 1080	2.3 µA	< 1	60	550/100	0.23
T1180P		0.67 x 0.3 x 0.28	810	590 to 1010	0.59 µA	< 1	60	530/170	0.055
T1187P		0.67 x 0.3 x 0.28	800	580 to 1070	0.66 µA	< 1	60	700/160	0.053

OPTOELECTRONICS

Bare Die

Phototransistors

Part Number	Product Image	Chip Dimensions L x W x H (mm)	Peak Wavelength (nm)	Spectral Bandwidth (nm) (50%)	Collector Light Current (E_e = 1 mW/cm² λ = 950 nm V_{CE} = 5V)	Collector Emitter Dark Current (nA)	Angle of Half Sensitivity (± °)	Rise Time/ Fall Time (ns)	Photo Sensitive Area (mm²)
T1090P6		0.53 x 0.53 x 0.185	840	440 to 1070	65-750 µA**	1	60	4300/7700	0.14
T5096P		0.39 x 0.39 x 0.185	910	660 to 1030	72-600 µA**	< 1	60	3800/3500	0.057

Note
*The measurements are based on samples of die which are mounted on TO- header without resin coating
**Binning is available

Ambient Light PIN Photodiodes

Part Number	Product Image	Chip Dimensions L x W x H (mm)	Peak Wavelength (nm)	Spectral Bandwidth (nm) (50%)	Reverse Light Current (E_V = 100 lx, CIE illuminant A, V_R = 5 V)	Reverse Dark Current (nA)	Angle of Half Sensitivity (± °)	Rise Time/ Fall Time (ns)	Photo Sensitive Area (mm²)
T1610P		2.97 x 2.97 x 0.28	560	390 to 800	2.9 µA	2	60	100/100	7.7
T1670P		0.72 x 0.72 x 0.28	560	390 to 800	138 nA	0.1	60	100/100	0.27
T1677P		0.72 x 0.72 x 0.28	570	430 to 700	87 nA	0.1	60	100/100	0.27
T1678P		0.72 x 0.72 x 0.2	570	440 to 700	87 nA	0.1	60	100/100	0.34

Ambient Light Phototransistors

Part Number	Product Image	Chip Dimensions L x W x H (mm)	Peak Wavelength (nm)	Spectral Bandwidth (nm) (50%)	Collector Light Current (E_V = 100 lx, CIE illuminant A, V_{CE} = 5 V)	Collector Emitter Dark Current (nA)	Angle of Half Sensitivity (± °)	Rise Time/ Fall Time (ns)	Photo Sensitive Area (mm²)
T1070P		0.72 x 0.72 x 0.22	570	440 to 800	50 µA	3	60	-	0.25

Note
*The measurements are based on samples of die which are mounted on TO- header without resin coating

Custom Design

Vishay offers highly flexible design and fabrication of semi- and full custom specific photodiode and emitter chips. The huge variety of applications and assembly options requires bare die that are tailored to the specific application to keep the full potential of the device. A good fit between chip, assembly, and packaging is becoming ever more important with tighter space and power requirements.

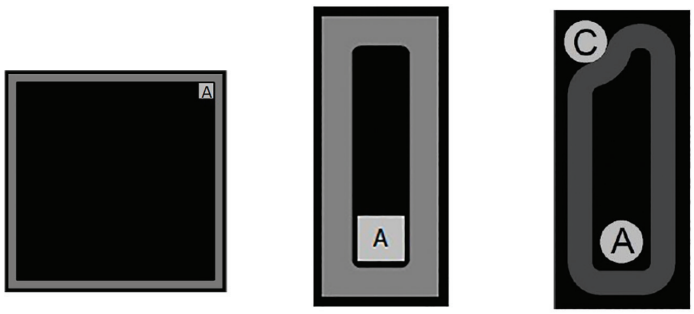
Vishay's flexible technology base allows customization for a range of parameters and features as listed below:

Emitters

- **Geometrical Design**
  Chip outside dimensions, thickness, pad size, and shape and pad positions can be adjusted according to the customer specification.
- **Pad Topology**
  Chip topology can be customized with respect to interconnect technology.

Photodetectors

- **Geometrical Design**
  Almost all geometrical parameters of a photodiode can be customized. This includes chip outside dimensions, chip thickness, pad size and shape, pad positions, photodiode position in an array, and alignment marks.
- **AR Coating / Optical Filters**
  Depending on impinging wavelength and application all photodiodes are equipped with an AR coating. Customization allows us to match the AR coating to the wavelength needed by the customer.
- **Pad Topology**
  Depending on interconnect technology pad topology can be also optimized.
- **Pitch**
  Linear or two-dimensional arrays with customizable pitch.

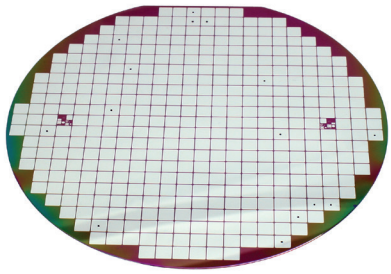


Packing Options

Vishay provides you with several packing options which can fit with virtually any assembly line. Parts are 100 % probed and inspected.

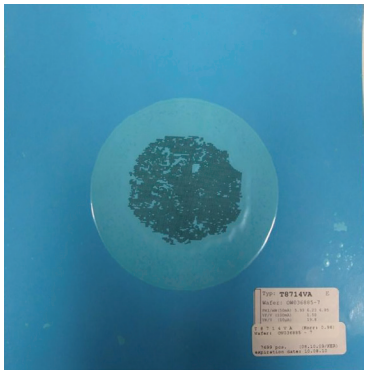
Unsawn wafer

Die are not singulated, wafers are provided in box.



Sawn wafer on loose foil

The wafer is provided on blue film where dies are singulated, ready for pick and place, bad chips are removed, and measurement data is attached.



Sawn wafer on discoframe

Wafer is provided on blue foil; probed and inked; measurement data is attached.

Upon request chips can also be delivered on plastic frames.

For shipment, the wafers are arranged in stacks. The stacks are hermetically sealed in plastic bags to ensure protection against environmental influence (humidity and contamination).

The following documents are available upon the request:

- Material content certificate
  - RoHS (DIN EN 62321)
- Halogen free (DIN EN 14582)
  - SGA reports
  - Failure catalogue
  - ESD test results (according to the JEDEC standards)

OPTOELECTRONICS

Bare Die

SEMICONDUCTORS

MOSFETs Segment

MOSFETs
- Low Voltage TrenchFET® Power MOSFETs
- Medium Voltage Power MOSFETs
- High Voltage Planar MOSFETs
- High Voltage Superjunction MOSFETs
- Automotive Grade MOSFETs

ICs
- VRPower® DrMOS Integrated Power Stages
- Power Management and Power Control ICs
- Smart Load Switches
- Analog Switches and Multiplexers

Diodes Segment

Rectifiers
- Schottky Rectifiers
- Ultrafast Recovery Rectifiers
- Standard and Fast Recovery Rectifiers
- High Power Rectifiers / Diodes
- Bridge Rectifiers

Small Signal Diodes
- Schottky and Switching Diodes
- Zener Diodes
- RF PIN Diodes

Protection Diodes
- TVS TRANSZORB® and PAR® Diodes (unidirectional, bidirectional)
- ESD Protection Diodes (including arrays)

Thyristors / SCRs
- Phase Control Thyristors
- Fast Thyristors

Power Modules
- Input Modules (diodes and thyristors)
- Output and Switching Modules (contain MOSFETs, IGBTs, and diodes)
- Custom Modules

Optoelectronic Components Segment

Infrared Emitters and Detectors

Optical Sensors
- Proximity
- Ambient Light
- Light Index (RGBW, UV, IR)
- Humidity
- Quadrant Sensors
- Transmissive
- Reflective

Infrared Remote Control Receivers

Optocouplers
- Phototransistor, Photodarlington
- Linear
- Phototriac
- High Speed
- IGBT and MOSFET Drivers

Solid-State Relays

LEDs and 7-Segment Displays

Infrared Data Transceiver Modules

Custom Products

PASSIVE COMPONENTS

Resistors and Inductors Segment

Film Resistors
- Metal Film Resistors
- Thin Film Resistors
- Thick Film Resistors
- Power Thick Film Resistors
- Metal Oxide Film Resistors
- Carbon Film Resistors

Wirewound Resistors
- Vitreous, Cemented, and Housed Resistors
- Braking and Neutral Grounding Resistors
- Custom Load Banks

Power Metal Strip® Resistors

Battery Management Shunts

Crowbar and Steel Blade Resistors

Thermo Fuses

Chip Fuses

Pyrotechnic Initiators / Igniters

Variable Resistors
- Cermet Variable Resistors
- Wirewound Variable Resistors
- Conductive Plastic Variable Resistors
- Contactless Potentiometers
- Hall Effect Position Sensors
- Precision Management Encoders

Networks / Arrays

RF and Microwave Resistors

High Voltage Resistors

Dividers

Non-Linear Resistors and Temperature Sensors
- NTC Thermistors
- PTC Thermistors
- Thin Film RTDs
- Varistors
- Platinum Chip Temperature Sensors

Magnetics
- Power Inductors
- Power Chokes
- High Frequency RF Inductors
- Magnetic Actuators
- Wireless Charging Coils
- Planar Devices
- Transformers
- Custom Magnetics

Connectors

Capacitors Segment

Tantalum Capacitors
- Molded Chip Tantalum Capacitors
- Molded Chip Polymer Tantalum Capacitors
- Tantalum MAP Capacitors
- Polymer Tantalum MAP Capacitors
- Coated Chip Tantalum Capacitors
- Solid Through-Hole Tantalum Capacitors
- Wet Tantalum Capacitors

Ceramic Capacitors
- Multilayer Chip Capacitors
- Disc Capacitors
- Multilayer Chip RF Capacitors
- Chip Antennas
- Thin Film Capacitors

Film Capacitors

Power Capacitors

Heavy-Current Capacitors

Aluminum Electrolytic Capacitors

ENYCAP™ Energy Storage Capacitors